MANAGEMENT OF BIOLOGICAL AND CHEMICAL INCIDENTS: SIMULATION-BASED DECISION SUPPORT

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ABSTRACT
Decision making processes during biological or chemical incidents represent a challenging and demanding issue. This task constitutes of several complex activities and important decisions. In case of unintentional accidents in agricultural plants or within related industries, these decisions have to be made by personnel who are usually not primarily trained for such situations. Therefore any available support tool, which can increase the probability of successful management of these incidents, should be employed. The main aim is to minimize the consequences, ensure the quality of products and protect people and animals and other crucial assets. From the technological perspective, various approaches or principles have been already applied and intended for computer-based support of biological or chemical incidents management. Nevertheless, the multi-agent technologies can be also effectively utilized. As an example, this paper presents model applicable for the management of biological or chemical incidents created in the multi-agent NetLogo environment. The main contribution to the scientific field includes the characterization of specifics related to the discussed type of decision-making process. Moreover, within the paper the description of the simulation model is provided, parameterization is explained, and areas for further research are outlined.

Key Words: Biological Incident Management; Chemical Incident Management; Decision Making Process; Multi-agent Technologies; Simulation Modelling
INTRODUCTION

Currently, agriculture and related industries are closely connected with advances in the area of biology and chemistry. Occasionally, biological or chemical incidents occur. These apparently represent a considerable threat for our society and have more serious consequences than ever before. This can be explained by more sophisticated biological agents and chemical compounds, increasing value of endangered assets and also by fast development of technologies within last few decades. The incidents can be categorized to these caused by the biological or chemical weapons and the second group includes the unintentional occurrence of such problems exemplified by the leakage of a dangerous substance from a plant or laboratory, or natural incidence of a disease within animal herds. The intentional incidents are usually easier manageable, because their focal point can be typically identified quickly and localized more precisely. Therefore, the critical assets can be recognized faster and adequately protected. The appropriate reaction to these incidents is conducted only by trained personnel, usually pertaining to police, epidemiological or armed forces. On the other hand in case of unintentional accidents, which occur within agricultural mills or plants, people responsible for the management of such complex and difficult tasks are usually not trained enough for prompt and professional decisions which would protect the critical assets. Therefore, the biological and chemical incidents remain challenging as well as important task for both researchers and practitioners. Considering the aforementioned reasons, a tool for decision support and for the improvement of the decision effectiveness and consequences minimization needs to be used. The main aim of this paper is to introduce the multi-agent based simulation, because it provides with the advantages such as problem complexity elimination, incident scenario modeling, or more effective resource planning and utilization. Moreover, the demands on non-expert decision makers are decreased significantly. It ensures flexible and more precise attitude to the incident management.
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MANAGEMENT BIOLOGICKÝCH A CHEMICKÝCH INCIDENTŮ: PODPORA ROZHODOVÁNÍ ZALOŽENÁ NA SIMULACÍCH

ABSTRAKT

Klíčová slova: management biologické havárie; management chemické havárie; multiagentové technologie; rozhodovací proces; simulační modelování
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