Monitoring, Verification, and Enforcement of U.S. Cap and Trade Programs

Reid Harvey, U.S. EPA
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Outline

- Scope of U.S. federal cap and trade programs
- Monitoring
- Reporting
- Verification
- Enforcement

Overview of US Cap and Trade Programs

- SO_2
  - Started 1995, implemented in two phases
  - National in scope, only electric power units (~3,500 units)
  - Cap set 10 million tons below 1980 levels
  - Results: As of 2005, emissions are 41% below 1980 levels
  - No units out of compliance in 2005

- NO_x
  - 1999 to 2002: Northeast regional program (12 states)
  - 2003: Federal program involving 22 states
  - Scope includes electric power and large boilers (~2,700 units)
  - Results: As of 2005, NOx emissions are 57% lower than 2000
  - 99 percent compliance rates (e.g., 12 tons of penalties in 2005)

- In 2005, Clean Air Interstate Rule lowered caps for both SO_2 (starting 2010) and NO_x (starting 2009) about 70 percent in 28 states and Washington, DC.

- Clean Air Mercury Rule set 2010 national cap in place for mercury. Cap and trade approach is an option for states.

- Cap-and-trade provisions of CAIR and CAMR are being challenged in court.

Comparison of programs

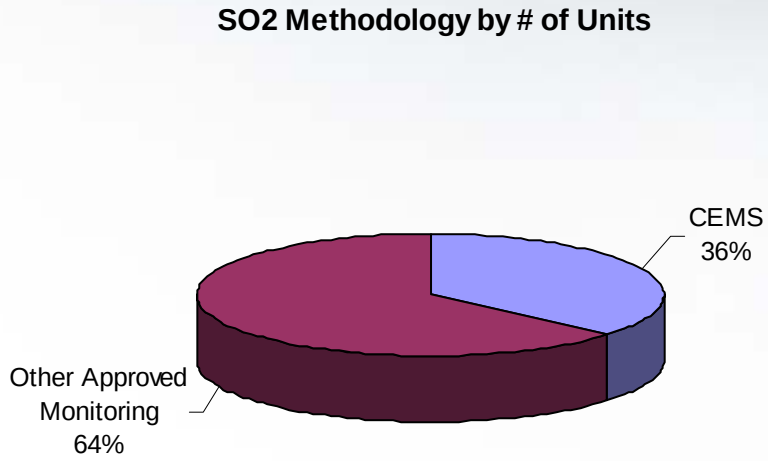
	EU ETS	U.S. SO_2 & NO_x
Status	Since 2005	Since 1995
Sectors and applicability	Electric power, oil refineries, coke ovens, metal ore & steel, cement kilns, glass, ceramics, paper & pulp	Electric power (SO_2) Plus large industrial boilers (NO_x)
Regulated	~10,000 facilities	7,000 units
Political Jurisdiction	25 (EU member states)	1 (U.S. Federal) plus states
Emissions covered	CO_2 (opt-in other gases)	SO_2 & NO_x
Project Offsets	Yes	No
Estimated value of annual allocation	$35-40 billion	$3-5 billion

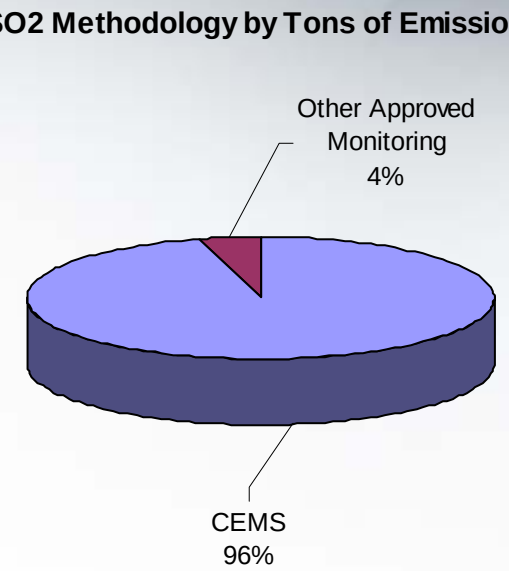
Monitoring

Complete Emissions Data Required

- All emissions from affected sources are monitored and reported
  - Hourly emissions must be reported
  - Conservative substitute data must be reported when CEMS are unavailable
  - Flexible provisions for smaller emitting sources
  - Collaborative approach with industry

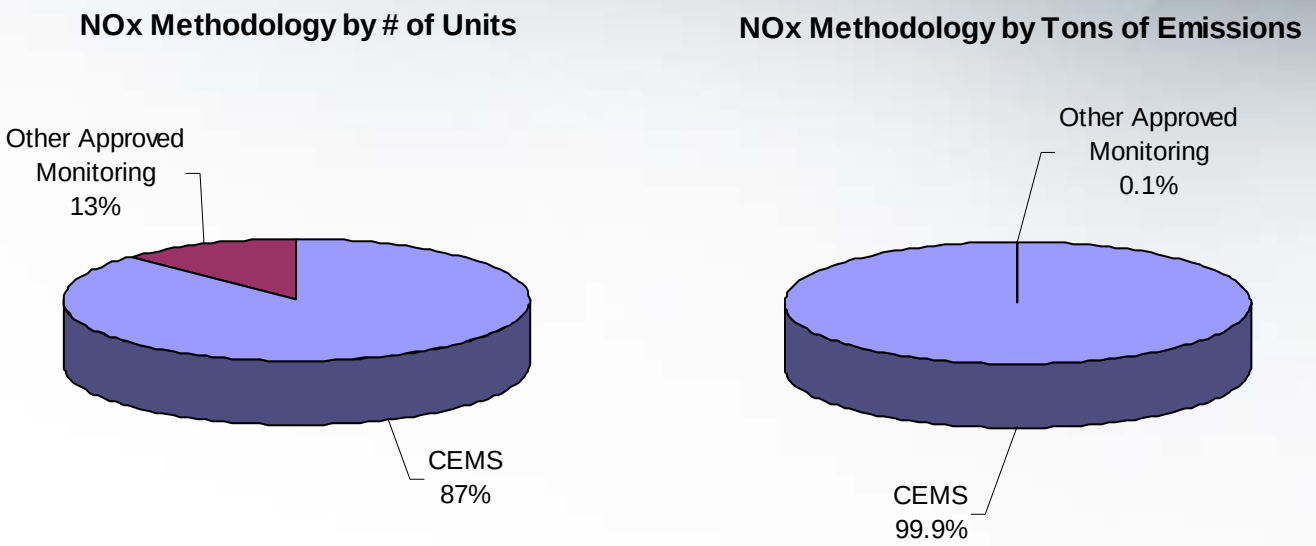
SO_2 Monitoring





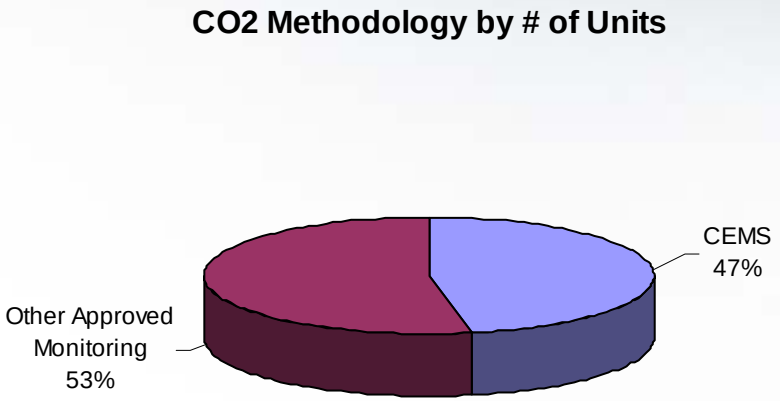
- While only 36% of the units must use CEMS to directly measure SO_2, those units account for 96% of the total emissions
- The other units use alternative monitoring to account for emissions at a lower cost without affecting the overall accuracy of the program

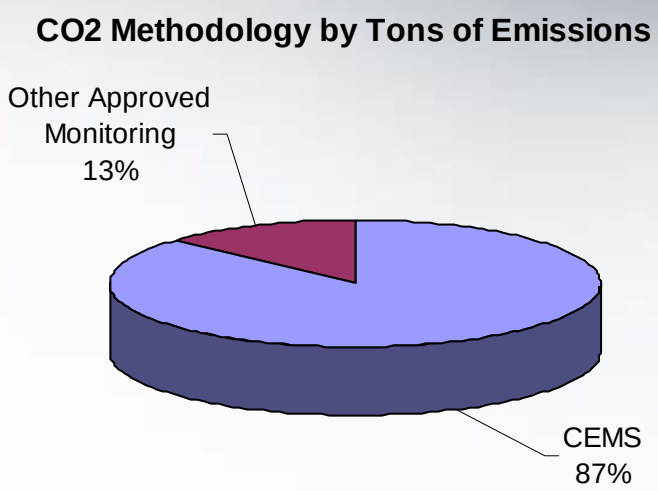
NO_X Monitoring



- For monitoring NO_X, 87% of the units use CEMS. These units account for 99.9% of the emissions.
- 13% of the units use approved alternative monitoring for NO_X. These units account for less than 0.1% of the total NO_X emissions.

CO_2 Monitoring





- For monitoring CO_2, 47% of the units use CEMS. These units account for 87% of the emissions.
- 53% of the units use approved alternative monitoring for CO_2. These units account for 13% of the total CO_2 emissions.

Substitute Data

- EPA regulations (Part 75) designed to account for data loss due to:
  - Analyzer or monitoring system malfunction
  - Missing, late or invalid QA tests
  - Monitoring interferences
- Emission values must be captured for each hour of operation in a consistent and accurate manner
- When a quality assured data value is not obtained for an hour of operation, Part 75 specifies specific substitute data procedures for determining emissions

Substitute Data

- There are 4 “tiers” of Substitute Data for CEMS
- The Substitute Data “tiers” are based on the annual Percent Monitor Availability (PMA)
- As the PMA lowers the required Substitute Data value becomes more conservative
  - Designed to encourage high monitoring availability through implementation of a QA/QC that includes preventative maintenance, and daily evaluation of CEMS performance
  - PMA typically exceed 99% (annually)

Substitute Data

- Tier I - Least conservative (95% monitoring availability)
  - If missing data period lasts $\leq$ 24 hrs take the average before/after value (not conservative)
  - If greater than 24 hrs, then take the 90th percentile value or average HB/HA, whichever is greater (somewhat conservative, 10% of the measured values in the lookback (e.g., 720 hours for CO_2)were higher)
- Tier II - conservative (90%)
  - If missing data period lasts $\leq$ 8 hrs take the average before/after value (not conservative)
  - If greater than 8 hrs, then take the 95th percentile value or average HB/HA, whichever is greater (somewhat conservative, 5% of the measured values in the lookback were higher)

Substitute Data

- Tier III - Conservative Estimate (80-90%)
  - Maximum measured value in lookback period
- Tier IV - Maximum Conservative (<80%)
  - Maximum potential value without regard to controls
  - Most conservative replacement Value
  - Highest cost to sources in extra allowances

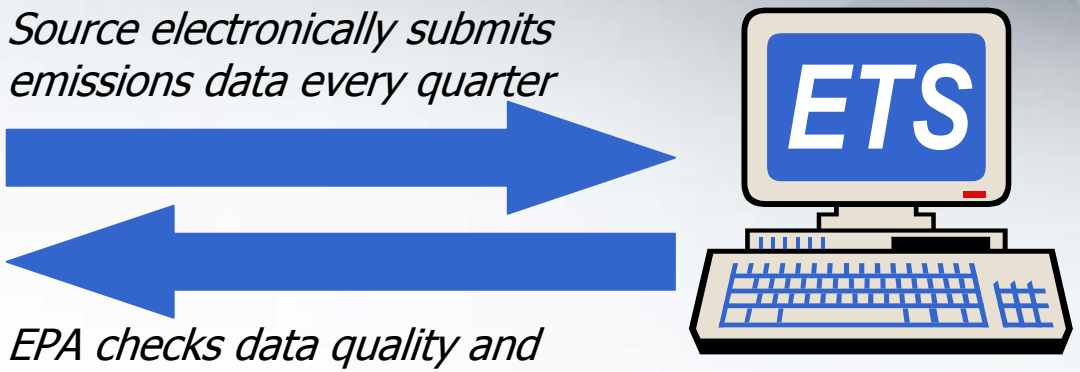
Compliance Flexibility for Low-Emitting Sources

- Examples of EPA's flexibility toward low emitting sources:
  - Exempt new units ≤25 MW that burn only fuels with sulfur content ≤0.05% by weight
  - Gas- or oil-fired peaking units can use NOx vs heat input correlation instead of CEMS
  - Low mass emitters (emit ≤25 tons SO2 and <100 tons NOx annually) can use conservative default SO2, NOx and CO2 emission factors

Reporting

Electronic Reporting and Feedback

Source electronically submits emissions data every quarter



EPA checks data quality and provides automated feedback to source

	Reporting Period or Quarterly	Cumulative Annual or Cumulative Ozone Season	EPA Accepted
SO2	2633.4	5629.1	2633.4
CO2	230774.0	601228.0	230774.0
Heat Input	2249279.0	5013635.0	2249279.0
NOx Rate	0.3	0.3	0.3

Standardized Electronic Reporting

- Enormous amount of emissions data requires a standardized, electronic reporting format for the program to succeed
  - Computer software can be used to efficiently analyze and check data quality
- Failure to report involves potential for civil and criminal penalties

Costs

- Capital costs around 80,000 – 170,000 USD
- Annual operating costs around 15,000 – 24,000 USD
- Lower costs for low mass emitters
- Low government costs (15 monitoring staff)

Verification

Verification

- Field audits using calibration gases and independent monitoring equipment
- Targeted audits using documented set of criteria (EPA uses software to target audits), and
- Audits on randomly selected sources

Reducing Conflicts of Interest

- Regulated source determines its own emissions
  - performs QA testing using either in-house test teams or private testing companies;
  - either way, the testers are paid by the regulated source

- Sources are required to notify EPA and State Air Agency when QA testing is planned so that agencies can send observers

Testers and Observers

Verification – Lessons Learned

- Electronic audits are most effective if a sufficiently detailed, standardized, electronic reporting format is used, e.g., XML

- Sources can run their data through standardized data checking software prior to submittal to agency

- Field audits are best performed by trained personnel (could be accredited to a common consensus standard, e.g., ISO, ASTM or other) with no conflicts of interest

Enforcement

Enforcement

- Financial penalties exceed value of allowances
  - 2004 SO_2 penalty was $2,963 vs. spot auction bid price of $300/ton
  - Despite this, in 2004, four units paid penalties of about $1.4 million for 465 excess tons of SO_2
  - No SO_2 units out of compliance in 2005
- Excess emissions penalty
  - Offset the excess emissions by an equal tonnage amount from the next year (SO_2)
  - 3 to 1 allowance surrender penalty for NO_x
- Discretionary civil penalties
  - $32,500 per day per violation (in 2006)
- Criminal penalties – available but not used to date

Summary of lessons learned

- Reduced requirements for smaller emitters or where superior test results are achieved
- Progressively stringent substitute data requirements to ensure continuous reporting
- Comprehensive electronic reporting to enable targeted audits; and
- Automatic statutory penalties greater than cost of allowances

For more information

Reid Harvey
Climate Change Division
U.S. Environmental Protection Agency

harvey.reid@epa.gov
1-202-343-9429

http://www.epa.gov/climatechange
http://www.epa.gov/airmarkets