Enhancing Citizen Participation in preparedness and recovery in radiation accidents: review of existing APPs for citizen based dose measurements

Paola Fattibene[1], Jean Francois Bottollier-Depois[2], Sara Della Monaca[1], Liudmila Liutsko[3-5], Francois Trompier[2], Joan Francesc Barquinero[6], Leonardo Barrios[6], Cecile Challeton-de Vathaire[2], Vadim Chumak[7], Cinzia De Angelis[1], Didier Franck[2], Cristina Nuccetelli[1], Takashi Ohba[8], Koichi Tanigawa[8], Elisabeth Cardis[3-5]

[1]ISS, Rome, Italia; [2]IRSN, Fontenay-aux-Roses, France; [3]ISGlobal, Barcelona, Spain; [4]CIBERESP, Madrid, Spain; [5]UPF, Barcelona, Spain; [6]UAB, Barcelona, Spain; [7]NRCRM, Kyiv, Ukraine; [8]FMU, Fukushima, Japan.

1. Background

Experiences after Fukushima accident did show that self-made radiation measurements create opportunities for:

- providing information to individuals
- empowering individuals to take an active role in their own decisions, thus regaining control on their lives
- increasing insight of individual exposure and official limits
- compare and integrate official data from off-site monitoring

On the contrary, Chernobyl experience demonstrated a deficiency of public involvement in data collection and dissemination, due to lack of training, education, methodological unity, etc. and evidenced the need for development of tools suitable to this scope.

Use of these technologies should be encouraged, but minimum quality standards should be fostered and misuse be avoided.

2. Project description and goals

The EU project SHAMISEN SINGS, funded under the CONCERT call 2017 and started on October 2017, aims at enhancing Citizen Participation in preparedness to, and recovery from, radiation accidents using novel tools and mobile apps for data collection of radiation measurements, health and well-being indicators.

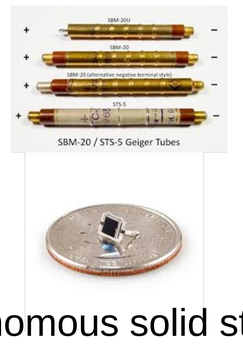
Work Package 2 is focused on the usage of plug-in devices and apps for self-made radiation measurements. Here we report a list of gaps which deserve further studies that we identified from an analysis of the scientific literature and online information.

3. Types of citizen based radiation measurements

The types of citizen based tools can be classified in five groups

1. Mobile apps able to convert to dose the signal coming from the *CMOS sensor* (used in the phone cameras) which is then used as *ionizing radiation detector*

2. Mobile apps calculating exposure based on data from network of environmental radiation measurements

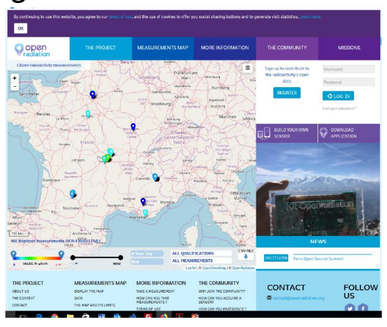


Credits: IRSN

3. Solid state or gaseous detectors that can be connected to the smartphone (via cable, BT or WI-FI) with display, storage and sharing of data through a dedicated mobile apps.

4. Autonomous solid state or gaseous detectors. Most detectors of type 3 and 4 for public are Geiger Müller tube and photodiode.

Source: https://mightyohm.com/blog/2014/11/a-spotters-guide-to-the-sbm-20-geiger-counter-tube/



5. Website for sharing measured data: https://www.openradiation.org

4. Main results from the literature

- Information and communication technologies and uses have evolved rapidly since Fukushima (7 years ago). In parallel the number of mobiles is increasing and it is estimated that 70% of the world's population will use smartphones by 2020.
- Devices and mobile apps were tested mainly by producers and in fewer cases by independent researchers.
- The tests were carried out in laboratory radiation fields (^{60}Co or ^{137}Cs) and mainly measured the response to dose and dose rate.
- Many mobile apps and devices studied are no more available.
- Mobile apps and detectors offer various possibilities: geolocalization, data storage, data sharing, continuous monitoring.

5. Gaps which deserve further studies

- Tests in environmental radiation fields are missing.
- Response at low dose rate should be evaluated, because 95-99% of measurements performed by publicfall in that range.
- Questions should address how cosmic radiation affects the response or how to evaluate the detector inherent background.
- Detector parameters other than its response to dose and dose rate should be evaluated, e.g. response stability through days, in different environmental and detector temperatures, the effect of using an incorrect calibration.
- How far improving characterization and calibration procedure would improve the measurement quality and relaibility?
- Parameters such as reliability and quality of ergonomy, scientific content, connectivity, geolocalization, data sharing were ignored in most of previous studies.
- In particular, accuracy of geolocalization (if any) and quality of connection to internet or to mobile phone also play a relevant role in the good usage of these devices.
- The fast turn-over of technologies of detectors and mobile apps calls for a continuous going-on study of the tools on the market.
- Other questions related more to social aspects that should be addressed are: How will these data be used by institution, media, public in case of nuclear emergency? How will data be or can be trusted? Can it help in the management of a nuclear emergency? How can these tools be useful to educate public on radiation, radiation effect and risk? Finally, legal aspects should be explored (cf. responsibility for wrong or inaccurate geolocalization or dose rate measurements).

Funding information, references and web sites

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SHAMISEN SINGS web: http://radiation.isglobal.org/index.php/en/shamisen-sings-home
SHAMISEN Project web: http://radiation.isglobal.org/index.php/nl/shamisen-project //