Development of Non-point Source Air Pollution Standard System in China

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Abstract. Non-point source air pollution refers to the air pollution type that have no obvious source, which is regarded as an important contributor to the atmospheric pollution problem. Comparing to the point-source and linear-source air pollution, the standardization in the relation to non-point air pollution China is relatively sluggish. The present paper collected and analysed the existing air pollution standards in China, and establish the non-point source pollution standard system in the accordance with different sectors such as industry, agriculture, construction, transportation and social life. Due to the overlapped functions and unclear jurisdiction of different administrative departments, as well as the lagging progress of the government-dominated standard, a paradigm shift of non-point source air pollution standardization should be from government-dominated to market-oriented model. The lessons learned for other developing countries includes expanding standardization to multi-aspects to realize full lifecycle control and management, building rapid responding mechanism of standardization to reconcile with industry and social transformation, integrating outdated standards into new versions, and establishing market-based standard system.

1. Introduction
The mitigation of air pollution is of strategic significance in China. Normally, Air pollution falls into four categories according to the source of the containments, namely, point source, linear source, non-point source, and natural source. The point source emission inventory can be estimated according to the online monitoring data and production conditions, and the spatial distribution can be predicted based on the latitude and longitude coordinates of point source. Linear-source air pollution is mainly yielded by automobile. Hence the spatial distribution of linear-source pollution can be obtained by investigating the traffic flow and road mileage. Compared to point-source and linear-source, the non-point source air pollution have broader coverage, which may involve the human activities of several sectors such as industry, agriculture, construction, textile and dyeing, catering and cooking, and daily life. Due to the wide scale and relatively ambiguous source, it is very hard to estimate the spatial distribution of non-point source and take corresponding control measures.

With regard to regional scale, except for the research on national-scale emission inventory, the research on regional-scale emission inventory has been improved. Chinese scholars have carried out investigation and researches on the pollution source emission inventory in the Yangtze River Delta Region and Pearl River Delta Region. Zheng Junyu et al. estimated the 2008 atmospheric non-point source pollutants emission inventory in Pearl River Delta Region, used the population distribution raster data in Pearl River Delta Region as the spatial distribution weight factors, and established the atmospheric non-point source 3km×3km gridded emission inventory in such region. Chen Nan established the pollution source emission inventory in the Chengdu Economic Circle Region (namely, Chengdu, Deyang, Mianyang,
Meishan and Ziyang), and distributed the emission amount into the 4km×4km grid through the population weight factor method. The research on urban atmospheric pollution source emission inventory focuses on Beijing, Tianjin, Shanghai and etc [1].

From the perspective of pollution source category, the domestic scholars carried out the researches on the emission inventory of a certain emission source, such as researches on the emission inventory of biomass burning, garbage burning, ship, wharf, and road mobile source, and industrial point source, and proposed the guidelines and policies to solve corresponding environmental problems in combination with research results and environmental conditions. In terms of pollutants category, more researches were made to the emissions of SO₂, NOₓ, CO, VOCs, NH₃, PM2.5 and PM10.

With more national attentions attracted to air quality conditions, Ministry of Environmental Protection issued the Technical Guideline regarding Preparation of Atmospheric Fine Particulate Matter (PM2.5) Source Emission Inventory (On Trial), Technical Guideline regarding Preparation of Atmospheric Volatile Organic Compounds (VOCs) Source Emission Inventory (On Trial), Technical Guideline regarding Preparation of Biomass Burning Source Atmospheric Pollutants Emission Inventory (On Trial), and Technical Guideline regarding Preparation of Fugitive Dust Particles Emission Inventory (On Trial) in 2014, which provided the grading and classification standards of emission source, technical procedures and methods of inventory preparation, acquisition methods and channels of emission amount calculation parameters, and the application and estimation of emission inventory, meant that China would have authoritative technical guidelines to instruct the preparation of source emission inventory, and were of great significance for promotion of preparation works of pollution source inventory.

2. Definition of Non-point Source Pollution

By definition, the atmospheric non-point source pollution refers to the atmospheric pollution type without fixed emission points, featuring the large quantity, low position of emission source, and small emission strength, such as the crop residue open burning, construction fugitive dust, stockpile fugitive dust, dense and low-lying residential chimneys, ammonia nitrogen volatilization resulted from overfertilization, and etc. The non-point pollution has stronger randomness and invisibility and the environmental impact has the hysteresis and vagueness. Therefore, it is very hard for its supervision and accountability.

The differences between non-point pollution and point pollution & linear pollution are as shown in Table below.

Table 1. Features and Monitoring of Atmospheric Point Source, Linear Source and Non-point Source Pollution.

| Category of emission source | Determination of emission responsibility | Monitoring and control |
|-----------------------------|------------------------------------------|-----------------------|
| Point source                | Definite                                 | It is easier to implement the strength and total amount control over major emission points. |
| Linear source               | Generally indefinite                     | It is very difficult and it is required to draw out various linear pollution source layout and density figure in such region in advance, and take comprehensive monitoring and control measures. |
| Non-point source            | Generally indefinite                     | It is very difficult and it is required to classify emission sources in advance according to emission features, summarize the time variation laws of various emission source according to emission laws, and take the comprehensive monitoring and control measures. |

3. Standardization for Non-source Air Pollution

The non-point source air pollution prevention and control standards should at least cover the identification of the pollutants, estimation of the emission amount and prediction of distribution of the pollutants.
3.1. Identification of the Pollutants

Due to various types of non-point sources, it is required to firstly classify the types of pollution sources. Through the relevant literature investigation and research, the atmospheric non-point source pollution may be determined and classified in accordance with the Table below.

| First class | Second class | Third class |
|-------------|--------------|-------------|
| Technical process | Petrochemical industry | Chemical production |
| Use of solvent | Other process | Volatilization of oil |
| Combustion of biomaterial | Combustion of biomaterial for residential use | Crops |
| Combustion of fuel | Coal | Liquefied petroleum gas |
| Incineration of wastes | Medical wastes | Timespan |
| Ammonia source | Crops | Animal |
| Dust source | Dust in open area | Spices |
| VOCs from natural source | Dust from road | |

3.2. Estimation of the Potential Emission Amount

After identifying the pollutants of the non-point source air pollution, it is required to collect and sort out the non-point source pollutant emission factors according to requirements of emission inventory preparation guideline document issued by Ministry of Environmental Protection and with reference to literature regarding emission factors. Then, the total potential emission amount of non-point source pollution can be estimated based on the production scale, input of raw material, reduction of the control measure, and etc.

3.3. Prediction of the Distribution of the Pollutants

Compared to the air pollution emitted from point source or linear source, non-source air pollution is relatively random and discontinuous. Therefore, it is necessary to establish the correlation between the pollution emission with time and space. In order to determine the emission limits in a specific area, the industrial production value, GDP, population size, farm area, crop output and other statistics data must be taken into consideration.

4. Non-point Source Pollution Standard Framework in China

4.1. Procedure to Establish the Non-point Source Pollution Standard Framework

According to Mai, the establishment of a standard framework can be divided into the following procedures is as: 1) objective analysis of standard system, mainly refers to the analysis and determination of transverse and longitudinal objectives of the standard system; 2) standard demand analysis, mainly refers to the analysis of deficient items of demand standards in the system based on the positioning results of objective analysis; 3) standard applicability analysis, mainly refers to the suitability analysis with regard to the content use of existing standards, and the provision of corresponding analysis conclusions; 4) the structure design of standard system refers to the standard classification and selection.
and detailing of appropriate system structural relationship; 5) the preparation of standard system table mainly refers to the design of standard information items and summary of standards; 6) the preparation of standard making and modification planning table mainly refers to the design of information relationship of planning table, which shall be prepared according to the making and modification items of standard system table; 7) The collection or compilation of existing standards of the standard system, is mainly collected according to existing standards listed in the system table; 8) the drafting of standard system table; 7) The collection or compilation of existing standards of the standard system, which shall be prepared according to the making and modification items of standard making and modification planning table mainly refers to the design of information feedback of use information mainly refers to the delivery of standards to the user, the promotion of and contents of preparation description and the preparation will be made according to this; 9) the printing and publicity of standard system mainly refers to the printing of standard system report and the collection of problems existing in use; 10) the use of standard system and the collection and publicity of standard system mainly refers to the printing of standard system report and the collection and conduct of system publicity; 11) the improvement and maintenance of standard system mainly refers to the amendment or modification of standards according to feedback problems, and the addition of newly prepared standards into the standard system database, for the dynamic maintenance of standard system database.

4.2. Non-point Source Pollution Standard Framework
The atmospheric non-point pollution prevention & control standard system developed by classification according to industrial categories, is as shown in the Figure 1. To put the framework to practical use, the standard framework needs to be divided according to types of different pollutants. At the same time, according to the technical elements given in GB/T 3840 Technical Methods for Making Local Emission Standards of Air Pollutants, the guidance can provide for the technical contents of atmospheric non-point source pollution prevention & control standards.

![Diagram](image_url)

**Figure 1.** Non-source air pollution standard framework.

4.3. Collection and Sorting of Standards
More than standards are collected and sorted in accordance with the proposed standard framework. Among them, there are many limit value, inspection and other fundamental and general standards, but the special technical standards are seriously deficient. The list of standards can be seen in the Table below.
Table 3. Sort-out conditions of non-point pollution prevention & control standards.

| No. | Standard |
|-----|----------|
| 1.1 | HJ 524-2009 Codes for Air Pollutants |
| 1.1 | HJ 801-2016 Ambient Air and Waste Gas-Determination of Amide Compounds -Liquid Chromatography |
| 1.1 | HJ 492-2009 Air Quality-Vocabulary |
| 1.2 | GB 11667-1989 Hygienic Standard for Inhalable Particulate Matter in Ambient Air of Residential Areas |
| 1.2 | GB 16297-1996 Integrated Emission Standard of Air Pollutants |
| 1.2 | GB/T 17095-1997 Hygienic Standard for Inhalable Particulate Matter in Indoor Air |
| 1.3 | HJ 653-2013 Specifications and Test Procedures for Ambient Air Quality Continuous Automated Monitoring System for PM10 and PM2.5 |
| 1.3 | HJ 656-2013 Technical Specifications for Gravimetric Measurement Methods for PM2.5 in Ambient Air |
| 1.3 | HJT 55-2000 Technical Guidelines for Fugitive Emission Monitoring of Air Pollutants |
| 1.3 | HJ 800-2016 Ambient Air-Determination of the Water Soluble Cations (Li+, Na+, NH4+, K+, Ca2+, Mg2+) from Atmospheric Particles Ion Chromatography |
| 1.3 | HJ 799-2016 Ambient Air-Determination of the Water-Soluble Anions (F-, Cl-, Br-, NO2-, NO3-, PO43-, SO32-, SO42-) from Atmospheric Particles-Ion Chromatography |
| 1.3 | HJ 549-2016 Ambient Air and Stationary Source Emissions -Determination of Hydrogen Chloride-Ion Chromatography |
| 1.3 | HJ 733-2014 Guideline for the Determination of Volatile Organic Compound Leaks and Uncovered Liquid Surface Emissions |
| 1.3 | GB 20891-2014 Limits and Measurement Methods for Exhaust Pollutants from Diesel Engines of Non-road Mobile Machinery (CHINA III, IV) |
| 1.3 | HJ 664-2013 Technical Regulation for Selection of Ambient Air Quality Monitoring Stations |
| 1.3 | GB 6921-86 Measurement Method of the Concentration of Airborne Particulate Matters |
| 1.4 | HJ 2000-2010 Technical Guidelines for Air Pollution Control Projects |
| 1.4 | GB/T 3840-1991 Technical Methods for Making Local Emission Standards of Air Pollutants |
| 1.4 | HJ 663-2013 Technical Regulation for Ambient Air Quality Assessment (On Trial) |
| 1.4 | HJT 14-1996 Principle and Technical Methods for Regionalizing Ambient Air Quality Function |
| 1.4 | HJT/T 55-2000 Technical Guidelines for Fugitive Emission Monitoring of Air Pollutants |
| 2.1 | GB 26453-2011 Emission Standard of Air Pollutants for Flat Glass Industry |
| 2.1 | GB 29620-2013 Emission Standard of Air Pollutants for Brick and Tile Industry |
| 2.1 | GB 4915-2013 Emission standard of air pollutants for cement industry |
| 2.1 | GB 29620-2013 Emission Standard of Air Pollutants for Brick and Tile Industry |
| 2.1 | HJT 393-2007 Technical Specifications for Urban Fugitive Dust Pollution Prevention and Control |
| 2.1 | GB 20950-2007 Emission Standard of Air Pollutant for Bulk Gasoline Terminals |
| 2.1 | GB 20951-2007 Emission Standard of Air Pollutant for Gasoline Transport |
| 2.1 | GB 20952-2007 Emission Standard of Air Pollutant for Gasoline Filling Stations |
| 2.1 | DB33/ 660-2008(2013) Limits for Exhaust Pollutants from In-use Vehicle Equipped Ignition Engine in Short Transient Loaded Mode |
| 2.1 | DB33/ 843-2011(2013) Limits for Exhaust Smoke from In-use Vehicle Equipped with Compression Ignition Engine under Lug-down Test |
| 2.1 | HJ 689-2014 Limits and Measurement Methods for Exhaust Pollutants from Diesel Engines of Urban Vehicles (WHTC) |
5.3 GB 18352.5-2013 Limits and Measurement Methods for Emissions from Light-duty Vehicles (CHINA 5)

5.3 GB 14621-2011 Limits and Measurement Methods for Exhaust Pollutants from Motorcycles and Mopeds under Two-speed Idle Conditions

5.3 GWKB 1.2-2011 Hazardous Materials Control Standard for Motor Vehicle Diesel (IV, V)

5.3 GWKB 1.1-2011 Hazardous Materials Control Standard for Motor Vehicle Gasoline (IV, V)

5.3 HJ/T 54-2000 Measuring Method for Exhaust Pollutants from Diesel Engines of Vehicles

5.3 GB 14762-2002 Limits and Measurement Methods for Exhaust Pollutants from Positive Ignition(P.I) Engines of Vehicles and Vehicles Equipped with P.I. Engines

5.3 GB 18352.1-2001 Limits and Measurement Methods for Emissions from Light-duty Vehicles (Ⅰ)

5.3 GB 17691-2001 Limits and Measurement Methods for Exhaust Pollutants from Compression Ignition (C.I.) Engines of Vehicles

5.3 GB18176-2007 Limits and Measurement Methods for Emissions of Pollutants from Mopeds on the Running Mode (CHINA Stage III)

5.3 GB 14622-2007 Limits and Measurement Methods for the Emissions of Pollutants from Motorcycles on the Running Mode (CHINA Stage III)

5.3 HJ/T 291-2006 Equipment Specifications and Quality Control Requirements for Gasoline Vehicles Exhaust Emission Test in Steady-state Loaded Mode

5.1 GB 18483-2001 Emission Standard of Cooking Fume (On Trial)

5. Conclusions
This research studied the current status of work on non-source air pollution standardization in China with reference to the experience of the current authors. The standard framework on non-source air pollution is established by summarizing over 40 national and industrial relevant standards. The problems and potential barriers for the non-source air pollution standardization are analyzed and come down to sluggish, overlapped, government-dominated, and lagging international standards. A paradigm shift of biogas standardization should be formed from government-dominated model to market-oriented model by promoting enterprise and group/association standards. The international standardization of air pollution can be expected to help mitigate the deterioration of the air quality in the developing countries around the world. The world-renowned standardization system for the Chinese biogas industry would be of immense value for reference to other developing countries that intend to tackle down their own atmospheric problem.

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