Global Efforts to Monitor Stationary Source Emissions

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Introduction

Member States of the United Nations = 193

Today's presentation
> Will address emissions and air quality monitoring in 10 of those countries

Introduction

Major sources of air pollution

> Stationary sources such as power stations, oil refineries, industries

> Mobile sources such as motor vehicles, ships, aircraft

Others

> Open burning of waste materials

> Transboundary air pollution

Introduction

Air quality monitored in different ways
Two common approaches:

- Ambient – measure overall air quality for a city, province, territory, state, or country
  - Many countries have programs to conduct this monitoring
  - Calculations done to estimate pollutants released into the atmosphere from all sources
  - Limitation – difficult to account for variations, random factors, prone to bias from a multitude of sources

Introduction

Two common approaches (*continued*):

> At the source – e.g., a smokestack at a power plant
> - This is a way to qualify/quantify the pollutants emitted from specific facilities

Introduction

Countries use various approaches, often in combination, to ensure the quality of stationary source monitoring

Some examples:
> Mandate sample collection and/or analysis standards
> Require polluting facilities to self-monitor and self-report results to regulators
> Require stack testers to be certified
> Require laboratories to be accredited

Introduction

More Examples:

➢ Require on-site supervision by regulators of stack testing
➢ Require stack testers or laboratories to participate in Proficiency Testing (PT)
➢ Require sampling event specific PT samples (aka Audit Samples)

There is no apparent consensus

United States of America

United States of America

Air quality goals and objectives based on source category

- ➤ Mobile
- ➤ Stationary

Regulations

- ➤ Clean Air Act
  - Provides the broad outline and authority for regulation of air pollution
- ➤ Governing body is EPA
  - White House Office of Management and Budget reviews EPA's regulations and their costs/benefits

United States of America

Clean Air Act, Title I

Establishes the basic regulatory structure for control of most commonly produced stationary and mobile sources of air pollutants

EPA identifies pollutants that endanger public health or welfare (worthy of regulation)

- Goals and objectives are defined in terms of National Ambient Air Quality Standards (NAAQS)
- These standards apply nationwide

United States of America

NAAQS

EPA reviews, every 5 years, whether new information provides basis for revising standards

Role of States

- In non-attainment areas, uses State Implementation Plan (SIP) to document strategies for achieving NAAQS
- EPA approves or disapproves SIPs and has authority to impose sanctions on non-complying states
- EPA may also devise Federal Implementation Plan (FIP) to meet the standards
- In attainment areas, must also have programs to prevent significant deterioration of air quality

NAAQS (*continued*)

Other programs (aside from SIP and FIP) aimed at reducing criteria pollutant emissions, as established by Clean Air Act (and mandated by Title I)

- ➤ New Source Review (NSR)
- ➤ New Source Performance Standards (NSPS)
  - These govern the rules for construction of new and modification to existing stationary sources

United States of America

TNI Stationary Source Audit Sample (SSAS) Program

> Governs the requirements for quality assurance for stationary source testing
> Privatized program since 2011 (in collaboration with EPA)

Quebec, Canada

Quebec, Canada

Has quality assurance and control (QA/QC) program in place overseen by a Regulatory Agency

Published Sampling of Atmospheric Emissions from Stationary Sources (Booklet 4 of Sampling Guide for Environmental Analysis)

Sampling specs must include QA/QC program for validating results and control measures implemented for compliance with critical aspects of sampling

Quebec, Canada

Main contaminants studied at stationary sources

- Particulates
- Inorganics (e.g., metals, Nox, SO2, HCl, etc.)
- Organics (volatiles, semi-volatiles, etc.)

Quebec, Canada

Some EPA methods in CFR 40, Part 60 are used in Quebec program:

- Method 3A
- Method 8
- Method 13A or 13B
- Method 18
- Method 25A
- Method 29

- Method 7E
- Method 10
- Method 16A
- Method 21
- Method 26A
- Method 201A

Quebec, Canada

For continuous monitoring equipment, EPA specs applied to ensure optimal installation and measurements of contaminants

- Opacity, US EPA Performance Spec 1
- NOx and SO_2, US EPA Performance Spec 2
- O_2 and CO_2, US EPA Performance Spec 3
- CO, US EPA Performance Spec 4
- Reduced Sulfur compounds, US EPA Performance Spec 5

Analysis of stationary source samples performed by a laboratory accredited by the Minister of the Environment of Quebec (Ministere de l'Environnement du Quebec)

European Union

European Union

EA = European co-operation for Accreditation

> Offers accreditation (ISO/IEC 17011) to certification bodies (ISO/IEC 17021), laboratories (ISO/IEC 17025), and inspection bodies (ISO/IEC 17020) involved with stack sampling

> Accreditation Bodies shall use CEN/TS 15675:2007 "Air Quality - Measurement of stationary source emissions," in the assessment of organizations involved in emission measurements (or stack sampling)

European Union

Also has approval scheme for Automated Measuring Systems (AMS)

➢ prEN 15267-3 = Performance specs and test procedures for AMS for measuring stack emissions

➢ EN14181 = QA standard for AMS which measure stack emissions

- Laboratories evaluating AMS must be accredited to ISO 17025

European Union

Different European countries (UK, Germany, Italy, and France) have different AMS requirements that confused operators and manufacturers, so a mutual recognition was established and uniform standards applied (e.g., prEN 15267-3)

Will help reduce trade barriers in the EU since testing and certification in one EU member state should mean recognition in other member states

European Union

Proficiency testing for laboratories that analyze samples from stationary sources – originated in France but now open to any interested European laboratory

Has similar objectives as the audit sample testing done in the US (TNI SSAS Program)

- Compare results from different laboratories
- Assess skill of operators/samplers
- Evaluate method

United Kingdom

United Kingdom

Environment Agency of England & Wales administers the Monitoring Certification Scheme (MCERTS)

> Operates according to ISO 17024:2003 "Conformity assessment – General requirements for bodies operating certification of persons."

> Published standard for MCERTS

United Kingdom

Any stack emission monitoring carried out for regulatory purposes must meet MCERTS requirements:

➢ Comply with emission limits

➢ Calibrate Continuous Emission Monitoring systems (CEMs) including QA work under EN 14181

➢ Participate in trials on new technologies to reduce pollution

United Kingdom

Laboratories and stack testers performing monitoring for regulatory purposes must be accredited by UKAS to ISO 17025 for MCERTS. This includes the requirement to use MCERTS certified personnel.

Three levels of personnel:

➢ Trainee

➢ Level 1 (Technician) – min. 6 months experience, pass level 1 exams (multi-choice + narrative)

➢ Level 2 (Team Leader) – min. experience 15 monitoring jobs at individual or multiple sites, depending on scope of certification sought; pass level 2 interview + exams

United Kingdom

Personnel certification valid for 5 years

➢ Includes health and safety training

➢ For those curious about costs, Level 1 costs about $625; Level 2 is $1500+.

United Kingdom

Proficiency Testing Schemes

PTs are required by MCERTS. The National Physical Laboratory (NPL) hosts three kinds of PTs:

1) Particulates

2) Calibration Gas: measure test gases from certified cylinders (NOx, SO2, CO, O2, and VOC) at typical plant concentrations

United Kingdom

3) Gas Measurement: Uses a "Stack Simulator Facility" to test a complete CEM system from sampling probe to analyzer. Able to reproduce a wide range of simulated stack gases under controlled conditions.

➢ Testers travel to NPL with their own equipment and are monitored during test

Australia

Australia

Australia does not set national air quality emissions standards; authorities in individual States and Territories set standards

Standards are developed by Standards Australia®, an independent non-profit consensus standards organization

Australia

An Example - Western Australia

➢ Not all facilities required to adhere to QA/QC policies when using CEMS

- Monitored facilities selected based on expected emission levels, proximity to population centers

➢ Focus is on SO2 levels

St. Petersburg, Russia

St. Petersburg, Russia

In the former Soviet Union, the government promoted industrial production at all costs for decades

Scant concern for environmental and health consequences

Since the breakup of the Soviet Union, greater attention is being paid to environmental protection, but resources remain limited

St. Petersburg, Russia

Progress in reducing stack emissions often offset by growth in numbers of automobiles (over 2,000,000 in Moscow alone)

Limited budgets have led to innovative approaches to monitoring emissions

St. Petersburg, Russia

Stack monitoring at a public plant in St. Petersburg uses "biomonitoring" with Achatina gastropods... GIANT AFRICAN SNAILS! Snails grow up to 8" long.

Started using snails in 2011. Water quality has been monitored using crayfish since 2005.

Intended to detect trace amounts of toxins that would be too costly to monitor with conventional means

St. Petersburg, Russia

Why use giant snails?

> Snails have lungs and breathe air "like people do"

> Snails have a shell on which sensors can be attached without affecting the snail

> Snails are tireless workers and will work for lettuce and cucumbers

Sensors monitor snail heart-rates and movement for signs of illness from exposure to toxins in stack emissions

São Paulo, Brazil

São Paulo, Brazil

Federal Republic divided into 26 States

São Paulo is largest State by far, by both population and industrial production

São Paulo's government agency responsible for environmental protection is Companhia Ambiental do Estado de São Paulo (CETESB)

São Paulo, Brazil

CETESB issued rule in January 2010 regarding stationary source emission monitoring

- ➤ Owners of stationary sources required to conduct testing
- ➤ Defines requirements for monitoring plans, frequency of testing, allowable methods, sampling volumes, and reporting format
- ➤ Laboratories should be accredited by Inmetro (National Institute of Metrology, Quality, and Technology)
- ➤ Stack testers must obey safety standards set by Brazilian Regulatory Standards

São Paulo, Brazil

Some EPA methods in CFR 40, Part 60 are recognized for use by CETESB:

- Method 18   - Method 23

- Method 25A   - Method 26A

- Method 29   - Method 30

- Method 101   - Method 101A

India

India

Central Pollution Control Board (CPCB)

Oversees the National Air Quality Monitoring Program (NAMP) that uses monitoring equipment in over 300 operating stations throughout India

- Determines status or trends of ambient air quality
- Determines whether ambient air quality standards are violated
- Collects data for air quality improvements

Required quality assurance measures

➢ CPCB officials' visit to monitoring stations and monitoring labs; submittal of findings in inspection reports

➢ Review meetings with monitoring agencies to discuss problems re. monitoring activities

➢ Training program for field and laboratory staff involved in NAMP

India

Required quality assurance measures (continued)

➢ Analytical quality control exercises using Ring Test Facility to evaluate performance of different laboratories (sending double-blind samples)

➢ Beginning 8-12-2011 – all laboratories participating in the NAMP are required to have either ISO 17025 or ISO 9001 with OHSAS 18001 (equivalent to US OSHA)

China

China

China's Ministry of Environmental Protection is responsible for regulation of environmental concerns in China

Numerous municipal agencies such as Beijing Municipal Environmental Protection Bureau

Currently setting up a new network of air quality monitoring stations to measure SO_2, NO_2, PM_{10}, O_3, and CO levels at key geographic areas throughout China

Plan involves:

> Establish new air quality standards
> Build monitoring stations and train personnel (due 2012)
> Collect data (start 2013)
> Report and analyze data, determine next steps

China

Ongoing controversy about veracity of air quality measurements released by official sources

Beijing typically reports "good" air quality; US Embassy in Beijing operates its own monitoring equipment, and typically reports air quality as "unhealthy."

US Embassy set up an automated Twitter feed (now with over 22,500 followers) to provide hourly air quality reports

China

Singapore

Singapore

National Environment Agency (NEA) has control measures and enforcement program to prevent air pollution

  ➢ Requires industries to conduct source emission tests and take remedial measures where necessary

  ➢ Accredits stationary source testers

  ➢ Conducts regular inspections of stationary sources to ensure that pollution control equipment is maintained and properly operated

  ➢ Conducts source tests gaseous emissions, fuel analyses, and smoke observation of chimneys

Sri Lanka

Sri Lanka

Developed a policy-level document "Clean Air 2015: Action Plan for Air Quality Management"

Discussed adoption of legally enforceable standards for stationary source emissions (2010)

- Has document called "Revised & Proposed Environmental Standards," addressing ambient air quality and stationary source emissions
- EPA methods used as reference methods
- Plans to include auditing and quality assurance procedure in their standards

Aid for Emerging Programs

Aid for Emerging Programs

Non-Governmental Organizations (NGOs), WHO, and UN have written papers to promote awareness amongst developing nations

EPA's Integrated Environmental Strategies (IES) Program

- ➤ EPA providing financial assistance to some countries to develop and improve their pollution programs

Aid for Emerging Programs

> IES Program participant countries

- Argentina   - Brazil
- Chile   - China
- Colombia   - South Korea
- India   - Mexico
- Philippines

> 1998 through present? (last record of existence 2010)

Aid for Emerging Programs

World Bank Group, through its International Finance Corporation (IFC), offers investment and management assistance to encourage private sector development in developing nations

IFC publishes "Environmental, Health, and Safety General Guidelines"

> Specifies limits on stack emissions for projects funded or managed by IFC

> Establishes quality guidelines for monitoring SO_2, NO_2, PM_{10}, $PM_{2.5}$, and Ozone

> Specifies that stack height be limited according to Good International Industry Practice (GIIP)
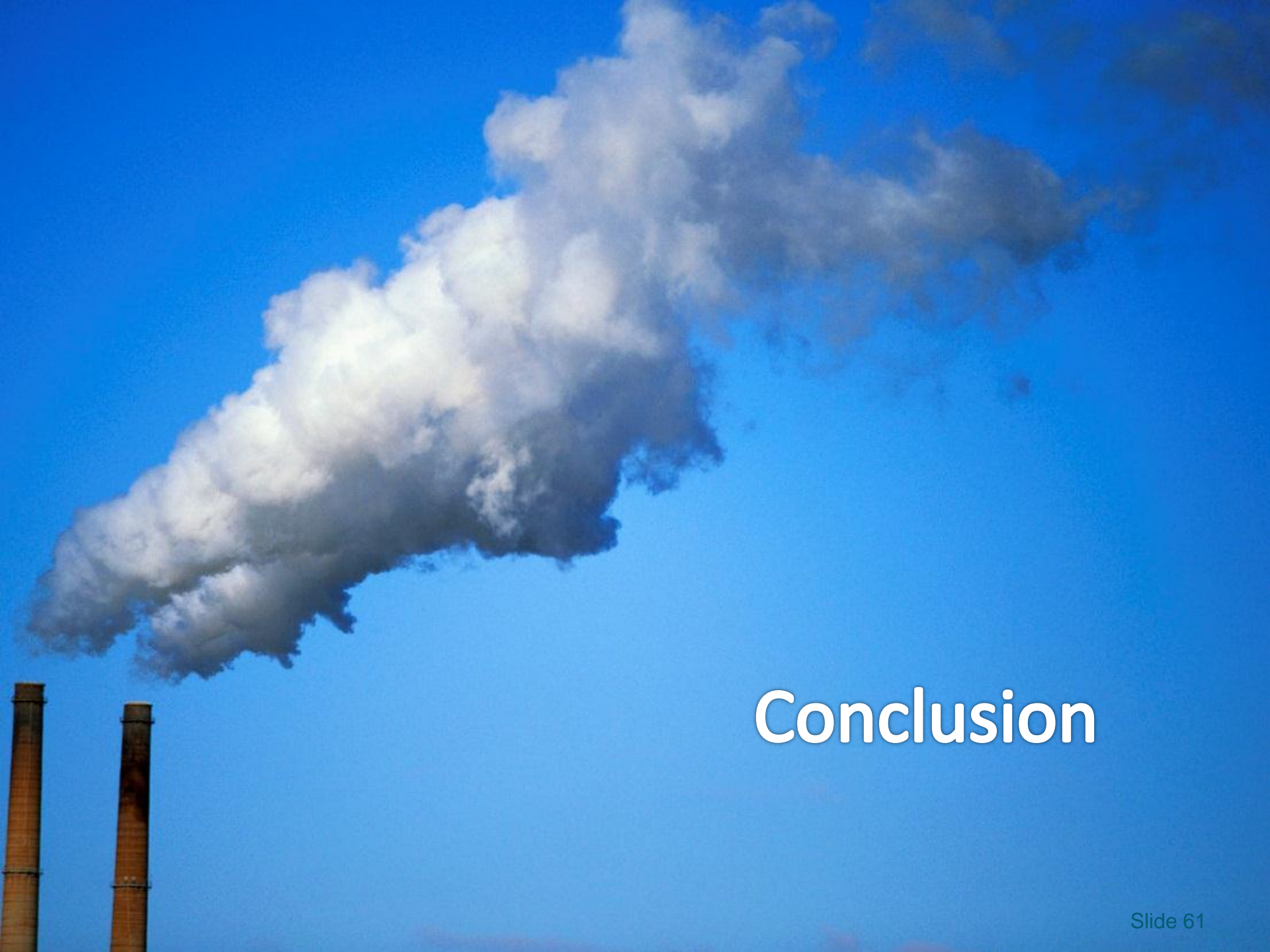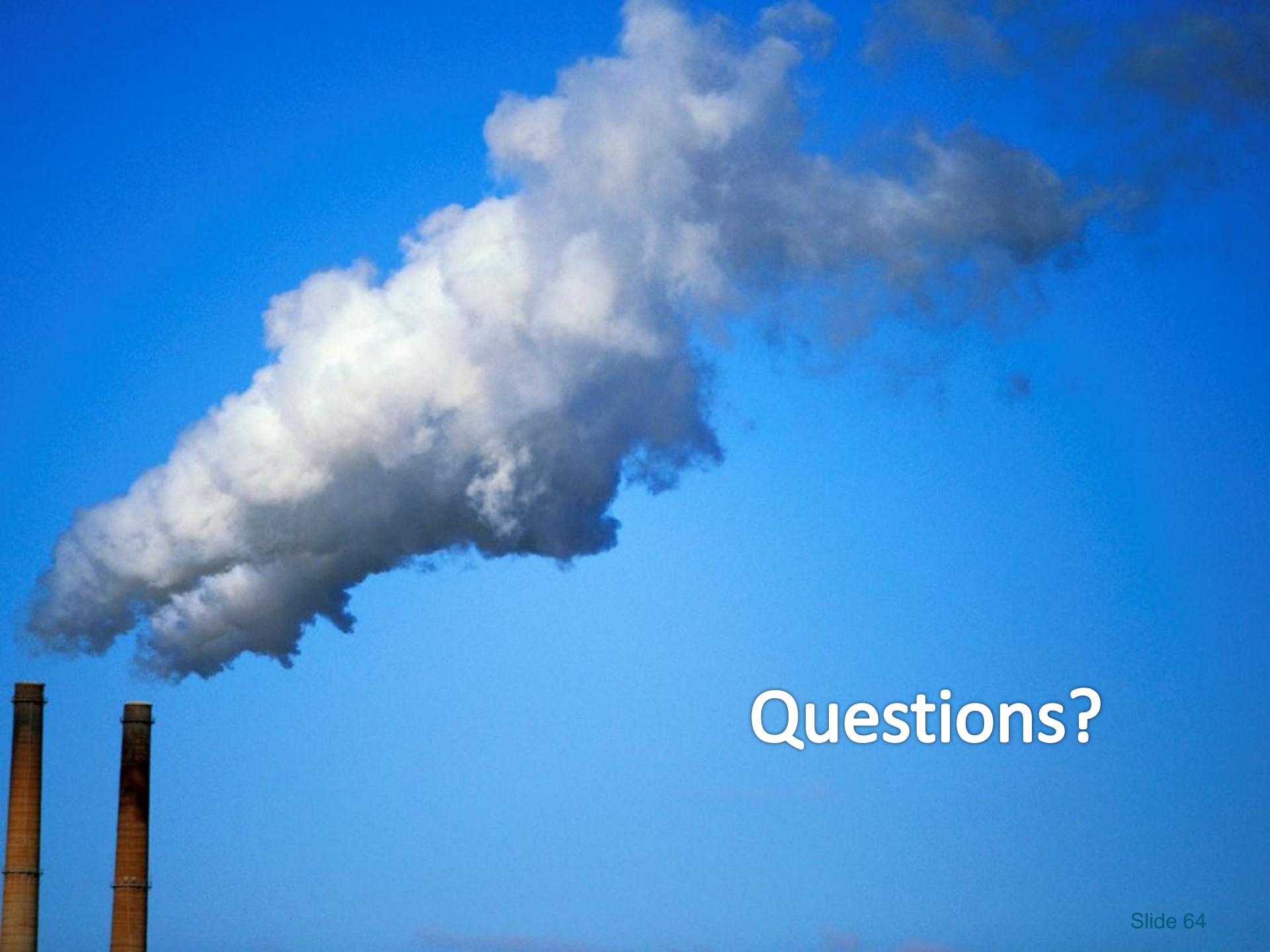
Conclusion

Conclusion

Quality assurance and control measures applied in different ways

1) Analysis of audit samples
2) Certification of samplers under simulated field conditions; they go to a specific testing site
3) Proficiency testing for laboratories
4) Monitoring by regulators
5) Accreditation of testing labs

Conclusion

What drives different approaches to Quality Assurance?

- ➤ Different primary pollutants
- ➤ Different sources
- ➤ Different emission ceilings
- ➤ Different overseers or responsible government agencies
- ➤ Different quality cultures instilled in institutions
- ➤ Different risk perception (i.e., if people don't perceive it as a risk, they don't do anything about it)
- ➤ Socio-economic and political factors
- ➤ Funding

Questions?