

ANALYZING THE FIRE DANGER OF SHANGHAI CITY

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ABSTRACT

Like other metropolises in the world, Shanghai has modernized harbours, airports, industries of all categories, flourishing commerce and developed culture. Along with the development and opening of Pudong, Shanghai will become one of the largest financial and trade center in the west bank of the Pacific Ocean. But the rapid economical development and concentration of people will also bring about increasing fire hazard to Shanghai, fire death, injury and property losses have become more and more serious. The article synthetically analyzed fires Shanghai has occurred since the liberation in the light of fire causes, locations, scales, fire death and injury and economic losses, and also analyzed main sources of fire hazard in Shanghai, combining current structural characteristics of the metropolis such as application of steel construction, construction of superhighrise buildings with glass curtain walls, large scale underground garages, subways, and recent development of high-grade, precision and advanced industries indicated by petrochemical complexes, air and marine transport, metroelectronic and computers, astronavigation, and measures which should be taken to deal with the hazards.

1. INTRODUCTION

Shanghai is one of the largest cities in the world. It has a very large population. The roads and streets of Shanghai proper are intricate and complex. High buildings rise quickly one after another, Under-river tunnels, underground railways, underground garages and other underground projects are being built in secession. Petrochemical complexes are being established constantly. All kinds of household electrical appliances spread rapidly and consumption of fuel gases is steadily on the increase. And the transportation at ports is becoming busier and busier. According to the preliminary statistics, 6,159 fires took place during which 313 people died and 469 were injured and the direct economic losses amount to 49.134 million yuan in Shanghai from 1985 to the end of 1991, 233 of them are great fires and the direct economic losses amount to 34.151 million yuan. This showed that though the great and destructive fires are not very often, the economic losses are as heavy as 70% of the total ones. For example, Shanghai Biological Product Research Institute suffered such heavy losses in the great fire on April 8, 1990 that 6.4 million yuan were lost. Therefore, it is absolutely necessary for us to adopt effective measures to prevent great fires in Shanghai.

2. SHANGHAI'S CONFLAGRATION THREATS

It is of the first importance that we must find out what Shanghai's conflagration threats include. The great fires and the hidden dangers of them in Shanghai in recent years tell us that the great fire dangers

mainly come from:

(1) Petrochemical Industry

Shanghai's petrochemical enterprises have been made further great advances mainly since the liberation of China in 1949. And they have been developed more rapidly in recent over 10 years. At present, there are some 10,000 chemical enterprises are using a lot of petrochemical products. Among them, 50 are large enterprises.

A. Overall arrangement and internal distribution of chemical enterprises are not rational yet.

On the one hand, this was because the overall city planning has shown no consistency for a long time. And on the other hand, the area of Shanghai proper has been continuously expanded with the regulation of the overall arrangement of Shanghai city and more chemical works have grown. But there are old equipment and small space area in these chemical works which are built 30 years ago. Moreover, most of these factories are interlocked with either town residences or other enterprises. Take Shanghai Dye Chemical Works as an example, there is a space of only 4 meters between the steam boiler and vulcanizing pan in No.3 workshop and the purified petroleum benzene tank in vulcanizing workshop section. But according to the rule, there should be a space of 25 meters between them. Another example in the ethylene factory of Shanghai Petrochemical Complex in Shanghai's suburb. The amount of combustible liquid in the division of tanks of material for ethylene device is up to 26,610 m³, but the thoroughfare for fire control around the division of the tanks is seriously blocked up. Once there is a fire, the thoroughfare for fire control will be overspread by such strong heat radiation that fire fighters cannot enter the division of the tanks. People there will follow the same old disastrous road to the fire in the Huangdao division of the tanks. What grave consequences!

B. In some chemical factories, all kinds of industrial installation, containers, materials etc, do not accord with the demands of safety. Besides, scientific maintenance is lacking for a variety of equipments being used.

There are 2 units of 2,000 m³ spherical pressure tank at No.2 chemical plant in Shanghai Petrochemical Complex. They have been put in operation for more than 10 years. The two tanks were examined by shooting, but 38.1% of the pictures of one tank and 31.5% of those of another tank showed that the product was not up to standard. The safety valves of the 9 sets of industrial installation imported from abroad in the first phase project have been damaged to a certain degree. What is more, safety in production is not ensured because the ordinary chemical factories have not taken any measures to regularly examine different kinds of containers and industrial installations.

C. Problems to be solved in the management of hazardous chemicals.

The hazardous chemicals warehouses are not managed properly in many factories. And hazardous effluent liquors go into drainage ditches without treatment. For example, the waste acrylonitrile and acetone alcohol in the drainage ditch were burnt by scorching hot filaments in a fire at a chemical factory on July 8, 1987.

(2) High Buildings

In recent years, high buildings have grown rapidly in Shanghai, owing to the rapid development of economy and expansion of Pudong New Area. We estimate 1,200 high buildings and large mansions will have stood in Shanghai by the end of 1992, 30 of them will be higher than 100 meters. High buildings standing in great numbers embody the modernization of Shanghai city while they make extremely difficult the fire fighting with safety. This is reflected by following points:

A. Superhigh buildings have been built one after another. The high buildings in which the steel structures and glass screen walls are adopted are increasing day by day. The architectural complexes of multipurpose buildings with great space which are internationally

prevalent have quietly been in vogue in Shanghai. This poses a new technical problem which brings much difficulty to the fire control with safety.

B. The inside of the high buildings is decorated mostly with flammable materials.

C. Shanghai's many multipurpose high buildings, which include workshops, offices and storehouses, are shared by a number of corporations. A unified management is difficult to be carried out there. And in these buildings, all kinds of piping erection are complicated, disorderly and unsystematic. Commonly, there are too many positions of openings. They have not strictly been separated lengthwise and crosswise. It becomes a great trouble to fire-extinguishing.

D. There are obsolete self-fire-fighting facilities in Shanghai's many old buildings, which are short of fire extinguishers in numerical quantities. And there are not or few fire alarms and automatic spray fire-extinguishing installations.

(3) Aquatic Fire Fighting

Shanghai Harbour is the largest port of China, and it is a port of call for over 10,000 ships each day. The water transport is very busy here. However, the aquatic fire-fighting facilities over the Huangpu River are simple and crude because we have been behind with the basic installations for years. And we are in much hidden dangers of fire. Here are the highlights.

A. At present, nearly 20 unpowered old barges, whose total oil volume is up to more than 9,000 tons, are serving as the aquatic filling stations in Shanghai. Most of them were built long ago, so the equipments have become obsolete. The oil barges of some units as organizations have no stationary shore to pull in. They do not draw alongside orderly. And other ships often draw alongside around them. The ships and the barges do not keep at a distance for safety.

B. There are not enough supervision of fire control of the oil barges and other ships. Practical measures have not been adopted by ships in open fire operation and in fire prevention of the dangerous goods which are combustible and explosive.

C. The oil wharves along the river do not conform to the standard of fire protection. It is frequent occurrence that a safe distance is not kept between the oil tanks and storehouses. And there is no fence to block the oil.

D. There is not enough aquatic fire-fighting equipment. And all the fire brigades are not distributed rationally.

(4) Underground Civil Air Defence Works

The existing underground civil air defence works of Shanghai are mainly used for warehouses, workshops, shops and markets, which have quite a few drawbacks and disadvantages. Large crowds of people gather there. They are not in good order. The raw materials, machines and equipments are laid up here and there. There are few and small passages but not a few turns. They are short of both lighting installations for emergency and fire-fighting equipment. Electric wires are not connected properly. Dangerous goods—what is more—are being stored in the underground warehouses. Once fire is caught, the consequences would be too ghastly to contemplate.

3. OUR WAY TO DEAL WITH FIRE

(1) We must carry out the policy of putting prevention first and combining preventive measures with the practice of fire fighting and act on the principle of "Person in charge should be in a responsible position". Leading bodies at different levels must place the policy of "putting prevention first" before everything else and conduct various forms of propaganda to help all the people realize the very importance of fire fighting with safety. Only in this way can we take precautions against hidden danger of fire.

(2) We must study the characteristics and tactics of putting out a fire in the petrochemical industry and tighten our control of hazardous chemicals which are combustible and explosive.

(3) Facing the new problems such as superhigh-storey, steel structure glass screen wall and great space of modern high buildings, we will utilize modern technology and strengthen the scientific management. We will practise sprayed coating on all-steel structure for fire protection. We will take all the preventive measures for glass screen wall and boarden the extended floorslab. We will increase the height of outer roof beam to separate for fire control. We will fix the water screen fireproof rolling curtain in shared space for fire protection. And we will decrease the use of indoor combustible materials to reduce the load of fire in the buildings.

(4) We will devote major efforts to strengthening the foundation work of aquatic fire fighting and to the propaganda, education and supervision of aquatic fire control. According to the principle of "seeking unity of management and being led by organizations at all levels", a network of land-water joint fire protection will be formed.

(5) We will improve and increase Shanghai's fire-fighting equipment. Because the area of Shanghai proper has been constantly enlarged in recent years and especially the Pudong Development Zone has taken shape, the quantity, quality and performances of existing fire-fighting equipment are not adapted to the changed conditions. Based on the concrete conditions of Shanghai's fire control, we think we must strengthen the routine force of fire fighting and pay special attention to the following 2 points:

A. We will develop helicopter especially for fire control. In Shanghai, the roads and streets are complex and narrow and there are numerous pedestrians on the pavement. And high buildings and large mansions stand like trees in a forest. Under these circumstance, we will achieve good results from using helicopter to cooperate well with the land fire brigade and conduct the three-dimensional fire-fighting.

B. We must take vigorous action to develop robot especially for fire control. Because a great quantity of chemical products are used in Shanghai, a vast amount of smokes and poisonous gases will probably produce in the course of fire and strong thermal radiation will often follow. Under these circumstances, it will be much safer and more effective for us to robot in fire fighting.

(6) We will improve Shanghai's fire control communication apparatus and establish a fire fighting safety control centre. We have had some great fires due to our backward means of communication and lack of wise tactics. This problem will not be solved until the fire fighting safety control centre is established. The two major functions are as follows:

A. A quick effective electronic-controlled system to give a fire alarm. It will tell us the place, degree and nature of fire.

B. An expert system of the electronic-controlled fire-extinguishing system. The information of fire-extinguishing will be analysed automatically. And the expert system will be used to command and transfer the relevant fire brigades.