

Greenhouse Gas Mandatory Emissions Reporting

Power/Utilities Sector Third Technical Discussion



**June 21, 2007
Sacramento**

Draft Regulatory Concepts



Draft Regulatory Concepts For Mandatory Reporting

Who, What, How, and When
Stationary Combustion Emissions
Process Emissions
Fugitive Emissions
Mobile Emissions
Repository by Facility
Indirect Emissions

Defining a Facility

- Sources of GHGs on contiguous or adjacent properties
- Common operational control with authority to implement environmental, health, safety rules

Who Will Report

Source Based

- In-state Operators of Generating Facilities ≥ 1 MW by Power Unit (Fossil Fuels, Biomass/Biogas, Geothermal)
- No Reporting from hydro, wind, solar, or nuclear facilities (Hybrids will report)
- Operators of an out-of-state facilities (Optional)

Load Based

- Electric Retail Providers
- Marketers/Brokers

Who Will Report (Continued)

Under Separate Section of the Regulation

- Operator of Co-Generation and Self-Generation

Facilities \geq 1 MW

- Co-Generation and Self-Generation regardless of size if part of a refinery, cement plant, or other operation that already reports under a different sector

What, How, and When

- CO₂, N₂O, CH₄, HFCs, PFCs, SF₆
- Operational/Management Control
- Annually (Phased-In)

In-state Generating Facilities Will Report

- MW Rating
- Annual Net MWh of Power Generated
- Average Annual Heat Content
- Average Annual Carbon Content if Measured
- CO₂, N₂O, CH₄ Emissions from Combustion
- Process CO₂ from Acid Gas Scrubbers
- Fugitive CH₄ from Coal Storage
- Fugitive CO₂ from Geothermal
- HFCs from Cooling Units Supporting Power Generation

Out-of-state Generating Facilities Will Report (Optional)

- MW Rating
- Annual Net MWh of Power Generated
- Average Annual Heat Content
- Average Annual Carbon Content if Measured
- CO₂, N₂O, CH₄ Emissions from Combustion
- Process CO₂ from Acid Gas Scrubbers

Retail Providers Will Report

- In-state facility level information if applicable
- Fugitive SF6 for service area
- CO2 from Mobile Sources \geq 25,000 MTs
- Power purchased/consumed for end-use in buildings/facilities
- CO2, N2O, CH4 from Power Purchases
- CO2, N2O, CH4 from Wholesale Sales and Exports
- Emission Factors for Use by Customers

Power Marketers/Brokers Will Report

For Power Imported and Sold into California

- MWh, CO₂, N₂O, CH₄ for specified imports
- MWh, CO₂, N₂O, CH₄ for unspecified imports by region

Stationary Combustion CO2 Emissions Methodologies

Natural Gas

- U.S.EPA Acid Rain Program (Part 75) data if applicable plus average annual heat content (HHV) based on measured data.
- If NOT applicable, use Fuel-Based Method with
 - Daily Fuel Consumption
 - Monthly heat content measurements
(can be provided by supplier)
 - Default carbon content factors provided by ARB
 - Default oxidation fractions provided by ARB

Stationary Combustion (CO₂)

Coal and Petroleum Coke

Option 1

- Part 75 CO₂ CEMS Method if under oversight of regulatory agency (federal, state, or local air district). Must use Acid Rain CO₂ CEMS data if applicable if Option 1 is selected.

Option 2

- Fuel-Based Method Based on
Weekly Fuel Consumption (based on daily use)
Weekly Measured Heat Content
Weekly Measured Carbon Content
Default Oxidation Fraction of 1.0 (Latest IPCC)

Stationary Combustion (CO₂)

Refinery Gas

Option 1

- CO₂ CEMS Method if under oversight of regulatory agency (federal, state, or local air district)

Option 2

- Fuel-Based Method Based on
Hourly Fuel Consumption
Hourly Measured Heat Content
Daily Measured Carbon Content
Default Oxidation Fraction

Stationary Combustion (CO₂)

Biomass and MSW

- CO₂ CEMS Method if under oversight of regulatory agency (federal, state, or local air district)
- Emissions from biomass considered carbon neutral
- MSW is NOT carbon neutral unless carbon neutral portion is determined using ASTM D6866 on a quarterly (?) basis

Stationary Combustion (CO₂)

Biomass and MSW without CO₂ CEMS

- Fuel-Based Method with
 - Daily Fuel Consumption
 - Daily heat content measurements
 - Default carbon content factors provided by ARB
 - Default oxidation fractions provided by ARB

(Are there any sources combusting biomass or MSW without CEMS?)

Stationary Combustion (CO₂)

Diesel, Fuel Oil, Kerosene, Residual Oil, LPG (ethane, propane, butane)

Option 1

- CO₂ or O₂ CEMS Method under oversight of regulatory agency (federal, state, or local air district)

Option 2

- Fuel-Based Method with

Fuel Consumption for periods that match new shipments/deliveries

Heat Content Measured with shipment/delivery

Default carbon content factors provided by ARB

Default oxidation fractions provided by ARB

Stationary Combustion (CO₂)

Landfill Gas and Biogas from Wastewater Treatment considered carbon neutral

Option 1

- CO₂ CEMS Method under oversight of regulatory agency (federal, state, or local air district)

Option 2

- Fuel-Based Method with
 - Daily Fuel Consumption
 - Daily heat content measurements
 - Default carbon content factors provided by ARB
 - Default oxidation fractions provided by ARB

Stationary Combustion Co-Firing

If carbon neutral fuel is co-fired with fossil fuel, emissions are reported separately using applicable methodologies

If CO2 CEMS method is used

Option 1

A Fuel-Based Method may be used to calculate fossil fuel emissions to be subtracted from total CO2 CEMS emissions

Option 2

ASTM D6866 on a quarterly (?) basis

Stationary Combustion N₂O and CH₄

Option 1

- Use of N₂O or CH₄ Stack Testing under oversight of regulatory agency and appropriate ASTM Methods
(Frequency?)

Option 2

- Use of Default Emission Factors provided by ARB

Process Emissions From CO₂ Acid Gas Scrubbers

Acid Gas Scrubbers Methodology

$$\text{CO}_2 = S * R * (\text{CO}_2 \text{ MW} / \text{Sorbent MW})$$

Where:

CO₂ = CO₂ emitted from sorbent, annual metric tons

S = Limestone or other sorbent used, annual metric tons

R = Ratio of moles of CO₂ released upon capture of one mole of acid gas

CO₂ MW = molecular weight of carbon dioxide (44)

Sorbent MW = molecular weight of sorbent
(if calcium carbonate, 100)

Fugitive Emissions

- HFCs from Cooling Units that Support Power Generation
 - CH₄ from Coal Storage
 - CO₂ from Geothermal
 - SF₆ from T&D Circuit Breakers
- Utilities will report information for their service areas

Mobile Source Emissions

- Retail Providers will report CO₂ emissions \geq 25,000 MTs from fuel usage
- Include description of fleet by fuel type
Description of motor vehicles includes number of on-road vs off-road vehicles by horsepower or gross vehicle weight and age

Repositories for Facility-Level Emissions

- In-state facilities based on verified data
- Out-of-state facilities based on EIA/U.S. EPA data (compiled by ARB/CEC) or verified data submitted voluntarily by out-of-state facility
- Emission factors based on Annual CO₂, N₂O, and CH₄ Emissions and Annual Power Generation

Indirect Emissions

- Retail Providers report power purchased and consumed for end-use in buildings/facilities
- Database calculates indirect emissions
- Indirect emissions are in separate category

Cogeneration: Proposed Approach



Cogeneration Facilities: Mandatory Reporting

- Grid Connected Cogeneration and Stand-Alone/Self-Generation Facilities ≥ 1 MW
- Cogeneration and Self-Generation Facilities Part of Sectors Mandated for Reporting
 - Refineries
 - Power/Utilities
 - Cement Plants
 - GRP $\geq 25,000$ tons
- Responsible Reporting Party
 - Management/Operational Control
- Reporting Requirements

Cogeneration: Reporting Requirements

- Type of Facility
- Fuel Type and Amount Consumed
- CHP Technology Type(s)
- Total CO₂, CH₄, N₂O
- Total electricity (MWh) output, sold to the grid, sold or provided to other users, and consumed on-site
- Total thermal energy (BTUs) output, usable thermal energy, and BTUs consumed on-site
- Indirect electricity purchases
- Allocated emissions based on energy stream output

Cogeneration: GHG Emissions Allocation

- Stationary Combustion Emissions On-Site Reported as Direct Emissions
- Methods Evaluated
 - Work Potential
 - Energy Content
 - Public Utilities Commission (PUC) Conversion
 - Efficiency
- Considering Two Approaches
 - PUC Conversion Method
 - California Climate Action Registry (Registry) Efficiency Method

PUC Conversion Method: GHG Emissions Allocation

$$\text{Emission Rate} = \frac{\text{Total GHG Emissions}}{\text{Electricity Output (kWh)} + \text{Usable Thermal Energy (kWh)}}$$

Where:

Total GHG Emissions

= Metric Tons CO₂e

Electricity Output

= Total Produced Annually

Thermal Energy Output

= Usable Thermal Energy*

Allocated Emissions:

Emissions_{Electricity} = Emission Rate • Electricity Output

Emissions_{Thermal Energy} = Total GHG Emissions – Emissions_{Electricity}

*FERC Definition: Thermal Energy Delivered to a Thermal Host

PUC Conversion Method: Example Calculation

$$\text{Emission Rate} = \frac{\text{Total GHGEmissions}}{\text{Electricity Output (kWh)} + \text{Usable Thermal Energy (kWh)}}$$

Where:

Total GHG Emissions	= 435,982 Metric Tons CO ₂ e
Electricity Output	= 1,100,600 MWh
Usable Thermal Energy	= 2,710,000 million BTU
Emission Rate	= 0.00023 Metric Tons CO ₂ e/kWh

Allocated Emissions:

Energy Stream	Metric Tons CO ₂ e
Electricity	253,138
Thermal Energy	182,844
Total	435,982

Note: Example calculation uses API Compendium Assumptions & Input Data

Registry Efficiency Method: GHG Emissions Allocation

Thermal Energy	Electricity
$E_H = \frac{H/e_H}{H/e_H + P/e_P} \times E_T$	$E_P = E_T - E_H$

Where:

E_H = Emissions allocated to steam production

H = Total steam (or heat) output (MMBtu)

e_H = Efficiency of steam (or heat) production

P = Total electricity output (MMBtu)

e_P = Efficiency of electricity generation

E_T = Total direct emissions of the CHP System

E_P = Emissions allocated to electricity production

Registry Efficiency Method: Example Calculation

$$E_H = \frac{\frac{3.614 \times 10^{12} \text{ BTU}}{0.80}}{\frac{3.614 \times 10^{12} \text{ BTU}}{0.80} + \frac{3.755 \times 10^{12} \text{ BTU}}{0.35}} \times 435,982 \text{ metric tons CO}_2\text{e}$$

Where:

E_H = Emissions allocated to steam production

H = 3.614×10^{12} BTU

e_H = 80% (Efficiency of steam production)

P = 3.755×10^{12} BTU

e_P = 35% (Efficiency of electricity generation)

E_T = 435,982 metric tons CO_2e

E_P = Emissions allocated to electricity production

E_H = 129,186 metric tons CO_2e

E_P = $435,982 - 129,186 = 306,982$ metric tons CO_2e

Comparison of Methods: GHG Emissions Allocation

Energy Stream	PUC Conversion Method (Metric Tons CO ₂ e)	Registry Efficiency Method (Metric Tons CO ₂ e)
Electricity	253,138	306,796
Thermal Energy	182,844	129,186

Cogeneration: Key Questions

- Should ARB adopt the PUC Conversion Method or the Registry's Efficiency Method?
- Do cogeneration facilities collect data on actual thermal energy and electricity production efficiency values?
- Are there any recommendations for ARB to adopt another method to allocate GHG emissions?
- Other comments?

Verification: Initial Concepts



Why Verification?



- AB 32 requires it
- Expected under international standards
- Experience with voluntary reporting shows the need
- Complexity of emissions estimation
- Critical for credibility of program

Verification: Initial Proposal

- Require annual third-party verification for refineries, utilities, and power plants and co-generation facilities selling power to the grid or other users
- Require triennial third-party verification for cement plants and other stationary combustion sources $\geq 25,000$ tons CO₂
- Require annual third-party verification for anyone entering a future market

Third Party Verification

- Consistent with existing standards, including ISO
 - Already required for CCAR members
- Verifiers to be trained under ARB approved curriculum
 - Demonstrated expertise
 - Consistency in verification

Regulation to Specify

- Core GHG data verification requirements
- Accreditation requirements for verifiers
- Conflict-of-interest limitations
- ARB oversight

Verification Activities

- Identify sources and review data management systems
- Focus on most significant and uncertain sources
- Differences exceeding 5 percent considered significant
- Detailed verification report to facility and ARB

Reporting and Verification Timing

- Power Plants & Co-generators selling energy to other users
 - Emissions reports due by April 1
 - Verification complete by July 31
- Utilities, Refineries, Cement Plants and other stationary combustion sources
 - Emissions reports due by September 1
 - Verification complete by December 31

Accreditation

- ARB to specify requirements necessary to become verifier
- Propose following fairly stringent international and CCAR approaches

Conflict of Interest

- Term Limit
 - Verifiers to be changed after 3 years of conducting verification activities
 - Allowed to resume with client after 1 year off cycle for verification
- Conflict of Interest Policy
 - Must agree not to act on behalf of reporting facility as both consultant and verifier concurrently or within any 3 year period

Verification Oversight

- ARB staff responsible for enforcing regulation
- Verification process will assist efforts to enforce compliance
- Targeted review of submitted data and verifiers

Upcoming Dates

Comments Due to ARB on Power/Utilities Concept
June 29, 2007

Draft Regulatory Language from ARB
Late July or Early August, 2007

Mandatory Reporting Workshop – All Sectors
August 9, 2007 (Sacramento)

ARB Contacts

**Richard Bode – Chief
Emissions Inventory Branch**
rbode@arb.ca.gov
(916) 323-8413

**Doug Thompson – Manager
Climate Change Reporting Section**
dthompson@arb.ca.gov
(916) 322-7062

pburmich@arb.ca.gov
(916) 323-8475
dpapke@arb.ca.gov
(916) 323-2308
rsahota@arb.ca.gov
(916) 323-8503

www.arb.ca.gov/cc/ccei/ccei.htm

