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Effect of Physical and Chemical Properties of Explosive Materials on the Conditions of their Use

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Keywords: explosive ordnance; explosive materials; physical and chemical properties; molecule structure; oxidizer; detonation propagation velocity.

Abstract. The components of the most common explosive ordnance in Eastern Europe have been analysed. The most dangerous explosive materials that rescuers may encounter when disposing explosive ordnance and clearing territories from mines have been identified. Such hazardous materials include tetryl, texogen, trinitrotoluolol, mercury fulminate, lead azide, lead trinitroresorcinate. An analysis of the chemical structure and physical and chemical properties of such materials has been carried out. It has been established that explosive materials can be divided into two classes with similar values based on such parameters as detonation velocity, volume of explosion products, and explosion heat. It has been established that the chemical structure of their molecules corresponds to the said two classes of physical and chemical properties. The first class includes materials based on hydrocarbons, the second includes materials based on heavy metals. It has been established that the specific volume values for the second class materials increase significantly, and exceed the indicators for the first class materials. This is due to the difference in the density of such materials by 2 to 4 times. The established features of the physical and chemical and explosive parameters of explosive materials can be used in the development of standard operating procedures and plans of actions of rescuers in order to increase the safety of handling the explosive ordnance.

Introduction

The latest achievements of scientific and technical progress in the defence industrial complex are leading to an increase in the variety and lethality of weapons. Mine weapons have one of the oldest histories. A few centuries ago, man first began to use the powder energy of explosion. It is used for killing and maiming manpower, damage and subsequent disabling of equipment, by impact of explosion and shrapnel. As practice shows, during military conflicts, mine weapons carry losses not only for military units, but also for the civilians, among whom a significant part is children.

As a result of the full-scale invasion of the Russian Federation into Ukraine, almost half of the territory of our country was potentially contaminated with mines and explosive ordnance (EO). The area of the territory that needs to be cleared from EO is 185,000 square kilometres. Operational demining of roads and settlements will be carried out throughout the year, however, complete demining will take a long time. An analysis of the experience of using EO in local wars and armed conflicts shows that the use of mines has the following characteristics: instead of long minefields, small groups of mines and even individual mines are usually placed; mine groups and individual mines are most often placed unsystematically and are not recorded in documents, placement of controlled mines becomes more widespread; minefields; a huge number of improvised and home-made mines, detonators and explosives are used, which are dangerous in making and use for those who make them. In such cases, the demining of EO requires knowledge and analysis of the technical component of the explosive device and the chemical properties of explosive materials.