

## **Enhancement of regional radiation-monitoring and emergency response systems**

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Under the actual international regime of safe use of atomic energy the availability of up-to-date radiation monitoring systems and the preparedness for responding to eventual radiation accidents are deemed to be among the most important elements of ensuring safety.

In accordance with the Russian Federal Law #68-FL of December 21, 1994 (new edition of December 18, 2006) and the Resolution #335 of the Russian Federation Government of May 27, 2005, measures in response to local- or regional-scale radiological emergencies are to be taken at the local or regional level. This means the demand for establishing radiation-emergency-response systems in regions with nuclear-power-use facilities and radiation-hazardous facilities and thus with potential hazard of initiating radiological emergencies (including emergency situations with off-site radioactivity release). The Russian Far East (including the Primorskiy kray) represents one of such regions.

To provide prompt and adequate response to any radiation event, i.e. a response enabling minimization of not only the radiation impact on workers, population and the environment but also of economic losses along with optimization of financial expenses for immediate and subsequent response actions, the establishment of an appropriate regional monitoring and emergency-response system is necessary. Such a system should comprise the following obligatory elements:

- facility-level and regional-level Automated Radiation Monitoring Systems (ARMS);
- a Regional Crisis Center (RCC) integrating the Regional Government Situation Center and the relevant centers of the Civil Defense and Emergency Service and the Russian Hydrometeorological Service (Roshydromet);
- crisis centers at major radiation-hazardous facilities;
- a regional emergency-technical center and facility-level emergency units;
- a system of service-and-communication lines enabling transfer, collection, processing, storage and presentation of information to emergency responders at facility, regional and federal levels;
- a software-and-hardware complex of on-line expert support of decision-making on protection of personnel, population and territories;
- a system of on-line expert support of RCC activities; and
- training and teaching of personnel.

Such a system shall be integrated with the relevant federal systems of: Rosatom (the Rosatom's Situation Crisis Center), EMERCOM of the Russian Federation (the EMERCOM's Crisis Situation Management Center), Roshydromet (the Roshydromet's Federal Information and Analytical Center) as well as with their expert-support systems (the Technical Crisis Center of IBRAE RAS).

To date the establishment in Russia of the very first regional system of the above-described type is nearing completion in the Murmansk region. The work is being conducted under financial support of the Northern Dimension Environmental Partnership (NDEP) Support Fund. Proposals on developing a similar system in the Arkhangelsk region are presently under agreement. In the future their integration - together with the relevant system of the Leningrad

region – into a single Northwest Russia’s regional system is planned. The following few slides illustrate the structure of the system under development and the functions of its individual elements.

1. Functional diagram of the Murmansk region emergency response system.
2. Interfaces within the Crisis Center of FSUE ‘SevRAO’.
3. Flow diagram of scientific, technical and expert support to emergency-responders by the Technical Crisis Center of IBRAE RAS.
4. Satellite communications under the Project.
5. Layout of monitoring stations of the regional ARMS.
6. Data flows in the regional ARMS.
7. Mobile radiation survey laboratories.

Thus the first experience of establishing a complex regional-scale system of automated radiation monitoring, evaluation of situations, expert support of decision elaboration and making, adequate response to radiation emergencies and training of personnel has been successfully implemented in the main in the Murmansk region. The Project will be completed in full by the end of 2007. Thus we may actually follow the process of integration of a variety of already existent and new facility-level, regional-level and branch-wise local-level systems and elements of the radiation situation monitoring and analysis into a single system under a centralized supervision. We may also trace the process of closing of feedforward and feedback information chains as well as functioning of various-type communication and data-transfer channels. Such an undoubtedly positive experience should be developed further and implemented in other Russian regions.

The actual situation in the Far East Russia is in many respects similar to that of the Northwest Russia (each administrative region of the Russian Far East has radiation-hazardous facilities, contaminated territories and aquatic areas; works on complex decommissioning of nuclear naval objects and environmental remediation of contaminated areas are conducted there; spent nuclear fuel, radioactive waste, reactor units of former nuclear submarines are stored and transported, *etc.*). Thus the application of a complex approach to establishment of a regional radiation monitoring and emergency response system in the Far East Russia would be also logical, especially taking account of plans for construction and running in the region of both stationary and floating nuclear power plants.

To date nuclear- and radiation-hazardous facilities are concentrated in the following three locations of the Far East Russia: in the neighborhood of the cities of Vladivostok and Petropavlovsk-Kamchatski and in the town of Sovetskaya Gavan. There are also radioisotopic thermoelectric generators dispersed over the whole coastal zone and the central areas of the Peninsulas of Kamchatka and Chukotka.

Let us consider the Primorskiy kray in more detail. There are here several major nuclear- and radiation-hazardous facilities involved into complex decommissioning of nuclear vessels and nuclear service ships and remediation of contaminated territories. These are DalRAO’s facilities as well as the following facilities of joint (with the Russian Navy) use: the former Coastal Maintenance Base (CMB) in Sysoeva Bay; the Temporary Storage Facility (TSF) for reactor compartments in Razboinik Bay; the railway terminal in Dunai settlement; the loading pier in Koniushkova bay; the Far East Plant “Zvezda”, the Chazhma shipyard; and the waterborne storage center for retired nuclear submarines (including damaged ones) and nuclear maintenance ships in Pavlovskiy Bay.

Though the radiation situation is presently monitored at all the mentioned facilities, only few of them have been equipped with ARMS elements. The layout of ARMS elements available presently in the Primorskiy kray is shown on the next slide. These are: the operating system at the Far East Plant “Zvezda”, ARMS elements at CMB in Sysoeva Bay; individual sensors at the TSF for reactor compartments and in Vladivostok-city. In these systems some of the gauging equipment are obsolete, and their more advanced analogues have been developed by now.

To establish a full-valued regional radiation monitoring system, at first modernization and completion of already existent facility-level systems and ARMS elements are necessary as well as adding to them of some new elements. The conceptual development performed by scientists of IBRAE RAS (the developers of the RAMS in the Murmansk region and of some RAMS elements in Primorskiy kray) jointly with specialists of the facilities and designers demonstrate the following. Two next slides demonstrate existing and planning elements of the RAMS at the facility in Sysoeva Bay. However if taking alone, the data of measurements and radiation survey would be of little use without a system of prompt and skilled expert analysis of all data and elaboration of proposals on necessary and sufficient actions, and – what is the most important – without a system of co-ordination and taking of crucial decisions based on the results of performed analysis and elaborated proposals.

As demonstrated above, for this purpose the development of a system of situation and crisis centers, integration of the existent elements into a single system, completion of the system with missing elements and its equipment with reliable communication lines (telephone, cellular, satellite, fiber-optic, *etc.*) are necessary. In other words, one needs to go through the way similar to that already passed with success in the Murmansk region under support by regional authorities, governmental agencies and foreign partners.

About two years ago specialists of Rosatom, FSUE ‘DalRAO’ and IBRAE RAS developed proposals on the development of a full-scale radioecological monitoring and emergency-response system while managing naval complex-decommissioning objects, spent nuclear fuel and radioactive waste in the Far East Russia. The proposals developed are based on the experience of already operating branch-wise and regional systems and take account of proposals developed earlier by different organizations.

As expected, the system to be developed will incorporate: -a regional center in Vladivostok-city; and -local information-analytical centers in Primorskiy kray (Fokino-town), Khabarovskiy kray (town of Sovetskaya Gavan) and Kamchatka region (Viliuchinsk-town). Each local center will integrate facility-level ARMSs at enterprises concerned with complex decommissioning of nuclear submarines and management of spent nuclear fuel and radioactive waste.

The main potentialities of the system to be developed include:

- on-line access to information on radiation-hazardous objects, current radiation situation and environmental contamination;
- visualization of the radiation monitoring data;
- simulation and calculation of radionuclide spreading in air and water and evaluation of the radiation impact on personnel, population and the environment in case of potential radiation accidents;
- support of decision-making on protection of personnel and population in case of emergencies;

- software-and-methodic support of trainings and exercises of personnel and emergency-rescue units;
- regular information of regional authorities and population on environmental risks caused by complex decommissioning of nuclear submarines and management of spent nuclear fuel and radioactive waste.

In my opinion, this is a rather topical task for the Far East Russia which solution is of interest for both Russian and foreign members of the Global Partnership Initiative. Furthermore, analysis of potential consequences of hypothetical threats and eventual radiation accidents at the above-mentioned facilities demonstrates that under specific conditions radioactivity transfer via air and water to considerable – and even transboundary – distances is possible. Such an event would surely have adverse economic effects but its psychological and political consequences would be undoubtedly of prime importance. Several hypothetical scenarios and their effects will be examined in a special presentation in more detail.

To avoid such a development of events and minimize their implications, efficient and reliable monitoring of the radiation situation as well as preparedness for professional and well-coordinated response to any potential events are necessary, i.e. the establishment of an up-to-date radiation-monitoring and emergency-response system. This task should be one of the main priorities while planning the works and the international cooperation in the Far East Russia.