Development of Ambient Air Quality Monitoring System in Shanghai

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Outline

- Introduction
- Ambient Air Quality Monitoring Network
- Air Quality Management for Shanghai EXPO
- Future Prospect
Introduction

Shanghai

Location:

Shanghai sits on the Yangtze River Delta on the China's eastern coast

GDP:

$10,537 per capita, annual increment of 10%

Area: over 5,800 km²

Population: over 18 million

Climate:

northern subtropical maritime monsoon climate, sunshine, plenty of rainfall and distinctive seasonal difference
Introduction

Shanghai Environmental Monitoring Center (SEMC)

✓ Established in 1983 with about 200 staff
✓ SEMC is the state level, leading environmental monitoring center under MEP in China
✓ SEMC is the authorized agency to notify the environmental quality to the public and government, including ambient air, surface water, soil, noise, etc.
✓ Extensive cooperation with domestic researching institutes/universities
✓ International exchange with USEPA, Italy, WB, ADB, UNEP etc.
Air Quality Monitoring System

- Development of air quality monitoring:
  - 1980s: 5 air monitoring stations
    - TSP, SO₂, NOₓ
  - 1990s: 14 air monitoring stations
    - Sites and parameters
  - 2000-2005: 24 air monitoring stations
  - Now: Above 4,000,000/year

- Data quantity:
  - 200,000/year

- Air quality daily report and forecast from 1999

- Sites and parameters:
  - 49 air monitoring stations
    - PM₁₀, SO₂, NOₓ, CO, O₃, PM₂.₅, VOC
    - Haze, visibility
    - Traffic monitoring
Air Quality Monitoring Network

Criteria Pollutants Monitoring

- **Ambient Air Stationary Monitoring:**
  
  Automatic: $\text{PM}_{10}$, $\text{SO}_2$, $\text{NO}_x/\text{NO}_2/\text{NO}$, $\text{CO}$, $\text{O}_3$, $\text{PM}_{2.5}$

- **Manual methods-lab analysis:**
  
  Falling dust, TSP, acid rain, Pb, F- and ion etc.

- **Near road traffic pollution monitoring:**
  
  2 mobile, 1 stationary: $\text{CO}$, $\text{NMHC}$, $\text{SO}_2$, $\text{PM}_{10}$

- **Industrial VOCs Monitoring:**
  
  3 pilot stations
Air Quality Monitoring Network

Automatic Monitoring

**49** automatic monitoring stations, covering **18** districts and counties

**Nine** stations are National Controlling Points (including 1 rural site.)
Air Quality Monitoring Network

Manual methods-lab analysis

More than **20** manual method sites

More than **270** points of fall dust
Pollution Sources Monitoring —— CEMS

Status quo of installation of CEMS

- Electric power: 41%
- Energy sources: 15%
- Steel smelt: 13%
- Chemical industry: 9%
- Machine manufacturing: 7%
- Cement: 6%
- Waste incinerator: 2%
- Others: 8%

About **210** sets of CEMS for major pollution sources including power plant, coal fired boilers
Attainment rates have achieved 85.0% for last 6 years.
Annual Concentration

![Annual Concentration Chart](chart.png)

- **PM$_{10}$**
- **SO$_2$**
- **NO$_2$**

<table>
<thead>
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<th>YEAR</th>
<th>PM$_{10}$</th>
<th>SO$_2$</th>
<th>NO$_2$</th>
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<td>0.08</td>
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<td>0.08</td>
<td>0.05</td>
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</tbody>
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Air Quality Management for Shanghai EXPO

Air Quality Goals

Working Mechanism

Monitoring Evaluation

Real-time Forecast & Pollution Warning for 48h

Regional Transformation

Air Improvement Plan

Joint Field Campaign

Improvement Evaluation

Measure Implement

Comfortable Air Quality
Better City, Better Life!
**Goal for Air Quality Management – 2010 Expo**

- Local emission sources control plus regional emergency emission control
- The preliminary emission sources, PM$_{10}$ and O$_3$ should be mainly controlled.
- Conventional measures and emergency action:
  - **Conventional measures**: three-year planning for environmental protection
  - **Emergency action**: emission controlling measures in short period based on air quality forecasting

**accessibility, operational and economic effectiveness**
Regular Measures

Based on the forth “three-year action plan for environmental protection”

- Promoting coal desulfurization and denitrification facilities
  - Completion of power plant desulfurization-17 plants

- Controlling the emissions of motor vehicles
  - Implementation of State IV standard for new vehicles
  - Oil and gas recovery in filling stations
  - Phasing out the old vehicles

- Strengthening the control on fugitive dust
Emergency Actions

Level II

Moderate pollution

- High pollution corporation shutout
- Enlarge limit range of vehicles
- Strengthen control of shipping pollution
- Strengthen control of fall dust

Level I

Serious pollution

- High pollution corporation shutout
- Enlarge limit range of vehicles
- Strengthen control of shipping pollution
- Strengthen control of fall dust

Yellow early-warning: API>90;
Red warning: API>110 on important days; 48-hour notification in advance.
Air Pollution Forecast System
Application of Airnow-I system in Shanghai
Air Quality Notification & Forecasting

Website

PDA

Email

Electronic screen

Server of API reporting system

Fax
Joint Campaign

Joint campaign in spring festival

- The influence of increasing of people activities on ambient air quality
- The observation of fine particulate matters, especially \( \text{PM}_{2.5} \) pollution

Joint campaign in May

The observation on fine particulate matters, visibility, ozone and related precursors, evaluating the performance of emission control.
Emission Inventory

The emission amount of various pollutants in Shanghai is relatively higher than other big cities.
Our Challenges

- Pollution type has changed.
  - Coal smoke type → Combined pollution

- Composition of pollution sources is complicated.
  - Chemical industry + Vehicles + Fuel burning + Fugitive emissions

- Regional complex air pollution is obvious.
  - Shanghai → YRD
  - \(\text{SO}_2, \text{dust}...\) → Haze, ozone...

Air Toxic
Haze
\(\text{O}_3\)
Acid rain
Fine PM

Current monitoring system cannot satisfy pollution control requirement!
Future Prospect & Challenge

- Pay more attention to secondary pollutants, such as haze, ozone, etc
- Establish integrated monitoring network of PM$_{2.5}$, visibility, ozone and its precursors
- Adding more pollutants into API to make better understanding with public sense

- How to optimize the current network to cover different objectives- parameters? sites? Data analysis?
- How to set up the regional network- mechanism? Unified methods & QAQC? Funding?
Thank You!

Q & A

Welcome to 2010 Shanghai EXPO