The results of the analysis of the current state of the creation and operation of refuelling complexes of wheeled vehicles specially the big carrying capacity, taking into account their environmental, fire and explosion

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Abstract. This article presents the results of the analysis of the creation and operation of multi-wheeled vehicle filling stations for the significance of creating a generalized methodological apparatus in order to ensure a sustainable reduction in the risk of accidents, explosions, man-made disasters and reduce the mortality of people at gas stations. More and more people are killed, injured and burned if fire safety measures are not followed when refueling large multi-axle wheeled vehicles. Accidents and explosions cause significant damage directly to the gas station itself, as well as to tankers carrying explosive fuel and substances. The substances used are mainly characterized by fire and explosion hazards. Therefore, in addition to pollution of environmental objects such as soil, air and water resources, and, as a result, changes in the ecosystem, further fire or explosion is possible. In this case, there is both an energy impact on neighboring objects, and their possible destruction. This article discusses the indicators of accidents in the event of accidents on vehicles, primarily on tankers, a preliminary assessment of the consequences of accidents and the possibility of taking measures to prevent the factors leading to them. The creation of a generalized methodological apparatus for assessing the consequences of accidents will make it possible to assess emerging emergencies without dividing them into classes of transported substances.

1. Introduction

To ensure comprehensive protection of facilities from emergencies, accidents and emergencies during the operation of refueling complexes for heavy-duty vehicles, it is of particular importance to develop a methodology and engineering measures aimed at evaluating and ensuring the comprehensive safety of the multi-axis wheeled vehicle refueling system.

Specific regulatory requirements for the prevention and prevention of emergencies are imposed on the territory of gas stations and dangerous areas, fuel filling columns, storage tanks for petroleum products, pipelines, and the site for draining petroleum products from a tanker. Gas stations (gas stations) and complexes (gas stations) are the most important part of the country's oil product supply...
The object of research in this article is a complex of object gas stations of stationary and mobile type.

The life cycle of the research object includes the following stages:
1. The newly designed and built filling station was not in operation;
2. Newly built filling station, in operation for less than a year;
3. Filling station, in operation for more than a year, equipped in accordance with the project documentation;
4. Filling station, in operation for more than two years, having physically and functionally outdated operational characteristics of buildings and equipment, located, requiring investment to improve performance;
5. Filling station, not in operation as of the evaluation date (operation has been temporarily suspended or discontinued for any reason)

Statistics show that today 43% of fires occur due to violations of operating rules and safety regulations, 22% due to malfunctions of electrical equipment and lighting devices, 13% due to fuel spills, and other causes are much less common.

Therefore, measures of environmental friendliness, fire and explosion safety at gas stations require special attention, both at the time of operation and at the time of construction.

Regular violation of these requirements and disregard for fire safety rules when refueling multi-axle wheeled vehicles by service personnel, violations during operation and maintenance of large-sized wheeled vehicles lead to irreversible consequences, such as the occurrence of emergency situations and, as a result, the death of people.

Unfortunately, the existing methods and measures to prevent emergencies are not effective enough, because accidents, explosions, fires, fuel spills are a rare threat to human life and health at the present time.

Thus, the development of a new methodology and engineering measures aimed at assessing and ensuring the comprehensive safety of the multi-axle wheel refueling system is an urgent problem today.

One of the most common problems that arise when servicing and refueling vehicles with particularly heavy load capacity is the depressurization of the tank.

The substances used, which are transported on tankers, are mainly characterized by fire and explosion hazard. Explosions and fires can occur when the steam-air mixture ignites both inside the tank equipment and in an open area. Therefore, in addition to pollution of environmental objects such as soil, air and water resources, and, as a result, changes in the ecosystem, further ignition or explosion of these substances is possible.

2. The study of the creation and operation of filling stations for wheeled vehicles of especially large carrying capacity, taking into account their environmental, fire and explosive properties

Oil spills may occur due to complete or partial destruction of storage tanks, pumping or pipeline equipment. Destruction is most often the result of corrosion processes, defects during installation work. According to statistics, the vast majority of gas stations in Russia do not meet the requirements of fire and environmental safety.

During the raids, massive serious violations were detected at gas stations in the Bryansk, Rostov regions, Krasnodar territory, as well as in other regions. Such statistics indicate that there are no working mechanisms in the industry to respond to violations.

Gas station owners in most cases downplay or completely ignore the facts of emergency situations in order to avoid liability, which significantly increases the fire hazard of stations. Analysis of statistics on accidents at gas stations in Russia and abroad, during which emergencies that could cause damage to the health of personnel and equipment of the facility were considered, showed that spilled oil products were most often ignited.
In about 18 percent of cases, there were explosions. Almost all serious emergencies at gas stations were accompanied by harm to the health of employees, as well as significant damage to property. In some cases, even complete destruction of objects was observed. Such disappointing statistics indicate the urgent need to make decisions to eliminate existing violations in the field of fire safety at the design and operation stages of petrol stations.

**Figure 1.** Diagram of the development of an emergency situation with depressurization of the tank

Based on this scheme, it is possible to create an algorithm for calculating the consequences of an emergency.

Input data required for assessing emergency situations on tankers:

a) characteristics of a chemically dangerous object (filled with a dangerous substance on a tank truck):
   - types of containers, amount of dangerous substance (S);
   - physico-chemical and Toxicological properties of OM or products of their destruction (taking into account the hazard class, mechanisms of Toxicological action of the substance, its speed of action, resistance, ways of impact on the environment);
   - finding environmental objects, including people, at the accident site;
   - presence of explosive and fire-hazardous substances at the accident site.

b) characteristics of a chemical accident:
   - place and time of the accident;
   - cause of the accident;
   - scale and nature of the accident;
   - the number of hazardous substances or products of their destruction, thrown out, spilled during the accident, their aggregate state.

Spillage of a dangerous substance is accompanied by contamination of a certain volume of soil. When dealing with the consequences, the issue of reclamation is costly because of the need to neutralize the entire volume of contaminated land [7]. The cost may increase significantly due to an increase in the hazard class of waste. To reduce environmental pollution, it is necessary to implement
measures to reduce losses of petroleum products from evaporation, spills, reduce emissions of pollutants from wastewater and flue gases, and improve the quality of their treatment [2].

According to statistics from 2019, most often there were fires at gas stations, they accounted for 60% of the total number of accidents.

Depressing statistics show that the measures taken to date are not sufficiently developed and are not effective enough.

An external impact may cause a Strait fire and a fireball.

In emergency situations there is a simultaneous flow of high speed and low speed combustion processes. In the second case, a Strait fire or fireball may occur.

Assessment of the heat radiation intensity of the Strait fire

The intensity of thermal radiation $q$ is determined by:

$$q = E \times F \times t, \text{ kWt/m}^2$$

where

$E$ is the average surface heat radiation density of the flame, $kW / m^2$;

$F$ - angular irradiance coefficient;

$t$ is the atmospheric transmittance.

For real rocket fuel fireballs, the radius and time of heat exposure are determined by:

$$R = 17.6 M^{0.32},$$

$$R = 20.78 \text{ m},$$

$$\tau = 2.71 M^{0.32},$$

$$q = E \times F \times t, \text{ kWt/m},$$

where

$E$ is the average surface heat radiation density of the flame, $kW / m^2$; $E = 450 kW / m^2$.

$F$ - angular irradiance coefficient;

$0.012 = 100 mt$ is the atmospheric transmittance.

We determine the intensity of thermal radiation at a distance of 100 m from the center of the fireball:

$$q = 76.5 \text{ kWt/m}^2$$

The dose of heat radiation affecting people from the "fireball" is determined by:

$$Q = q \cdot \tau = J/m^2.$$
In the course of patent research, it was revealed that there is a significant decrease in the volume of patents received for improving and analyzing designs and techniques in this area, which indicates a decline in the interest of specialists in this matter.

3. Conclusion
Thus, the use of a new generalized methodological tool will allow assessing the consequences of emergency situations on tankers, taking into account the environmental, energy and physical impacts on the surrounding objects, as well as help reduce the risks of emergencies, accidents and emergency situations and prevent the death of people.

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