



Republic of the Philippines

Department of Environment and Natural Resources

ENVIRONMENTAL MANAGEMENT BUREAU

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PRIORITIES AND INITIATIVES TOWARDS STRENGTHENING EMISSION STANDARDS FOR COAL-FIRED POWER PLANTS AND POLLUTING INDUSTRIES

15 November 2023

Engr. Jundy T. Del Socorro

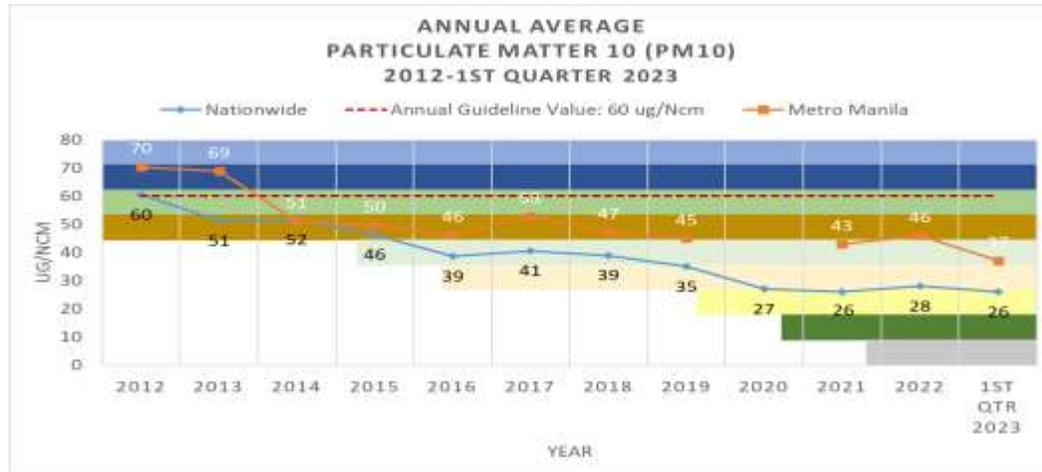
Air Quality Management Section Chief

BAOQ
BETTER AIR QUALITY
CONFERENCE

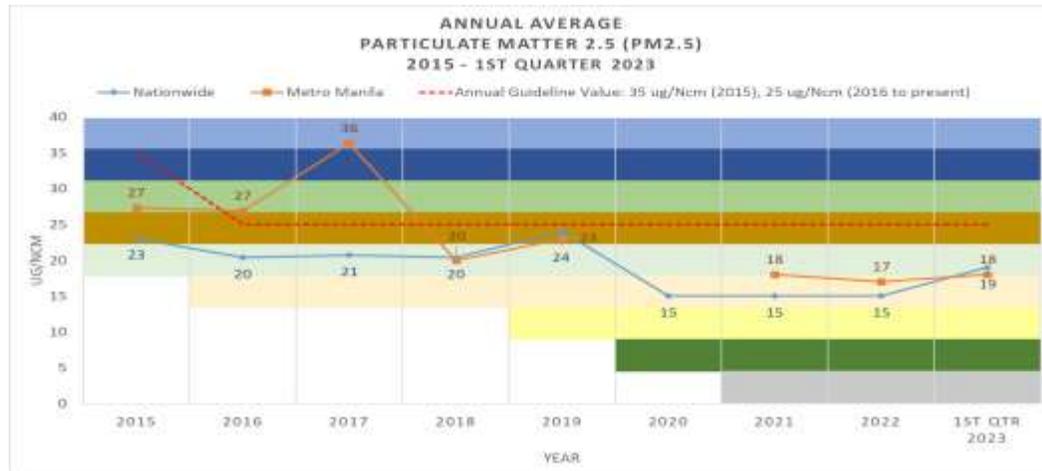




Policies and Particulate Matter (PM₁₀ and PM_{2.5}) Monitoring



PM₁₀ has significantly improved by **57%** (from 60 ug/Ncm in 2012 to 26 ug/Ncm in 1st Quarter of 2023) nationwide and **47%** (from 70 ug/Ncm in 2012 to 37 ug/Ncm in 1st Quarter of 2023) for Metro Manila



PM_{2.5} significantly improved by **22%** (from 23 µg/Ncm in CY 2015 to 18 ug/Ncm in 1st Quarter of 2023) nationwide and **30%** (from 27 ug/Ncm in 2012 to 19 ug/Ncm in 1st Quarter 2023).

- Pursuant to Biofuels Act 2006 minimum of 2% biodiesel content of Diesel
- Pursuant to Biofuels Act 2006 minimum of 1% biodiesel content of Diesel
- Pursuant to Biofuels Act minimum 5% bioethanol content of Gasoline
- Pursuant to Biofuels Act minimum 10% bioethanol content of Gasoline
- Implementation of EURO IV Fuels
- Implementation of EURO IV/4 Emission Standards
- Reinstatement of requirement for the firms to submit test result for Sulfur Dioxide (SO₂)
- Implementation of Air Quality Network Center, requiring major industries to connect their CEMS/COMS to EMB Data Center.
- Implementation of Oxygen Correction factor for industries

Proposed Road Map for Clean Air

Ongoing revision of ambient air quality standards (hazardous air pollutants) and emission standards (mass emission rate standards)
Ongoing review of Emission Charge System (ECS)

Full implementation of real-time DAHS for firms with CEMS
The transition of PETC to PMVIC
Designation of attainment/non-attainment airshed areas
Development of Guideline Values for additional hazardous air pollutants (black carbon, dioxin, furans, some trace metals)
Review/revision of guideline values for other criteria pollutants
Initial Airshed Attainment Designation
Additional Online systems for Stack Testing & Accreditation, CEMS-RATA Submission

Adoption of Euro V Fuel Standards
Implementation of at least 5% of Government Fleets shall be EV (EMB proposal)
EVIDA Law CREVI
Transition to 10% ethanol (gasoline) and 5% (diesel)
Review of Ambient Air Qty Guideline Values

Improvement in air quality and reduction of air pollution

2023

2025

2027

2024

2026

2028

Review of Euro V Emission and Fuel Standards
Implementation of at least 5% of Corporate and Government Fleets shall be EVs; gov't- bet. 2023 to 2030 – DOE
Review/revision of guideline values for PM₁₀
Review/implementation of policy for Local Air Quality Monitors, e.g. sensors
Development of mass emission rate standards

Development of Guideline Values for additional hazardous air pollutants (BC, PAH, VOC, H₂S, DF, metals, Criteria Air Pollutants)
Review/revision of guideline values for other criteria pollutants
Implementation of developed mass emission rate standards
Implementation of emission charge system
Implementation of emission standards mass emission rate standards, Emission Quota (Industrial Airshed)

Adoption of Euro V Emission Standards
Full implementation of the PUVMP, including VULP

Implementation of MC 2021-14: “Establishment of an Integrated Air Quality Network Center using a Uniform Data Acquisition and Handling System (DAHS) which shall act as Repository of Firms with Continuous Emission/Opacity Monitoring Systems (CEMS/COMS)”



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EMB MEMORANDUM CIRCULAR No. 2021 - 14

SUBJECT : ESTABLISHMENT OF AN INTEGRATED AIR QUALITY NETWORK CENTER THAT MONITORS AND SERVES AS REPOSITORY OF REAL-TIME INDUSTRIAL EMISSION FROM FIRMS REQUIRED TO INSTALL CONTINUOUS EMISSIONS MONITORING SYSTEMS (CEMS)/CONTINUOUS OPACITY MONITORING SYSTEM (COMS) THROUGH THE USE OF A UNIFORM DATA ACQUISITION AND HANDLING SYSTEM (DAHS), AND IN RELATION TO CLARIFY PERTINENT PROVISIONS OF DEPARTMENT ADMINISTRATIVE ORDER NO. 2017-14

SECTION 1. RATIONALE

Section 38 of the Philippine Clean Air Act of 1999 (RA 8749), the Department through the Bureau shall require any person who owns or operates any emission source to: (a) establish and maintain relevant records; (b) make relevant reports; (c) install, use and maintain monitoring equipment or methods.

Continuous Emissions Monitoring Systems/Continuous Opacity Monitoring Systems (CEMS/COMS) are globally recognized technology used to measure emissions/opacity in stacks of industrial sources.

Under Department Administrative Order No. 2000-81, in relation to Department Administrative Order No. 2007-22 “Guidelines on the Requirements for Continuous Emission Monitoring Systems (CEMS) and Other Acceptable Protocols, thereby Modifying and Clarifying certain Provisions of Section 5, Rule X of DAO 2000 - 81 and Other Related Provisions”, major industries are required to install CEMS/COMS to monitor their industrial emission.

SECTION 3. DEFINITION OF TERMS

- a. **Excess Emission** – the emission concentration recorded by CEMS/COMS which exceeds any applicable emission limits or standards pursuant to Section 19 of RA 8749. The said excess emission shall be considered as actual exceedance under Section 45 thereof.
- b. **Data Acquisition and Handling System (DAHS)** – the CEMS hardware and software components that take the output from the analyzers, combine it with other information, compute emissions.
- c. **Startup** – the setting-in of operation of an affected facility for any purpose. The end of the startup period shall begin upon the return to the normal operating condition of an Air Pollution Source Equipment/Installation (APSEs/APSIs) from a shutdown and/or malfunction state, such as but not limited to the following: return of power supply to the Grid/In-House; return to normal operation or manufacturing condition.
- d. **Show Cause Order (SCO)** – an order issued by the Bureau, or any of its authorized representatives, apprising the firm subject of the complaint, indicating the acts or omissions being complained of, and requiring them to explain the said acts or omission.
- e. **Shutdown** – the cessation of operation of an affected facility for any purpose.
- f. **Malfunction** – any sudden, infrequent, and not reasonably preventable failure of air pollution control equipment, process equipment, or a process to operate in a normal or usual manner. Provided, that failures caused in part by poor maintenance or careless operation are not malfunctions.
- g. **Zero-Data Loss** – a configuration in the system to preserve the data by having a buffer of at least 60 days in the event that a communication cannot be established.



a UNEP convened initiative

CEMS and COMS Requirements



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MC 2021-14

SECTION 6: DETERMINATION OF EXCEEDANCE THROUGH THE USE OF EXCESS EMISSION AVERAGING TIME

The DAHS shall automatically determine the excess emission averaging time and compare it with the applicable standards

1. **Opacity** - any **rolling 5-minute period** during which the average opacity of emission exceeds 20% opacity.
2. **Oxides of Sulfur as Sulfur Dioxide (SO_x as SO₂)** - any **rolling 3-hour period** during which the average emission (rolling arithmetic average of 3 contiguous 1-hour periods, reported every 5 minutes) exceeds the applicable standards.
3. **Oxides of Nitrogen as Nitrogen Dioxide (NO_x as NO₂)** - any **rolling 3-hour period** during which the average emissions (rolling arithmetic average of 3 contiguous 1-hour periods, reported every 5 minutes) exceeds the applicable NO_x as NO₂ standards.
4. **Particulate Matter (PM)** – any **rolling 1-hour period** during which the average emissions (rolling arithmetic average of 1-hour periods, reported every 5 minutes) exceed the applicable standards.
5. **Carbon Monoxide (CO)** - any **rolling 4-hour period** during which the average emissions (rolling arithmetic average of 4 contiguous 1-hour periods, reported every 5-minutes) exceed the applicable standards.

CEMS and COMS Requirements



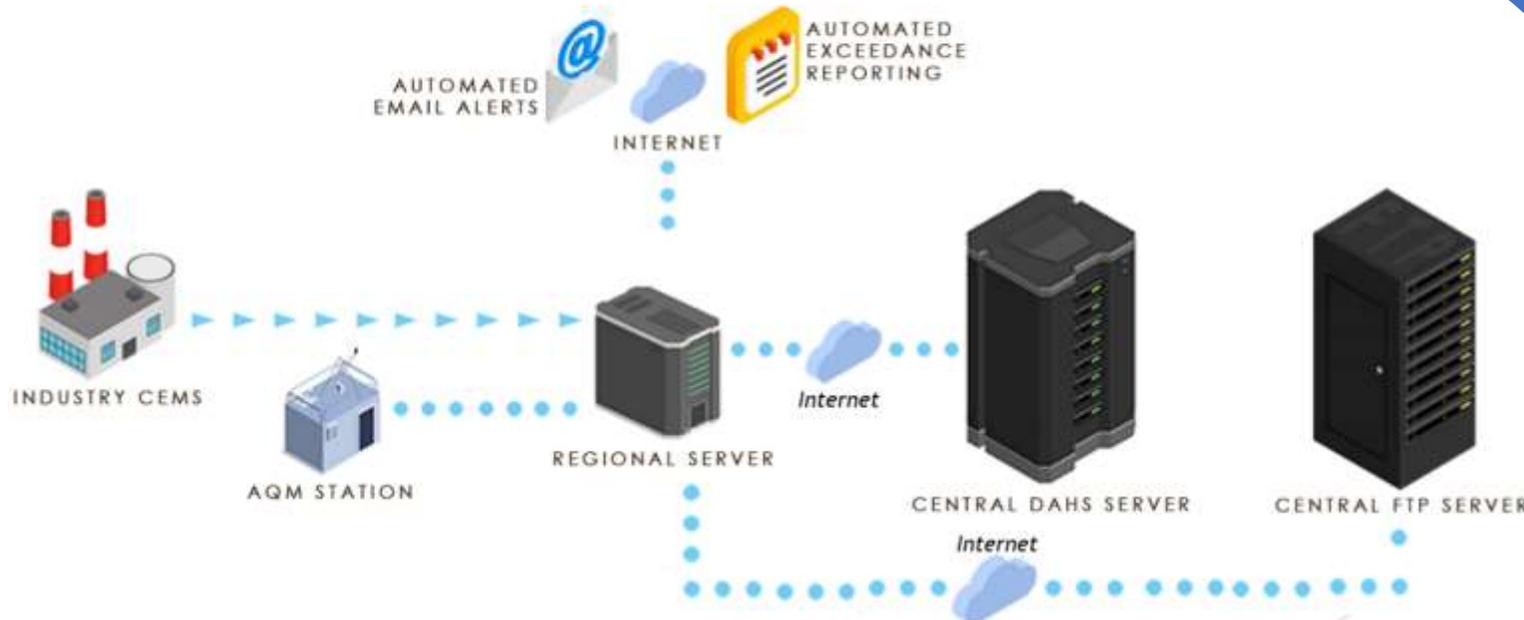
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SECTION 7: ACTIONS TAKEN IN CASE OF EXCEEDANCES

ANNEX B

PRESCRIBED FRAMEWORK FOR EMB AIR QUALITY NETWORK OPERATION CENTER



Exceedance detected by the DAHS

Email SCO to the proponent

Proponent to submit explanation in 24 hours

If no explanation, exceedance shall be considered legitimate

Endorsement to PAB

CEMS and COMS Requirements



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ANNEX D DATA TRANSMISSION

1. Opacity (any rolling five-minute period)

e.g:

30 % Opacity Exceedance No.1 for Day 1:

8:05AM to 8:10AM

5-minute exceedance (1 hour average is composed of 12 X 5-minute reading)
(reported 8:10AM)

30 % Opacity Exceedance No.2 for Day 1:

9:10AM to 9:15AM

5-minute exceedance (1 hour average is composed of 12 X 5-minute reading)
(reported 9:15AM)

Note: Show cause order (SCO) reported for Day 1, showing Exceedance No.1 and No.2

Exemption: As per Section 2 (b) of Rule XXV of DAO 2000-81-Visible Emission Standards for Smoke and Opacity, exceptions to the requirements stated herein may be allowed under the following circumstances:

1. The opacity limit hereinbefore prescribed shall not apply to the emission of dark smoke for less than five (5) minutes in a period of one (1) hour provided that the total period of such emission shall not exceed an aggregate of fifteen (15) minutes in any twenty-four (24) hours;

Scenario 1: Day 1

Opacity=21% (0400 -0404); 30%(0415-0418); 45%(0445-0448)

Opacity Exceedance >20% = 4 minutes+ 3minutes+3Minutes= 10 minutes

Evaluation: < 5minutes per occurrence; within 1 hour; < 15 minute Aggregate, within 24 hour cut off

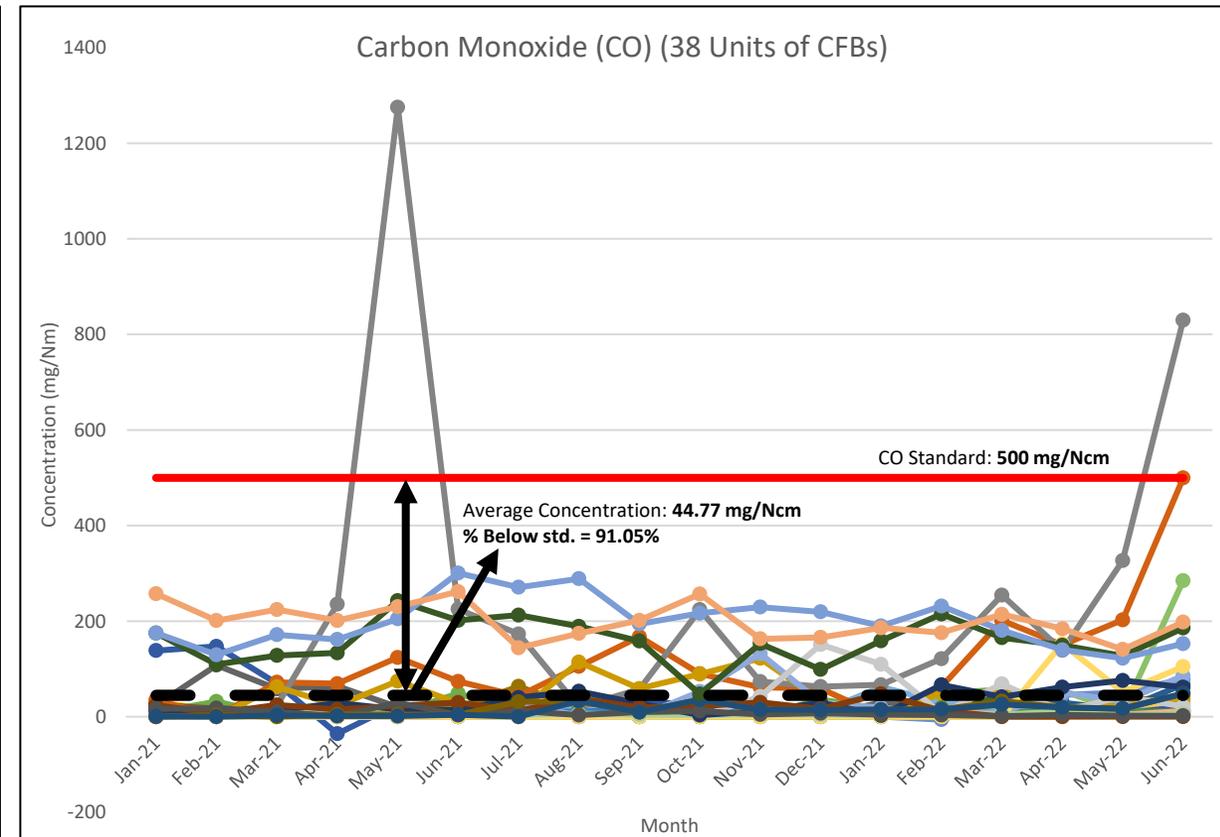
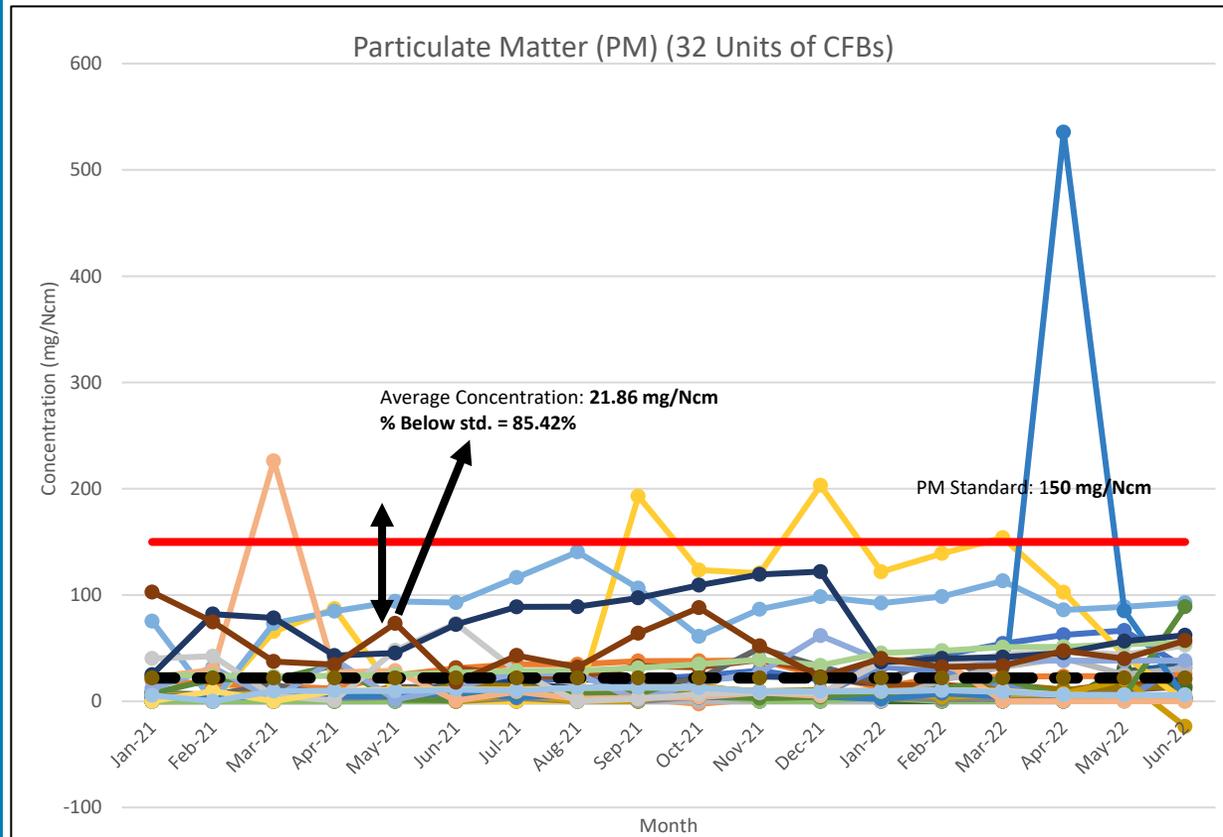
Scenario 2: Day 2

Opacity=23% (0400 -0406); 32%(0410-0418); 41%(1200-1207 –Sept 13,2020)

Opacity Exceedance >20% = 6 minutes+ 8 minutes+7 Minutes=21 minutes

Evaluation: >5minutes per occurrence; not within 1 hour ; > 15 minute Aggregate, passed 24 hour cut off (0000 to 1200)

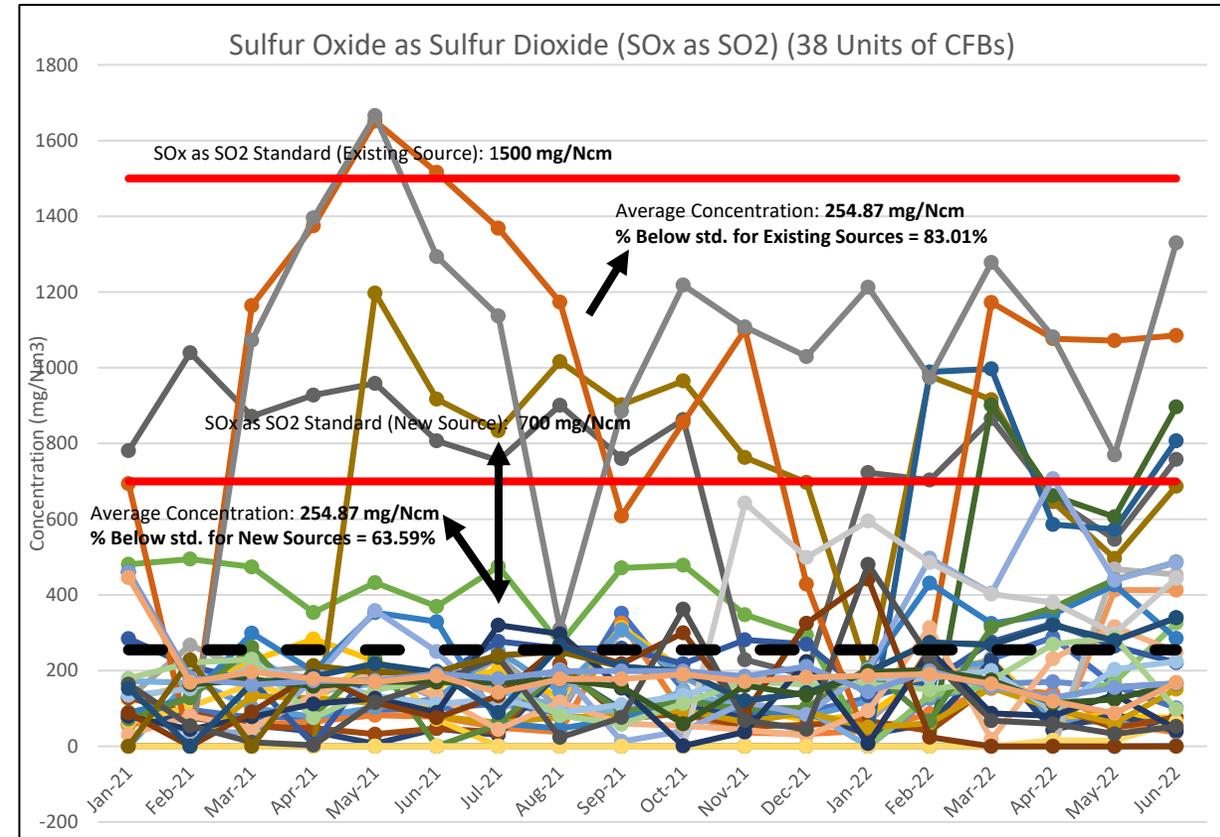
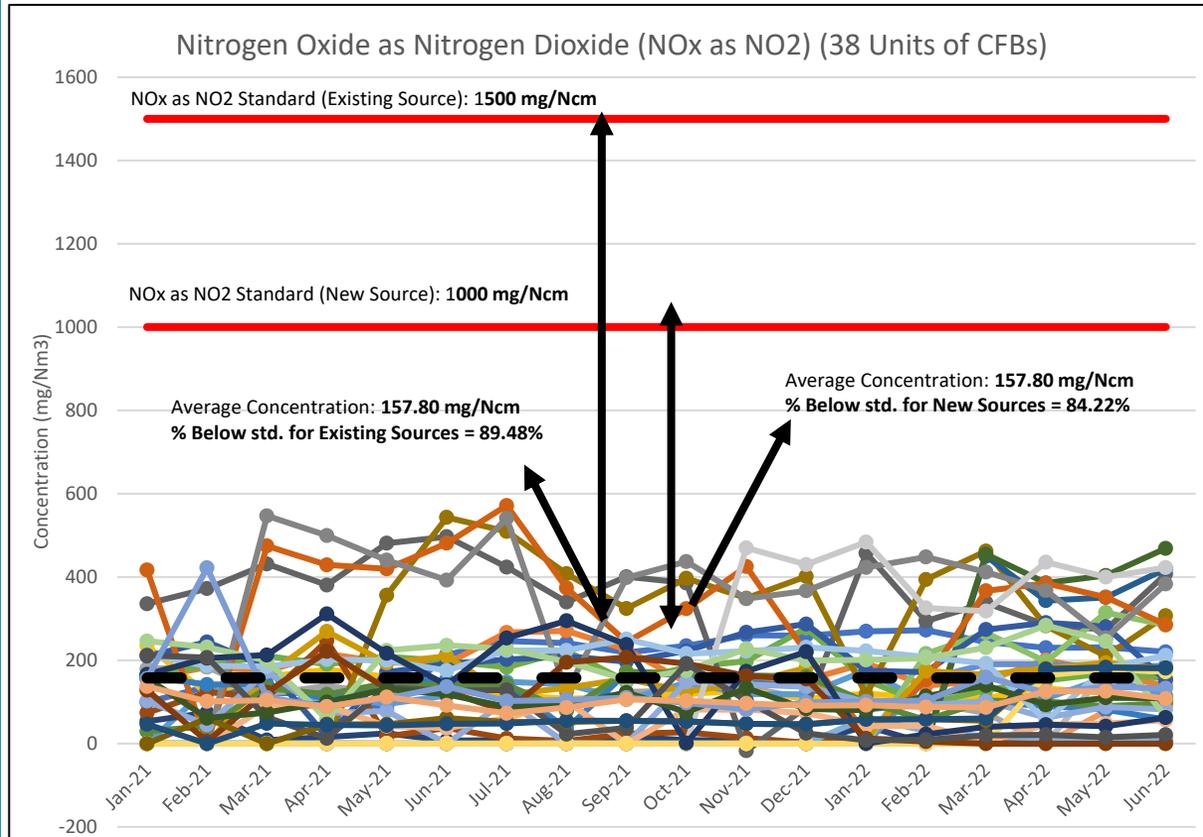
CEMS Data Analysis (32 CFB Units)



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CEMS Data Analysis (32 CFB Units)

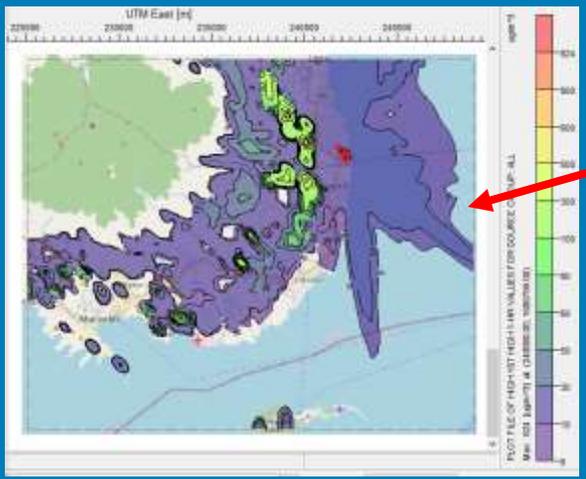


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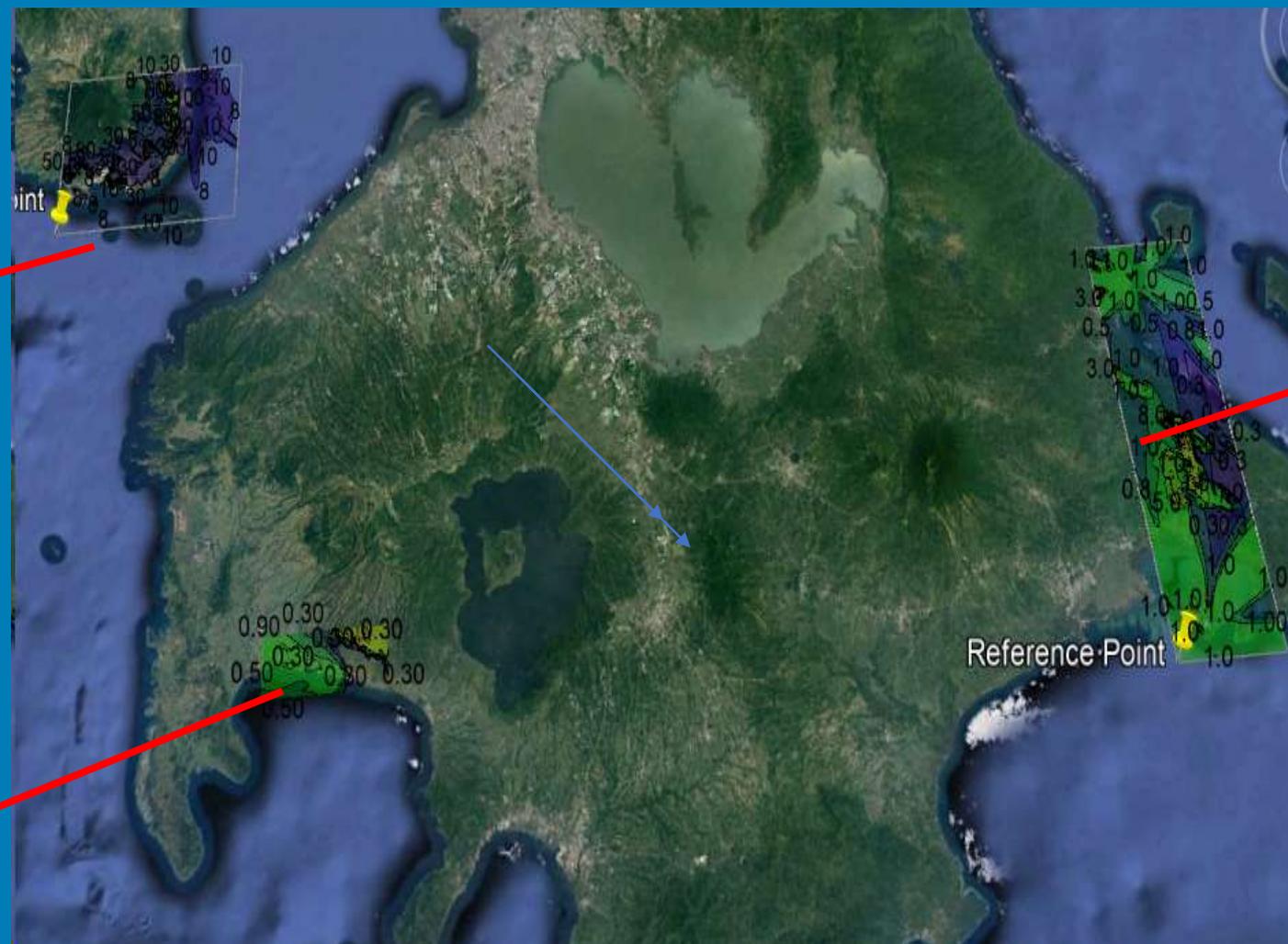
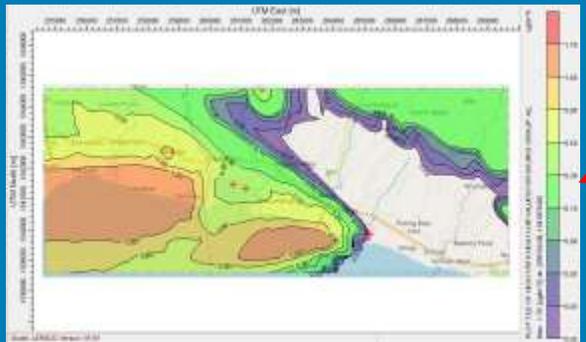


Coal-Fired Power Plants Emission Assessment of NESSAP and 2022 CEMS Data AERMOD 11.2 NESSAP Domain in Three (3) Luzon Areas

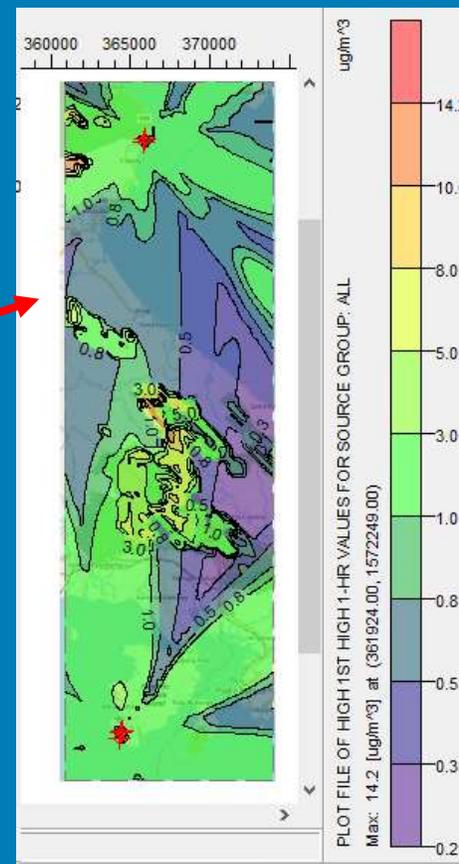
Bataan, Region 3



Batangas, Region 4A



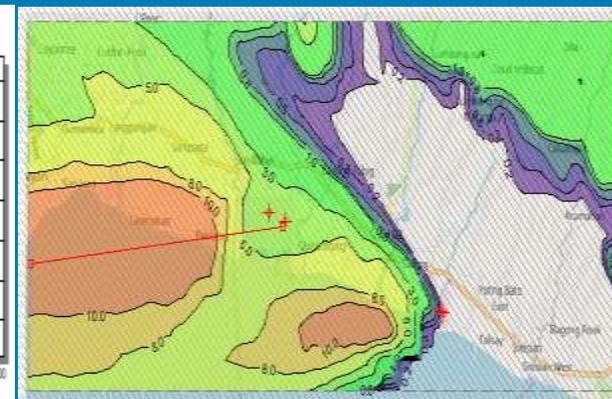
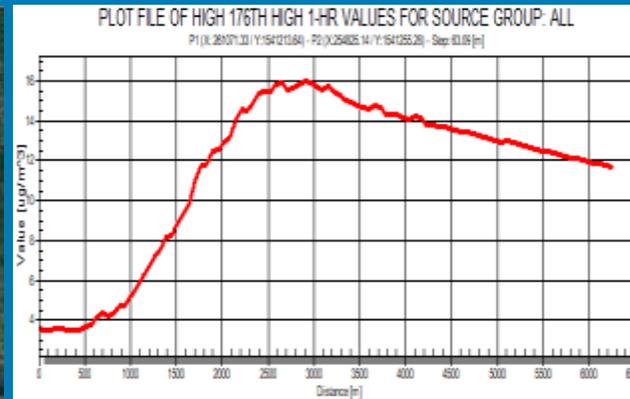
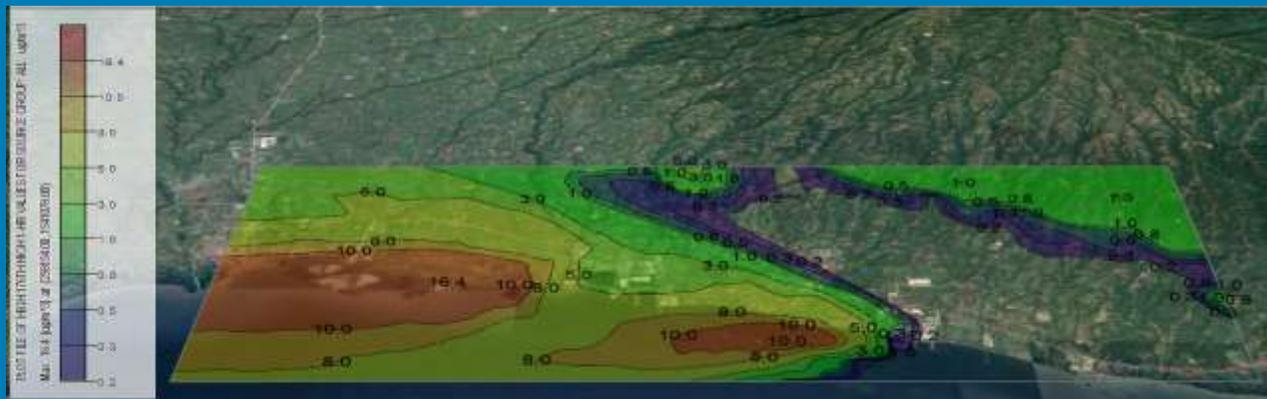
Quezon, Region 4A



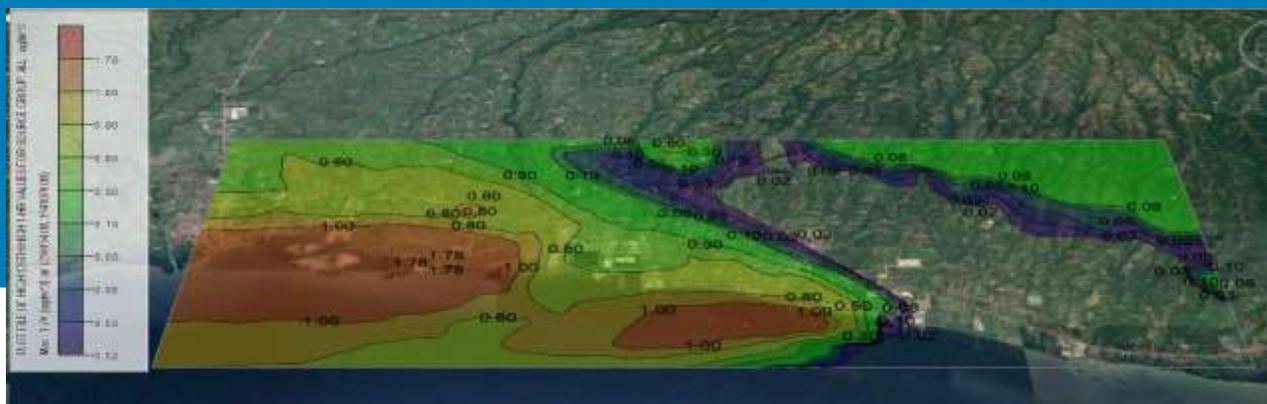
Coal-Fired Power Plants Emission Assessment of NESSAP and 2022 CEMS Data AERMOD 11.2 NESSAP



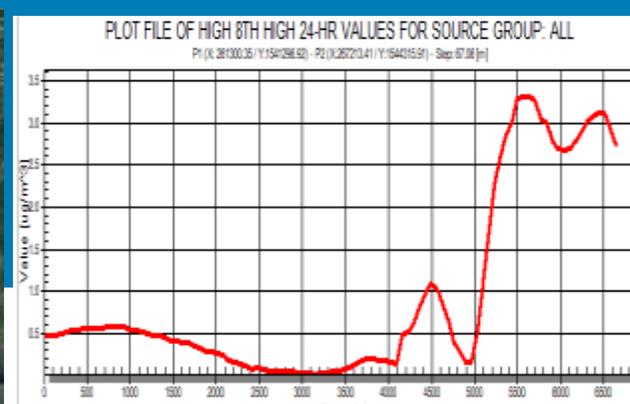
PM 1 hr 98th Percentile NESSAP



1 hr 98th Percentile 2022 CEMS Data 32 CFBs



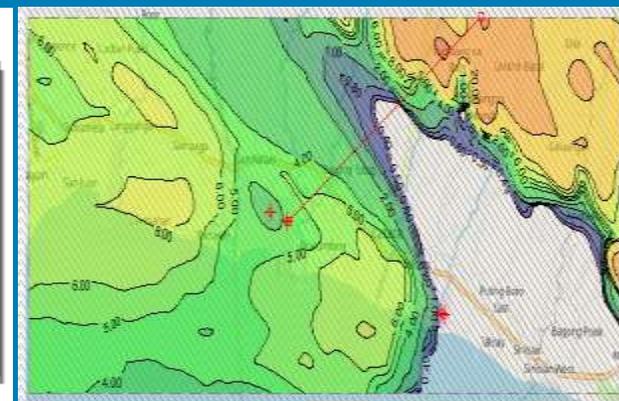
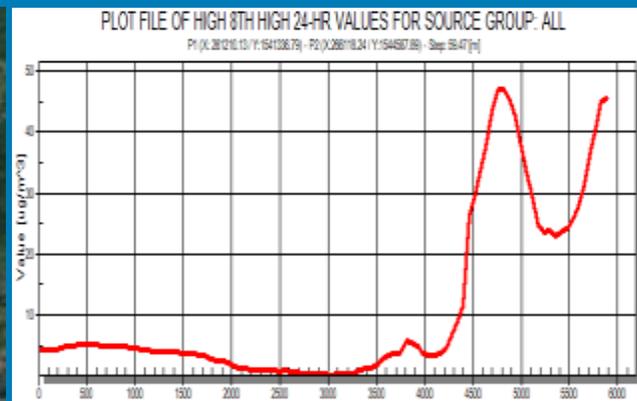
GLC max Plume Cross Section



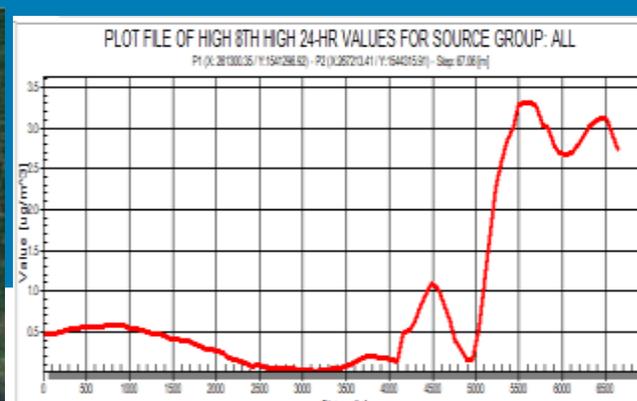
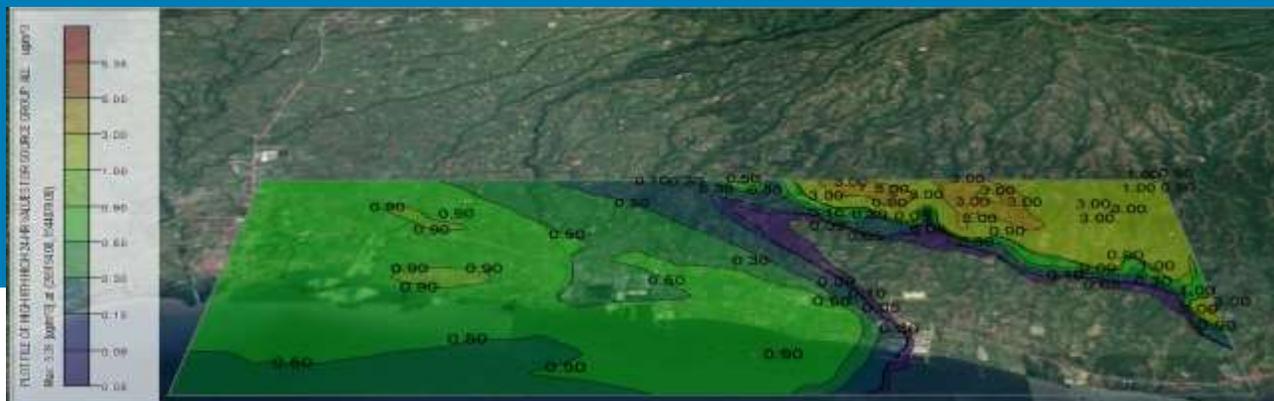
Coal-Fired Power Plants Emission Assessment of NESSAP and 2022 CEMS Data AERMOD 11.2 NESSAP



PM 24 hr 98th Percentile NESSAP



24hr 98th Percentile 2022 CEMS Data 32 CFBs



Assessment of Ambient Air Qty Data in Reviewing the NESSAP using Applications of Statistical Analysis in Air Quality Management

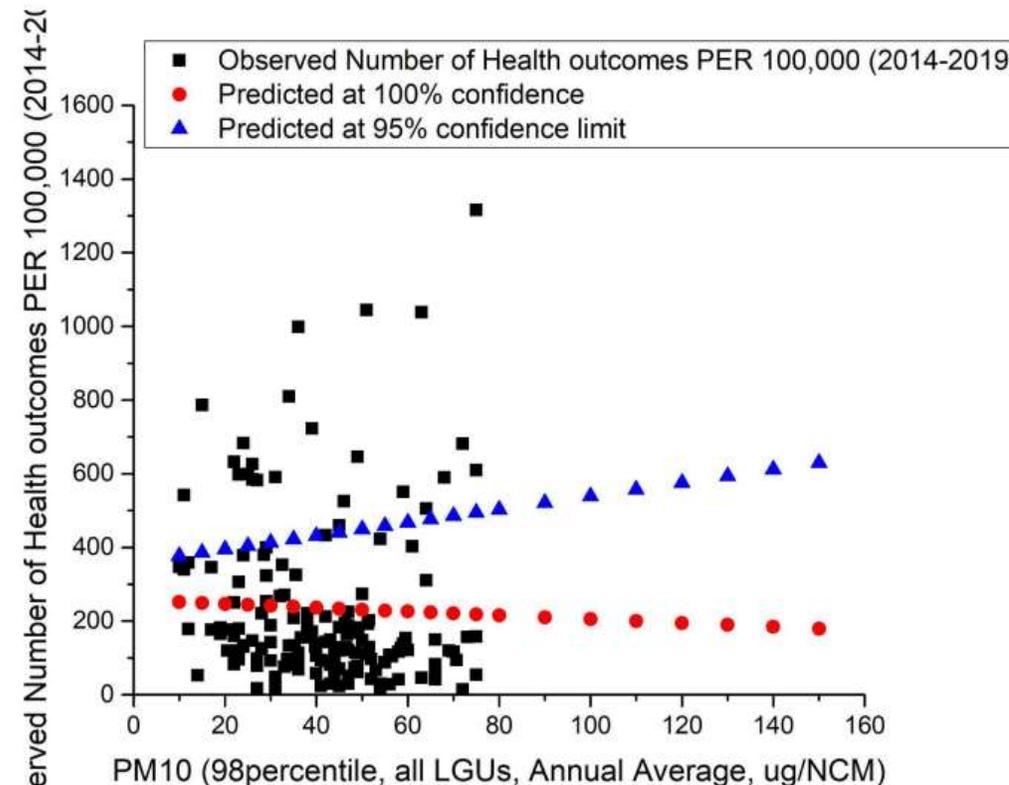
Annual PM 10, ug/NCM	Actual (Predicted, 95%UCL) Number of Health Outcomes per 100,000 people	WHO (2021)	Remarks
20	251 (395)		Recommended Annual GV 2~4 in 10,000
30	241 (413)		2~4 in 10,000
40	236 (431)		2~4 in 10,000
50	231 (449)		2~4 in 10,000 Recommended revised DAILY GV
60 (current annual GV)	226 (467)	15 ug/m3 (Annual)	2~5 in 10,000
90	210 (521)		2~5 in 10,000
120	194 (575)		2~6 in 10,000
150 (current Statistics)	179 (629)	45 ug/m3 (Daily)	2~6 in 10,000

	Observed Number of Health outcomes PER 100,000
Number of Points	154
Degrees of Freedom	152
Reduced Chi-Sqr	54136.33345
Residual Sum of Squares	8.22872E6
Pearson's r	-0.03582
R Value	0.03582
R-Square(COD)	0.00128
Adj. R-Square	-0.00529
Root-MSE (SD)	232.67216
Norm of Residuals	2868.57503

Health Outcomes: COPD, Asthma

Summary

	Intercept				Slope				Statistics	
	Value	Standard Error	95% LCL	95% UCL	Value	Standard Error	95% LCL	95% UCL	R-Square(COD)	Adj. R-Square
Observed Number of Health outcomes PER 100,000	256.91832	51.84162	154.49514	359.34151	-0.51873	1.17376	-2.83772	1.80026	0.00128	-0.00529



1 in 10,000 : High risk
 1 in 100,000: Moderate risk
 1 in 1,000,000: Low risk
 (US EPA, 2005)



Way Forward Policies

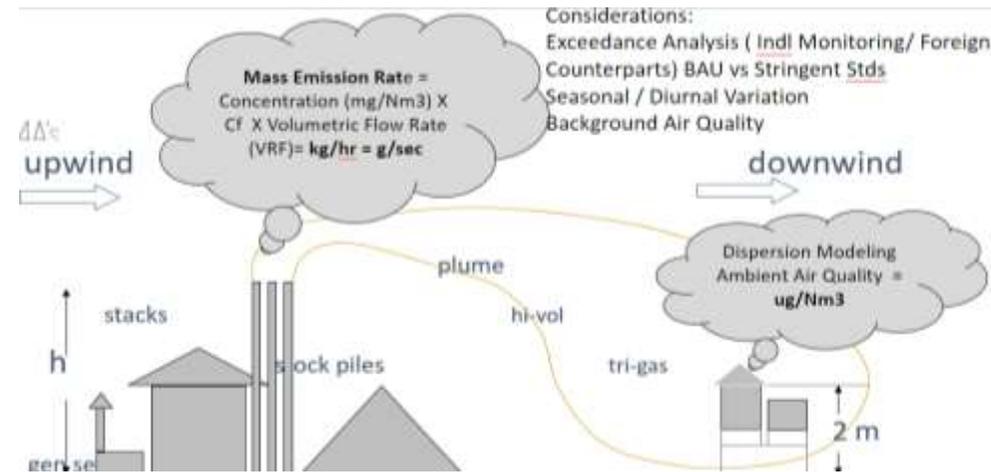
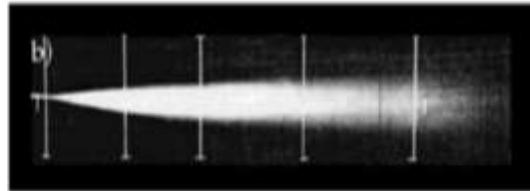
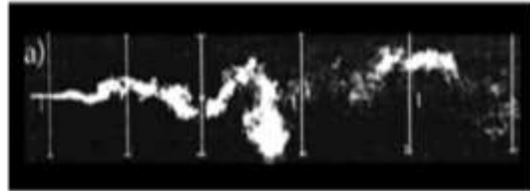
Ongoing Review of NESSSAP Towards Mass Emission Rate Standards

Emission

Concentration = 1 hr Snap Shot of Emission (mg/Nm³)

Mass Rate = Accumulation of Emission over period a period of operating

mg/Nm³ x VFR = Kg/hr X AOH = Tons/ yr



Industry Category MERS review

1. Liquid fuel
 - Fuel-burning equipment using light fuel oil (LFO) i.e. gensets and boilers
2. Solid fuel
 - 2A: Coal, power plants, both on-grid and off-grid
 - 2B: Biomass power plants C
3. Gaseous fuel
 - 3A: Fuel-burning equipment using CNG, etc.
 - 3B: Industrial process equipment – cement industry D
4. Industrial process equipment
 - 4A: Steel smelting and/or rolling; steel sintering
 - 4B: Glass manufacturing and others

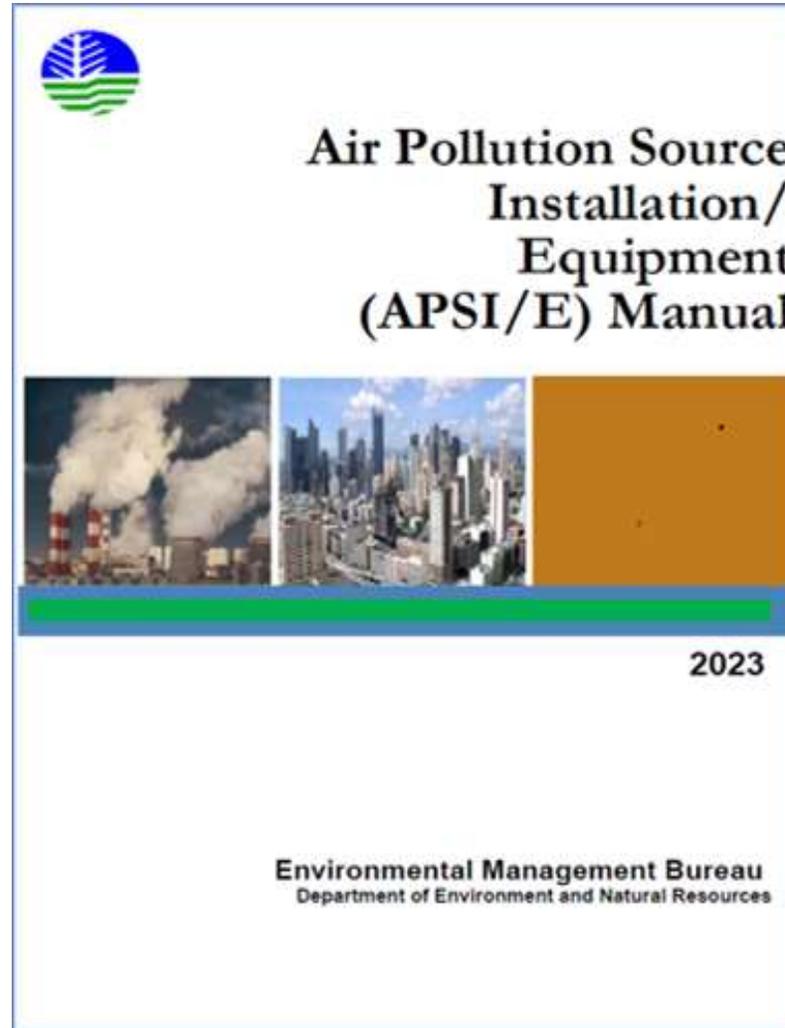


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Way Forward Policies

OPMS Requirements for PTO Application (Updates, Improvements)

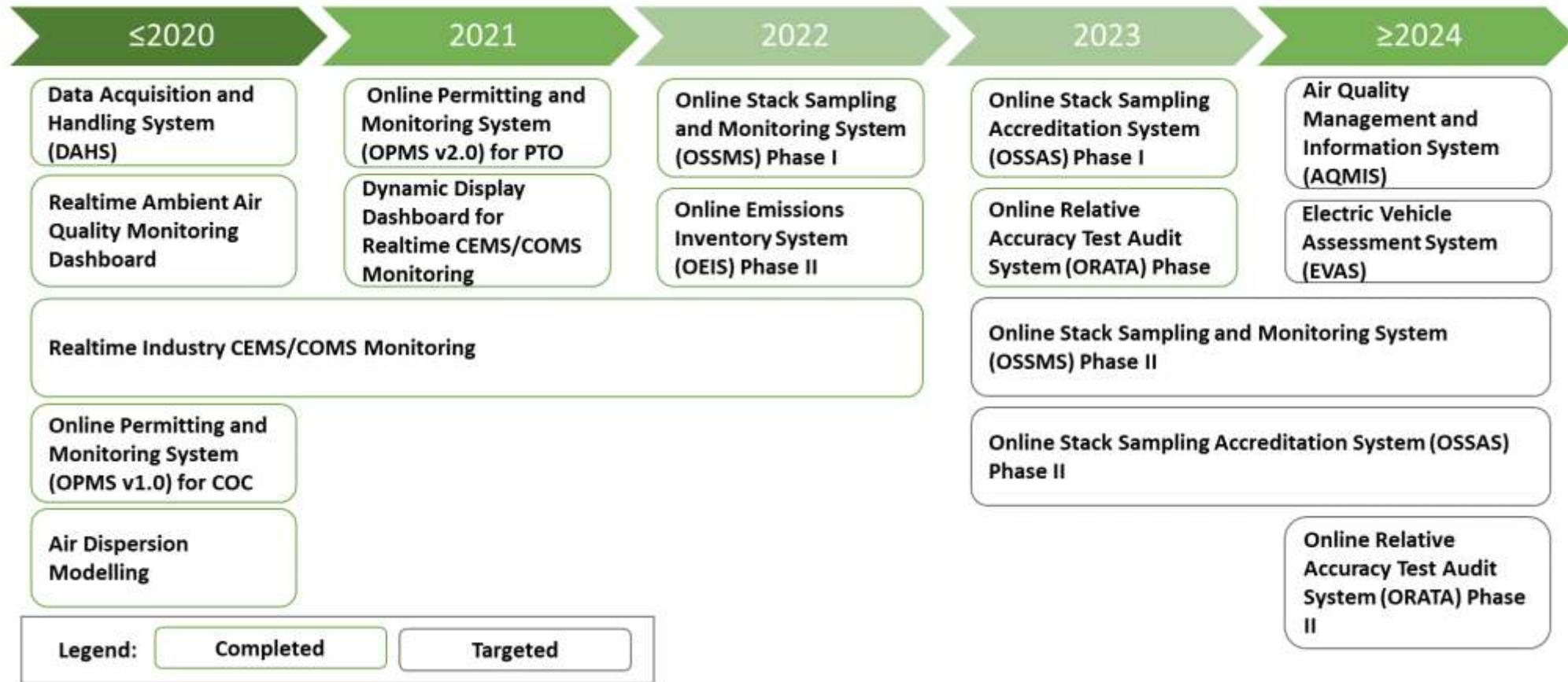


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Way Forward Policies

Air Quality Management Online Systems



Way Forward Policies

Development of Emission Charge System

$$EC = E_n \times R$$

EC Emission charge or emission discharge fee (in Php/year or Php/quarter)

E_n Rate per kilogram of priority pollutant emitted (eg., Php/kg of PM)

R Net mass emission discharge (kg/year or kg/quarter)

$$E_n = [E_c \times Q_f \times N_f] \times C_F$$

E_c Emission concentration (mg/Ncm) from stack sampling/CEMS (whichever is applicable)

Q_f Dry standard volumetric flow rate of stack emission (Nm³/day)

N_f Number of days/year in operation emitting pollutants

C_F Unit conversion

The outcome of the calculation was an emission fee for PM₁₀, which is roughly equivalent to **Php 110,000++/ton** or **Php 110/kg**

$$F_P = F_{Base} + (F_{Source1} + F_{Source2} + F_{Source3} + \dots + F_{SourceN}) \times f_{Airshed,x}$$

where
F_P

Annual emission fee for emissions from all sources included in permit P subject to emission monitoring or reporting
Annual fixed basic fee for emissions from sources included in permit P

F_{Source1} / F_{Source2} / ...

Annual emission fee for source 1 / source 2 / source .. / source N included in permit P and subject to emission monitoring or reporting

F_{Source2} / F_{SourceN}

F_{Source1} / m_{1,SO2}

= $f_{SO2} \times m_{1,SO2} + f_{NOx} \times m_{1,NOx} + f_{CO} \times m_{1,CO} + f_{PM} \times m_{1,PM} + f_{speo} \times$

where

f_{SO2} is a factor for SO₂ expressed in PHP
f_{NOx} is a factor for NO_x expressed in PHP
f_{CO} is a factor for CO expressed in PHP
f_{PM} is a factor for PM expressed in PHP
f_{speo} is a factor for specific air pollutants e.g. VOCs or HAPs expressed in PHP

m_{1,SO2} / m_{1,NOx} / m_{1,CO} / m_{PM} is the mass of SO₂ (NO_x / CO / PM) emitted from source 1 in the period between day of birth of anniversary of permit and day of calculating the fee. (Normally one year period from anniversary to following anniversary), expressed in tons

f_{Airshed} x is a weighing factor for airshed X, to which emissions of sources subject of permit P (permit to operate/ temporary permit) contribute, the factor might be specified also for attainment / nonattainment areas within given airshed

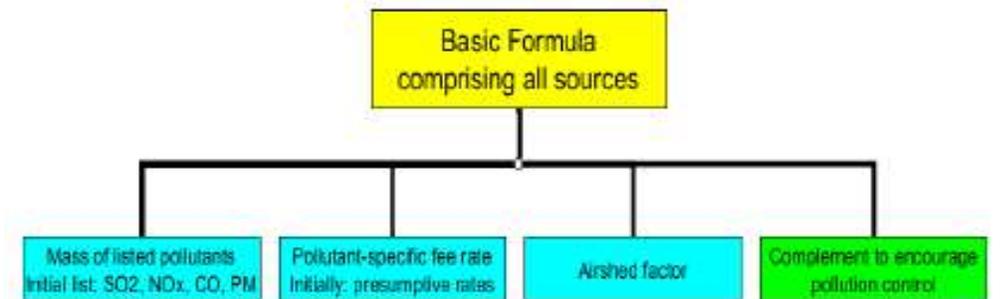


Figure 11: Terms included in the basic formula to calculate emission fees



Thank you for listening!

Please visit

<https://air.emb.gov.ph/>

For Air Quality Permits, please visit

<https://emb.gov.ph/air-quality-management-permits/>



**PTO
ONLINE** Permit to Operate Air



**COC
ONLINE** Certificate of Conformity



**FEES AND CHARGES OF
FRONTLINE SERVICES**



**Online Permitting and Monitoring System
Process Flow**

For Air Quality Statistics

<https://emb.gov.ph/air-quality-management-data/>



Air Quality Data



Emission Inventory



**Third Party Source Emission
Testing Firms**