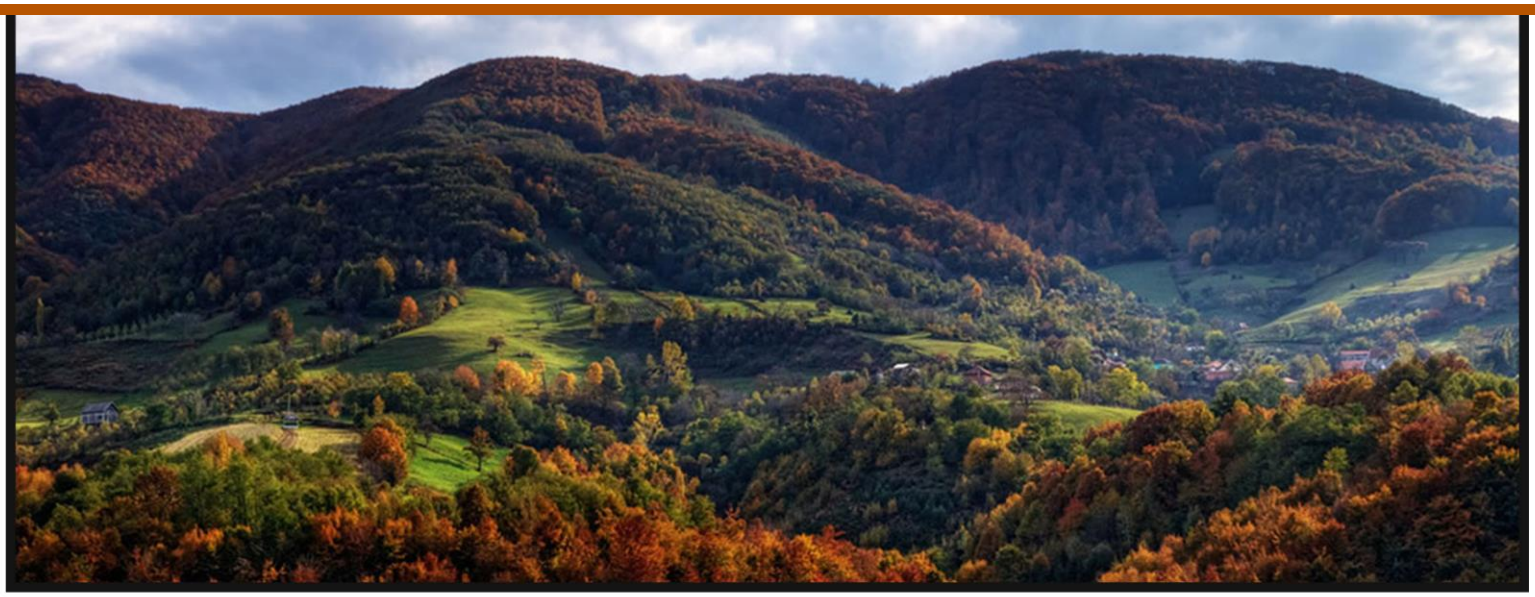

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XXX СИМПОЗИЈУМ ДРУШТВА ЗА ЗАШТИТУ ОД ЗРАЧЕЊА СРБИЈЕ И ЦРНЕ ГОРЕ

2. - 4. октобар 2019. године
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EMPIR PROJECT 16ENV04 PREPAREDNESS – MAIN GOALS AND RESEARCH DIRECTIONS

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ABSTRACT

16ENV04 Preparedness is a research project within the EMPIR 2016 environment call. The main project goal is to increase the preparedness for nuclear and radiological incidents and accidents that might occur in the future. The preparedness will be increased by pursuing several directions of research: use of unmanned aerial vehicles for radiological measurements, use of transportable air-sampling systems, investigating the crowd sourced radiological data for possible official uses and investigating the use of passive dosimetry systems for ambient monitoring. Another aspect of preparedness is to try to reduce the possibility of unwarranted panic caused by the data disseminated by citizen networks and other sources and to increase confidence in official data. To realize the project goals, communication with stakeholders and dissemination of results are of greatest importance.

1. Introduction

The European Metrology Programme for Innovation and Research (EMPIR) is a programme aimed at metrology research, supporting and developing the SI system. One of the aims of the programme is to address the big challenges that exceed the budgets and possibilities of individual National Metrology Institutes (NMI) and Designated Institutes (DI) by providing additional funding and bringing several NMIs and DIs together. Another aim is to consolidate European research to make it more competitive globally. The programme also has capacity building projects which are intended to help emerging NMIs and DIs develop to the point where they can contribute to European science and take part in other EMPIR calls. EMPIR calls cover several different areas: health, environment, energy, industry, fundamental metrology, standardisation, research potential (capacity building) and dissemination (following successful projects from other calls).

"16ENV04 Preparedness, Metrology for mobile detection of ionising radiation following a nuclear or radiological incident" (in the following text – Preparedness), is a joint research project from the 2016 environment call. The project has brought together 17 partners in total – 3 NMIs, 3 DIs and 11 externally funded partners – the European Commission Joint Research Centre, universities, testing laboratories etc.

The project has 4 work packages dealing with different research topics. Vinca Institute of Nuclear Sciences (VINS) is involved in work packages 1, 2 and 4, with a total of twenty researcher months.

2. Project overview

Nuclear and radiological accidents and incidents may cause exposure of the public to ionising radiation and radioactive contamination. Possible events include terrorist attacks. During such events, thousands or even millions of people may be affected. In some cases, large scale decontamination is not possible so there is a need for long-term measurements in affected and contaminated areas. The need for preparedness, i.e. for fast and reliable response and for exchange of information is stated in several International Atomic Energy Agency and European Commission documents, among others [1, 2, 3].

Dealing with nuclear and radiological events requires reliable and metrologically sound data. New and improved measurement methods as well as measurement instruments are needed to improve the capabilities for quickly gathering relevant data for large areas. Advances in autonomous vehicles, especially unmanned aerial vehicles (UAV), provide new possibilities for quick and safe measurements in contaminated or inaccessible areas. Proliferation of low-cost instruments within citizen networks also provides possibilities to gather huge amount of data, but the metrological relevance of such data is questionable and will be investigated within the project [4].

The project has five main objectives:

1. Development of Unmanned Aerial Measurement Systems (UAMS), along with the novel methods and procedures for their use
2. Development of transportable air sampling systems
3. Investigation of the relevance of the data provided by citizen networks and development of instruments suitable for citizen networks
4. Harmonization of the use of passive dosimeters for ambient monitoring and creating new procedures
5. Facilitating the uptake of the project's results by the various stakeholders [4].

3. Unmanned aerial detection of radiological data – work package 1

Unmanned aerial vehicles provide a means of fast response during a radiological or nuclear event. UAVs can be combined with measuring devices and ground control to create Unmanned Aerial Measurement Systems. Such measurement systems have several advantages over conventional equipment: data can be acquired faster, measurements can be performed in areas that are inaccessible or unsafe for emergency teams and larger areas can be covered. This technique is also very useful for mapping the contaminated area.

First step in investigating the use of UAMSs and UAVs within Preparedness is the survey of the current legislation regarding the UAVs and the current state of the art regarding both UAMSs and UAVs. Within this task, existing on-board acquisition and transmission protocols are investigated, as well as data format protocols. Air traffic regulations are an important part of this task, because they are different in different European countries, which significantly complicate the possible use of UAMSs in emergency situations.

Other tasks regarding the UAMSs deal with building and characterizing systems based on different spectrometers. The desired features for such systems are a long flight time and hence a long measurement time, high accuracy, electromagnetic compatibility, among others. Due to the limited payload of the available UAVs, spectrometry systems need to be compact. Characterization of UAMSs is performed by running different Monte Carlo codes.
New software will be written and existing software improved regarding data acquisition, processing, transmission and analysis. A procedure for on-board radionuclide concentration calculation will be developed too, so the quantity of data transmitted can be optimized. Additional software will be developed that is capable of calculating dose rate based on the low, medium and high resolution gamma spectra. If possible, the UAMSs will be automated to find hotspots, fly to them and measure radionuclide concentrations.
Finally, protocols will be developed to test and calibrate UAMSs and the field tests will be conducted in accordance with those protocols.

4. Transportable air-sampling systems – work package 2

Another aspect of preparedness for nuclear and radiological events is the capability of measuring radioactive contamination in the air. Air sampling systems should be transportable so that they can be deployed at the appropriate sites and the deployment should be rapid so the data can be acquired quickly. Automation of the measurements and remote transmission of data are also necessary to improve the response in emergency situations.
Within the Preparedness project, several air sampling systems will be developed and field-tested, alongside the existing commercial systems. Additionally, rapid radiochemical separation procedures will be developed for the measurement of the activities of alpha and beta emitters collected by air sampling systems.

5. Non-governmental networks – work package 3

Non-governmental networks for ionizing radiation monitoring are in expansion, especially since the Fukushima accident. These networks provide quasi real time data, usually on the levels of the natural ambient dose equivalent rate. On the one hand, the huge amount of data generated by such networks could possibly be used by governmental agencies for better evaluation of the situation and making decisions. On the other hand, the data is available to the general public and could possibly cause unjustified panic or could cause the public to lose confidence in official information. Although some research is already available, especially on the SAFECAST network [5, 6, 7], a comprehensive study (as recently started within the Preparedness project, including intercomparison exercises) has not yet been conducted.
The key point in using data generated by non-governmental networks is the metrological background of such data, i.e. whether or not the data are metrologically sound. Within Preparedness, web and literature surveys of non-governmental networks are conducted. As a result of the surveys, 16 types of measuring instruments used in non-governmental networks (MINN) are selected, sourced and commissioned. Finally, the selected MINNs will be tested for inherent background, linearity, energy dependence and the overall performance will be evaluated.

Possible use of CMOS sensors as dosimeters will also be investigated. The CMOS sensors are widely used in mobile phone cameras, and there are several existing applications purportedly measuring dose rates based on the CMOS readings. New types of low-cost instruments will be developed. The new devices will be suitable for official and non-governmental use.
The investigation of the non-governmental networks will also have the additional goal to evaluate the possible use of the crowd sourced data for the European Data Exchange Platform – EURDEP [8].

6. Use of passive dosimetry systems for emergency situations – work package 4

Passive dosimeters, including TL (thermo-luminescence), OSL (optically stimulated luminescence), RPL (radio-photoluminescence) and film dosimeters are currently used for environmental monitoring, i.e. the measurement of ambient dose equivalent in the environment. The advantage of such systems is that they can be used for long term measurements, they can be deployed in large numbers, they don't require power to operate, and they are small, robust and cheap. The possible applications of passive dosimeters in the aftermath of a nuclear or radiological event are very important. However, passive dosimetry procedures are not harmonized within Europe, which could make it difficult to compare results obtained by different services and to reach conclusions regarding the radiological situation.
Within the Preparedness project, comprehensive surveys on the existing standards and the literature data on the use of passive dosimeters in emergency situations will be undertaken. A large comparison of passive dosimetry systems was undertaken and at least 10 existing systems will be tested extensively for linearity, angular dependence and energy dependence. The use of electrets as ambient passive dosimeters will also be investigated. Finally, the harmonization of procedures for measurements using passive dosimeters at European level will be attempted.

7. Conclusions

The research planned within the Preparedness project will help the radiation protection community in Europe and worldwide to deal with radiological and nuclear accidents in the future. The results will be used to protect the public against the dangers caused by ionising radiation, but also to reduce the effects on the environment. One of the key desired outcomes of the project is the strengthening of the public confidence in the official information and the lessening of the possibility of unjustified panic caused by disseminating non-reliable data. Good communication with all stakeholders and the dissemination of the project results are of critical importance for the realisation of the project goals.

8. Acknowledgement

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EMPIR PROJEKAT 16ENV04 PREPAREDNESS – GLAVNI CILJEVI I PRAVCI ISTRAŽIVANJA

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SADRŽAJ

16ENV04 Preparedness je projekat iz poziva EMPIR 2016 za zaštitu životne sredine. Glavni cilj projekta je poboljšanje pripravnosti za nuklearne i radiološke incidente i akcidente, koji bi mogli da se dogode u budućnosti. Pripravnost će biti poboljšana tako što će se izvršiti istraživanja u nekoliko pravaca: upotreba bespilotnih letelica za radiološka merenja, upotreba mobilnih sistema za uzorkovanje vazduha, istraživanje mogućnosti korišćenja radioloških podataka iz nevladinih mreža i korišćenje sistema pasivnih dozimetara za monitoring okoline. Još jedan od načina za poboljšanje pripravnosti je smanjenje mogućnosti bezrazložne panike koja bi mogla da bude izazvana diseminacijom merenja iz nevladinih mreža i drugih izvora, što bi moglo da izazove i smanjenje poverenja u zvanične podatke. U cilju realizacije projekta, od velikog značaja su diseminacija razultata i komunikacija sa svim zainteresovanim stranama.