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# Analysis of Industrial Emergencies Involved in Dust and air Explosions in Industrial Enterprises

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**ABSTRACT:**The article analyzes accidents caused by dust and air explosions in industrial enterprises. In recent years, there has been an increase in the number of dust and air explosions in technically developed countries, which requires scientific research in this area to prevent this.

**KEYWORDS**: dust-air mixture explosions, explosion, lower explosion limit of flame, amount of dust, allowable concentration.

## I. INTRODUCTION.

The risk of explosion is determined by the presence of an explosive air-dust mixture in the room - the possibility of the formation of HChA, a potential source of flame that occurs in the room during the combustion of explosive HChA. The possibility of the formation of explosive HChA in a hazardous local volume of a building, or the need to prevent an explosion, is currently an important topical factor in determining the category of explosive hazards in production.

Particulate matter particles of various sizes create a hazy environment that floats in the air for a long time and has a lower density. When such small particles accumulate in large quantities, they explode like gas and flammable liquid vapors [2; 16 p.].

## II. MAIN PART.

Typically, the amount of dust in the air is measured in $g/m^3$ or $mg/m^3$[7; 27-33 p.]. The amount of lower density for the explosion of most combustible dusts is very large units, but it is difficult to form a mixture in such a unit (e.g. sugar powder, peat dust, the lower limit density for their explosion is 1350 $g/m^3$ and 2200 $g/m^3$) a high-powered flame pulse will be required to explode the dust [9; 214 p.].

In the initial phase of an explosion, the smallest particles in the air ignite and the larger particles ignite at the heat they release, after which, if the density is high enough, the ignition becomes voluminous and causes an explosion. Therefore, the lower limit of density determines the risk of fire and explosion of dust. The category of explosive dusts (see Figure 1) includes dusts with a density of up to 65 $g/m^3$, corresponding to the lower limit of ignition (sulfur dust, flour, etc.) [3; 29-35 p.].

**Figure 1. Explosions of dusty air mixtures**

If the lower limit of ignition is more than 65 g / m3, they belong to the category of fire-hazardous dusts (tobacco, wood dust). According to foreign sources, the number of fires and explosions in enterprises involved in the production of flammable dust, including in the chemical industry, continues to grow, and 32 out of every 436 explosions that occur in chemical production facilities are caused by a mixture of dust and dust itself. Table 1.1 shows

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an increase in the number of dust explosions in the United States [4;17-b.].

**Table 1.1**

**The rise of dust explosions in the United States and the amount of material damage they cause**

| Years | Number of explosions | Number of people | | Material damage (in million US dollars) |
|---|---|---|---|---|
| | | Died | Injured | |
| 2010 | 380 | 308 | 680 | 0,213 |
| 2011 | 888 | 575 | 1110 | 80,0 |
| 2012 | 1110 | 648 | 1772 | 102,3 |
| 2013 | 1173 | 681 | 1792 | 119,4 |

The only U.S. plastics industry suffered $5.6 million in damage from fires and explosions [9; 215 p.]. According to Swedish insurance companies, over the next 2005-2015, insurance premiums in the country increased by 6-7 times to $4-5 million [6; 44-45 p.]. In 2014, 78 dust explosions were reported at Japanese industrial enterprises (184 victims), in addition to 69 explosions accounted for the chemical industry: including organic semi-finished products, paints, plastics, synthetic detergents and others [3; 27 p.].

According to the American Insurance Association in 2014, 20% of the total number of dust explosions accounted for plastic mass areas. There are a lot of explosions in the coal mining industry. The study noted that the amount of annual material damage in all developed countries and the number of deaths from fires and dust explosions has been increasing in the last 5-10 years [5; 324 p.].

In 2015, there were 11 coal dust explosions and was killed 63 people in Russia [11; № 4].

At the same time, it should be noted that the chemical industry produces raw materials for many relevant industries[6; 44-45 p.]. Accidents at chemical plants can disrupt the work of other companies that work with them and cause great economic damage from fire or explosion. Table 1.2 shows the causes of dust explosions [8; 671 p.].

**Table 1.2**

**Distribution of dust by cause of explosions**

| Causes of dust explosions | | Percentage of total amount,% |
|---|---|---|
| 1. | Technical, including: | 65,8 |
| 1.1 | - failures and malfunctions in equipment | 18,8 |
| 1.2 | - working on new foreign equipment | 9,4 |
| 1.3 | - spontaneous combustion of sediment dust | 18,8 |
| 1.4 | - spontaneous combustion as a result of natural drying | 9,4 . |
| 1.5 | - static electricity | 9,4 |
| 2. | Violation of technology | 15,5 |
| 3. | Not specified | 18,7 |

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**Table 1.3**

| Production process | Number of cases |
|---|---|
| Crushing | 26 |
| Dust collection | 13 |
| Drying | 10 |
| Shipping | 7 |
| Saving | 4 |
| Turning on | 2 |
| Other processes | 16 |
| Overall: | 78 |

As can be seen from Table 1.3, the most explosive processes are: crushing, dust collection and drying[8; 671 p.]. Dust explosions can usually occur in two or more stages[10; 5 p.]. A "primary" explosion is a hanging state of dust in the air that has accumulated on the ground, technological equipment, construction sites, and so on. An explosion of the resulting dust-air mixture can cause a catastrophic increase in pressure.

94% of dust-air mixture fires occur in "basic" process equipment. In 28% of cases, "secondary" explosions were observed in buildings[9; 214 p.]. Sediment dust can explode not only as a result of "major" explosions in process equipment, but also as the dust becomes suspended in the air. The causes of "secondary" explosions in buildings are, for example, the destruction of structures, equipment, process and ventilation pipes, equipment failure, and others.

## III. CONCLUSION

1. Based on the analysis of data on air-dust mixture explosions, they usually occur in two or more stages, most often in technological equipment during the processing or transportation of dust-producing products.
2. Existing regulations have found that there is no way to determine the amount of dust that can create an explosive airborne dust in a room on a local scale.
3. An analysis of industry regulations has shown that the room category in which most of them contain explosives is determined only in accordance with the lower limit concentration of the flame - the value of the AQChK, which does not preclude unreasonable exaggeration of the category.

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