

# URBAN AIR QUALITY MONITORING DEVELOPMENT IN TIANJIN , CHINA

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**Abstract:** Tianjin is the third largest city in China and was one of most polluted cities in china as its highly developed industries and high density of population.

The automatic air quality monitoring system has been developed since 1997. 22 monitoring stations, which including 13 national level stations, has been build by 2003. PM<sub>10</sub>, NO<sub>2</sub> and SO<sub>2</sub> are continuously monitored and the results are published to public through TV, radio and newspaper. O<sub>3</sub> and CO are monitored in some stations too and falling dust monitored monthly in more than 90 sites.

Air quality monitoring network has taken an important place and provides technical support for air quality management and decision making. Many years monitoring shows that dust and smoke pollution is major problem. PM<sub>10</sub> has not met the national standard in most time of year, which effected by many reasons such as industrial emission, urban construction and sandstorms .SO<sub>2</sub> is in heavy pollution status in heating season as coal is still main energy source in the city. NO<sub>2</sub> can meet the national standard at present, but the concentration is keeping growth as automobiles increasing sharply in the city. Blue Sky Acton has been started since 2001, and many measures have been adopted to control dust and SO<sub>2</sub> pollution.

**Keywords:** monitoring network, air quality, Blue Sky Action

## 1, Introduction

Tianjin is the third largest city in China and the important economic center and port city in the north of China. It locates at northeast of Huabei Plain and downstream of Haihe River, 120 km from Beijing on southeast. Its total area is 11,000 km<sup>2</sup>, in which 377km<sup>2</sup> is built-up urban area. The total population is 960,000. Tianjin is also one of the four municipalities directly under the central government.

With the economic developing rapidly and constantly population growing, urban construction gets into a highly development period in the past few years. The pressure on environment even stands out. Environmental air pollution problems affect directly the sustainable development of the city's economy and human health. In order to control and improve environmental air quality and to create a favorable investment environment and a perfect human living condition, Tianjin municipal government had set up air quality goal and taken a series measures to reduce air pollution. Blue Sky Action was started formally in 2001. In which the special control measures are made to solve the coal-burning pollution, dust pollution, automobile pollution, industrial pollution, etc. Tianjin air quality monitoring network has been formed since 80's and kept improving gradually. Since 1997, automatic air quality monitoring network has been built. Capacities and functions are improved greatly. Air quality monitoring takes a very important role and provides technical support for air quality management as the followings:

- Trend of air quality for strategy making of air quality improvement;
- Background air quality data for air quality management;
- Information for public;

Air pollutant emission control;  
Evaluation of management scenarios;  
Data for air quality forecasting

## **2, Urban air quality monitoring network optimization and construction**

Tianjin air quality monitoring network consists of two levels networks of national controlled and local controlled stations. Within the range of the original built-up urban area of 156 km<sup>2</sup> in 1989, 7 national level monitoring stations (including a clean site) are optimized and participated in running and management of national monitoring network.

With urban construction development in recent years, urban scale has expended and function has changed greatly. According to Tianjin Urban Overall Plan (1996-2010), the urban area has increased to 377 km<sup>2</sup>. This consists of center built-up area and Binhai area that located on coast area. Thus 7 stations as before are difficult to represent synthetically the whole air quality level and pollution status. The beginning of the Tenth Five-Year Plan (2001-2005), we accomplish successively to set additional national level stations and optimize local level monitoring network.

As to urban layout adjustment, the research on Tianjin urban air quality national level station optimization and rebuilding has been accomplished. Additional monitoring stations were set up according to results. Now there are 13 national level monitoring stations (including a clean site) established in urban center and Binhai area, which basically meet to city development demand. To further show urban air pollution status and tendency, and to enhance air quality management in district levels, the additional 9 local level stations was build up around other administrative districts in 2002. Thus management and construction of air monitoring stations are fulfilled in the all of 19 districts of Tianjin. It accesses the overall level of urban air quality sincerely, objectively and accurately, and provides technical supports for different levels urban air quality management.

Tianjin environmental air quality automatic monitoring system has been developed since 1997. So far total 22 national and local level air automatic stations have been built, in which 13 national level stations still participated in national air monitoring network. Tianjin air quality daily report has been published to public through CCTV, radio and newspaper since 2000. Urban air quality forecast system was set up and 24 hours air quality forecasting has been published too since 2001, based on air quality forecast models established.

At present, the all of 24 monitoring stations have ability to monitor PM<sub>10</sub>, SO<sub>2</sub> and NO<sub>2</sub>, some of stations monitor O<sub>3</sub> and CO and weather conditions as well .Meanwhile, automatic air monitoring instruments, technique and QA/QC procedures have been developed comparability. DOAS system has been adopted in newly built stations. TEOM mass measurement system to monitor PM<sub>10</sub> give a assure on precise and accuracy .

## **3, Urban air quality status**

Coal is still taken as a major energy source in the city due to energy feature and economic development level in Tianjin. The consumption of coal accounts for 70-75% of the total energy consumption. So dust and smoke and sulfur pollution will be always kept as major factors in the long time. Industries discharge has taken an important factor in air pollution. However, it is obvious that urban infrastructure construction such as building and road constructions and automobile emission bring out air pollution problems significantly in recent years. The dust pollution which are measured as TSP and PM<sub>10</sub> turn into the chief pollutants in most time of year. PM<sub>10</sub> pollution reflects air quality up to

86% days of whole year. The monitoring showed that concentrations of TSP and PM<sub>10</sub> in urban area keep going down constantly in past few years. However, the annual means for TSP and PM<sub>10</sub> never meet the national standard and still exceed the second level of national standard by 30-40%. The sources of dust pollution have been quantified from the research on "Source Analysis of particle pollutant in Tianjin". The research showed that all kinds of urban construction pollution give a high contribution ratio to dust pollution, accounting for 34-38%.

Particularly SO<sub>2</sub> emissions are relatively heavy during heating season in winter, alternately became the chief pollutant in comparison with PM<sub>10</sub> pollution. The concentration of SO<sub>2</sub> in heating season was approx. 2.6 times higher than those in non-heating season, which is caused by coal burning from many small boilers. Annual mean for SO<sub>2</sub> reaches 0.073 mg/m<sup>3</sup> in 2003, exceeding 21.7% of the second level of nation annual limit. From the research on source analysis showed the contribution ratio of coal dust remains the second rank to the PM<sub>10</sub> in whole year, however it rise up the first one at the period of heating season and up to 25% contributions. So the pollution form coal burning is still one of the most important factors to air quality in urban region.

Despite the annual mean of NO<sub>2</sub> can still meet the second level of national standard so far, the NO<sub>2</sub> pollution has a raise tendency since 1995. Annual mean of NO<sub>2</sub> reached 0.051mg/m<sup>3</sup> in 2003, increasing 10.9% than last year. The research on source analysis of particle showed dust from automobile gas has increased 13-16% of contribution ratio and much higher than that in 80's. It is obvious that dust from trail gas is an indispensable problem in the modern sociality as cars increased sharply in recent years.

#### **4, Air Pollution control and air quality management**

Environmental protection has been recognized as basic national police by China government. Tianjin Municipal Government pays more attentions to improve urban air quality in the recent years. Tianjin government puts forward a total goal of establishing environment protection model city from 2001 to 2004, in which environmental quality including air quality and water quality should be comprehensively improved and better living environmental conditions in the city could be achieved. For addressing air pollution problems, Blue Sky Action was started formally in 2001. Air quality target was set up in Blue Sky Action. That is to achieve the 80% days of year in Class II of good level air quality by 2004 and major air pollutant could meet the national standard basically by 2005. A series measures have made to reduce air pollution. Main efforts concentrated on dust and smoke control and sulfur pollution reduction.

##### **4.1 Measures of control sulfur pollution**

Built up total approx. 400km<sup>2</sup> of the coal-free area in central area of Tianjin.

Promote clear fuel and low sulfur coal in central urban area; increase the proportion of clean energy.

Cut off the coal-burning boiler below 4 tons/ hour in urban area by 2002 and cut off major coal-burning boilers below 10 tons/ hour by 2004 in the central area. Promote centralized heating system and natural gas network.

Improve the efficiency of dust removal and desulphurization in coal-burning equipments.

Implement the total pollutant load control of air emission.

Realizes continuous emission monitoring system to major air pollution sources.

##### **4.2 Measures of control dust and smoke pollution**

Grow afforesting rate and increase greenland to 35% of urban area by the end of year 2004.

Increase the road sweeping and washing rate to control wind-borne dust from open sources.

Enhance management of construction sites to reduce wind-born dust from open sources.

Promote leak free transportation for trucks to central urban area.

#### 4.3 Measures of control automobile emission

Implement strictly the national new standards of automobile emission for new produced cars. Avoid non standard new cars to market.

Strengthen annual automobile examination and management, and on road random check to trail gas.

Forbid heavy polluted vehicles driving on road.

Execute motors I/M regulation.

Actively develop public transportation.

Promote clean fuel vehicles

Achievement has been taking place by implementing Blue Sky Action. Studies on Blue Sky Action assessment show the most of prevention measures controlled efficiently air pollution problems and made air quality to keep at the better level already. Annual mean of TSP and PM<sub>10</sub> of dust pollutants have a slow and declined tendency year by year; SO<sub>2</sub> emission decreases fluctuantly within the volume of coal consumption increased. The days of retaining the Class II of good level in all year were up to 75% and 72.3% in 2002 and 2003. Following further measures are taken, the days of Class II of good level is expected to reach 80% by then end of year 2004,