



THE SYSTEM OF EMERGENCY CARDS FOR PRIMARY ACTIONS IN ACCIDENT AT RADIOACTIVE MATERIAL TRANSPORT IN RUSSIA

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SUMMARY

In the paper are reviewed the current and new designed system of the emergency cards for consignments of radioactive materials in Russian Federation, within the framework of a uniform state system of warning and liquidation of consequences of extraordinary situations and functional subsystem of warning and liquidation of accident situations of Federal Agency for Atomic Energy.

1. INTRODUCTION

For 50 years of mass shipments of radioactive materials (RM) in Russia there were not registered both serious radiation effects on the population and personnel owing to such shipments and there were not almost RM transport accidents as well. The total number of transport infringements at RM shipments is estimated only as singles for these years.

Nevertheless, in frame of "The Uniform state system of warning and liquidation of emergency situations" [1] the functional subsystem of warning and liquidation of emergency situations of the Federal Agency for atomic Agency (Rosatom, earlier Minatom of Russia) operates in Russia. One of the tasks of this subsystem is the providing the planning, the preparing and the carrying measures at RM transport accidents. The execution of this task is carried out by Accident-Emergency Service for Transport of Rosatom (AES T).

One of the normative - technical elements of Accident-Emergency Service for Transport in Russia is the system of the emergency cards (EC) for realization of primary activities in case of incidents and accidents at transport of RM. Such requirement takes place for the transport of other dangerous goods (DG) pursuant to rules and other normative documents which are operational in Russia on various mode of transports (see, for example, [2], [3], [4], [5]).

Within 2003-2004 years the system EC for transport of RM in Russia was revised cardinally. One of the major characteristics of this system is its conformity with EC systems, developed and operational in other countries. Below in the paper the conceptual approaches to the Russian EC system for consignments of RM and its tasks are considered, and the description of the particular contents of EC with brief substantiation is submitted.

2. THE CURRENT SYSTEM OF EMERGENCY CARDS FOR RM CONSIGNMENTS

The general system of emergency responses which is operational in Russia, envisions the following documents in order of the extension of its scope:

- Emergency cards for separate consignments of RM;
- Instructions of the personal accompanying RM consignment for a case of accidents at RM transport;
- Emergency plans of a consigner (consignee) for a case of accidents at RM transport;
- Emergency plans of nominal emergency - saving formations of AES T;
- Emergency plans of AES T (common or separate ones for various modes of transport);
- Emergency plans of regional and local government bodies;
- Common national emergency plan for radiological accidents within the framework of Uniform state system of warning and liquidation of emergency situations.

ECs are the documents maiden, lower layer. Nevertheless, they should be proper inscribed in the general system of emergency state acts. Allowing, that the overwhelming part of shipments of RM in Russia (former USSR) implemented with accompanying staff, at development of EC the general approach was accepted, that the main user of EC should be such accompanying staff. In this respect EC can even substitute the instructions of accompanying staff for a case of accident and to be not so limited in relation both total number of EC, and volume of everyone of EC.

Outgoing from this, two types of EC were developed for RM consignments, which are in action now. One type is intended for fissile nuclear materials (NM), 21 ECs. Other type - for consignments of radioactive substances (RS, non fissile RM), 119 ECs. Besides to some RM consignments the special ECs are applied, for example, for some international carriages or for transport by water modes. As mentioned above it is difficult to apply two types of ECs to a water modes in view of specific organization of emergency activities at sea shipment.

AC for RS have been drawn up in such a manner that the actions of the participants of shipment and other persons which are appearing in place of accident (emergency divisions of fire guards, medical staff of first aid and medical entities, special emergency teams of consignors and divisions of AECs) are to be coordinated and regulated. Everyone of AC corresponds to the type of radionuclide with the description of physicochemical properties of matter, characteristics of a radionuclide, kind of its hazard and large list of illnesses caused by this material, which arise at a direct contact with radionuclide and inhalation of it. Last circumstance has stipulated a great number (119) of ACs for RS.

In cards the actions of a great many of persons and divisions are regulated, that, however, is not too burdensome at usage of EC by the trained accompanying staff. Also the cards require the identification of the category of accident to be made during primary emergency actions. The proper characteristics of each category of accident are indicated in these ACs.

As a whole, it is necessary to mark that presentation of the information about hazard of RS in EC does not correspond to the real dangers in view of a principle of optimization and the real level of safety provided at RM shipments, including, in an emergency conditions, and does not promote effective realization of emergency activities. Besides ACs are drawn up as some "reference book" on properties of a dangerous goods, types of probable diseases and methods of their treatment, instead to be a short clear guide to action in complicated conditions of accident. The volume of one EC makes of 7- 8 pages of the printed text.

In many aspects the mentioned above provision of ECs for RS take place in ACs for NM. The system of the last contains more general classification of RM consignments, that has limited number of ECs up to 21. Information in these ECs is more targeted on realization of emergency activities. On the other hand these ECs have the greater volume (up to 14 pages) and as a matter of fact really these cards are the instruction for accompanying staff on a case of accidents by transport.

3. NEW SYSTEM OF EC FOR RM CONSIGNMENTS

3.1. General matters

In connection with the development and scheduled enactment of the new national «Regulations for Safety at Transport of Radioactive Materials » (NP-053-04) [11] the problem was put to analyze the operational ECs system and to prepare respective modernization of this system. Besides due to the needs to take into account the new classification and marking of RM consignment in NP-053-04, it was necessary to take into account transports of many types of RMs without accompanying staff, to ensure coordination of a EC system for RM consignments with ECs intended for transportations of others DG in Russia and with similar EC systems for RM acting (developing) in a world, and to take into account the guidelines of IAEA on this problem as well.

At the analysis of the operational EC system and development of changes a number of general problems determining the contents of ACs should be resolved, namely:

- Users of ECs;
- Form and volume of ECs;
- Priority of actions;
- Contents of ECs.

The users of the emergency cards

It is understandable, that the definition of the ECs users very strong stipulates both structure and contents of ECs. At absence of special accompany staff for RM consignments or in case of invalid of such accompanying staff as a result of accident, users of ECs in accident place will be the plenipotentiary representatives of internal affairs, fire or medical services. Certainly, in place of accident random completely by-standers can be in most cases as the first. However, ECs should be counted not for them, but for persons who has authority for on realization of some actions, possessing the applicable assignments, whom instructions the other persons in place of accident will follow.

For actions (both primary, and subsequent) of accompanying staff at accident there in principle need not to have the ECs. Such persons according to a general system of emergency arrangements by transport should have detail schedule (instructions) of a consignor for a case of accident with RM consignments and/or the detail instruction on actions for accompany staff itself (drawn up on the basis of the mentioned schedule) taking into account the high training level of the staff as well. Thus such schedule and instruction can and should have the information with reference to particular transported consignment in view of its features. Accompany staff besides should already be trained to operate under these documents, that is, as a matter of fact to know them and to act almost by heart.

At the same time other authorized persons, besides that they will not be trained to actions on liquidation of consequences of accident, most likely can not (and from here and do not owe) beforehand be acquainted with the schedule (instruction) of a consignor. Therefore, for a co-ordination of actions of accompany staff and other persons in accident place it is represented as very important that the most necessary primary actions were executed by accompany staff and under their guidance namely according to AE (about what it is reasonable to point out in EC). It is understandable, that such staff should know the EC practically by heart.

The card should be unified for all listed categories of persons. Therefore, outgoing from a principle of a weak link, EC should be counted for specially unprepared staff, but for familiar with by a general EC system for RM and, probably, previously acquainted, at any rate, with general scheme of ECs. In EC the priority of staff persons and at the same time the strong instruction for management of primary actions, that will stipulate also subordination of the remaining participants in aspects of general measures.

The form and volume of the emergency card

The guidelines of IAEA, including the form of ECs, are submitted in the document "«IAEA-TECDOC-1162" [6], in which the standard schedules are presented for all probable participants of acting at all stages of liquidation of consequences of accident on the basis of the unified approach to emergencies on radiation objects and at RM transport, including instruction on realization of primary actions for the supervisor in accident place, representative of internal affairs, fire service and first medical aid. These instructions are set up as the legible sequence of operations and have no more than 2 -3 pages. The system of ECs similarly formulated is in force in the North-America states [7] and in EU states (card of hazard at transport and ERICards for the fireman) [8].

Taking into consideration the guidelines of IAEA, experience of other countries and main users of ECs, definite above, EC should be brief, but not in injury of the indispensable information. EC should be reshaped as legible algorithm of actions, instead to content the descriptions.

In EC the warning about potential hazard of consignment should be indicated not underestimating, but also not uprating this hazard. The form of presentation should give reliance to staff both concerning undertaken actions, and concerning a real level of hazard, or, faster, real level of safety instead of to intimidate him. EC should be drawn up clearly for reading with allocation of separate parts of EC, for example, by colour.

Priority of actions

In the Law of the Russian Federation « About protection of the population and territories from extraordinary situations of natural and technogenous nature » is said, that liquidation of extraordinary situation are emergency, salvage and other urgent activities, directed at first of all on saving of life and health maintenance of the people, decrease of the sizes of injury to an environment, localization of zones of extraordinary situation and cancellation of the dangerous factors. In the guidelines of IAEA [6] it is underlined, that the measures on saving life of the people are prime, despite of presence of irradiation. The same principle is professed in the Law of Russian Federation « About salvage and rescue services and status of the rescuers».

Therefore in EC it is necessary to point, that priority in primary actions in place of accident is the saving of the people lifes, rendering assistance to injures. The subsequent actions should be directed on making measures for non-admission of ascending of threat to the population and environment, and that first of all is connected to liquidation of a fire as well.

3.2. Content of the emergency cards

The analysis of ECs used in Russia for RM, of requirements to ECs in transport rules for other DG by various modes of transport [2], [3], [4], [5], guidelines of IAEA [6] and ECs, adopted abroad [7], [8], allows to determine following provisions (sections), which should be contained in the emergency cards:

- Characteristics of a dangerous material. In this section the indispensable physical characteristics of RM consignment determining methods of management of it;
- Hazards. In section the types of hazards intrinsic to consignment are given which can be revealed itself at extinguishing fires;
- Means of individual protection;
- Responses. The main actions are included here in case of leakages and fires;
- First medical aids;

- Main safety measures. The safe distances for an evacuation of persons involved in accident, telephones of competent bodies for the messages on emergency, both volume and form of the messages are included in this section;
- Precautions after interference. This section can contain the guidelines on actions in relation of person involved in accident and of decontamination of the equipment (in cards for fire-fighting crews).

It is necessary to note, that if the naming of sections in the documents analyzed coincides, its contents has essential difference, specially in comparing of emergency cards adopted in Russia with ECs acting abroad. Therefore it was necessary to determine the contents of sections of new ECs on the basis of the laws acting in Russia, norms and rules, experience of usage of ECs in our country, and abroad.

The characteristics of dangerous goods and its condition

Taking into account the potential users of EC, it is expedient in this section to formulate problems (versions of the brief description of a condition), the answers to which will allow to consigner or representative of ERC (emergency response center) to identify the category of accident after obtaining the message from a crash scene.

Warning about hazard and dangerous characteristics of consignment

Taking into account the potential users of ECs the content of packaging should be expressed by understandable categories, by such as "hazard not considerable", «hazard media (high, very high)», "not dangerous". Besides it is necessary to point out other types of hazards intrinsic to consignment, and probable ways of effect it to the man as well.

Safe distances for an evacuation of the persons having appeared in the accident region and injures

In Russian ECs, as well as in ECs of the North-America states, the safe distances are indicated in meters. In ECs for RM, designed in EU, the dangerous zone is determined as a zone with ultimate output of a dose on boundary equal 25 $\mu\text{Sv/h}$. In case of absence of the dosimeter to determine a dangerous zone it is not obviously possible. Besides in the guidelines of IAEA [6] boundary of a dangerous zone is determined by dose rate equal 100 $\mu\text{Sv/h}$. Advisable IAEA's initial safe distances at radiation emergencies are shown in the table.

Situation	Initial safe distance
Undamaged package: I-WHITE, II-YELLOW or III-YELLOW	the proximate zone around of package
Damaged package: I-WHITE, II-YELLOW or III-YELLOW	in radius of 30 m or at the indications(readings) 100 $\mu\text{Sv/h}$
Undamaged ordinary source (consumer goods) as the detector of a smoke	the proximate zone around of a source
Others unsheltered or unknowns sources (damaged or undamaged)	in radius of 30 m or at the indications(readings) 100 $\mu\text{Sv/h}$
Leakage of RM. Large leakage of RM.	a spot a plus of 30 m around Spot a plus of 100 m around
Fire, explosion or smoke	in radius of 300 m
Spent fuel	in radius of 100 m
Plutonium leakage	in radius of 100 m
Explosion, fire with nuclear weapon	in radius of 1000 m

The radiuses of safety according to our opinion should be expressed in meters and to have the following values: for the exempted packages, packages of types IP-1, IP-2, IP-3, and type A and packages UF₆ at absence of damage - 30-50 m; in case of leakage of radioactive content - 100 m, in case of a fire - 300 m, for packages of types B and C at absence of damage - 30-50 m; in case of leakage of radioactive content - 300-1000 m, in case of a fire - 1000 m. These distances are offered for removing the persons involved in accident, and downwind.

Permissible methods of management of packages for preventing expansion of the area of radiological contamination

Such actions are stipulated in all existing ECs for RM and it suppose removing of undamaged packages, if it is necessary for a non-admission of expansion of accident, at leakage and diffusion of package content.

Permissible methods of fire extinguishing

The main problems, which arises at development of fire extinguish methods for RM packages are probable consequences at applying of water for extinguishing fires in aspect of safety criticality control and probable spreading of contaminated water utilized at extinguishing. Outgoing from the analysis of these problems, the limitations on usage of water should not be recommended.

Measures of the first medical aids

The measures of the first medical aids are expedient to draw up recognizing that injures with potential signs of exposure do not demand an immediate treatment, but for them it is necessary to estimate a level of the dose. The external exposure or contaminations does not cause immediate appearance of signs or diagnostic symptoms. Therefore, if the injures has a loss of consciousness, disorientation, burns or other pathological phenomena, it is necessary to search for their reasons outside of connection with irradiation, and it is necessary to execute ordinary procedures of a medical aids on detection and removal of threatening reason for life or traumas and aids under the biotic indications. The specific of a medical aids at accident with RM is to prevent propagation of radiological contamination at transport of patients and realization of special processing for preventing entry of radionuclides in an organism.

In current EC in Russia and in EC designed in countries of EU there are indications on an inadmissibility of fulfilment of synthetic breathing by a method «from mouth to mouth». It is represented unfairly conservative, and contradicts a principle of prime saving of persons, whom life is threatened with hazard, not looking on the radiation factors.

Protective clothes and personal hygiene

Taking into account the real users of ECs, it is not expedient to recommend indication in ECs of special means of personal protection. Very probable that such means will be no in place of accident. If there are such means at accompany staff, this staff knows itself (without help of EC), when and how to use them. In this section it is expedient to point out, in what situations, what measures of personal protection should be envisioned using the capabilities and to warn about inadmissibility to eat period, to drink and to smoke in the accident region.

Telephones for messages about accident

Apparently, it is not necessary to overstrain EC with a list of all telephones. From the representative in place of accident the message must be sent to Rosatom, to ERC and to organization of informer. The further dissemination of information about accident must be put on these organizations responsibility.

Actions on safety control of persons involved in accident

Here it is necessary to point out, that the chief in place of accident should provide measure on detection of the people involved in accident, registration of them and detention of them until the group of radiation monitoring specialists arrives.

3.3. Number of ECs

The data of IAEA [10] and the analysis of a possible accident conditions demonstrates, that the primary actions at accident with RM consignments on the road, railway and air (in an airport) transport, practically are identical. Therefore ECs for such accident should not differ. The specificity for EC takes place for accident for sea and inland water transport and may be for aircraft catastrophes.

The classification of potential hazard of consignment transported is carried out according to types of packages. Allowing that circumstance, that the type of package limits maximum permissible activity and/ or a maximum admissible level of radiation, the selection of this characteristic for classification of ECs is represented as justified.

Dispute problem is the expediency of allocation of cask with fissile material in separate ECs. Basically in conditions of emergency, especially, at primary actions, it is practically impossible to optimize such actions from the

point of view of preventing criticality. On the other hand that conservatism, which is used in transport rules concerning safety control on criticality, should guarantee exception of criticality at all possible accident and emergency actions.

Nevertheless, taking into account classification of UN numbers and proper shipping names, and also special attention, which is given to fissile materials, including requirements for physical protection, it is expedient to have for such consignments the separate EC.



Thus, outgoing from the indicated reasons a new system of ECs includes 6 ECs for the following types of RM consignments:

- EC for the exempted packages;
- EC for industrial packages and packages type A (with non fissile RM);
- EC for packages type B and type C (with non fissile RM);
- EC for industrial packages and packages type A (with fissile RM);
- EC for packages type B and type C (with fissile RM);
- EC for packages with UF₆ (fissile and non fissile)/

For use the ECs should be joint in one booklet with a general description of the EC system and of using order. The project of one of EC developed, namely EC for industrial packages and packages type A (with non fissile RM) is below shown.

6. REFERENCES

- [1] Order of the government of the Russian Federation from 30.12.2003 years No. 794 «About the uniform state system of warning and liquidation of extraordinary situations».
- [2] «Regulation of the shipments of dangerous goods by automobile transport», Order of Mintrans of Russia from 08.08.1995, No. 73 (in wording of order from 11.06.1999 No.37 and from 14.10.1999 No. 77).
- [3] «Regulations for safety and order of liquidation of accident situations with dangerous goods at transportation by rail », MPS of Russia, 1997, Order the deputy minister 25.11.1996, No. ZM-407.
- [4] « Actions on providing flight safety at incidents with dangerous goods»
- [5] «About the order and requirements on preparing the dangerous goods for sea carriage», Order of Mintrans of Russia from 23.10.98, No. MF-34/195.
- [6] «Generic procedures for assessment and response during a radiological emergency”. IAEA -TECDOC-1162, Vienna, 2000.
- [7] " North American Emergency Response Guidebook ", 1996.
- [8] Paper of International conference on safety at transportation " EMERGENCY RESPONSE IN THE FIELD OF THE TRANSPORT OF RADIOACTIVE MATERIAL IN GERMANY " C. Fasten, F. Nitsche, D. Trepesch.
- [9] «Provision about organization of activities on liquidation of consequences of accidents by transportation of nuclear materials and radioactive substances by federal railway transport (PLA-2001) », Moscow, 2002.
- [10] " Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material ", IAEA Safety Standards Series ' TS-G-1.2 (ST-3), Vienna, 2002.
- [11] "Regulations of safety at transportation of radioactive materials". NP-053-2004. Moscow, 2004.

	EMERGENCY CARD No. 1021	
	<ul style="list-style-type: none"> • This card shall be used for primary actions at accident with radioactive material consignment on road, rail and air transport, and sea and inland water ports as well. • Primary action management is carried out by consignment accompany person or consignment guard person (until arriving the emergency management person proper assigned) • If the mention above persons are absent (or invalid) – major persons of transport, internal affairs or fire-emergency organizations arriving to accident place • Radiological hazards from this consignment emergency actions would provide minimal risk even if the packages have been destroyed at accident 	
Dangerous Goods Class 7 Radioactive Materials, RM UN Numbers: 2912, 2913, 2915, 3321, 3322, 3332		
INFORMATION ON CONSIGNMENT FOR ITS IDENTIFICATION		
UN number and proper shipping name of consignment	2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I) non fissile or fissile-excepted
	2913	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II) non fissile or fissile-excepted ^b
	2915	RADIOACTIVE MATERIAL, TYPE A PACKAGE, non-special form, non fissile or fissile-excepted
	3321	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II) non fissile or fissile-excepted
	3322	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III) non fissile or fissile-excepted
	3332	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM non fissile or fissile-excepted
Type of package	Type IP-1, Type IP-2, Type IP-3, Type A	
Labels	White or white-yellow labels with the sign of radiation hazards (trefoil) and words «RADIOACTIVE», «CONTENTS», «ACTIVITY» etc	
Other notes	Names of consignor, consignee, fabricator and others.	
TO PROVIDE MESURES OF INDIVIDUAL PROTECTION AT EMERGENCY ACTIONS		
<ul style="list-style-type: none"> – No smoking, no eating, no drinking, no natural needs at the region of accident – To stay at the region accident only for necessary emergency actions according to emergency card, in other cases to stay outside the accident region at downwind – Undamaged packages to treat in gloves, do not treat the damaged packages – Do not go through and touch the leakages and spills from packages – To use respirators, gas-mask, bands and other protective means for protection of breathe ways if the packages have been damaged – To wash carefully the skin after exiting the accident region 		
MAIN ACTIONS AND ORDER OF ACTIONS (to carry out simultaneously if the personals are sufficient)		
ATTENTION!	The first, priority and urgent actions are to save and to make medical aid for the persons, whom life is in danger, to extinguish the fires at any accident situations	
1. Doing urgent aid to persons whom life in danger		
<ul style="list-style-type: none"> – To call urgent medical aid service and carry out the following – To put out the injures from conveyance and piles and to remove them from accident region to downwind - At stop of heart – to make indirect massage of the heart and to make skill breathe, at wounds – to treat the wounds 		

and to band, at strong bleeding – to make bandage, at breaking – to make splint, at burns – to put antiseptic band

2. Extinguishing the fires

- At fire to call the fireman team and to extinguish the fire by the all measures that you have
 - To remove the undamaged packages from fire region as possible
 - The packages do not affect on means of fire extinguish
- Means of extinguishing – asbestos tissues, sand, special inorganic powders, water, foam, all fire extinguishers

3. Specifying the identification and evaluating the statement of consignment

- The consignments (packages) are on the conveyance or outside
- The packages are not damaged or have got small damages
- The packages have got strong damages but without visible leakage of the content
- The packages have got strong damages with leakage of the content or have been destroyed
- The packages are or have been in the fire or explosive

4. Removing of injures (without health hazards) and strangers

- If the packages are undamaged or have got small damages – 30 - 50 m, if the strong damages or destroying the packages – 100 m, if the packages are staying in the fire or explosive region – 300 m to downwind
- To mark the accident region by radius 30 m, to put as possible the signs of dangers and to not permit entrance into accident region for strangers and conveniences
- To arrest the persons, facilities, conveyances for which you suspect radioactive contaminations, until arriving of radiological specialists

5. Informing by any available connection channels

- Place, date and time of accident, name of informer and primary emergency action chief at the accident places
- UN numbers, other information according to labels and notes on the packages and conveniences
- The statement of consignment after accident according to evaluations as in items 3 above
- About injureds and their statements

The information have to be send to the following organizations:

- Federal Agency for Atomic Agency (Rosatom), phone **(095) 239-24-28**
- Emergency Responce Centre (ERC) of Rosatom, phone **(812) 247-56-53**
- Regional MChS Bodies (phone **01**), MIA and Transport (as appropriate) organizations
- Other organizations according to instructions of consignment accompany persons

6. Measures against expansion of accident consequences

- At liquid leakage to sand it, or to cover it by soil or by other inflammable materials
- To cover the damaged packages and dispersible materials by film, tarpaulin or plates
- To block by ditches or embankments the leaking the water, used at fire extinguishing

7. Further actions

- If there are the consignment accompany persons to act according to their instructions
- If there are not the consignment accompany persons to hold the contacts to Rosatom or ERC and to act according their instructions
- Moving of transport through the accident region to permit only with agreement of Rosatom or ERC

ACTIONS OF URGENT MEDICAL AID TEAM AT THE ACCIDENT PLACE

- Aid according to the injures and the traumas. Possible exposures should not provide clinical developing and do not require the urgent treatment
- At the contacts with the package content to wash abundantly by water the wounds, burns, skin, eyes
- To try to get from emergency action head the names of radionuclides in accident packages and exposure doses for injures. Inform these data to hospitals where the injures will be or have been sent to
- Inform the emergency action head about the names (address) of hospitals where the injures have been sent to and number of urgent medical help team at the accident place
- At arriving to hospital the injures having been at contacts with radioactive materials have to be put clothes and shoes

out (if possible) and these items have to be packed into synthetic packets together personal things