



SOLUTION OF CRISIS SITUATION CONNECTED WITH SPILLAGE OF DANGEROUS SUBSTANCE DURING TRAFFIC ACCIDENT

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Abstract: Crisis situations connected with spillage of dangerous substances are relatively often involved in road traffic accidents. This crisis situation is often assessed as an emergency event that influences the lives and health of affected participants, their property and natural environment, too. Undesirable spillage of dangerous substances, especially oil products (e.g. diesel oil, gas, and other) but also service fluids (e.g. engine oil, gear oil and other) from means of transport during road traffic accident results in increasing contamination of natural environment, especially soil, water sources and air, too. Within the Integrated rescue system, the units of the Fire and Rescue Services concentrate on early identification of spilled dangerous substance, on its early localization and subsequent removal with help of sorptive materials and of low expansion foam. The actual practical experiences require examining and analysing mutual interactions among selected dangerous substances and sorbents on various soil samples in dependence on time factor, actual meteorological and climatic situation, kind and conditions of contaminated terrain surface.

Key words: traffic accident, sorbent, dangerous substance, soil, crisis situation, emergency event, low expansion foam.

INTRODUCTION

Transport of dangerous substances and their possible leakage and spillage onto the roads is high-risk activity due to possibility of emergency crisis event occurrence. Transport process can be positively affected especially before its realization by acceptance of security measures based on practice and actual legislative. Leakage of dangerous substances as a result of transport accident, natural disaster or malicious abuse of dangerous substances for terrorist attack, etc. presents the greatest risk for dangerous goods transportation. Risk is a quantitative and qualitative expression of danger, degree or measure of danger. Risk consists of two basic components – size of potential impact and probability of emergency event occurrence. The main factors, affecting the risk of crisis situation occurrence that is solved as emergency event connected with dangerous substance leakage onto the road during transport accidents, are as follows [1, 2, 3]:

- road transport density,

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- frequency and volume of realized transportations,
- properties of transported dangerous substances,
- technical condition of roads,
- territory segmentation, meteorological and climatic conditions,
- technical level and capacity of transport means,
- training of the transport means personnel,
- accessibility and professionalism of integrated rescue units, and other.

To ensure the acceptable risk measure it is necessary to carry out quantitative risk analysis. Risk analysis holds considerable probability measure since it is not possible to specify reliably in advance the time, place or range of crisis situation, so called emergency event. Transport security, safety and quality are influenced by large number factors that can be according to their source divided into three basic groups [1]:

- a man – human factor,
- means of transport,
- environment.

Danger connected with dangerous substances transportation is necessary to be foreseen, identified and especially it is important to ensure prevention against possible negative impacts as threat to life and health of stricken participants, property losses and contamination of natural environment (e.g. soil, water and atmosphere). Sufficient information and knowledge about dangerous substances form assumptions for reducing the risk of crisis situation occurrence as emergency event during their transport.

1. CRISIS SITUATIONS, LEAKAGES OF DANGEROUS SUBSTANCES AS A RESULT OF TRANSPORT ACCIDENTS

Within the integrated rescue system just the Fire and Rescue Units of the Slovak Republic are concentrated on early identification of dangerous substance leakage, on its quickly localization and subsequent removal with help of suitable equipment and available machinery. In transport accidents, connected with leakage of dangerous substances onto the roads, the oil leakage is the most often concerned (e.g. driving fuel, service fluids). Intervening members of the Fire and Rescue Units of the Slovak Republic are instructed during solving these crisis situations by internal regulations, methodical regulations No.90 and 100 of the Presidium of the Fire and Rescue Services of the Ministry of Interior of the Slovak Republic. Intervention services for transport accidents are realized through the motor-cars of the fire and rescue services, technical and ecological motor-cars that dispose of necessary equipment for performing all activities to rescue the lives of transport accident victims and all activities concerning the place of accident, rescue of persons from the car, cars and the measures connected with leakage of service fluids. In case of car accident connected with leakage of dangerous substances the intervening firemen carry out the activities and acts in accordance with the procedure as follows [4, 5]:

- *Arrival of the unit on the place of transport accident:* it is necessary to take care of the firemen security and arrival of other units.
- *Place of intervention:* to carry out all activities to ensure security of intervening persons (placing equipment, shoulder of road, danger light, tapers).
- *Realization of research:* to find out quantity and type of crashed accident vehicles, dangerous substances and working liquids, their leakage, danger of fire and explosion, injured persons, number of fellow passengers, stability of crashed accident vehicles, type of drive, necessity of heavy recovery technology
- Stabilization of motor-car: against displacement, overturning, to prevent from self-acting change of motor-car position.
- *Disconnection of accumulator.*

- *Prevention against danger substances leakage (e.g. driving fuels, service fluids, and others): sealing of the leakage place, collecting vessel placing, sorbent use.*
- *Rescuing and protection of transport accident victims: all activities necessary for rescue of persons.*
- *Removal of transport accident effects from the road: removal of spilled dangerous substances, finders, motor-cars from the road, recovering the road.*

2. PROCEDURES AND MEASURES OF RESCUE UNITS IN SOLVING CRISIS SITUATION, LEAKAGE OF DANGEROUS SUBSTANCE AS A RESULT OF TRANSPORT ACCIDENT

Within the rescue units the Fire and Rescues Services members have dominant task. After arrival on the place of occurred crisis situation, so-called emergency event, connected with leakage of dangerous substance as a result of transport accident, it is important [4, 5]:

- To gather and evaluate basic information about dangerous flammable liquid (type and quantity, flammability and explosiveness of substance, solubility in water, characteristic properties, probability of next danger and threat, determination of removal procedure).
- To safeguard place of leakage and intervention (enclosing the place, prohibition of driving and persons entry, provision of security for intervening units, use of suitable sorbent).
- To remove the source of undesirable leakage and pollution (closing valves, etc.).
- To separate stricken area (placing barriers, scum boards, astriction of channel inlets).

Measures carried out by rescue units participating in solving occurred crisis situation [4, 5]:

- Collection and separation of captured dangerous substances.
- Collection and separation of saturated sorbents.
- Taking off testing samples of water and soil
- Subsequent redevelopment works.
- Record about accident, leakage, fire... (about solution of specific crisis situation).
- Repair and exchange of defective tools used during intervention.
- Proposal of preventive measures to avoid similar crisis situations occurrence – emergency events (specific accidents, leakages, fires, explosions of dangerous substances during transport accidents and other).

Principles of dangerous substances leakage removal as a result of transport accident [4, 5]:

- In case of the fire threat, more dangerous substance has to be covered by layer of foam, because its flash point is – 25 °C and the flammable and explosive vapours can easily take fire.
- It is necessary to prevent from dangerous substances leakage from the car with help of sealing wedges, bandages, sealing bag, cover and sealant...
- If it is not possible to prevent from dangerous substances leakage, it is necessary to place impounding vessels under place of leakage.
- To prevent from penetration of dangerous substances (especially oil substances) into canalization, shafts, cellarage, holes and thereby also surface waters.
- In case of the threat to people, equipment, or contamination of ground water it is necessary to transfer oil substances and catch them in impounding vessels.
- If the liquid layer is under 5 cm it is necessary to cover it by appropriate quantity of sorbents.
- Contaminated sorbents have to be collected by wooden shovels and kept in suitable impounding vessels by the time of their transport.
- During removal of untightens it is necessary to use only non-sparking tools (danger of fire or combustion).

- Transferring of service fluids or oils can be done only with use of non-sparking pumps or approved immersion pumps.

3. PROCESSES OF SORPTION AND DESORPTION OF SERVICE FLUIDS DURING TRANSPORT ACCIDENTS

Undesirable leakage of driving fuels (e.g. petrol, oil) and service fluids (e.g. motor oil, gearbox oil, cooling mixture and others) contaminating natural environment, especially water, soil and atmosphere is often result of the road transport accidents [6-10]. The firemen localize and liquidate leakage of above mentioned dangerous, inflammable liquids with help of sorbents and prevent from possible fire with use of extinguishing agent- heavy foam [6, 7, 9, 10]. Based on the practice it is needed to analyse and investigate effect of the selected driving fuels and service fluids in interaction with sorption substances and extinguishing media with concentration on various types of soil and with aim to reduce their environmental impacts. Speed and range of dangerous flammable liquids penetration into soil depend especially on type and state of terrain surface (asphalt, concrete, gravel, ground...), meteorological and climatic situation in the region (summer, winter, rain, snow...), type of soil and time horizon factor. Under such conditions it is rather difficult to assess the range of environment contamination with concentration on soil, sorbent type influence on sorption and desorption of used liquids, volume of absorbed liquid in used sorbent and effect of applied extinguishing substances – heavy foam on range of liquid penetration [2, 7, 9, 10].

These issues were solved within the project VEGA – MŠ 1/0820/10 „Sorption and desorption processes of service fluids during transport accidents „in period of two years. In the first stage were solved partial tasks as follows: [2, 7-10]:

- Carrying out literature retrieval, study and assessment of actual situation in leakage of service fluids during transport accidents on the roads of the SR.
- Assessment of basic characteristics of service fluids, used sorption substances and extinguishing media, their supplementary analysis for obtaining needed parameters.
- Evaluation of basic parameters of single types of soil, their specification from the view of road network.
- Proposal of methodical procedure and modelling of penetration of service fluids into selected types of soil.
- Proposal of analysis (qualitative and quantitative evaluation) for finding out the interaction of service fluids with soil, sorption substances and extinguishing media.

Realization of single tasks required actual specialized literature and respective software. Based on the work carried out in the first year to fulfil the tasks it was necessary to ensure suitable hardware, software, devices, technical and laboratory means, chemicals for analyses and technology for measurements.

In the second stage of the project it was necessary to concentrate on the practical measurements in laboratory conditions with orientation on required results and proposals for realization in practice. These partial tasks were realized [2, 6, 7, 9, 10]:

- Supplementary analysis of needed parameters of service fluids and their interaction with single types of selected soils.
- Measuring model situations of service fluids penetration into selected soils.
- Qualitative and quantitative analysis of service fluids in single soil samples.
- Qualitative and quantitative analysis of service fluids after interaction with sorption substances and extinguishing media.
- Qualitative and quantitative analysis of service fluids after combined interaction with sorption substances and extinguishing media.

This practical part of the project solution was realized in laboratory conditions with use of necessary material, technical and apparatus equipment. The project was applicable oriented and so it includes theoretical assessment with subsequent experimental measuring the results of which are values utilizable for state and public administration bodies, operators and professionals with focus on

the Fire and Rescue Services of the SR. The contribution of the project is also in the pedagogical field within students and doctoral students' participation in theoretical and practical part, realization of single tasks and application of the results in educational process at the Faculty of Special Engineering of the University of Zilina in Zilina in study fields „Rescue Services“, „Crisis Management“, „Security Management“, „Transport in Crisis Situations“.

CONCLUSION

Saving human lives, property and also natural environment is the main priority in solving the crisis situations concerning the transport accidents connected with danger substance leakage. Driving fuels and service fluids cause great burden for natural environmental, they are able to contaminate affected soil, ground waters and atmosphere with their vapours. It is necessary to prevent their further leakage and eliminate their possible negative impacts on natural environment through application of adequate sorbents and heavy foam.

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VEGA - 1/0820/10 ME "The processes of sorption and desorption of fluids in road accidents"

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