

# Study on the Present Situation, Causes and Countermeasures of Air Pollution in Hubei Province

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**Abstract**—It is an objective that the government propose to achieve the target which is about 8% of the economic growth in this year's government working report of Hubei Province. However the air pollution situation of Hubei Province is little optimistic because the industrial emissions and smoke (powder) dust emissions had been risen in last five consecutive years. In order to curb the industrial waste gas, the government increase the corresponding facility, nevertheless, the result is disappointing. By studying the reasons for the air pollution in Hubei Province, it is easy to find a solution to the countermeasures. At the same time, it is necessary to complete the economic growth target and governance environment.

**Index Terms**—Air pollution Industrial emissions Trans-regional delivery

According to the definition of the International Organization for Standardization (ISO), "General speaking, Air pollution refers to the phenomenon that enough materials which are produced by human activities or natural processions appears enough concentration to enter the atmosphere due to achieve sufficient time, and thus to hurt the human body, health and welfare or the environment". Controlling of emissions to reduce air pollution is the top priority of the current national task.

In 2016, the average number of good air days in 17 key cities in Hubei Province was 73.4%. It up 7.3% compared with last year. And Carbon monoxide (CO) and ozone (O<sub>3</sub>) were down 22.2%, 7.1%, 14.1%, 16.9%, 5.3% and 4.8% respectively compared with 2015. The ambient air quality has been improved compared with last year. However, 16 key cities of Hubei province's air quality did not meet the average annual secondary standards when they had evaluated by the national "ambient air quality standards", except Shennongjia. In order to avoid the phenomenon which is that the air pollution effect on the public health hazards further intensify, it is necessary to analyze the status and causes of the air pollution because it may give the way to solve the problem of air pollution and to give the people better life when the air condition is improved.

## I. THE STATUS OF AIR POLLUTION

### A The annual average concentration of major pollutants

In 2016, the evaluation result shows that the annual average concentration of six major pollutants of 17 key

cities could not meet the national air quality secondary standard all. The 17 key cities exceeded standard of the inhalable particulate matter (PM<sub>10</sub>), except Shennongjia and Enshi. PM<sub>10</sub> excess is from 0.07 (Huanggang) to 0.43 (Jingzhou) times. As for the amount of fine particles (PM<sub>2.5</sub>), all the cities are exceeded, except Shennongjia. The data shows that PM<sub>2.5</sub> excess is from 0.29 (Xiaogan) to 0.83 (Xiangyang) times. All the cities are standard in Ozone (O<sub>3</sub>) standard, except Ezhou and Huanggang. Their excess are 0.09 and 0.1 times; And 17 key cities are standard in sulfur dioxide (SO<sub>2</sub>) and carbon monoxide (CO).

### B The annual average concentration of respirable particulate matter (PM<sub>10</sub>)

In 2016, the annual concentration of PM<sub>10</sub> was 85 $\mu$ g / m<sup>3</sup> in 17 key cities of Hubei Province. It is dropped by 14.1% when compared with the data of 2015 (99 $\mu$ g / m<sup>3</sup>). And it is dropped by 9.6% when compared with the data of 2013 (94 $\mu$ g / m<sup>3</sup>). The 12 cities (excluding the straight city, Enshi and Shennongjia forest district) which belong to the assessment field of the national in Hubei Province was 88 $\mu$ g / m<sup>3</sup> in the annual concentration of PM<sub>10</sub>. It is dropped by 13.7% than when compared with 2015 (102 $\mu$ g / m<sup>3</sup>), and it is dropped by 12.9% when compared with 2013 (101 $\mu$ g / m<sup>3</sup>).

The top five cities which have the highest concentration in annual average of PM<sub>10</sub> are as follows: Jingzhou, Jingmen, Yichang, Xiangyang and Wuhan. The 17 key cities of Hubei Province's concentration of PM<sub>10</sub> decline in varying degrees in 2016 when compared with 2015. The five cities of them which have large drop in concentration of PM<sub>10</sub> are as follows in sequence: Xiaogan, Xiantao, Qianjiang, Suizhou and Xianning.

### C The annual average concentration of fine particles (PM<sub>2.5</sub>)

In 2016, the annual average concentration of PM<sub>2.5</sub> was 54 $\mu$ g / m<sup>3</sup> in the 17 key cities of Hubei Province. It is dropped by 16.9% when compared with 2015 (65 $\mu$ g/m<sup>3</sup>). The 13 cities which obey the "13th Five-Year" Air Quality was 55 $\mu$ g/m<sup>3</sup> in PM<sub>2.5</sub> of the average Constraints. It is dropped by 16.7% when compared with 2015 (66 $\mu$ g/m<sup>3</sup>).

The top six cities which have the highest concentration in annual average of PM2.5 are as follows: Xiangyang, Yichang, Jingzhou, Ezhou, Qianjiang, Tianmen. Two of those cities which are Qianjiang and Tianmen were 59µg / m3 in annual average concentration. The 17 key cities of Hubei Province's concentration of PM2.5 decline in varying degrees in 2016 when compared with 2015. The five cities of them which have large drop in concentration of PM2.5 are as follows in sequence: Xiaogan, Xiantao, Wuhan, Jingmen and Huangshi.

*D The 90th percentile in maximum 8 hours per day of Ozone (O3)*

In 2016, the 17 key cities of Hubei Province was 139µg / m3 in the 90th percentile in maximum 8 hours per day of Ozone. It is dropped by 4.8% when compared with 2015(146µg/m3). The 13 cities which obey the "13th Five-Year" was 148µg / m3 in the 90th percentile in maximum 8 hours per day of the average Constraints Air Quality. It is dropped by 0.7% when compared with 2015 (149µg / m3).

The high-ranking cities in order are as follows: Huanggang, Ezhou, Wuhan, Xiaogan, Huangshi and Xianning. Two of those cities which are Huanggang are Ezhou exceeded limited of secondary standard in the 90th percentile in maximum 8 hours per day.

*E The proportion of good air quality days*

In 2016, the proportion of good air quality in 17 key cities of Hubei Province was between 64.2% (Ezhou)

and 92.9% (Shennongjia). The average number of good air quality days was 73.4%. It had increased 7.3 percentage points when compared with 2015. The 13 cities which appraisal by "13th Five-Year" was 71.4% in the proportion of the average number of good air quality days. It had increased 6.5 percentage points when compared with 2015. The high-ranking cities in order are as follows: Xiaogan (13.2%), Qianjiang (12.9%), Wuhan (12.6%) and Jingmen (12.2%)

II. THE CAUSE OF AIR POLLUTION

*A Industrial emissions*

The industrial emissions released contaminants which include soot, sulfur oxides, nitrogen compounds, organic compounds, halides, carbon compounds into the atmosphere. So the industrial emissions is an important source which lead to the air pollution, especially smoke and gas. The two steps of production processes produce the most important pollutants:

(1) fuel combustion, it will exhaust gases which has a high degree of harmful substances when coal and oil are in combustion process.

(2) dust and exhaust gases which produced by the production process: the most serious industries on air pollution include the thermal power industry, steel industry, petrochemical industry, cement industry, etc.

Industry	Unit	The main contaminant
thermal power	thermal power industry	Soot, sulfur oxides, carbon dioxide, polycyclic aromatic hydrocarbons
Metallurgy	steel industry	Soot, calcium oxide dust, ferric oxides dust
	coking plant	Soot, phenol, benzene, neon, sulfureted hydrogen
Chemical engineering	Petrochemical works	Cyanide, chloride
	Nitrogen, fertilizer plant	Sulphate aerosols, ammonia
Light	Paper mill	Mercaptan, effluvium, hydrogen sulfide
Materials, building materials	Cement plant	Soot
	Brick kilns	Hydrogen fluoride, sulfur dioxide

Figure 1: atmospheric pollutant from major factories

It is obvious from the table one. Even if total dust emission of sulfur dioxide, nitrogen oxides and smoke (powder) decreased, but the total industrial exhaust emissions has been increasing by year. It means that the

production model do not change essentially which has high input, high emission and high pollution mode. Therefore industrial emission is still one of the major sources of air pollution in Hubei province.

TABLE 1: TOTAL EMISSIONS OF INDUSTRIAL EMISSIONS, SULFUR DIOXIDE, NITROGEN OXIDES, SMOKE (POWDER) DUST, HUBEI PROVINCE

Items/year	2011	2012	2013	2014	2015
total industrial exhaust emissions (billion standard cube )	22840.8	19512.5	19986.9	21701.8	23643
Total industrial sulfur dioxide emissions (tons)	594980	548591	524005	506192	470683
Total nitrogen oxides emissions (tons)	669650	640008	612392	580222	514461
Industrial (tons)	477568	440941	404489	367357	318969
Smoke (powder) dust emissions (tons)	346150	349657	359525	504006	446974
Industrial (tons)	307356	281577	294788	438294	378130

Data sources: data from China Ministry of Environmental Protection and China National Bureau Statistics, organized by EPS DATA

*B transportation*

The influence of emission pollutants from automobile on the air environment is more and more serious with the

increasing of total automobile number in city. From 2010 to 2014, the total emissions of nitrogen oxides of motor vehicles in Hubei increased by 20%, accounting for 34.3% of the total.

TABLE 2: THE TOTAL MOTOR VEHICLE EMISSIONS OF HUBEI PROVINCE

Hubei Province	2011	2012	2013	2014	2015
Total emissions of nitrogen oxides (tons)	669650	640008	612392	580222	514461
Motor vehicles (tons)	179981	186849	194872	198999	180893
Total emissions of smoke and dust (tons)	346150	349657	359525	504006	446974
Motor vehicles (tons)	15460	16089	16553	16748	16751

Data sources: data from China Ministry of Environmental Protection and China National Bureau Statistics, organized by EPS DATA

Nitrogen oxide is one of the major sources of air pollution, and also the major factor leading to haze, ozone destruction and air pollution. Therefore, motor vehicle exhaust is one of the major sources of pollution of particulate matter in the air environment of Hubei Province.

*C Trans-regional delivery*

The typical transboundary environmental pollution problem is that atmospheric pollutants can be transport over a long distance because natural factors such as climate, wind direction influence the atmospheric environment. Huang Zhiji et al. (2013) examined the relationship between urban distance and environmental pollution emissions under the 3D framework of the World

Bank and found that there is a negative relationship between the distance and total pollution emissions, although there is a positive relationship between the emission intensity and emission intensity relationship.

Henan Province is nearby Province in the north, Anhui Province borders Hubei on the east, Jiangxi Province and Hunan Province is on the southeast and south of Hubei, Chongqing Municipality is adjacent the west and Shanxi Province is in the northwest of Hubei. Table 3 shows that, the total amount of industrial emissions of all Provinces which around Hubei have shown an upward trend except Henan and Hunan provinces. The aggravation of the air pollution in Hubei Province could be due to the emissions which are from neighboring provinces.

TABLE 3: THE TOTAL INDUSTRIAL EMISSIONS OF SEVEN PROVINCES ( MILLION STANDARD CUBIC METERS )

the total industrial emissions (province/year)	2011	2012	2013	2014	2015
Anhui Province	30410.8	29645	28335.4	29232.6	30794
Jiangxi Province	16102	14814.1	15573.8	15613.4	17055
Henan Province	40790.9	35001.9	37665.3	39628.7	36286
Hubei Province	22840.8	19512.5	19986.9	21701.8	23643
Hunan Province	16778.5	15887.5	17276.4	16050.5	15320
Chongqing Municipality	9121.1	8359.9	9532.4	9289.6	9928
Shanxi Province	15704.3	14767.4	16279.5	16542.5	17303

Data sources: data from China Ministry of Environmental Protection and China National Bureau Statistics, organized by EPS DATA

III. THE MANAGEMENT OF AIR POLLUTION

In order to further control the air pollution in Hubei Province, it should be made great efforts in the following aspects.

*A unswervingly adhere to strengthen the responsibility of local governments*

Leaders should take environmental assessment of ecological compensation as the starting point, investigate responsibility of ecological damage as a focal point, strengthen the assessment of environmental with air quality rankings, increase strength in interview, accountability and exposure to reduce the ineffectiveness of the work and environmental air quality improvement, continue to intensify the local government's effective implementation of legal responsibilities in the quality of ambient air, promote the local government to form a broad

pattern of environmental protection work under the leadership of party committees and governments, the division of labor by departments and the extensive participation of the community, and improve the ambient air quality in the enhancement of the joint efforts.

*B unswervingly adhere to scientific governance haze*

It is necessary to further increase the capacity of monitoring and forecasting in warning, strengthen analysis and judgment, scientifically formulate environmental air quality improvement action plans, and improve the rationality and accessibility of measures for the improvement of ambient air quality. It should increase investment in scientific research to accelerate the implementation of source analysis, and constantly improve measures in the relevance and effectiveness of haze governance. In order to establish a solid foundation which can prevent and control the Ozone pollution in the

eastern part of Hubei, it is important to highlight the ozone and other new primary pollutants and to have a judgement in advance analysis.

*C unswervingly adhere to the comprehensive policy*

It should make major breakthroughs and implement various policies to keep declining major pollutants because it is a crucial period for Hubei Province who want to improve the ambient air quality. The government not only strengthen pollution control in the key industries and enterprises, but also strengthen pollution control measures in non-point source to the prevention and control of motor vehicles, construction sites and road dust control, cooking fumes governance, gas stations and oil and gas storage, and so on. At the same time, it should formulate a targeted measure which is basis on the characteristics of pollution occurrence in temporal and spatial for banning burning straw and coping strategy in heavily polluted weather.

*D unwaveringly adhere to the joint defense and control*

Local people's government is the main responsibility which should prevent and control regional air pollution, so it is important to strength leadership's ability of organization and the working program of joint prevention and control on air pollution in the region is made by them. For targeted control, reduce peak pollutants and reduce pollution duration, it should pay high attention to establish per-contingency plans for heavy pollution weather. When heavy polluting weather is happened because of local pollution, all localities should take measures to respond to contingency plans in a hierarchical manner, also adopt measures such as limiting production, stopping production, restricting motor vehicles, and strengthening dust control measures. Where there is transmission pollution, all localities should adopt measures which is artificial increasing rainfall and so on to reduce the adverse effects of external pollution.

*E unswervingly guide the public participation*

The quality monitoring information of ambient air is full disclosure. The basic work include not only response to public concerns, but also relieve public sentiment. It is necessary to step up publicity on air quality improvement, boost community confidence in the improvement of ambient air quality and stimulate the enthusiasm of the whole society to take part in the improvement of ambient air quality. When important festivals and major events are

coming, forecast services should provide in time. Then the public's perception which is about the improvement of ambient air quality will be enhanced, after public life has been provided effectively serve.

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