

STUDY ON BUSINESS POLLUTION AND ITS COUNTERMEASURES IN SHANGHAI

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ABSTRACT: Over the past ten years, Shanghai has experienced a period of industrial restructuring and the economic development. The proportion of tertiary industry output in Shanghai's gross domestic production (GDP) is continuously rising. However, the rapid growth of tertiary industry has caused some adverse environmental effects, which, to a certain extent, have become the main reasons responsible for urban environmental deterioration and resident's complaints of their ambient environment. Based on the current investigation on the wide variety of business pollution in Shanghai, this paper analyzes the major problems existing in the environmental management of the tertiary industry, and discusses the factors and methods of assessment, and the ways of management and control.

KEY WORDS: business pollution, countermeasures, Shanghai

I. STUDY BACKGROUND

The term of business pollution in this paper refers to the reverse effects on the environment and human health arising from the processes of profitable commercial activities. It mainly includes noise pollution, oil smoke pollution, heat pollution, waste water pollution from restaurant, plastic package pollution and light pollution. During the process of industrial restructuring and the economic development, the proportion of the tertiary industry in Shanghai's gross domestic production (GDP) rose from 30.8% in 1990 to 40.1% in 1995. In the following fifteen years, two thirds of factories in Shanghai will be moved out from downtown area for developing tertiary industry. Until then, the proportion of the tertiary industry in Shanghai's economy is expected to reach 60% to 65%. However the adverse environmental effects caused by the rapid development of the tertiary industry, especially the development of commerce and service trades, are becoming a serious problem. Such effects will directly or indirectly cause physical and mental health impacts on consumers, residents and sellers, impair the quality of urban environment and the appearance of the city, disturb regular living patterns, and bring about wide

variety of environmental disputes(Xu,1994). Business activities have become one of the major environmental pollution sources following the industries in Shanghai. It is attracting more and more public and media attentions, and has become a new issue arising in Shanghai's economic and social development and environmental protection(Huang, 1993).

II. MAIN TYPES AND CHARACTERISTICS OF BUSINESS POLLUTION IN SHANGHAI

1. Waste Water from Restaurants and Hotels

Restaurants and hotels in Shanghai are flourishing sectors. In 1993, the monthly discharge of waste water from the whole city's restaurants and hotels was over 3 000 000 tons. There were 40 major restaurants and hotels discharging over 10 000 tons each, the total volume of this part was 850 000 tons, and only 47% of which——400 000 tons was biochemically treated. There are nearly 7000 middle and small sized restaurants and hotels with the capacity of discharge between 200 and 1000 tons/month each, only 40% of which are equipped with oil separating tanks, most of them have not any control facilities, and discharge waste water freely.

2. Waste Gas from Restaurants

Waste gas from restaurants is divided into coal smoke and oil smoke. Most of the small individual restaurants are coal burning, and lack facilities for oil smoke filtration. In addition, their exhaust outlets for waste gas often face the sidewalk or residential housing. Some breakfast making spots and night market food stands are operated in the streets, and a large amount of coal smoke and oil smoke is discharged freely, having great adverse effects on the environment.

3. Noise

Business noise mainly stems from the following aspects:

- (1) Noise from streams of people and cars in business districts and heavy traffic.
- (2) Noise generated in process of operating equipment installed in markets and restaurants, such as air conditioners, oil smoke purifiers and fan blowers.
- (3) Music with strong rhythm played lastingly or loudly in some entertainment places.
- (4) Noise caused by night construction against rules from some building sites (Every year in Shanghai, 7 000 000 – 8 000 000 m² buildings are completed on an average).

4. Heat Pollution

Heat pollution in the city's business quarters mainly originates from the air conditioners and hot oil smoke exhausted by restaurants. Due to the high density of property in Shanghai's business quarters, the exhaust equipments of air conditioners are usually placed on the sidewalk or hanged on the outwall and their exhaust outlets face the residential housing or sidewalk, which causes serious heat pollution due to the short distance between the exhaust equipment and pedestrians or residents, especially in summer when the temperature of hot gas exhausted from them is over 40°C .

5. Light Pollution

Light pollution refers to the harmful effects of the reflection or refraction of light from glass wall. Because of the different incident angles of sun light, the glass wall can reflect or refract sun light into residential housing and office rooms, which causes increases in indoor sun radiation and temperature and affects nearby residents. According to statistics, there were 600,000 square meters of glass wall in 1995 in Shanghai. Moreover, all kinds of billboards, neon lights, colorful lights, and floodlights in flourishing business quarters are shining together to form a "Night City". But as far as the residents in the business quarters are concerned, too strong light at night will disturb their normal sleep. Huangpu District in Shanghai have received more than ten complaints against light pollution in recent years.

6. Solid Waste

Business solid waste refers to the packing waste originated from commercial service trades. The main part refers to a large amount of the once-used plastic tableware for the fast food and beverage trades. At present, the daily amount of the discharged once-used plastic tableware has reached 500 000 pieces in Shanghai, and its total weight is more than 200 tons, which greatly increases the environmental load as it is difficult to degrade plastic in the environment.

7. Pollution in Open Markets

Markets are always located near the residential quarters to make purchases convenient for the citizens. Due to the factors of location, management and operation characteristics, the environment is obviously affected by waste water, manure of poultry, surplus leave rubbish, noise and foul smell produced in the process of operation.

8. Decrease of the Public Green Space

Along with the rapid development of business and real estate in recent years, some organi-

zations broke the wall along the streets for opening shops, or transfer the green space into commercially used land for gaining short-sight benefits. In that case, the already limited green space is decreased, and the city's ecological environmental quality is affected adversely.

The famous Zapu Food Street, which was rehabilitated on the basis of the old properties of commercial and residential mixture, has nearly 150 restaurants. Due to the lack of planning, it has caused the situation of crowded courtyards with eaters and polluted backyards with grease stain and wastes. Disputes between restaurants and residents happen frequently. 51 840 000 m³ of oil and coal smoke is discharged from this street monthly. The temperature of hot gas exhausted by air conditioners exceeds 40℃; the volume of waste water discharged by the restaurants is about 47 500 tons per month; and the concentrations of pollutants in the waste water exceed the national standards by several times, some of them even several ten times(Huang, 1994).

III. CURRENT SITUATION SURVEY OF BUSINESS POLLUTION IN SHANGHAI

1. Methods of the Survey

The survey was carried out between the period of 1993 and 1994, it lasted more than one year. In order to find out the main types of business pollution, its reasons, effects and effective ways to solve pollution disputes, thorough on-site investigations were made in most commercial streets and areas. With the help of members from environmental protection organizations in these streets or areas, the owners of shops and restaurants as well as nearby residents were organized to exchange their ideas.

2. Assessment Factors, Models and Processes

Investigation factors of current situation of business pollution in Shanghai can be found out in Fig. 1.

In the assessment, direct assignment method was adopted and then the comprehensive assessment results by weighted summation were given. The assessment method is listed as follows:

$$A = \sum_{i=1}^m K_i \cdot M_i$$

where A is the final mark of business pollution assessment; K_i is the weighted coefficient of the sub-system; M_i is the mark of the sub-system assessment; m is the number of the sub-system.

The assessment system for the city's business pollution has some characteristics of multi-level and multi-index. The weighted coefficients of every sub-system are determined by the method of Analytical Hierarchy Process(AHP). The weighted coefficients of every business street were determined comprehensively by considering the length of the streets and the number

of shops, and selected shop density—the amount of shops in an unit length of the street—as the comparative factor.

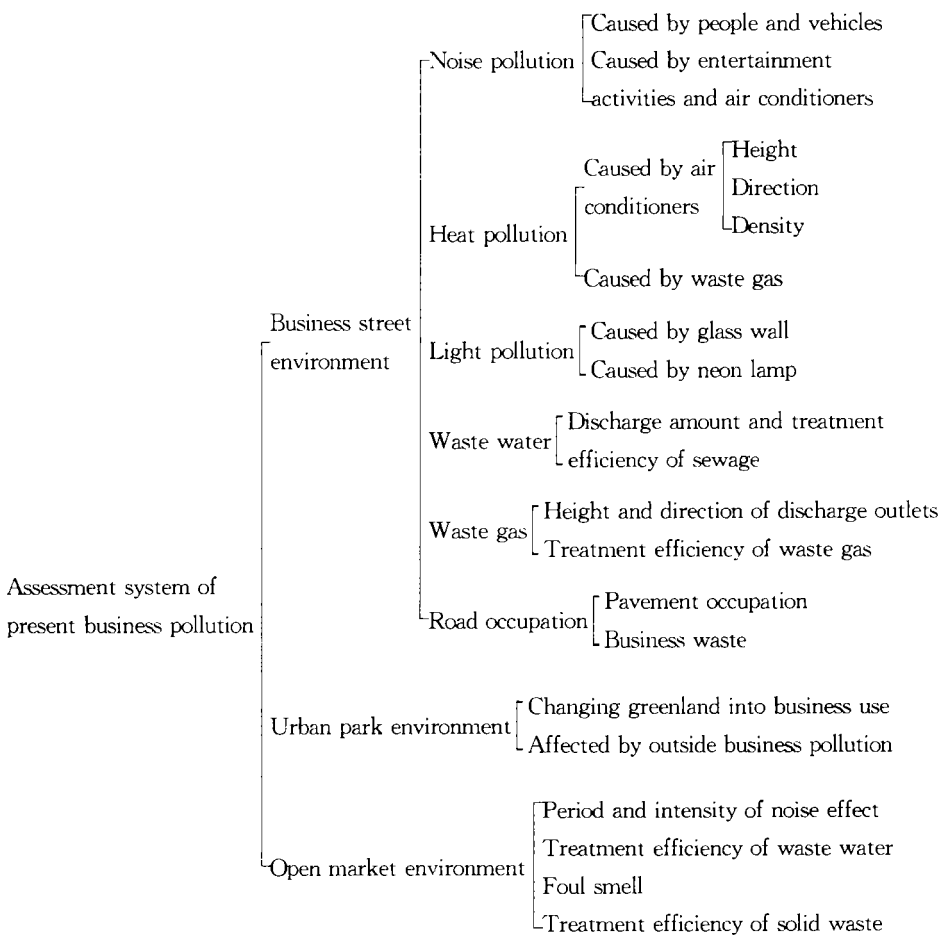


Fig. 1 Assessment system of present Shanghai business pollution

Due to the lack of the relevant standards, part of the assessment indexes can not be quantified. The feasible way is to combine the qualitative assessment with quantitative assessment. In that case, the traditional hundred-mark system was selected, and different marks to the corresponding index classes were given. The lower the mark is, the more serious the pollution is. (e.g. $A \geq 90$: no pollution; $90 < A \leq 80$: light pollution; $80 < A \leq 70$: pollution to a certain degree; $70 < A \leq 60$: obvious pollution; $A < 60$, serious pollution). In the processes of assessment, marks were given mainly based on the criteria of installment of pollution prevention facilities and the degree of business pollution.

3. The Current Business Pollution Analysis in Shanghai

3.1 Environmental quality in some main commercial streets and areas

The sampling survey was carried out in the streets and areas with a long history, hubs of

communications and high density of residents, and in some main parks and markets. Among the 29 commercial streets investigated, those with good shopping environment include East Nanjing Road, Middle Huaihai Road, East Yan'an Road, East Jinling Road, Fuzhou Road, Middle Yanan Road, etc. They are all known as famous commercial centers with busy commerce and distinguishing business features, and their environmental quality can reflect the basic situation of commercial environment in Shanghai. Those with obvious business pollution include Shimen Road, Changshou Road, Middle Xizang Road, Ruijin Road, etc. They have a large number of shops and high density of residents. In addition, the disputes between shops and residents caused by business pollution happen frequently. Those with poor commercial and environmental quality include the North Sichuan Road (before rehabilitation), Railway Station Area, Caojiadu Area, Wujiaochang Area, etc. Serious business pollution is mainly caused by noisy environment, small size shops, and a lot of restaurants with poor management and simple equipment.

3.2 Environmental quality in markets

Among the 11 markets investigated, the environmental quality of indoor markets is much better than that of open markets. Among the open markets, Tai'an Market is relatively good in environment. It requires every selling space to input clean vegetable; every trader must take responsibilities of environmental sanitation, and is required to wash and clean the place in time. Therefore, the operation of Tai'an Market causes little environmental pollution. The environmental quality in the former Changfeng Market was poor. It was located between two residential buildings in New Changfeng Residential Area. The serious noise pollution and accumulating waste water and rubbish on the road aroused serious antagonisms from the residents. Now it has been moved out of the area.

3.3 Environmental quality of parks

Ten parks affected by the development of commerce to certain degrees in the commercial areas were investigated. Among them, the Fuxing Park, the People Park and the Zhongshan Park are more seriously affected by business pollution in the aspects of more decrease in green space and more cases of breaking the wall for opening shops. The ecological value of these parks is high as they are located in downtown commercial areas. Therefore, they should be protected in order to maintain the environmental quality of the whole commercial quarters.

The sampling investigation results are shown in Table 1.

Table 1 Sampling investigation for current state of urban business pollution in Shanghai (1993 - 1994)

Site	Sample number	100 > A ≥ 90 %	90 > A ≥ 80 %	80 > A ≥ 70 %	70 > A ≥ 60 %	A < 60 %
Business street	29	3.4	34.5	31.0	24.1	6.9
Business spot	10	10.0	20.0	40.0	30.0	0
Open market	11	18.2	18.2	27.3	18.2	18.2
Park	10	0	40.0	30.0	30.0	0

IV. THE MAIN PROBLEMS EXISTING IN SHANGHAI BUSINESS ENVIRONMENT MANAGEMENT

1. Lagged Law-making in Business Environment Management

Business pollution is a new type of environmental problem under new situation . Up till now the major projects of business environment management are still at the level of single item control and case dealing. The means of environment management and the levels of law-making are relatively behind the rapid development of business and tertiary industry. The overall decision-making in comprehensive management is seriously lacked. More attention should be paid to pollution control caused by tertiary industry.

2. Weakness in Primary Study on Business Pollution

Business pollution has caused some harmful effects on urban environment quality and human health, but there is little study on its action mechanism, endangerment degree and assessment method. The situation directly lead to lack of enough scientific basis on drawing up management measures.

3. Lack of Special Discharge Standards for Business Pollutants

So far, the discharge standards of waste water and gas from business and service sector are similar to the ones executed by industry sectors in Shanghai, the situation in noise pollution control is similar. Because there are clear difference between the characteristics of business and industry pollution, it is obviously unreasonable to manage business pollution in the same way.

V. THE MEASURES TO CONTROL AND PREVENT BUSINESS POLLUTION IN SHANGHAI

1. Strengthening the Business Function in Commercial Districts through Rational Distribution

Due to historical reasons, there are perfect service facilities and good transport service in the downtown areas, which is the main cause responsible for high density of population and mixed distribution of commercial facilities and dwelling house in the areas. Therefore, the first step is to move residential quarters out of main business streets or to separate them for the sake of strengthening the business function in commercial districts and decreasing the disadvantage effects on residents.

2. Building Walking Streets Through Rational Transportation Plan in the Downtown

Narrow road, crowded people and vehicles, irregular installation of air conditioners outside and street peddler have caused serious noise and waste gas pollution in the downtown. It is strongly recommended to rebuild some flourishing streets such as East Nanjing Road into walking street in some special period, increase greenland, construct rest facilities and so on, it will be helpful for improving environment quality in business quarters.

3. Combining Unified Control with Decentralized Control

Single item control, decentralized and unified control should be adopted at the same time in business pollution control. The facilities such as oil separation, waste gas control measures, sound and heat insulation should be installed at each restaurant and entertainment places. To control waste gas discharged by restaurants densely, it can be purified by each polluter first, then discharged at high-altitude through a common tube.

It is also important to draw up discharge standards of different kinds of business pollutants as soon as possible, and to perfect the regulation of punishment with fines for business pollutants discharge.

4. Strengthening City Administration in Business Quarters and Environment Laws and Regulations

Some special laws and regulations should be drawn up on the basis of "Shanghai Environmental Protection Act". These include rules of air conditioners, neon lamp installation, use and management, rules of waste gas discharge management, rules of business packing waste management, rules of greenland management in commercial districts etc.

5. Promoting Clean Production and Raising Consumer's Environmental Awareness

It should be stressed that to treat discharged pollutants as well as to control production process waste are same important in environment management for tertiary industry. In other aspect, because the behavior of manufacturers and businessmen are greatly effected by consumers' environment awareness, it will be an effective way to decrease business pollution discharge by raising consumers environment awareness and promoting green consumption.

VI. CONCLUSION

In this paper, the main types of business pollution and their characteristics, the assessment factors, methods and control ways of Shanghai urban business pollution are discussed and ap-

proached systematically. The results of the investigation showed that the present situation of Shanghai business pollution are closely related to the following factors:

- (1) The irrational urban layout of mixed business facilities and dwelling quarters.
- (2) Lack of effective pollution control facilities in most units of business and service sector.
- (3) Over-crowded people and vehicles in the downtown.
- (4) Destruction of greenland ,illegal business facilities occupying part of pavement.
- (5) Lagged law-making in business environment management.

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