Performance evaluation methods and effect analysis of VOCs-related enterprises in key industries

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Abstract. VOCs pollution has a significant impact on the atmospheric environment. Volatile organic compounds (VOCs) are important precursors for the formation of fine particulate matter (PM₂.₅) and ozone (O₃), and have become one of the main pollutants of atmospheric pollution. In order to further improve the ambient air quality, it is urgent to comprehensively strengthen the comprehensive management of VOCs in key industries. Based on the characteristics of pollution production in VOCs-related industries, focusing on source control, unorganized collection, and end-of-line governance, develop a multi-factor and multi-indicator performance evaluation system, and use field surveys-field monitoring-site scoring-suggestions-corporate rectification Performance evaluation of key emission enterprises. On-site assessment was conducted on 380 companies in key industries related to VOCs, such as pharmaceuticals, pesticides, and chemicals, and 2,396 suggestions on environmental protection related rectification were put forward to guide enterprises to upgrade and achieve precise and scientific pollution control. After the improvement of deep governance, the calculation of emission reduction performance of VOCs-related companies shows that the annual emission reduction of VOCs in the pharmaceutical industry is 722.113 t a⁻¹, the annual emission reduction of pesticide industry is 842.555 t a⁻¹, and the emission reduction of chemical industry is 1498.835 t a⁻¹. The annual emission reduction is 3227.63 t a⁻¹, and the source control emission reduction is 6929.862 t a⁻¹. The total reduction of VOCs in 2019 is 13220.994 t a⁻¹.

1. Introduction
In recent years, the types of pollutants in the air have changed, and the proportion of ozone and PM₂.₅ pollution caused by VOCs has increased. According to the research at home and abroad, VOCs (volatile organic compounds) form secondary organic aerosols (SOA) under specific conditions, while SOA is an important factor affecting the visibility of the atmosphere and the main precursor of PM₂.₅, whose content in the atmosphere has an important impact on the haze pollution in the regional air.

At present, studies mainly focus on the evaluation of urban emission inventory, while there are few researches on the performance evaluation of VOCs-related enterprises at home and abroad. Pu Lihan [1] studied the internal performance evaluation system of enterprises in 2019, analyzed the connotation and
operation mechanism based on internal control, and discussed the performance evaluation system based on internal control. Wang et al. [2] established the national emission inventory of steel industry through energy and activity level data in 2016, obtained the emission factors of steel industry, and predicted the emission trend in 2030. In 2018, Cui Jiansheng [3] established the national air pollutant emission inventory of the thermal power industry in 2015 based on the CEMS (Continuous Emission Monitoring System) data, gave a specific description of the emission performance, emissions and the industry emission factors calculated by CEMS data of the thermal power industry in our country, and obtained the distribution characteristics of pollutants in the country according to the emissions.

In order to further implement the policy and achieve the goal of pollutant emission reduction, it is necessary to conduct an in-depth assessment on the VOCs emissions of enterprises in key industries such as medicine, pesticide, chemical industry and printing industry, reduce the total VOCs emissions, and improve the emission control level of VOCs-related enterprises. Therefore, it is necessary to conduct performance evaluation and propose in-depth governance issues and measures.

2. Methods of performance evaluation

In this time, 380 enterprises in key VOCs-related industries such as pharmaceutical, pesticide and chemical industry were assessed on site. In combination with national and local standards and relevant laws and regulations, the source control, unorganized collection, end-of-line governance and other detailed indicators of each industry were assessed by the proportion of 20%, 10%, 40% and 30%, respectively. The assessment methods are as follows:

2.1 Field surveys

On site, the expert team inspected and investigated the process flow, end-of-line governance facilities and automatic monitoring equipment of the main gas production and emission links in the production line of the enterprise.

2.2 Field monitoring

After on-site investigation, the expert team used the monitoring equipment provided by themselves for on-site monitoring, or selected the monitoring organization for retest, if there is any doubt between the actual emission situation and monitoring report of the enterprise or the end-of-line governance of the enterprise is not up to the standard.

2.3 Site scoring

According to the requirements of the industry on-site observation meeting, the rectification opinions pointed out by the experts in the first round of evaluation and the scoring table formulated by the Municipal Environmental Protection Bureau, the assessment was carried out according to “excellent”, “good”, “qualified” and “unqualified” after on-site investigation and monitoring. "Excellent" refers to that the average score is ≥ 90 and it meets the conditions of the difference index of “excellent” class; “good” refers to that the average score is ≥ 70 and < 90 and it meets the conditions of the difference index of “good” class; “qualified” refers to that the average score is ≥ 60 and < 70 and it meets the conditions of the difference index of “qualified” class; “unqualified” refers to that the average score is < 60. The scoring indicators are shown in Table 1. “Performance evaluation scoring table”.

| First-level indicators                  | Secondary indicators            | Score |
|----------------------------------------|---------------------------------|-------|
| Use of raw materials (10 points)       | Use of environmentally friendly, green, low- | 10    |
volatile organic ingredients

| Mode of transport (10 points) | Car transportation uses cars that meet the national five and above emission standards 10 |
|-------------------------------|-----------------------------------------------------------------------------------|
| Treatment process             |                                                                                   |
| Environmental protection     | Collecting effect and purification efficiency 5                                   |
| equipment level (20 points)   | Design normative 5                                                                 |
| Emission level (20 points)    | Reaching the standard situation 20                                                |
| Operation management level    | Operation management account 5                                                    |
| (20 points)                   | Level of automation 5                                                              |
|                               | Self-monitoring 5                                                                  |
|                               | Implementation of LDAR 5                                                           |
| Performance level (20 points) | Emission reduction performance (t VOCS·a⁻¹) 10                                    |
|                               | VOCs emissions(t·Ten thousand yuan output value⁻¹) 10                              |

2.4 Suggestions
After scoring, experts put forward suggestions according to the problems found in the field survey, including VOCs source control, unorganized collection, end-of-line governance facilities and operation management.

2.5 Corporate rectification
The enterprise carried out rectification according to the problems raised by experts, and submitted the corresponding rectification data and VOCs-related data after rectification.

3. Calculation method of VOCs production, emission and emission reduction
Through the emission node of air pollutants, the corresponding source of pollutants and corresponding end-of-line governance facilities of different chimneys or emission points are identified, and then the pollutant production and emission of each chimney or emission point are determined. The emission of air pollutants can be divided into direct emission and indirect emission. The amount of pollutant production is equal to the amount of emissions for direct emission without end-of-line governance facilities. The amount of pollutant emission for indirect emission is directly related to the end-of-line governance facilities. The key point of calculation is to determine the average treatment efficiency and operation coefficient of the end-of-line governance facilities.

3.1 Production calculation
For a certain section i, the production of a certain gas pollutant is calculated by the following formula:

\[ G_p = P_{p,i} \times M_i \]

Where:

- \( G_p \) — The average production of a certain gas pollutant of a certain section \( i \).
- \( M_i \) — Total products (total raw materials) of a certain section \( i \).
- \( P_{p,i} \) — Pollutant production coefficient of a certain section \( i \).

3.2 Emission calculation
Emission is defined as the emission of a certain gas pollutant from a chimney or atmospheric emission point in an enterprise, which means the emission of pollutants from a certain process or several processes after treatment, that is, the sum of the generated pollutants from a certain process or several processes after treatment (or untreated) [4].

The pollutant emission at the air outlet \( a \) is calculated by the following formula:

\[ E_a = \left[ G_{p_1} (1 - \eta_1 \cdot k_1) + G_{p_2} (1 - \eta_2 \cdot k_2) \right] \times (1 - \eta_a \cdot k_a) \]
Where:

- \( \eta_i \) — average removal efficiency of end-of-line governance facilities for a certain section \( i \). If there is no end-of-line governance facility in this section, then \( \eta_i = 0 \).

- \( k_i \) — the actual operation coefficient of the end-of-line governance facilities for a certain section \( i \), i.e., the power consumption of the waste gas purification facilities / the power consumption of the theoretical rated power. If there is no end-of-line governance facility in this section, then \( k_i = 0 \).

Then the total emission of a pollutant of the enterprise is calculated by the following formula:

\[
E_T = E_a + E_b + \cdots + E_X = \sum_{x=a}^{n} E_x
\]

### 3.3 Emission reduction calculation

1) Detection method:

- VOCs emission reduction of waste gas treatment facilities:
  \[
  = \text{[average concentration of VOCs at the inlet - average concentration of VOCs at the outlet]} \times \text{exhaust volume} \times \text{annual operation time}
  \]

2) Verification method:

- VOCs emission reduction of waste gas treatment facilities:
  \[
  = \text{VOCs production of waste gas in the collection section} \times \text{VOCs collection efficiency} \times \text{VOCs purification efficiency} \times \text{operation rate of treatment facilities}
  \]

### 3.4 Example calculation

Based on the analysis of the field measurement method and the material balance algorithm, combined with the actual situation of VOCs emission source terms involved in various industries, the sample source terms of VOCs only involve the use of organic solvents to calculate the emission, production and emission reduction. This time, the chemical raw materials in the pharmaceutical industry are taken as an example to illustrate and calculate. By referring to the Technical Specification Pollutant Permit Pharmacy Industry—Active Pharmaceutical Ingredient Manufacturing, involving the whole emission units of pharmaceutical manufacturing industry, it is suitable to adopt the material balance algorithm for the actual emission calculation method of VOCs, referring to the black box model for calculation.

The VOCs output of an enterprise is calculated by the following formula:

\[
\sum G_p = \sum (P_{p_i} \times M_i)
\]

Where:

- \( \sum G_p \) — the production of VOCs.
- \( M_i \) — total products (total raw materials) of VOCs production section \( i \).
- \( P_{p_i} \) — pollutant production coefficient of VOCs production section \( i \).

See Table 2 “Pollutant production coefficient of chemicals and APIs” for partial pollutant production coefficient of pharmaceutical industry.

### Table 2. Pollutant production coefficient of chemicals and APIs.

| Product name | raw material name | Process name | Scale level | Pollutant index | unit | Pollutant production coefficient |
|--------------|------------------|--------------|-------------|-----------------|-----|----------------------------------|
| chemicals and APIs | Chemical raw materials and chemical products, pharmaceutical intermediates | Chemical synthesis | \( \geq 1000 \text{ t.a}^{-1} \) | VOCs | | 36.808 |
| | | | 200–1000 \text{ t.a}^{-1} | VOCs | kg·t\(^{-1}\) product | 43.092 |
| | | | \(<200 \text{ t.a}^{-1} \) | VOCs | | 215.980 |
In the pharmaceutical industry, VOCs are usually used as extraction, dissolution and recover agents. They do not participate in the reaction and do not transform. Thus, the transformation output and product output can be ignored. Therefore, the key point of calculating the output is to determine the amount of pollutants output by the treatment. The formula is as follows:

\[
\sum G_{em} = \sum G_{in} - \sum G_{re} - \sum G_{tr-gas} - \sum G_{tr-liq} - \sum G_{tr-soli}
\]

Where:
- \(\sum G_{em}\) — The total amount of VOCs discharged in the form of pollutants.
- \(\sum G_{in}\) — The total amount of VOCs in the input materials.
- \(\sum G_{re}\) — The total amount of VOCs entering the recycled products.
- \(\sum G_{tr-gas}\) — In the calculating period, the amount of solvent \(i\) (single substance) converted into non-volatile organic substance after treatment by waste gas treatment device.
- \(\sum G_{tr-liq}\) — In the calculating period, the amount of non-volatile organic substances converted after treatment by waste water treatment device.
- \(\sum G_{tr-soli}\) — In the calculating period, the amount of non-volatile organic substances converted after treatment by solid waste treatment device.

In the emission calculation of this project, it is considered that the VOCs entering the wastewater and the VOCs existing in the solid waste are finally discharged into the atmosphere, taking \(\sum G_{tr-liq}\) and \(\sum G_{tr-soli}\) as zero.

Therefore, the calculation formula of emissions is:

\[
\sum G_{em} = \sum G_{in} - \sum G_{re} - \sum G_{tr-gas}
\]

\[
\sum G_{em} = \text{VOCs production} - \text{VOCs production} \times \text{VOCs collection efficiency} \times \text{VOCs purification efficiency} \times \text{operation rate of treatment facilities}
\]

\[
\sum G_{em} = (M_1 \times P_{pi}) \times \left(1 - \eta_{\text{VOCs collection efficiency}} \times \eta_{\text{VOCs purification efficiency}} \times \eta_{\text{operation rate of treatment facilities}}\right)
\]

4. Effect analysis

4.1 Score analysis of performance evaluation

According to the scoring rules, all enterprises are graded as “excellent”, “good”, “qualified” and “unqualified” respectively. Among them, 23 are “excellent”, 176 are “good”, 153 are “qualified”, 2 are “unqualified”, 26 are not involved in the evaluation due to upgrading of treatment facilities or other reasons. The results are shown in Figure 1.
4.2 Emission reduction analysis of performance evaluation

4.2.1 Emission reduction analysis of source control

In the three industries of medicine, pesticide and chemical industry, compared with 110 enterprises assessed in 2018, the emission reduction of these enterprises in source control in 2019 is shown in Table 3.

Table 3. Summary of performance of source control emission reduction.

| Industry          | Production in 2018 (t·a⁻¹) | Production in 2019 (t·a⁻¹) | Source control emissions reduction (t·a⁻¹) |
|-------------------|----------------------------|----------------------------|------------------------------------------|
| Pharmaceutical    | 1310.175                   | 420.451                    | 889.724                                  |
| Pesticide industry| 3238.403                   | 77.067                     | 3161.336                                 |
| Chemical industry | 3694.146                   | 815.344                    | 2878.802                                 |
| Total             | 8242.724                   | 1312.862                   | 6929.862                                 |

It can be seen from Table 3 that the pollutant production of the enterprises assessed in 2018 is 8242.724 t·a⁻¹, and the pollutant production of the enterprises mentioned above in 2019 is 1312.862 t·a⁻¹. Compared with the enterprises assessed in 2018, the emission reduction in source control in 2019 is 6929.862 t·a⁻¹.

In terms of emission reduction in source control, it mainly attributes to guiding enterprises to improve energy efficiency, develop cleaner technologies, update and replace products and raw materials that are harmful to the environment, and realize the clean production path of environmental and resource protection and effective management. Cleaner production has played an important role in it. Developing cleaner production is an effective means to control environmental pollution, which has completely changed the passive and lagging means of pollution control in the past. It emphasizes to reduce pollution before it occurs, that is, to reduce the generation of pollutants and the adverse impact on the environment in products, production processes and services. This initiative has the characteristics of high efficiency, bringing economic benefits and easy to be accepted by organizations, so it has become an effective means to control environmental pollution.
4.2.2 Emission reduction analysis of various industries

See Table 4 for VOCs emission reduction performance of various industries in 2019.

Table 4. Summary of emission reduction performance of various industries.

| Industry               | Number of enterprises | Pollutant emissions (t·a⁻¹) | Pollution discharge per 10000 yuan output value (t·10000 yuan⁻¹) | Pollutant emission reduction (t·a⁻¹) | LDAR emission reduction (t·a⁻¹) | Source control emission reduction (t·a⁻¹) |
|-----------------------|-----------------------|-----------------------------|-----------------------------------------------------------------|--------------------------------------|---------------------------------|------------------------------------------|
| Pharmaceutical industry | 49                    | 126.617                     | 0.016500                                                        | 698.888                              | 23.225                          | 889.724                                  |
| Pesticide industry     | 25                    | 47.784                      | 0.003190                                                        | 837.211                              | 5.344                           | 3161.336                                 |
| Chemical industry      | 155                   | 134.860                     | 0.088040                                                        | 1025.664                             | 473.171                         | 2878.802                                 |
| Wood-based panel industry | 17                  | 60.996                      | 0.068900                                                        | 178.112                              | /                               | /                                        |
| Plastics industry      | 22                    | 43.694                      | 0.001000                                                        | 212.464                              | 0.211                           | /                                        |
| Petrochemical Industry | 1                     | 11.9840                     | 0.000009                                                        | 593.684                              | /                               | /                                        |
| Furniture manufacturing industry | 8     | 8.322                       | 0.000341                                                        | 20.954                               | /                               | /                                        |
| Waterproof coating industry | 21     | 24.251                      | 0.000122                                                        | 99.033                               | /                               | /                                        |
| Painting industry      | 33                    | 146.103                     | 0.000032                                                        | 952.859                              | /                               | /                                        |
| Printing industry      | 26                    | 37.920                      | 0.068312                                                        | 258.681                              | /                               | /                                        |
| Coking industry        | 5                     | 9.297                       | 0.000241                                                        | 142.999                              | /                               | /                                        |
| Other industries       | 19                    | 34.703                      | 0.000686                                                        | 768.332                              | /                               | /                                        |
| Total                  | 380                   | 686.531                     | /                                                                | 5788.881                             | 501.951                         | 6929.862                                 |

Total emission reduction 13220.694

It can be seen from Table 4 that in eight furniture enterprises, the annual emission reduction of pollutants is 20.954t; in five coking enterprises, the annual emission reduction of pollutants is 142.999t; in 155 chemical enterprises, the annual emission reduction of pollutants is 1022.912t. It can be seen that the average emission reduction of furniture industry enterprises is the least, followed by coking industry, and chemical industry is the most.

There is a negative correlation between pollutant emission level and purification efficiency. The lower the emissions of the output value of 10000 yuan, the higher the purification efficiency. On the one hand, emission reduction activities of enterprises are conducive to a fresh and clean production environment and improve the image of enterprises. Through emission reduction, enterprises increase the utilization rate of resources, thus accelerating the economic development of enterprises. On the other hand, for the external impact of the enterprise, the reduction of exhaust emission not only can protect the environment and benefit people's quality of life, but also is our obligations and responsibilities as Chinese citizens.
In addition, the governance measures of some enterprises are too single, which affects the purification efficiency. It is not conducive to the production environment of the enterprise, but also affects the external image of the enterprise. We should strengthen the implementation of emission reduction measures, protect the environment and improve the quality of life of enterprise employees and surrounding residents.

With the progress of industrial civilization, the problem of environmental pollution and resource shortage has become increasingly prominent, and all sectors of the society are calling for cleaner production, energy conservation and emission reduction. Medical (pesticide) and chemical enterprises play an important role in the economy of our province, which is one of the pillar industries in our country. It is of great significance for the development of industry and agriculture, the modernization construction and the improvement of people's living standards.

4.3 Analysis on the characteristics and main problems of VOCs emission in some industries

In view of the existing problems of various enterprises, in order to meet the national and provincial policies and regulations, and achieve the goal of stable pollutant emission reduction, the expert group has put forward targeted countermeasures and rectification opinions for each enterprise. Now, the characteristics and main problems of VOCs emission of several key industries are summarized as follows:

4.3.1 Pharmaceutical industry

1. VOCs emission characteristics: 1) There are many emission points, with large emissions and serious unorganized emissions. 2) There are many intermittent emissions; the reaction process is basically intermittent reaction, and the solvent exhaust gas is also intermittent emissions. 3) The emissions are unstable. The composition of solvent waste gas is complex, and the types and concentrations of pollutants vary greatly. The same unit may discharge pollutants of different properties in different periods. 4) The solvent waste gas has a wide range of influence. VOCs in solvent waste gas mostly have the odor property, which are easy to spread, with low odor threshold value and wide influence range. 5) There are many emission accidents such as gas leakage, water spraying, water dripping and water leakage.

2. Main problems: 1) The phenomenon of gas leakage, water spraying, water dripping and water leakage is common in enterprises, the collection system of unorganized emission gas is not perfect, and the setting of gas-collection hood and collection pipe-network is unreasonable, which cannot realize negative pressure operation and has low collection efficiency. 2) The waste gas treatment facilities cannot reach the standard stably and need to be upgraded. 3) Some monitoring ports, monitoring platforms and monitoring reports of some enterprises are not standardized, some data of monitoring reports are questioned, and some monitoring companies have poor sense of professional responsibility. 4) The operating procedures of VOCs treatment facilities are simple, without detailed operation parameters; the stability of treatment effect lacks effective support materials. 5) The mechanism of leakage detection and repair (LDAR) of VOCs has not been established in the production process of some enterprises, such as static and dynamic sealing points, transportation and storage of raw and auxiliary materials.

4.3.2 Organic chemical industry

1. VOCs emission characteristics: 1) Generally, there are many waste gas emission points, almost covering every production equipment node, with large emission and serious unorganized emission, resulting in high concentration of waste gas within the factory. 2) Due to the intermittent reaction, the waste gas is discharged intermittently, and the air volume per unit time is extremely unstable. 3) Due to the complexity of solvent, the concentration and type of pollutants in waste gas vary greatly. The same device may discharge pollutants of different kinds and properties in different periods, and the emission is very unstable. 4) Most of the waste gas is VOCs with odor, which has strong diffusion, low odor threshold value and wide range of influence.

2. Main problems: 1) Some enterprises have poor anti-seepage performance on the ground of
production workshop, poor equipment maintenance, poor working environment, leakage phenomenon
and unorganized gas emission (including reactor feed port, centrifuge discharge port, hazardous waste
room and other links). The collection system of unorganized emission gas is not perfect, and the setting
of gas-collection hood and collection pipe-network is unreasonable, which cannot realize negative
pressure operation and low collection efficiency. 2) The waste gas treatment facilities cannot reach the
standard stably and need to be upgraded. 3) Some monitoring ports, monitoring platforms and monitoring
reports of some enterprises are not standardized. In the monitoring of VOCs waste gas, there is a
violation phenomenon and lack of relevant pollutant indicators. 4) The identification and operation
standing book of the on-site waste gas collection and treatment system of some enterprises are not
standardized, and the operation and management system of environmental protection facilities has not
been established. 5) The operating procedures of VOCs treatment facilities are simple, without detailed
operation parameters; the stability of treatment effect lacks effective support materials.

4.3.3 Industrial coating industry

1) VOCs emission characteristics: 1) It mainly comes from the use of organic raw and auxiliary
materials. The main discharge process is coating and drying. 2) Due to the intermittent reaction, the
waste gas is discharged intermittently, and the air volume per unit time is extremely unstable. 3) The
paint mist is easy to block the equipment for subsequent treatment process, so the pretreatment process
shall be set.

2) Main problems: 1) Promote the use of powder, water-based, high solid content, radiation curing
coating and other low VOCs content coatings instead of solvent-based coatings. We will vigorously
promote the use of water-based coatings for primer in automobile manufacturing, high solid content or
water-based coatings for intermediate coat and color paint in passenger cars, and accelerate the
transformation of intermediate coat and color paint in buses and trucks. The auto repair industry
encourages the use of water-based coatings. Wood furniture manufacturing vigorously promote the use
of water-based, radiation curing, powder coating and other coatings and water-based adhesives. Metal
furniture manufacturing vigorously promote the use of powder coatings. 2) Accelerate the promotion of
compact coating process, and encourage the use of automatic spraying, electrostatic spraying and other
technologies. In the production of automobile manufacturing, compact technology, electrostatic
spraying technology and automatic spraying equipment such as “three coating and one drying”, “two
coating and one drying” or no intermediate coating should be widely used. Auto metal parts enterprises
are encouraged to adopt powder electrostatic spraying technology. 3) Raw and auxiliary materials such
as coating, diluent and cleaning agent shall be stored in a sealed storage. The mixing, use and recovery
process shall be conducted by using closed equipment or operating in a closed space, and transported
by using closed pipes or containers. Except for large workpieces, open spraying and air drying are
prohibited. Except process constraints, the centralized mixing should be implemented in principle. 4) VOCs emission processes such as mixing, spraying and drying shall be equipped with effective waste
gas collection system. The waste gas from spraying should be pretreated by dry paint mist catching
device, and then the technology of “adsorption concentration + regenerative thermal oxidizer / catalytic
combustion” should be adopted. The renewable activated carbon adsorption technology should be used
for small air volume. The waste gas from mixing, drying and flowing can be treated together with the
waste gas from spraying. 5) Improve the self-monitoring plan, the standing book of operation
management of raw and auxiliary materials containing VOCs and the standing book of operation
management of environmental protection facilities; improve the setting of on-site signs and labels;
timely replace the filter cotton pretreated by the activated carbon adsorption device; recommend the use
of renewable activated carbon adsorption, concentration-combustion / catalytic oxidation and other
efficient purification facilities.
5. Conclusions
The performance evaluation of VOCs-related enterprises carried out in 2018-2019 has reduced VOCs emissions and provided strong support for achieving the national and provincial emission reduction target of reducing VOCs by 25% during the 13th Five Year Plan period. In order to further improve the quality of the atmospheric environment, it is suggested to continuously carry out investigation and evaluation, in-depth governance and performance evaluation for VOCs-related enterprises, adhere to difference management and control of performance classification, guide key industries to formulate relatively unified emergency emission reduction measures within the industry, and carry out differentiated management and control for related enterprises in key industry based on performance classification, so as to achieve the national and provincial standards of reduction and exemption for the optimal enterprise of corresponding emission reduction measures, to further reduce the contribution of VOCs to PM2.5 and ozone in the atmosphere and promote the further improvement of atmospheric environmental quality.

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