AIR QUALITY MODELING IN THE GULF OF MEXICO REGION STUDY

BOEM Contract No. M14PC00007
Darcy Wilson and Bebhinn Do, ERG
Till Stoeckenius, Ramboll Environ
BOEM COR: Holli Ensz

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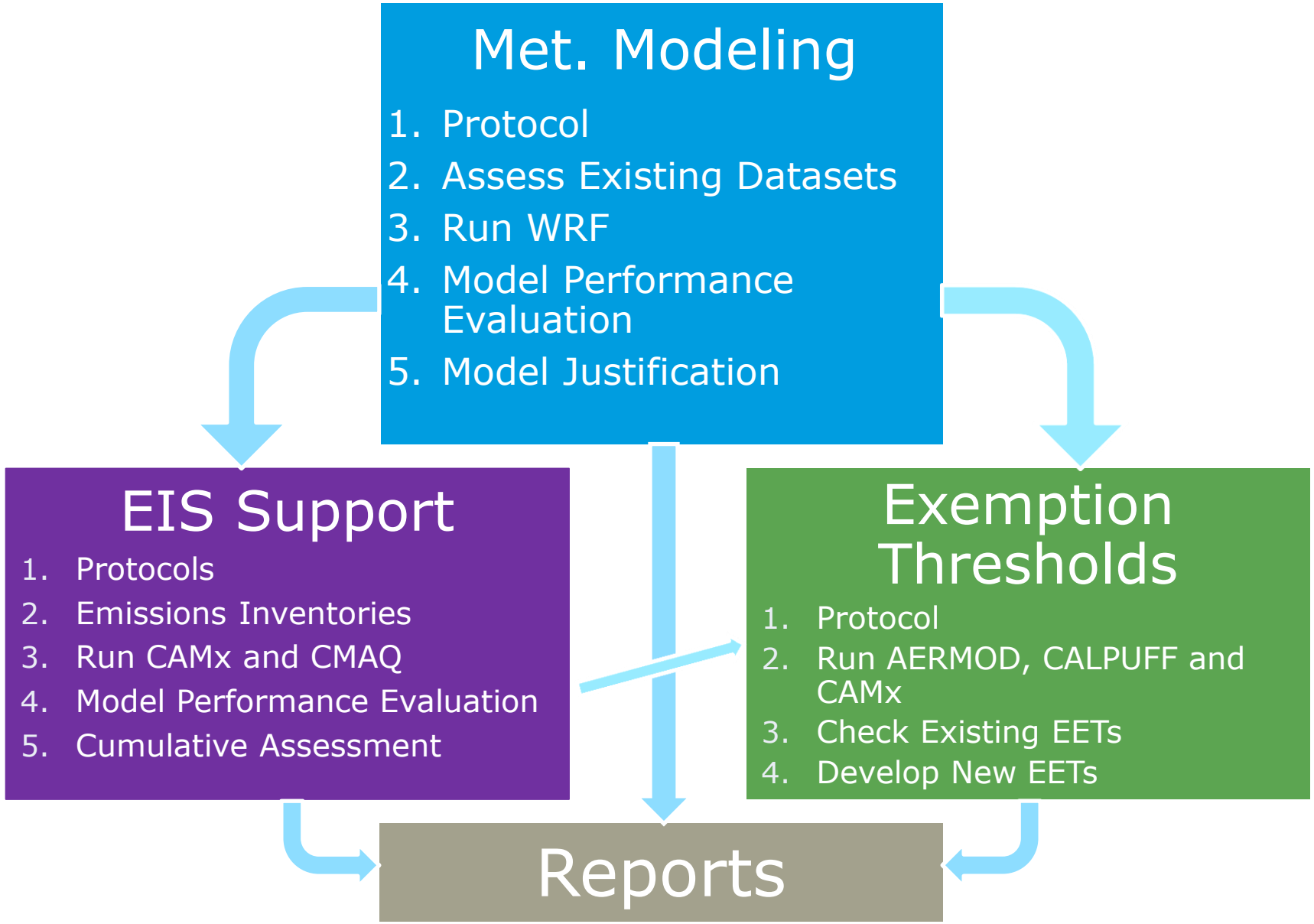
INTRODUCTION

- The USEPA sets National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment.
- BOEM is to comply with the NAAQS to the extent that Outer Continental Shelf (OCS) oil and gas exploration, development, and production sources do not significantly affect the air quality of any state.
- Air quality modeling is underway for the Gulf of Mexico Region (GOMR) to assess the OCS oil and gas development pre- and post-lease impacts to the states.
- BOEM will use this information pre-lease in the National Environmental Policy Act (NEPA) Environmental Impact Statement (EIS) cumulative analysis to support compliance with OCSLA.
- This information will also be used post-lease in the emission exemption threshold (EET) evaluation.

STUDY TASKS



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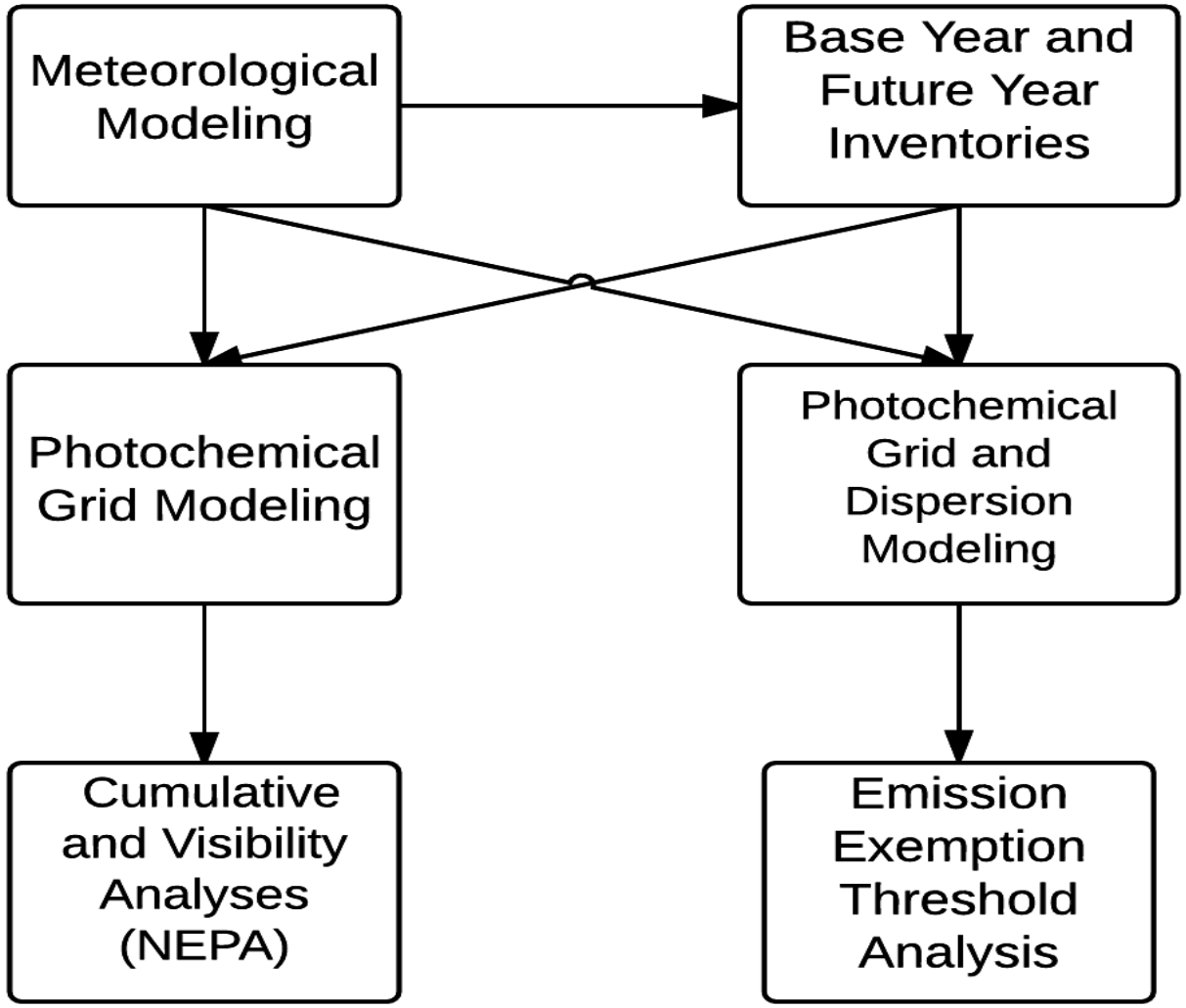
STUDY TASKS: DATA FLOW CHART



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STUDY CONTRACTORS

Eastern Research Group

- Emission Inventory Development
- AERMOD Modeling
- EET Evaluation

Ramboll Environ

- Meteorological Modeling
- Emissions Processing
- Photochemical Air Quality Modeling

Alpine Geophysics

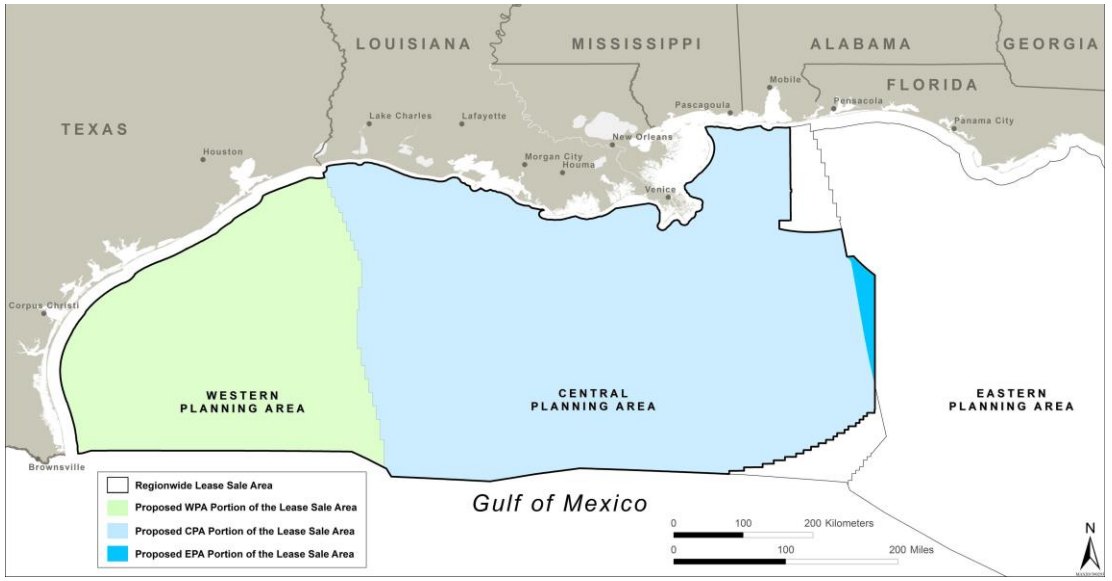
- Support for Emission Inventory Development
- CALPUFF Modeling
- Support for EET Evaluation

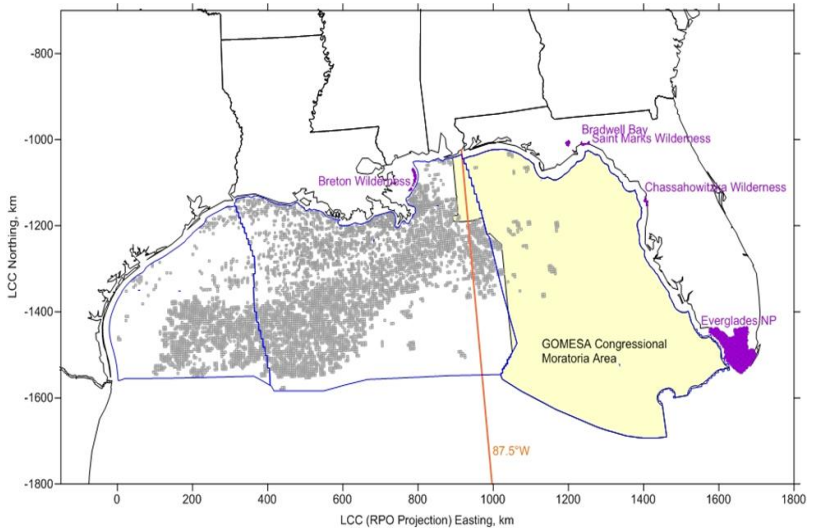
Science Review Group

STUDY GOALS AND OBJECTIVES

Focus of Today's Presentation

- Develop Five-Year Meteorological Dataset
- Develop state-of-the-art modeling platform for evaluating AQ impacts of existing and potential future OCS sources under OCSLA
  - Pre-lease cumulative NEPA analyses
  - Post-lease plan emission exemption threshold analysis
- Evaluate base year (2012) OCS source impacts
- Evaluate future 2017-2022 GOM Multi-sale EIS scenario impacts
- Complete OCD/AERMOD model justification
- Update emissions exemption thresholds





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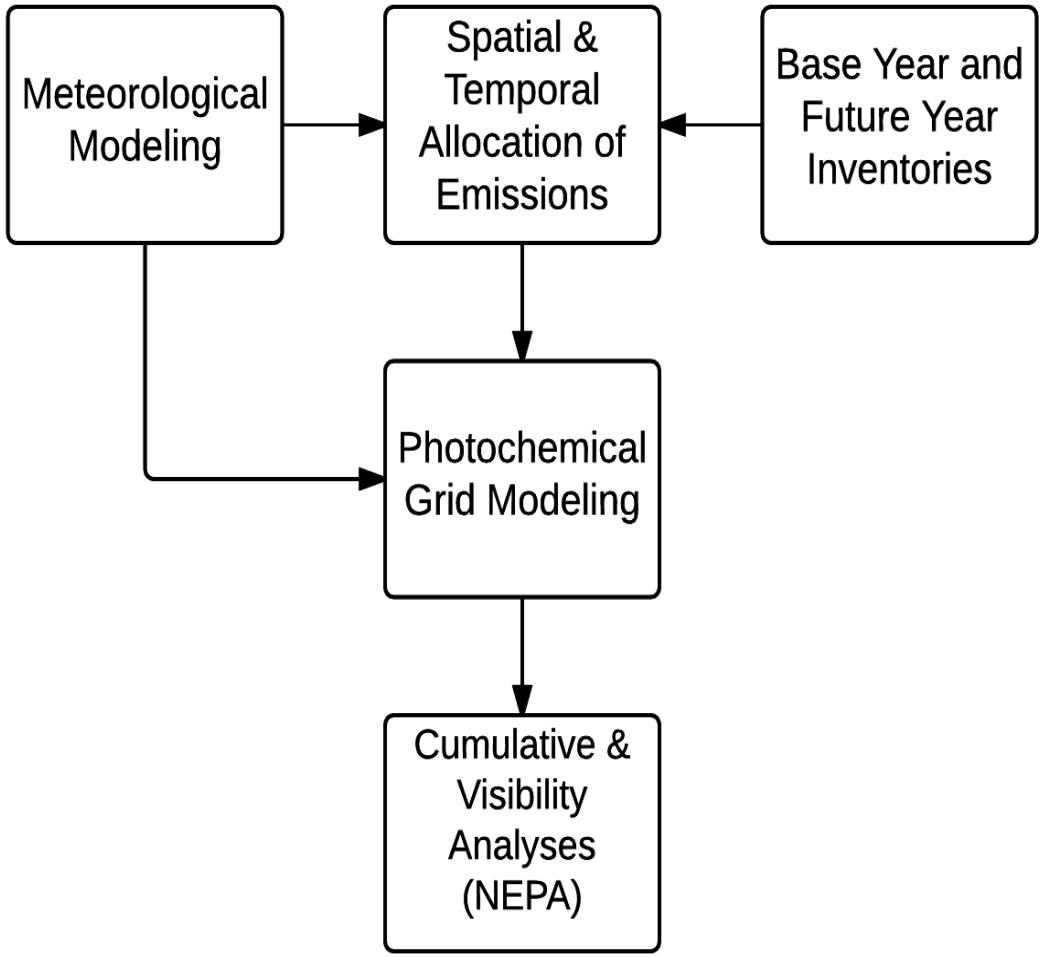
OVERVIEW— AIR QUALITY IMPACT ANALYSES

- Emission inventories
  - Base year (2012)
    - Characterize current conditions
    - Model performance evaluation
  - Future year (2017-2022) lease scenario
    - Estimate impacts of emissions growth/controls on future AQ
    - Examine impacts of specific groups of new sources, e.g., new O&G platforms
- Meteorological modeling
- Photochemical modeling



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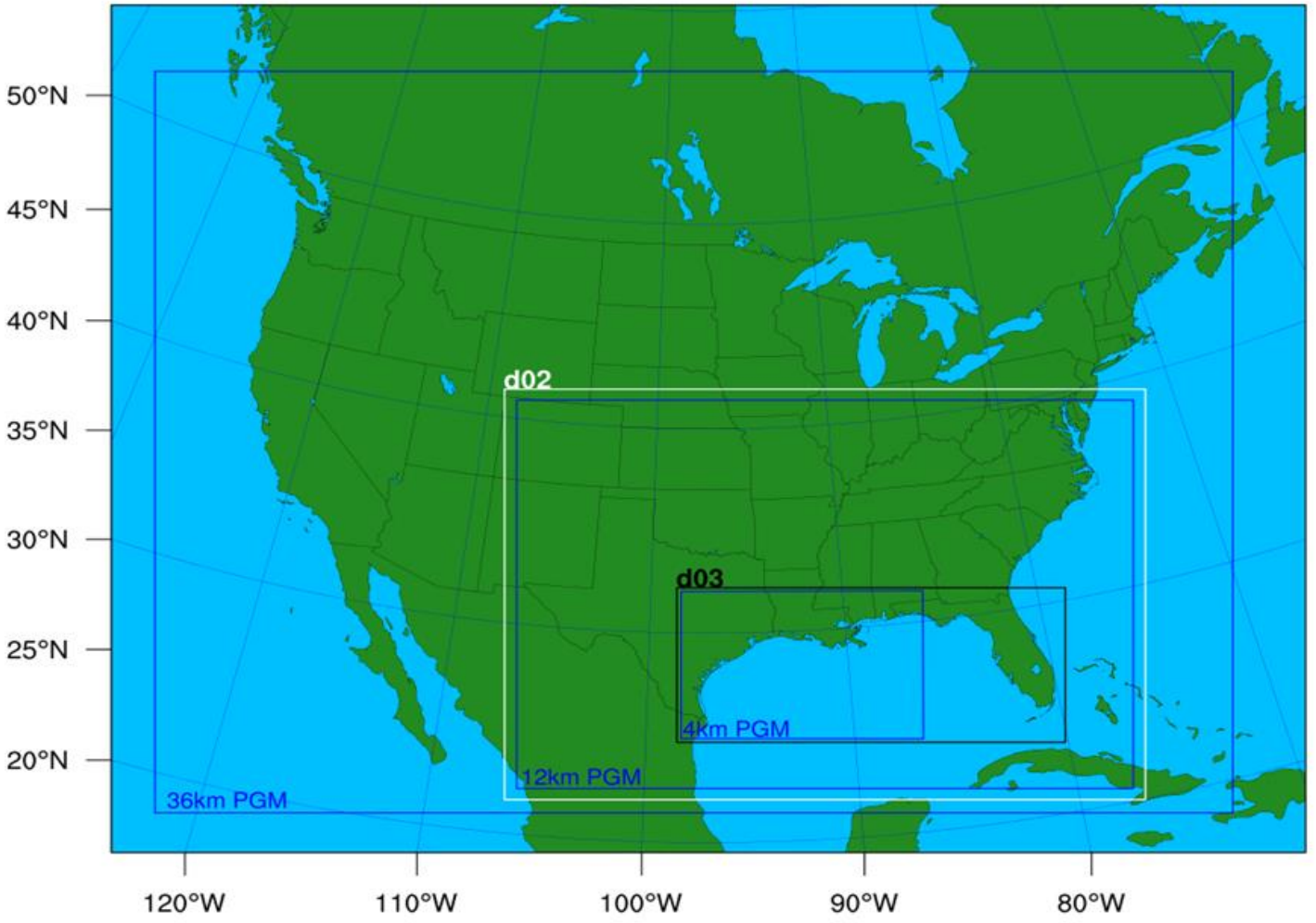
EMISSIONS INVENTORY DEVELOPMENT

Source: ERG

GEOGRAPHIC DOMAIN OF THE STUDY



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BASE CASE EMISSIONS INVENTORY

- Base Year: 2012
- Pollutants
  - Carbon monoxide (CO)
  - Lead (Pb)
  - Nitrogen oxides (NO_x)
  - Particulate matter (PM_{10} and $PM_{2.5}$)
  - Sulfur dioxide (SO_2)
  - Volatile organic compounds (VOCs)
  - Ammonia (NH_3)
- Sources:
  - OCS O&G sources: 2011 Gulfwide inventory
    - Platforms, marine vessels, helicopters
  - Other OCS sources: 2011 Gulfwide inventory
    - CMVs, LOOP, vessel lightering zones, biogenic/geogenic sources
  - Other US: USEPA 2011 NEI and 2012 modeling platform
  - Canada: USEPA 2012 modeling platform
  - Mexico: update of 2008 MNEI

BASE CASE EMISSIONS INVENTORY

- OCS O&G sources
  - Production platforms, drilling, pipelaying, support, and survey vessels, and helicopters
- Other OCS sources
  - Biogenic and geogenic sources
  - CMVs
  - Commercial and recreational fishing
  - LOOP
  - Military vessels
  - Vessel lightering
- Other US
  - Point, nonpoint area, and mobile sources; fires; onshore vegetation, etc.
  - QA/QC activities, emission estimates developed
- Canada
  - Point, nonpoint area, and mobile sources; fires
- Mexico
  - Point, nonpoint area, and mobile sources; fires

FUTURE YEAR EMISSIONS INVENTORY

- "No Action" Emissions:
  - O&G sources (existing): Gulfwide inventory
  - Other OCS sources: Gulfwide inventory
  - Other US: USEPA 2012 modeling platform with 2017 projections for most source categories
  - Canada: same as Base Year
  - Mexico: 2012 modeling platform with 2017 projections, offshore production platforms
- "Proposed Action" Emissions:
  - BOEM projected 2017-2022 Multisale activities:
    - New Platforms
    - Additional support vessel and helicopter activity

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PROPOSED FUTURE BOEM ACTION EMISSIONS

- Future year emissions based on BOEM 2017-2022 Multisale EIS information
  - Estimates based on 10 lease sales and a single sale
  - Covers the 5-year period, with 50 years of subsequent activity
- Annual emission estimates developed for projected activity
  - Exploration, delineation, development, and production well drilling
  - Platform installation
  - Pipeline installation
  - Platform oil and gas production
  - Platform removal
  - Support helicopters
  - Support vessels

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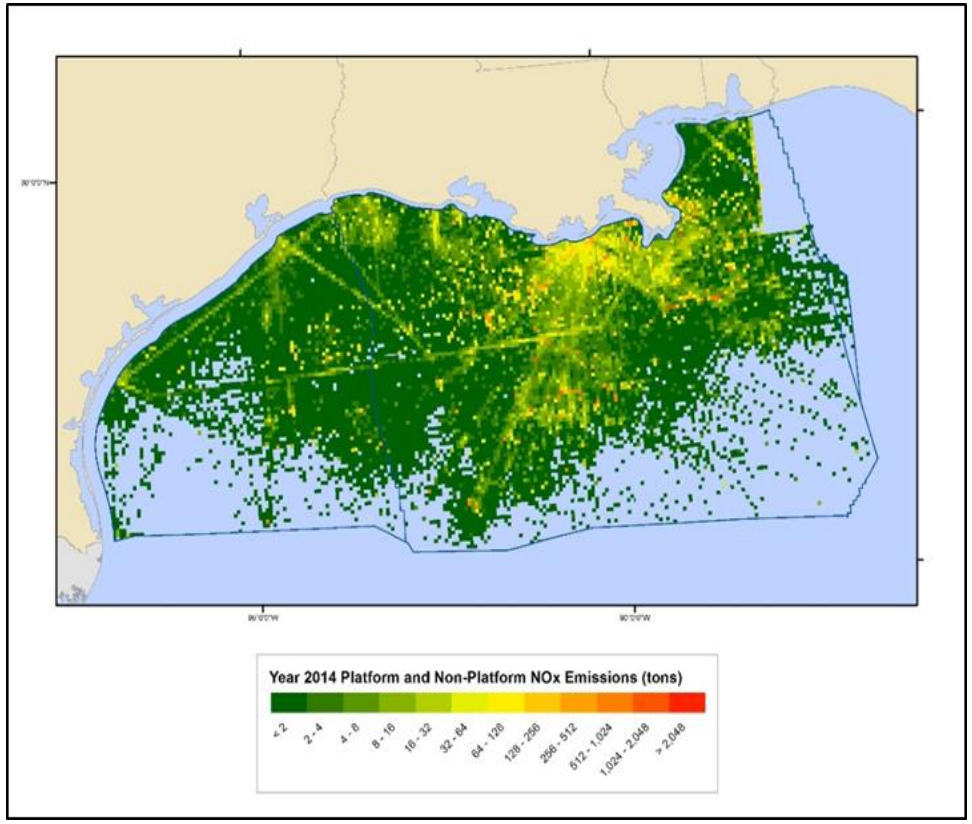
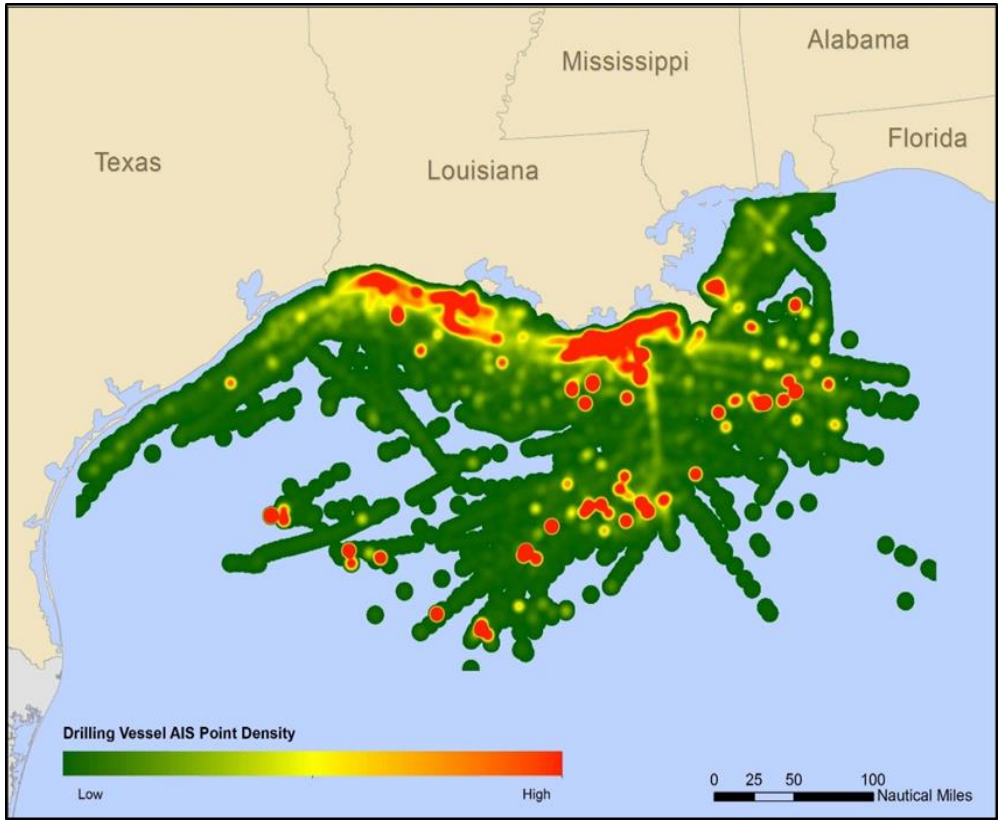
REFINED FUTURE SCENARIO EMISSIONS INVENTORY

- "No Action" Emissions:
  - 2014 Gulfwide inventory for existing OCS sources
- "Proposed Action" Emissions:
  - BOEM projected 2017-2022 Multisale activities:
    - Single lease sale
    - Ten lease sales
    - Refined spatial allocation of activities
    - Refined vessel round trip lengths
    - Updated emission factors for platforms based on water depth, single well shallow vs. multi-well

"NO ACTION" 2014 GULFWIDE INVENTORY

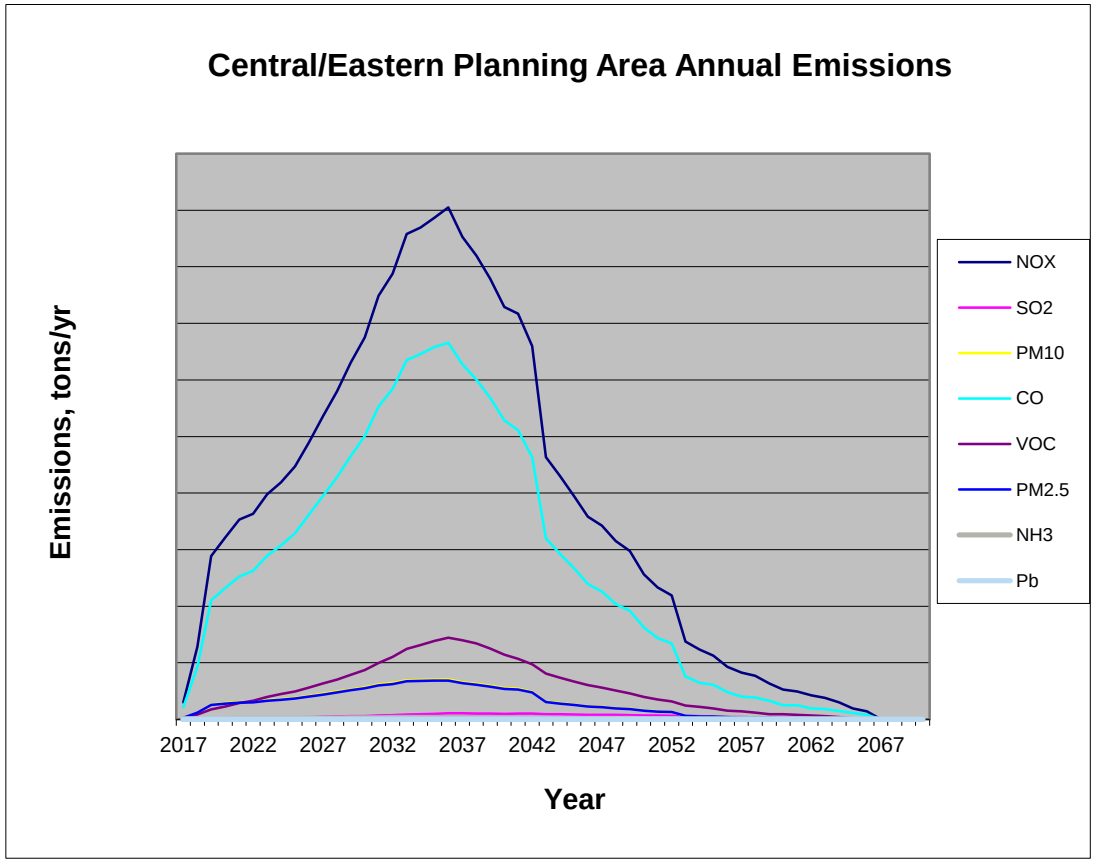


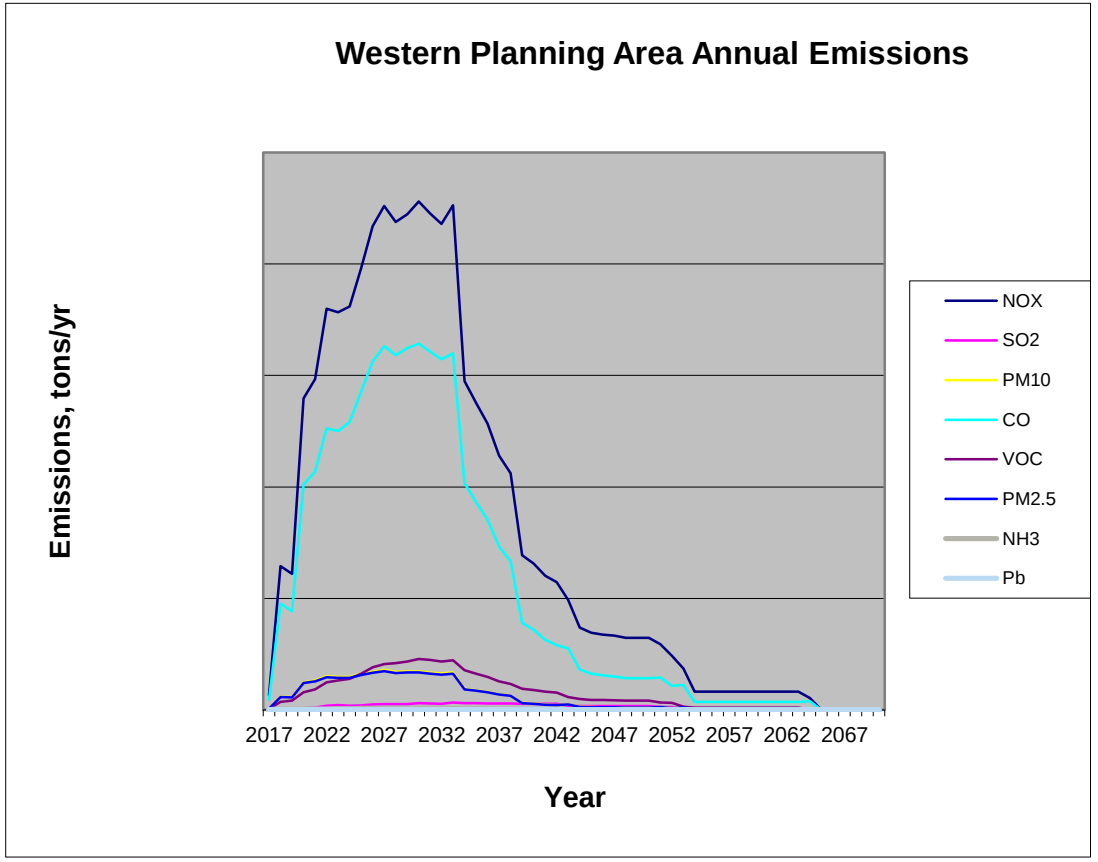


ESTIMATED EMISSIONS FROM ALL FUTURE BOEM SOURCES

- Year selected based on cumulative emission estimates from all ten lease sales ranging from 2017-2066
- Combined estimated emissions from two years into one representative year based on highest levels to model future BOEM activities
  - 2033: highest NO_x, PM, CO, and NH_3 emissions, driven primarily by support vessel activities
  - 2036: highest VOC emissions, driven primarily by production sources

ESTIMATED EMISSIONS FROM ALL FUTURE BOEM SOURCES: EXAMPLE





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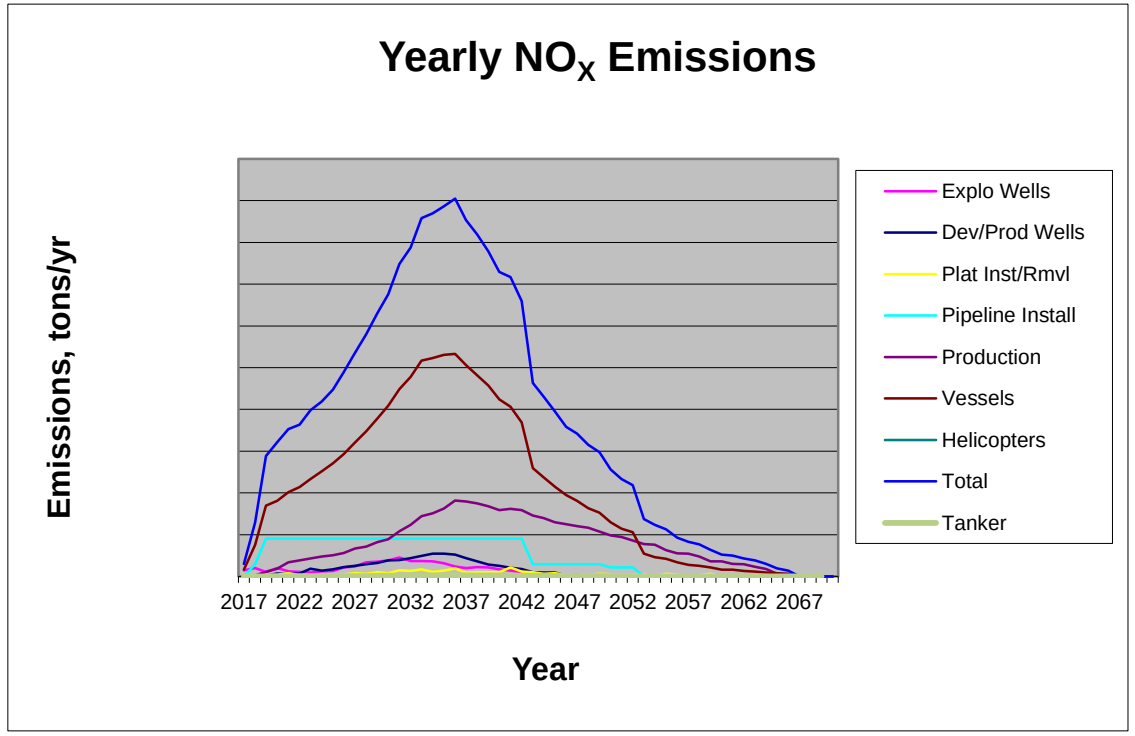
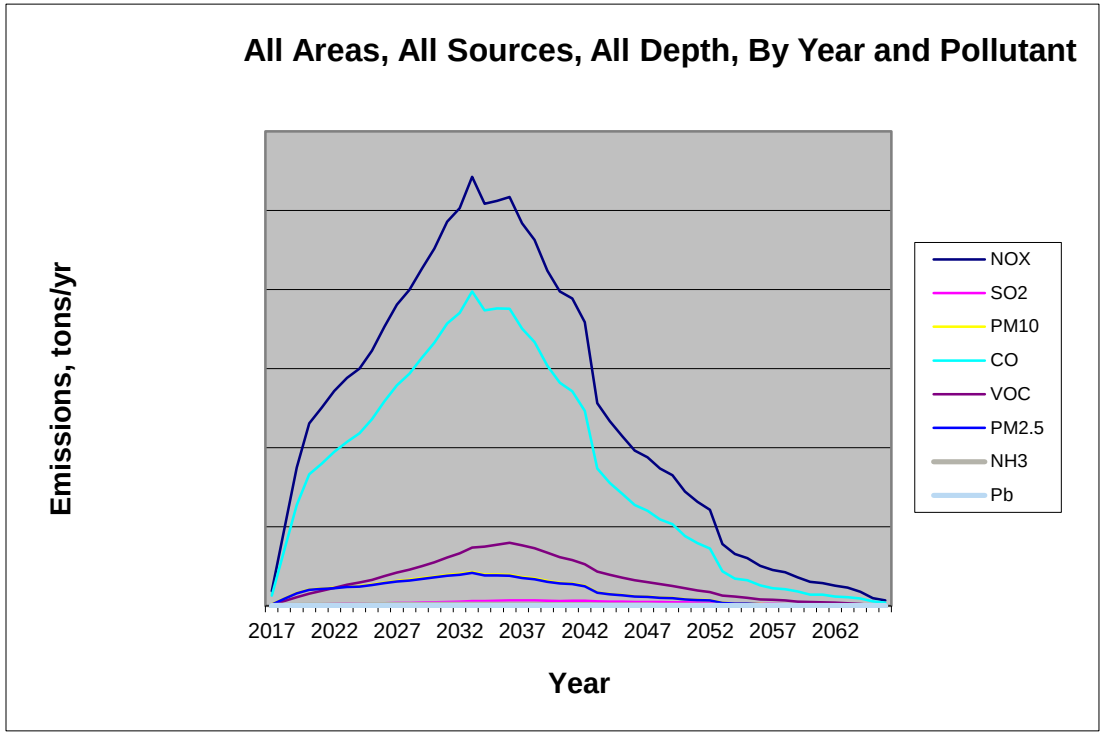
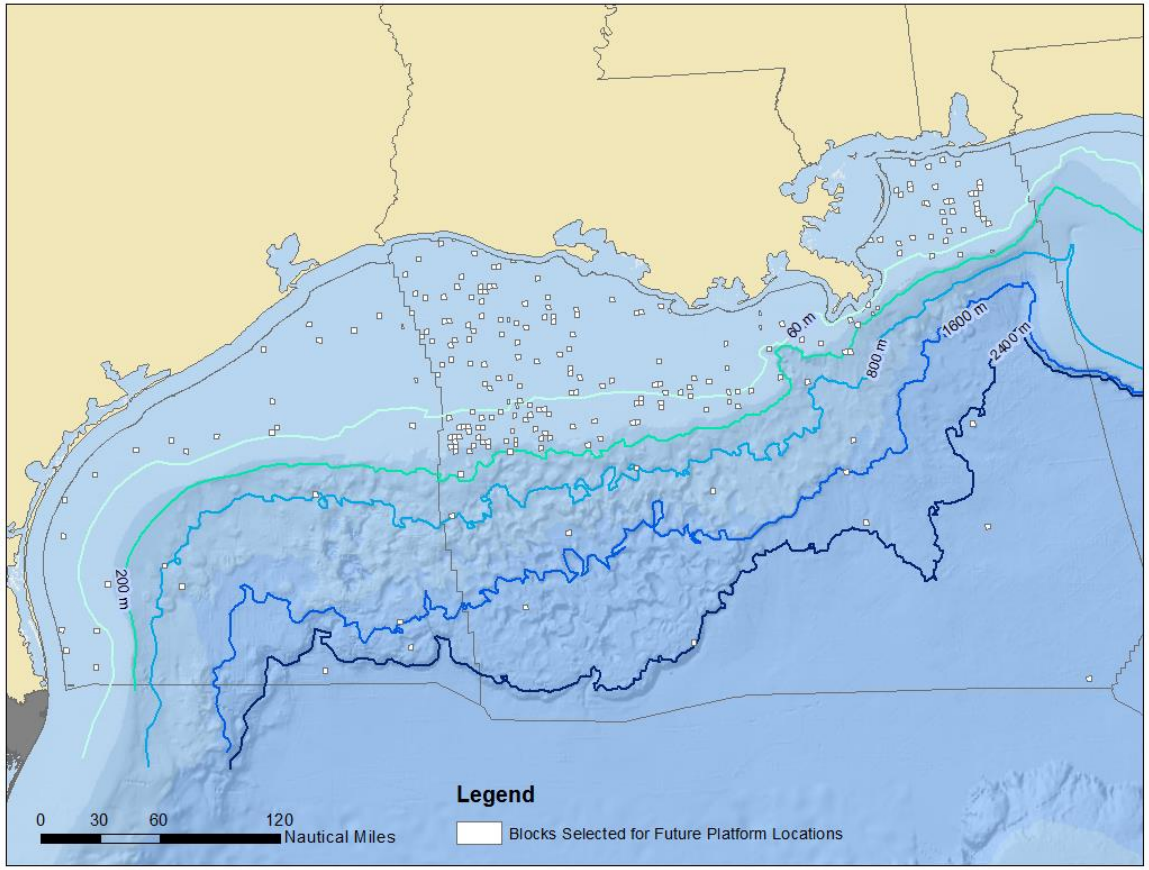
ESTIMATED EMISSIONS FROM ALL FUTURE BOEM SOURCES: EXAMPLE





SPATIAL ALLOCATION OF FUTURE EMISSIONS

- BOEM provided activity level by Planning Area and water depth



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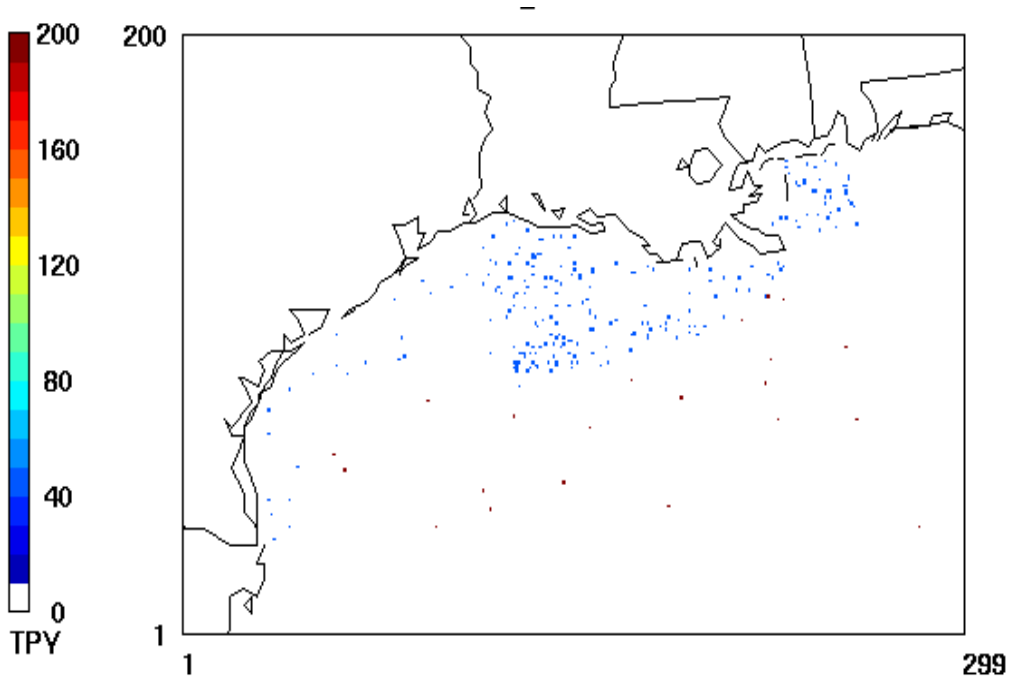
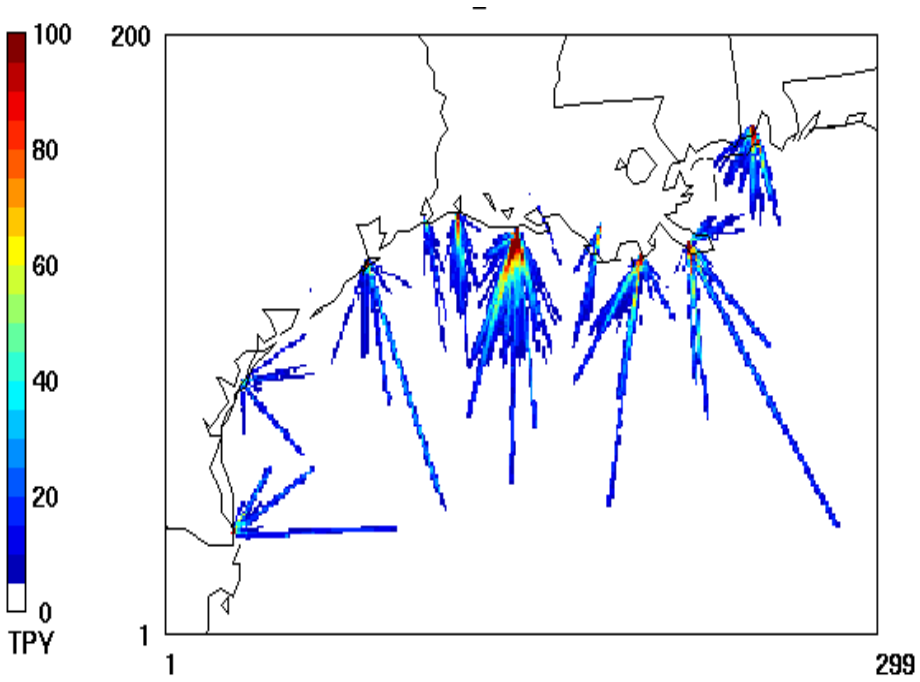
SOURCES ASSOCIATED WITH PROPOSED ACTION (NO_X EMISSIONS)

New Platforms



Additional Support Vessels and Helicopters



METEOROLOGICAL MODELING

METEOROLOGICAL MODELING STUDY TASKS

- Evaluate existing Weather Research & Forecasting Model (WRF) datasets
- Compile new 5-year WRF datasets
  - 2010-2014
  - Hourly resolution
- Used in this Study in the photochemical modeling and EET evaluation tasks
- BOEM will provide to operators for use in future dispersion modeling
- Also planned:
  - Model justification: Evaluation of Offshore and Coastal Dispersion (OCD) modeling results with AERMOD and CALPUFF modeling results

EMISSION EXEMPTION THRESHOLD (EET) EVALUATION

BACKGROUND

- BOEM's Emission Exemption Threshold (EET) is a screening tool to determine if a plan requires additional air quality analysis

- If emissions exceed the EET, the facility is required to conduct air quality modeling and control emissions

BACKGROUND (CONT.)

- Current formulas:

  For CO:

  $$E = 3400 \times (D)^{(2/3)}$$

  For TSP, SO_2, NO_X, and VOC:

  $$E = 33.3 \times D$$

  Where:

  E = Emission exemption amount (tons per year)

  D = Distance to shore (statute miles)

- Formulas were originally developed in the 1980s
- Evaluated against the NAAQS at that time
  - Different averaging times
  - Different indicators (TSP vs. $PM_{2.5}$)

EMISSIONS EXEMPTION THRESHOLD EVALUATION

- Objective: Robust review of the existing formulas to ensure they are still an appropriate screening tool given the changes in averaging times and the need to consider secondary formation of pollutants
- Approach:
  - Develop test sources (synthetic sources)
  - Modeling analysis
    - AERMOD, CALPUFF, and CAMx (secondary affects)
  - Comparison of modeled impact to significant impact levels (SILs) and to EET

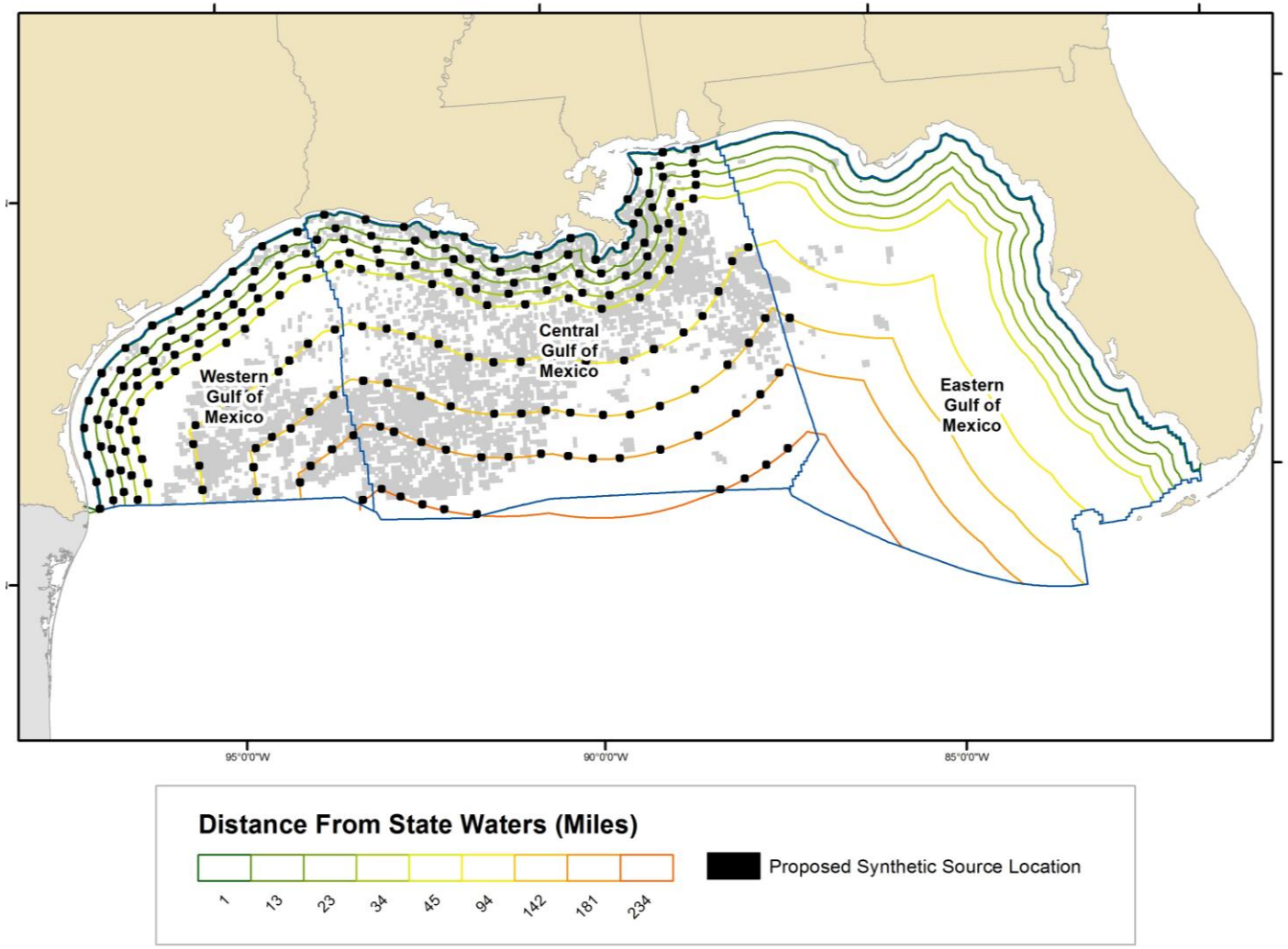
WHAT IS A SYNTHETIC SOURCE?

- Source that is representative of operations in the GOM, but is not a facility that currently exists
- The goal was to develop varying emissions levels that would cover the full distribution of emission levels seen in the GOM
- Reviewed actual Exploration Plan (EPs) and Development Operations Coordination Documents (DOCDs) from the last 5 years to develop a set of equipment configurations to represent five scenarios:

    1. Drilling (DRI) EP with support vessels, well testing
    2. Production (PROD) & DRI DOCD with support vessels
    3. PROD & DRI DPP with support vessels, pipeline emissions, facility installation and well testing
    4. PROD only DPP with support vessels
    5. FPSOs

SYNTHETIC SOURCE: PLACEMENT

- Determine representative distances from shore based on existing active lease block
- Selected modeling locations along these distances from shore lines at even intervals



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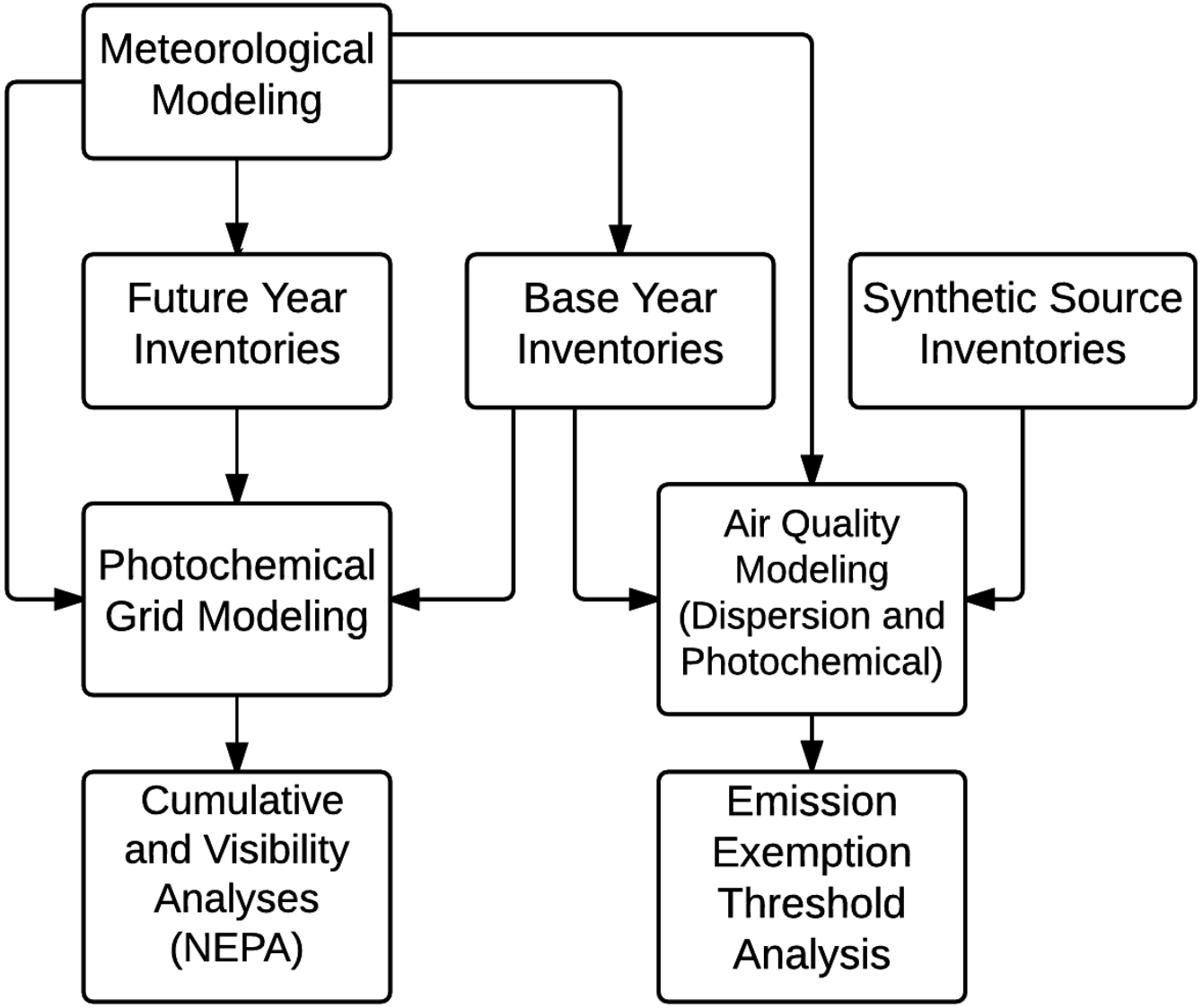
EET MODELING

- Using the same information as the cumulative impacts analysis task:
  - Extractions of the WRF modeling used as meteorology for AERMOD and CALPUFF
  - Same modeling set up and baseline for PGM modeling of secondary impacts



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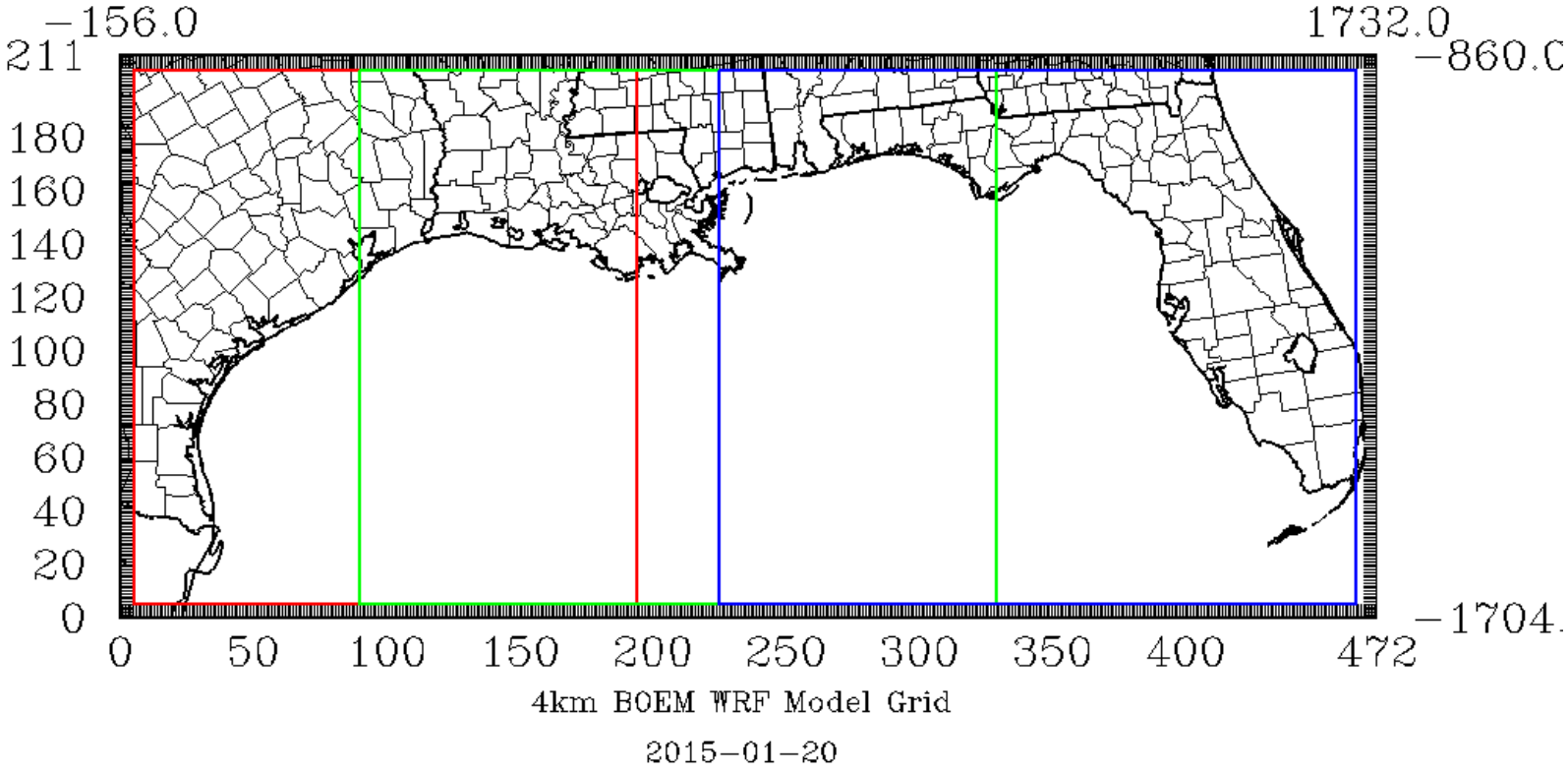
AERMOD MODELING

- AERMOD
  - AERMOD represents state of the science model
  - Model justification document developed and is under review by EPA
- Receptors along coast and Class I areas
- Individual runs for combinations of emission levels and distance to shore throughout the GOM
- MMIF extracted meteorological files will be available to operators at the end of the study

CALPUFF MODELING

- 3 sub-domain to cover GOM region
  - Domains will be available after the study for operator use
- Receptors along coast and Class I areas
- Individualized runs for sources placed at varying distances from shore



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CAMX/CMAQ MODELING

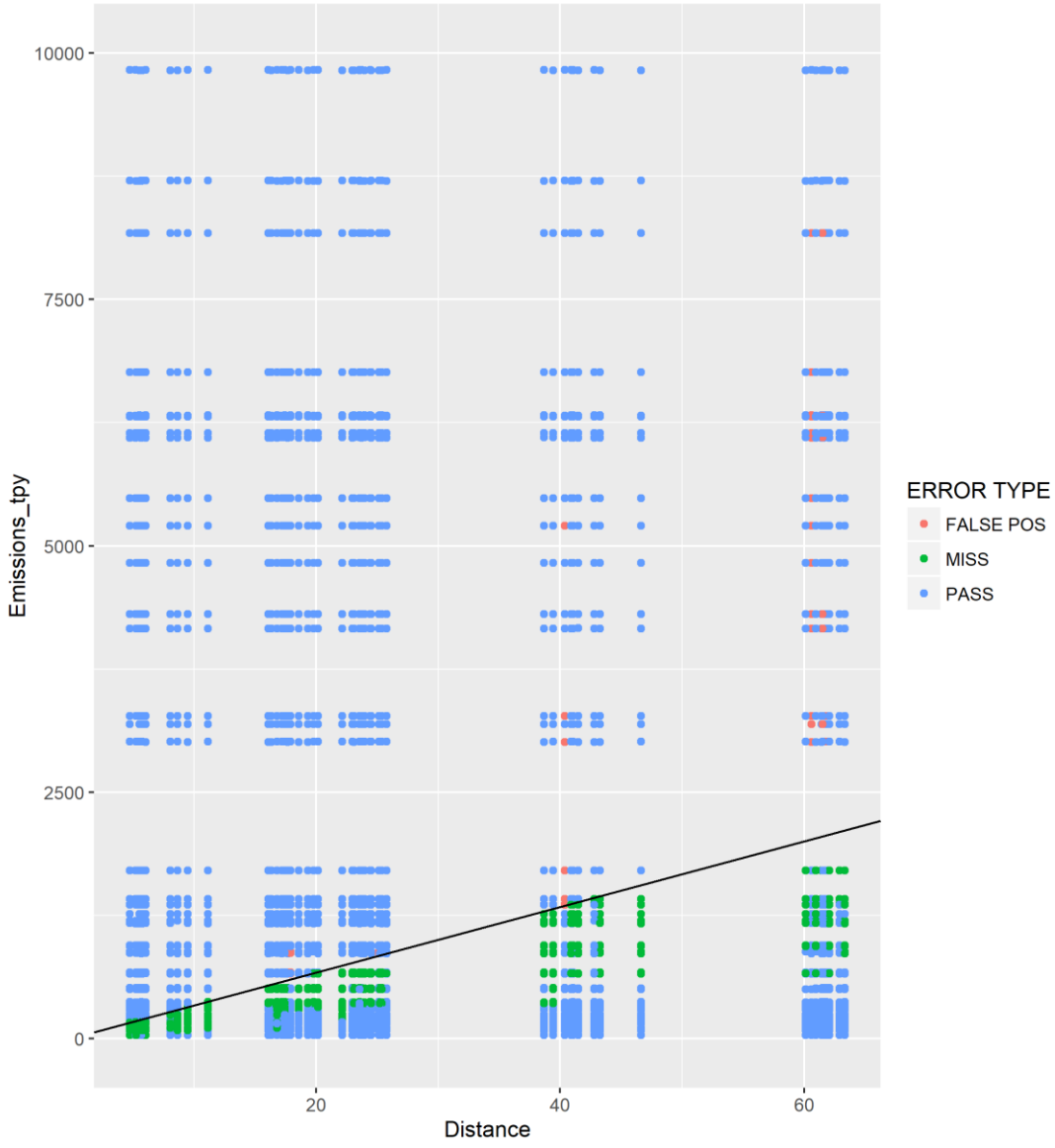
- Used to evaluate secondary formation impacts
- Aim is to be consistent with EPA Draft *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program*

EET EVALUATION (PRIMARY)

- Subject "synthetic" sources to EET formula
  - Does the EET say they should have to model?
- Compare the modeling results to the SILs
- Quantify outcomes
- Review results for patterns of misses and false positives
  - Determine which, if any, pollutants have a significant failure rate
  - Where the misses occur – near/far shore, Western/Central Planning Area

VISUALIZATION OF PERFORMANCE & RECOMMENDATIONS

- **Example** of visualization
  - See Error Type with respect to the current EET for each pollutant/NAAQS
- Also provide tables of percentage of each error type
- Inform BOEM on how EETs could be updated and possible other paths forward



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EET EVALUATION STATUS

- Modeling in progress
  - AERMOD – in progress
  - CALPUFF – in progress

QUESTIONS?