

# Development of Ecological Safety Structure of Exploitation Model of Firefighting and Emergency-Rescue Vehicle with Reciprocating ICE That Consumes Mixture of Biodiesel and Petroleum Fuel

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**Abstract.** A model of accident-free exploitation process for emergency and rescue vehicle with reciprocating internal combustion engine has been developed in the study on the basis of the averaged diagram of distribution of operational duty duration of State fire and rescue department in Kharkiv, and on the basis of already known models of exploitation process. The structure of exploitation model has been rationalized using the value of complex fuel and ecological criteria developed by Prof. Ihor Parsadanov. The analysis of the results of comparative calculation study both for using the pure diesel fuel of petroleum origin and for transferring the consumption of mixed fuel with different part of diesel fuel of biological origin has been carried out. Based on these calculations, the recommendation on increasing the ecological safety level of the studied process has been formulated which consists of providing the vehicle with the same advantages over other road users in its motion back to the location as when heading to the place of call by means on fixing such a rule in the Traffic Safety Regulations of Ukraine.

## INTRODUCTION

Ecological safety (ES) is an integral component of national security, both in global and local scale, with particular interest in some of the economic aspects of the complex criteria-based assessment process for its level, which is the main component of the final stage of ecological safety management system (ESMS) as a component of civil defense [1–3]. The considerations described above determine relevance of the study [4].

Research on aspects of ES of units of firefighting and emergency-rescue vehicle (FERV) has been reflected in the works of Ukrainian [5–7] and foreign [8–16] scientists and specialists, which indicates the relevance of research on the criteria-based assessment of the ES level of exploitation of such technique.

Quantitative and qualitative analysis of the results of mathematical modelling of thermodynamic properties of exhaust gasses, traditional and alternative motor fuels [17] for obtaining the base for ranking the variants of developing the structure of FERV with RICE exploitation model allows to formulate a list of recommendations for management decisions in the field of civil defense based on appropriate methodological apparatus [14,18] and basis provisions of public administration [19] and evaluation of ecological safety state of ecosystems [20], potential atmospheric pollutions [21] and appropriate risks of human health [22] including issues of pollution of environmental components with heavy metals and their compounds [23].

Such considerations are significantly relevant given that one of the main ways to overcome the inevitable fuel