

# Research on Fire Risk Assessment and Prevention and Control Measures for High rise Buildings

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**Abstract:** High rise buildings have many influencing factors and are interconnected, and the mechanism of fire occurrence is relatively complex. For the characteristics faced by such fire risks, conducting a risk assessment of high-rise buildings based on fire assessment analysis methods can objectively present the fire risk results of high-rise buildings. The results of fire risk can compensate for the numerous shortcomings of safety management work and provide sufficient basis for safety management. It can also provide targeted supplements and improvements based on the defects and problems that arise.

**Keywords:** High-rise buildings; Fire risk; Risk assessment.

## 1. Introduction

The characteristics of high-rise buildings include high height, large area, and high power consumption of various types of equipment. Once a high-rise building fires, it is highly likely to cause serious losses to society, including economic losses, casualties, environmental pollution, etc. According to the statistics of high-rise building fire accidents, the most frequent natural disasters occurring globally are fires, with annual economic losses caused by fires alone reaching over one billion RMB worldwide. Therefore, it is necessary to conduct a scientific evaluation and systematic analysis of the severity and probability of high-rise building fires, which is an urgent issue in the current field of fire risk assessment. The fire risk assessment method selected in this article is based on the analysis of fire risk assessment. It not only objectively reflects the evaluation results of the fire risk assessment faced by high-rise buildings, but also divides their fire levels based on the evaluation of fire risk assessment methods. The results of fire risk assessment can make up for the deficiencies faced by the system in safety management work, Relevant analysis and supplementation can also be conducted on safety management work [2].

## 2. Fire Risk Analysis of High-rise Buildings

The main characteristics of most high-rise buildings are: high height, large area, large and high number of floors, a large proportion of combustible materials in decoration materials, and high power consumption of various types of equipment [3]. The fire characteristics of high-rise buildings differ greatly from ordinary buildings.

### 2.1. There are numerous fire risks in high-rise buildings

Due to the high number of floors, high power consumption, and diverse types of electrical equipment in high-rise buildings, the power lines in high-rise buildings are extremely complex and cumbersome, resulting in high power consumption. The various personnel in high-rise buildings

come and go, and the floating population is not small, with many characteristics of density, variety, and high mobility. Most people have little understanding of the building structure in high-rise buildings. Based on the above reasons, once a high-rise building fires, people often feel at a loss, fearful, and extremely chaotic. According to relevant data [4], the higher the height and number of floors of a building, the greater the mobility or density of personnel. When facing fire risks, people need longer rescue time and more complex evacuation plans.

### 2.2. Rapid development of high-rise building fires

Due to the continuous development of the global economy, the demand for high-rise buildings has become greater, so the number of high-rise buildings will only increase, but the fire risk faced will also be greater. As is well known, the higher the height of a building, the greater the wind speed and the smaller the distance between high-rise buildings. Once a fire occurs, it will face many problems such as isolation difficulties and rescue difficulties.

### 2.3. Difficulties in extinguishing fires in high-rise buildings

High rise buildings are not only very high in height, but also extremely difficult in fire rescue. After a fire occurs in a high-rise building, professional firefighting and rescue can only be carried out through firefighters. However, due to the high height, multiple floors, and extremely complex structure of high-rise buildings, firefighting and rescue equipment may not be able to enter the high-rise building. Therefore, most rescue equipment can only rely on the firefighting facilities and equipment that are inherent in the high-rise building itself. Another aspect is the ability and means of human self rescue [6], which are the two main rescue methods after a high-rise fire.

### **3. Fire Risk Management of High-rise Buildings**

#### **3.1. Risk identification of high-rise building fires**

For the identification of fire risks in high-rise buildings, the main considerations are as follows:

##### **3.1.1. Factors that affect the occurrence of a fire**

There are many factors that affect the occurrence of fires in high-rise building projects, among which combustible materials, fire sources, air, space, and time are the five main factors that cause fires. Therefore, in order to carry out necessary fire safety work, these five factors should be given priority consideration in the event of a fire in high-rise buildings, which are the key points of operation in fire rescue [7-8]. In people's daily lives, flammable and explosive materials are often piled up. For these places with flammable and explosive materials, these five elements should be the main focus, and reasonable prevention and control should be carried out. Once a high-rise building fire occurs, it is necessary to control the combustion within a certain range of fire risk. For places other than this, the goal of controlling the three elements of combustion is the condition under which these three main factors occur simultaneously.

##### **3.1.2. Factors affecting the consequences of a fire**

The consequences of a fire in a high-rise building cannot be estimated. Once the fire is severe and people inside the building cannot receive effective rescue, it will cause large-scale casualties; Secondly, there are various types of materials in high-rise buildings, and equipment is prone to ignition, exacerbating the trend of fires and causing incalculable economic losses. The degree of fire varies, and the subsequent degree of differentiation is also quite significant, so the risk of fire consequences they face also has significant differences [9].

#### **3.2. Fire risk assessment indicators for high-rise buildings**

According to statistics, among the multiple high-rise building fire accidents that have occurred globally, building conditions, firefighting facilities and equipment, local cultural and geographical factors, climate factors, unit conditions, production methods, historical records, and accident cases are all important factors that affect the occurrence of high-rise building fires [10].

##### **3.2.1. Building information status**

The number of floors in a high-rise building, the height of the building, the age of the building, the overall fire protection layout of the building, the internal structure of the building, the function and usage of the building, the usage area and indoor area of the building, the types of combustible materials present inside the building, the overall fire protection equipment situation of the building, and the dynamic information of the overall fire protection equipment of the building. The number and types of units entering high-rise buildings, the maximum number of people that can be accommodated in high-rise buildings, information on the feasibility study stage, design stage, review stage, and completion acceptance stage of high-rise buildings [11].

##### **3.2.2. History**

Fire equipment structure, organizational structure, number of fire facilities and equipment, factors and types of hidden

dangers, completion of rectification, degree of completeness of certificates, illegal construction, etc.

##### **3.2.3. Cultural and geographical factors**

The population, population density, weather conditions, per capita GDP of the area where the building is located, the mileage of the local roads, the cultural level and educational level of the local population, etc. [12].

##### **3.2.4. Climate factors**

Wind direction, wind speed, wind condition, climate type, regional temperature and humidity, etc.

##### **3.2.5. Unit Information**

Record keeping records of various departments of the unit, water and electricity usage data of the unit, number of existing employees of the unit, business scope and level of the unit, records of whether the unit has paid social security for employees, ability and level of the unit management, qualification for fire safety operation of the unit, credit records of the unit, historical records, violation records, warranty records of water and electrical equipment of the unit, maintenance records of fire facilities of the unit, etc. [13-14].

##### **3.2.6. Other life information**

Water and electricity consumption, quantity of hazardous chemicals, natural gas usage data, gas supply data, elevator fault maintenance records, etc.

#### **3.3. Risk assessment index system for fire accidents in high-rise buildings**

According to the fire risk analysis of high-rise buildings, the accident tree analysis method can be used to conduct a detailed analysis of the safety risk factors during the construction process of high-rise buildings. The dangerous sources of fire risk accidents in high-rise building projects are mainly divided into fire sources, which mainly include on-site construction fire sources and external fire sources, as well as flammable and explosive materials, ineffective fire-fighting facilities or unusable fire-fighting equipment, as well as human operation errors by firefighters, and combustion caused by contact between open flames and flammable and explosive materials [15-16]. In addition to the aforementioned sources of danger, there are also risk control factors inherent in fire rescue, such as the failure of on-site rescue personnel to initiate emergency plans for fire accidents and the failure of on-site personnel to self rescue. The main reason for this is the lack of rescue conditions and materials [17-19]. Therefore, the risk assessment indicators for construction fire accidents in high-rise buildings mainly include: fire facilities and equipment, safety of the project construction site, fire sources at the construction site, external fire sources present at the construction site, storage safety of flammable and explosive materials, combustion caused by contact between flammable and explosive materials and open flames, fire rescue reliability, self rescue reliability, and emergency rescue reliability [20].

### **4. Countermeasures and Suggestions**

To prevent the occurrence of high-rise building fire accidents, corresponding measures should be taken from various aspects for protection, including:

(1) Maintain and protect fire-fighting facilities and equipment on time, and regularly inspect them for damage or old equipment; Regularly hold fire safety knowledge competitions, establish fire safety cultural activities,

strengthen the propaganda level and ideological awareness of staff, use various opportunities to promote fire and electricity knowledge, and use reasonable methods to provide fire safety knowledge training and education to the public.

(2) Strictly abide by the electricity regulations, strictly implement the fire regulations, and strictly adopt methods that comply with safety management for the use of fire and electricity. People living in high-rise buildings are prohibited from using high-power electrical appliances, modifying circuits and connecting wires without permission, using open flames, and bringing flammable and explosive materials into high-rise buildings. At the same time, high-rise buildings should be equipped with lightning protection and grounding protection devices.

(3) Strengthen fire safety education and training for staff, prevent unsafe behavior of people and unsafe conditions of objects in high-rise buildings, improve the unsafe environment of high-rise buildings, and enhance management level; Enhance the intensity of safety inspections and supervision.

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