An analysis of the environmental pollution of A specialized coal terminal In Tianjin Port.

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Abstract. In order to comprehensively evaluate the current situation of air pollution control in bulk terminal, the measures and effects of atmospheric environmental management of a specialized coal terminal company in Tianjin Port are studied. Through field investigation, monitoring and data analysis, the current situation of atmospheric environment of the subject was quantitatively analyzed and compared with national standard. The results show that, under the premise of using spray, covering, Wind-proof net and other management measures during monitoring, the atmospheric environment and major characteristic pollutants at the boundary of the terminal operating area meet the standard requirements.

1. Introduction:
In recent years, with the development of ecological civilization, the country has put forward higher requirements for the green, ecological and low-carbon development of the port. In 2011, the Ministry of Transport carried out a pilot project on low-carbon transportation, and Tianjin Port was identified as one of the first pilot units for green low-carbon circular ports in 2012.

On the afternoon of January 17, 2019, During a visit to Tianjin Port, General Secretary Xi Jinping stressed that in order for the economy to develop, the country should be strong and transportation, especially maritime transport, should be strengthened first. We should aim to build a world-class smart port, green port, better service Beijing-Tianjin-Hebei coordinated development and jointly build the "Belt and Road". November 13, 2019, the Ministry of Transport joined multiple ministries issued the 《Guidance on the Construction of World-Class Ports》 [1], which calls for the construction of a safe convenient, smart green, economical efficient, supportive and powerful, world-class port with a focus on the hub port. [2]

Efforts should be made to strengthen pollution prevention and control, promote the prevention and control of pollution in ports and ships, optimize pollution control models, improve the system of environmental protection standards, strengthen dust and dust suppression measures for bulk operations.

In the classification of port terminal business, the pollution problem of dry bulk terminal is relatively prominent, and dust control is the focus of dry bulk terminal pollution control. Tianjin Port as an important coal loading and unloading port in China, has a strong representative, so this paper selects a specialized coal terminal in Tianjin Port in the daily operation of the atmospheric environment monitoring results and governance for analysis.
2. Data arrangement.

2.1 Terminal data.
The number of berths designed for the terminal is 3, and the berths are $2 \times 70000$ tons and $1 \times 150000$ tons. The designed annual carrying capacity is 35 million tons, and the actual carrying capacity is 45 million tons. The coastline length is 890 meters, and the annual operation time is about 320 days. The total area of the yard is about 423000 square meters, the storage capacity is 1.44 million tons, the average storage period of coal is 3 days, and the storage yard is operated throughout the year.

2.2 Operating conditions.
The business scope of the company includes: the business scope of the company is only coal, and the mode of transportation is all railway into the port, water transport out of the port, only loading and unloading ship business. The coal loading capacity of the company in 2019 is 44.7 million tons.

2.3 Climatic conditions.
The project is located in Tianjin Binhai New Area, Tianjin Port, south of the port area, which is located in the mid-latitudes of the eastern coast of Eurasia, mainly dominated by monsoon currents, is a popular area of the East Asian monsoon, belonging to the continental climate\(^{[4]}\). The main climatic characteristics are: four seasons, windy spring, less rain, hot summer, concentrated rain, cool autumn, moderate heat and cold, cold winter, dry and less snow.

Binhai New Area year-round maximum wind trend for SW wind, frequency of 9%, the wind's monsoon change law is spring and autumn SW wind-based, summer SE-based, winter prevailing NW wind trend; The average temperature for many years is above 11 degrees Celsius, the average monthly minimum temperature is below -7 degrees Celsius in January, and the average monthly maximum temperature is above 29 degrees Celsius in July. In the last 50 years, the extreme maximum temperature reached 39.9 degrees Celsius (1997) and the extreme minimum temperature reached -22.9 degrees Celsius (1966). The average annual air pressure is 1016.4 millibars.

The average annual precipitation is 602.9 mm, which accounts for about 75% of the year in summer, and the air humidity is about 60%, with a maximum of about 75% in July. The annual average evaporation was 1909.6 mm and the sun was 65%.

2.4 Process.
The company specializes in coal cargo loading and unloading, where coal loading and unloading process flow as shown in the figure below.

![Figure 1 Coal loading and unloading process flowchart.](image)

2.5 Loading and unloading machinery.

| Serial number | Equipment name   | Model/load. | Number |
|---------------|------------------|-------------|--------|
| 1             | Loader.          | Volvo 180E  | 6      |
| 2             | Forklift.        | HELI 16T    | 1      |
| 3             | Sweeper.         | Benz Schmidt| 1      |
### 2.6. Analysis of the production and pollution link

Combined with on-site investigation and analysis of existing projects, the main atmospheric pollutant generation nodes during the current project operation period include:

1. Dust generated by coal entering the roll-over engine room by train;
2. The dusting effect of the work of the stacking machine, the company investigated in this paper adopts the treatment method of large arm sprinkler;
3. The second dust of the stack under the action of the wind.
4. Dust generated during belt transport;
5. Dust generated by the transfer tower drop.

### 3. Environmental protection measures

Based on the analysis of the previous pollution production link and the results of the monitoring data survey, the following measures have been carried out by enterprises in the prevention and control of dust:

1. Turn over the locomotive room wet dust removal. Traditional roll-over machine room is generally equipped with dry dust remover, the company investigated in this paper to take the dust-suppressing technology for wet-type dust removal, specifically for the roll-over machine dry fog sprinkler and funnel sprinkler technology.
2. The belt is closed confidentially. The belt machine is closed in the process of conveying materials, which reduces the influence of wind erosion in the process of transporting materials.
3. Heap picker sprinklers. The company investigated in this paper adopts the treatment method of water spraying and spray gun on the arm of the fighting wheel.
4. Mobile machinery sprinklers. In the cargo handling transfer process using sprinklers, fog gun trucks for accurate dust suppression.
5. Wind-proof net. Around the boundary of the yard, a fully closed wind-proof net was built around the height of about 18 meters, and the material was a polymer composite dust suppression board.
6. Cover All pallets that do not have job requirements for the time being are covered to prevent static dusting.
7. Monitoring of early warning. Companies in the field with real-time atmospheric monitoring points, monitoring data and the competent departments connected, real-time grasp of the plant air quality.

### 4. Environmental Air Impact Analysis.

#### 4.1. Current state of environmental air quality.

At present, Tianjin Port Group has carried out online monitoring of the surrounding environment of all bulk cargo companies under the company, monitoring indicators include: SO$_2$, NO$_2$, PM$_{10}$, CO, O$_3$, PM$_{2.5}$, monitoring methods adopted the 《Environmental Impact Assessment Technology Guidelines...
Atmospheric Environment [4] 《Air and exhaust gas monitoring and analysis methods》 and 《Environmental Air Quality Standard》 and so on the technical specifications.

Therefore, this paper will intercept the project surrounding 7 consecutive days of environmental online monitoring results, environmental background to explain.

Survey time and survey station.

The survey period was from 8 to 14 September 2020, with a total of eight monitoring points, of which three monitoring points were located north-south at the corporate site boundary and one monitoring point at the east-west border. The statistical results of the monitoring of the state of the atmospheric environment can be found in Table 2.

Table 2 Environmental air monitoring data sheet for 8-14 September

| Monitoring projects | Daily average (μg/m³) | Secondary environmental quality standard values ('g/m³') |
|---------------------|-----------------------|-------------------------------------------------------|
| SO₂                 | 0.6-21.8              | 150μg/m³                                              |
| NO₂                 | 19.7-66.1             | 80μg/m³                                               |
| PM₁₀                | 0-63.8                | 150μg/m³                                              |
| PM₂.₅               | 0-52.4                | 75μg/m³                                               |
| CO                  | 0.7-1.2               | 4mg/m³                                                |
| The₅                | 4.2-40.7              | 160μg/m³                                              |

The atmospheric environmental quality in the area where the project is located implements the requirements of the secondary standards in the 《Environmental Air Quality Standards》, as can be known from the monitoring data in the table above, the background values of the ambient air in September at the location of the project are good, and the targets of PM₁₀,PM₂.₅,SO₂,NO₂,CO and O₃ can meet the requirements of the secondary environmental quality standards in the 《Environmental Air Quality Standards》.

4.2. The monitoring and standard analysis of air pollution sources in the project plant boundary.

For the port dust pollution is the main source of air pollution, and the coal ore pier in the loading and unloading operations and open storage of wind erosion process TSP and PM₁₀ is the main component of dust, so on 28, 2020, the port area TSP contribution was investigated and monitored, monitoring the normal production operation during the monitoring period, The meteorological conditions and monitoring results during the monitoring period are shown in the table below.

Table 3 Weather conditions during monitoring.

| The detection point. | Wind.  | Average wind speed (m/s) | Atmospheric pressure (kPa) | Weather conditions. | TSP (μg/m³) |
|----------------------|--------|--------------------------|----------------------------|---------------------|-------------|
| 1#-1                 | Southeast. | 2.3                      | 102.1                      | Clear.              | 100         |
| 1#-2                 | Southeast. | 2.3                      | 102.1                      | Clear.              | 117         |
| 1#-3                 | Southeast. | 2.3                      | 102.1                      | Clear.              | 83          |
| 2#-1                 | Southeast. | 2.3                      | 102.1                      | Clear.              | 117         |
| 2#-2                 | Southeast. | 2.3                      | 102.1                      | Clear.              | 150         |
| 2#-3                 | Southeast. | 2.3                      | 102.1                      | Clear.              | 100         |
| 3#-1                 | Southeast. | 2.3                      | 102.1                      | Clear.              | 83          |
| 3#-2                 | Southeast. | 2.3                      | 102.1                      | Clear.              | 83          |
| 3#-3                 | Southeast. | 2.3                      | 102.1                      | Clear.              | 150         |
| 4#-1                 | Southeast. | 2.3                      | 102.1                      | Clear.              | 133         |
| 4#-2                 | Southeast. | 2.3                      | 102.1                      | Clear.              | 83          |
According to the monitoring results, the maximum concentration of TSP at the test point is 0.15 mg/m³, which meets the requirements of 1.0 mg/m³ of the monitoring concentration limit of particulate matter without tissue in GB16297-1996 《Integrated Emission Standards for Atmospheric Pollutants》.

5. Conclusions.
(1) As TianJin city and Tianjin Port Group’s own environmental management level increased year by year, the environmental air background quality in the area where the terminal is located during the monitoring period is better, there is no serious pollution phenomenon.

(2) PM₁₀, PM₂.₅, SO₂ and NO₂ at the plant boundary of the terminal operating area during the monitoring period meet the requirements of the secondary standards in the 《Environmental Air Quality Standards》

(3) The discharge of atmospheric major characteristic pollutants (TSPs) in the terminal operating area during the monitoring period meets the limits of the monitoring concentration of particulate matter without tissue emissions in the 《Integrated Emission Standards for Atmospheric Pollutants》

(4) Air pollution prevention and control aspects such as rolling machine room wet dust suppression, yard area spray, cover, wind net closure and other management measures reasonable and effective.

To sum up, this paper considers that the dust control work of professional coal terminal should be studied as the key environmental protection measures of this industry. And how to reasonably and effectively accurately suppress dust as the main technical direction of enterprise environmental protection governance in the future.

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