Research on how to improve environmental protection during fire emergency rescue

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Abstract. With the rapid development of the urban economy, the flow of people in the city has gradually become active, and the amount of urban fires has gradually increased. The difficulty in preventing and extinguishing fires is gradually increasing. How to identify, judge, inspect, analyze and evaluate the factors that cause fires, carry out reasonable operations on the fires after the fires, optimize the firefighting capacity of the fire department, and effectively control urban fires and the reduction of environmental pollution problems in fire rescue are the most important issues to be solved in the current situation. Briefly introduced the impact of fire accidents on the environment, systematically analyzed the sources of pollution and their hazards in fire accidents, and proposed the pollution control methods in fire accidents in combination with the existing firefighting methods, and made suggestions for improving the environmental protection of fire emergency rescue.

1. Research background
At present, due to the high concentration of population and economy and the rapid development of urban construction, the urban fire situation in China is severe. In 2010, the "11.15" catastrophic fire in Jing'an District of Shanghai caused 58 deaths and 71 injuries, and the direct economic loss reached 500 million yuan. In 2012, a fire broke out in the Ryder Commercial Building in Jixian County, Tianjin, killing 10 people and injuring 16 people. At 22:51:46 on August 12, 2015, the dangerous goods warehouse in the area of No. 95, Jiyun 2nd Road, Binhai New Area, Tianjin, was the first to explode, and the first explosion occurred at 23:34:06. The second, more dramatic explosion occurred at 23:34:37. At the scene of the accident, six fire spots and dozens of small fire points were formed. At 16:40 on August 14, the fire was extinguished. 165 people were killed in the accident (24 public security firefighters involved in rescue and rescue, 75 Tianjin firefighters, 11 public security police, 55 accident workers, surrounding enterprises and surrounding residents), 8 missing (Tianjin Port firefighters) 5 people, employees of surrounding enterprises, 3 members of Tianjin Port firefighters), 798 injured hospitalized (58 injured and heavily wounded, 740 lightly injured); 304 buildings (including office buildings, factories) And 73 units of warehouses, 91 residential buildings, 129 residential buildings, 11 residential buildings, 12,428 commercial vehicles, and 7,533 containers were damaged; as of December 10, 2015, according to the standards and regulations of the statistical standards for economic losses of casualties, the direct economic losses that have been approved are 6.866 billion yuan. The Tianjin Port "8·12" Ruihai Company's dangerous goods warehouse fire and explosion accident is a particularly serious production safety liability accident. The above fire accident data is shocking, causing significant losses to people's lives and property and serious environmental pollution. The environmental pollution caused by fire accidents is not only the harmful gases generated by burning and incomplete combustion, such
as carbon monoxide, carbon dioxide, dioxins, nitrogen oxides, soot, etc., but also includes fire extinguishing agents and hair used in firefighting [1]. Secondary pollution caused by chemical agents such as foaming agents after fire extinguishing. Contaminants can cause serious pollution to the environment as fire water enters the soil and groundwater systems. Personnel casualties and economic losses caused by fires of the same size will increase. To this end, how to strengthen environmental protection in fire emergency rescue is an urgent issue.

2. Analysis of the causes of environmental pollution caused by fire

2.1. Environmental pollution caused by building fires

With the continuous emergence of new building materials and decorative materials, some buildings even use inferior materials that do not conform to national standards, resulting in more and more toxic products in the fire, and more toxic. Toxic and harmful gases: carbon monoxide, hydrogen cyanide, carbon dioxide, acrolein, hydrogen chloride, sulfur dioxide, nitrogen dioxide, dioxins, etc. These poisonous and harmful gases are inhaled into the body, causing suffocation or poisoning, and spreading into the air can also cause environmental damage. Pollution. In addition to generating a large amount of toxic and harmful gases during the fire, a large amount of smoke will be generated, and if inhaled, there will be adverse reactions. The rate of death from inhalation of harmful combustion products in fires is much higher than the rate of other injuries and deaths, and more than 85% of deaths are caused by inhalation of harmful products in the smoke. This indicates that the smoke generated in the fire has caused great pollution and damage to the environment, which threatens people's health and life [2].

2.2. Environmental pollution caused by sudden accidents

China's chemical industry has a large output, a wide variety of products, complex processes, relatively backward technology, low level of personnel operation skills, and inadequate production management. Not only are there many by-products, but the "three wastes" have large emissions, and there are still serious accidents and sudden risks. Sexual spills occur at any time. If the accident is improperly disposed or not disposed of properly, hazardous chemicals will be released into the environment, causing environmental pollution. For example, on January 27, 2000, along the Shaxi River section in the upper reaches of the Minjiang River in Fujian Province, a production line of the Leguo workshop of a pesticide factory leaked, and a large amount of trimethylphosphate was flowed into the river. The pesticide polluted the river for dozens of kilometers and the river floated 100. More than 1000 dead fish.

2.3. Halon fire extinguishing agents used in firefighting will destroy the ozone layer

The atmosphere on Earth is one of the important components of the environmental system and is essential for the maintenance of life. The ozone layer is an important component of the atmosphere. Because the ozone layer can absorb most of the sun's ultraviolet rays, it blocks strong ultraviolet radiation to the surface of the earth, and at the same time heats the stratosphere, so that the ground creatures and humans are protected from ultraviolet rays. The "cosmetic suit" of plants. CFCs and
perfluoro Bromo hydrocarbons (known internationally as Halon, referred to as halon in China), which are widely used by humans, contain chlorine and bromine. Halon molecules decompose free radicals of chlorine and bromine after the atmosphere is exposed to sunlight. These chemically active groups combine with ozone to capture an oxygen atom in the ozone molecule, causing a destructive chain reaction that destroys the ozone, thereby reducing the ozone concentration and causing ozone holes. The main harm of ozone depletion on human health and its living environment is that a large amount of ultraviolet radiation directly radiates to the ground, which leads to an increase in the incidence of human skin cancer and cataract, and inhibits the function of the human immune system; crop damage reduction, affecting food production and food supply [3]; The food chain of marine ecosystems leads to ecological balance damage. Halon has a life span of several decades in the atmosphere and is one of the main culprits in destroying the ozone layer. The heavy use and emissions of similar compounds such as halons will inevitably lead to the destruction of the atmospheric ozone layer, which in turn poses a threat to living things on Earth. The consumption of ozone-depleting substances in China's fire protection industry accounts for 27.8% of the total national consumption, and the damage to the ozone layer is quite serious.

2.4. Fire pollution process will cause water pollution
Generally, in the process of firefighting, a large amount of water is used to cool the combustible materials or to extinguish the fire. The water used in the fire will take away the harmful substances generated in the fire, infiltrate into the underground, and discharge into the urban drainage system, causing water pollution. In particular, the waste water generated during the fire of chemical products and the foam used will increase the pollution of water bodies. In 1986, a fire broke out in the St. Dozen Chemical Warehouse in Bessel, Switzerland. Firefighters used millions of gallons of water during the fire fighting. These waters flowed into the Rhine with a lot of chemicals, causing a lot of fish. And other aquatic animals and plants died, seriously polluting the environment and destroying the ecological balance.

3. How to improve the environmental protection of the emergency rescue process

3.1. Establish a fire intelligent early warning system
On April 22, 2016, at 09:13 on April 22, 2016, Jiangsu Deqiao Warehousing Co., Ltd. organized the contractor (Huadong Construction and Installation Co., Ltd.) to initiate the welding operation in the oil pump tank area No. 2 exchange pump room. The pump house and nearby oil pipelines caught fire, causing the upper pipe gallery of the pump house to collapse. The storage tank No. 2401 on the south side of the pump house (2500 cubic meters of tank capacity, about 1,300 tons of gasoline during the incident) and No. 2402 with a small amount of residual gasoline the oil in the tank leaks along the damaged pipeline and burns. Before the accident, 25 kinds of dangerous chemicals such as gasoline, naphtha, methanol, aromatic hydrocarbons, glacial acetic acid, ethyl acetate, butyl acetate, dichloromethane and liquid hydrocarbons were stored, totaling 21.12 million tons, of which: oil products were about 140,000 tons, nearly 70,000 tons of liquid chemicals, about 1,420 tons of liquefied gas.

According to the preliminary investigation and analysis, the direct cause of the accident was that the company organized the contractor to seriously violate the safety management requirements of the hot-fire operation when the pipeline was welded in the pump room. The oil in the trench at the job site was not cleaned, and the combustible gas was not used. Analysis, electric welding and open flame ignited the oil in the site trench, the fire spread rapidly, leading to fire accidents. From the above two fire cases, it was found that the lack of flammable gas analysis led to the late tragedy. Therefore, it is necessary to increase the installation of the chemical storage warehouse and the enterprise's fire intelligent facilities, chemical gas leakage sensing instruments, wireless intelligent independent smoke detectors, wireless manual alarm buttons, sound and light alarms, and intelligent gateway controllers [4]. Need to access the city fire prevention and control alarm system through the network. In the event of a chemical hazard, the chemical gas leakage sensor will immediately issue an alarm. The mobile phone client will inform
the management personnel in the area to check the cause of the leak in time, and smother the accident in the cradle to reduce the fire caused by dangerous goods leakage. Environmental pollution caused. In the residential building, a wireless intelligent independent smoke detector must be installed, connected to the management personnel and the mobile phone client of the floor resident, and the system can automatically activate the wireless sound and light alarm after the fire is confirmed, and make the sound decibel Above 90 decibels and emits a strong flash that wakes up sleeping people on the floor. The evacuation command is broadcasted on the floor wireless escape broadcast. At the beginning of the fire, multi-level automatic warning is issued to maximize the fire warning time. Before the fire disaster is serious, evacuate the trapped people and protect the people's lives and property in all directions. Safety.

Figure 1. Fire Intelligence Early Warning System

3.2. Development and use of environmentally friendly flame-retardant materials
Currently, flame retardants are widely used in building materials. Flammable synthetic materials are flame retardant, self-extinguishing and smoke eliminating after they are added to the flame retardant. Flame retardant can effectively prevent fire and inhibit the spread of fire, reduce the incidence of fire, and reduce the environmental pollution caused by building fires. In order to avoid the secondary environmental pollution caused by construction fires, new and higher requirements are put forward for the development of flame retardants. Flame retardants are required to be not only efficient, flame retardant, non-toxic, carcinogenic, but also burnable. Smoke, no toxic gases, no heavy metals, and easy to regenerate, low cost, easy to recycle [5]. Intumescent flame-retardant systems, halogen-free flame-retardant polymer systems, nanomaterials and nanotechnology in flame retardants, as well as new modified flame-retardant materials and flame-retardant materials without any flame retardant It will greatly reduce environmental pollution problems in building fires. As shown in Fig. 2, it is an electropunk core-shell microfiber material with heat-triggered flame-retardant properties, which can effectively flame retard.
3.3. Using new curtain fire belt for pollution control
In order to overcome the limitations of traditional fire water curtains, the author proposed a new type of fire curtain tape. As shown in Fig. 3, the fire water curtain is no longer composed of water flow, but a chemical cloth is used to form a real curtain. The curtain is suspended from a metal frame, and the support frame is composed of a column and a beam. The beam is designed as a self-rotating drum structure with hooks to secure the curtain. The new style of curtain has obvious advantages over traditional water curtains:

(1) The new curtain does not need to consume a lot of water resources, and the saved water can be used for the fire fighting and rescue process. There is no need for a large amount of power consumption, as the fire rescue process often takes hours or even days. To maintain a water curtain requires a lot of power, the new curtain does not require a lot of power. (2) Substituting a solid curtain for water as an absorption medium for contaminated flue gas simplifies the subsequent treatment process and reduces the throughput. (3) There is always one side of the curtain close to the fire smoke source. If the curtain is static, the side close to the smoke source will eventually reach adsorption saturation, which will reduce the absorption efficiency. The new type of curtain adopts the drum type beam structure, the screen is constantly moving, and there is an absorption liquid storage tank on the ground (as shown in Fig. 3), so that the screen can absorb new absorption liquid, so that the absorption efficiency of the screen reaches Maximum, reducing the possibility of burning due to excessive temperature near the fire source side [6].

3.4. Prepare emergency plans to avoid secondary disasters caused by fire-fighting wastewater
The emergency plan is for specific equipment, facilities, places and environment. On the basis of safety evaluation, in order to reduce the personal, property and environmental losses caused by accidents, emergency rescue agencies and personnel after the accident, emergency rescue equipment and facilities, Conditions and circumstances, steps and programs of action, methods and procedures for controlling accident development, and scientific and effective planning and arrangement in advance [7]. For petrochemical enterprises with high risks, it is necessary to formulate emergency plans, especially for the collection and disposal of fire-fighting wastewater. Once a pollution accident occurs, the diffusion of pollutants should be kept to a minimum and the damage to the ecological environment should be reduced. In the case of dangerous goods leakage accidents, fire water should be concentrated and harmlessly treated to prevent pollution to the external environment. For example, Shanghai Chemical Industry Park has established a complete emergency response plan for emergency response through the establishment of a three-way wastewater emergency treatment line for enterprises, park sewage treatment plants and park closed artificial rivers, and regularly conducts practical drills at Shanghai Secco Petrochemical Co., Ltd. "9-8" In the fire, the emergency treatment waste water was properly disposed of and did not pollute the surrounding environment.
4. Conclusion
Fire protection work is closely related to environmental protection. Firefighting forces not only protect people's lives and safety, but also protect people's future life more harmoniously. Therefore, we should do our utmost to reduce environmental damage during fire rescue. In emergency rescue, reasonable measures should be taken, as well as scientific tactics to reduce the environmental impact during disaster relief.

References
[1] WANG Shuyun, TANG Jianli, LIU Aiqun, et al. Research on Fire Causes and Fire Management Countermeasures of Cotton Textile Enterprises. China Safety Science and Technology, Vol. 5 (2010) No. 28, p. 102 - 107.
[2] Xu Sunguang. Research on Environmental Protection Countermeasures in Chemical Accident Emergency Treatment. Environmental Science and Technology, Vol. 1 (2011) No. 21, p. 358 - 360.
[3] Wu Zongzhi, Li Kerong, Wang Yuhang, et al. Legislative Research on Strengthening Administrative Measures for Stop Production and Suspension of Safety Production. China Safety Production Science and Technology, Vol. 11 (2014) No.10, p. 7 - 11.
[4] Wen Jie. Safety Management of Construction Site of Water Conservancy and Hydropower Project. Water Resources and Hydropower Engineering, Vol. 5 (2012) No.43, p. 103 - 105.
[5] Zhang Yu. Experiment and Application of Natural Biological Fire Extinguishing Agent in Environmental Protection Water System. Fire Science and Technology, Vol. 1 (2017) No.36, p. 92 - 95.
[6] Shen Guojian. Discussion on the Relationship between Fire Fighting and Environmental Protection. Science Technology and Life, Vol. 4 (2013) No. 21, p. 197 - 197.
[7] YAN Pengfei, ZHANG Yong, YANG Guodong. Environmental Protection in the Process of Fire Disaster Control in Petrochemical Enterprises. Safety, Health and Environment, Vol. 7 (2012) No12, p. 30 - 31.