RETROSPECTIVE DOSE ASSESSMENT IN A RADIATION MASS CASUALTY BY EPR AND OSL IN MOBILE PHONES

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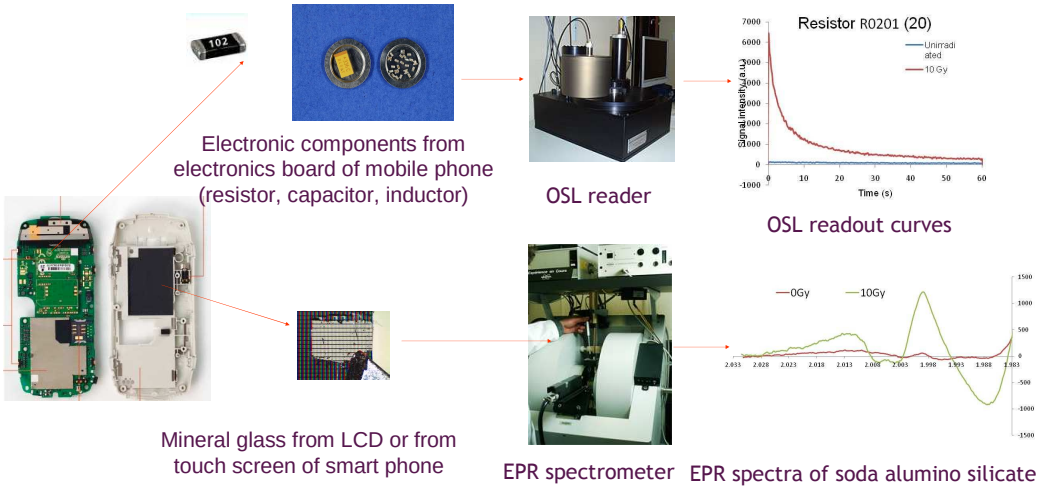
Context:

In the event of a **large scale radiological emergency**, **retrospective dosimetric techniques** are essential tools to provide timely assessment of radiation exposure to the general population and enable the identification of those exposed people who should receive medical treatment.
The available methods differ in their specificity and sensitivity to radiation, the stability of signal and speed of performance. Based on the emergency scenarios, different biodosimetric tools should be applied so that the dose information can be made available with optimal speed and precision. In order to increase the capacity of analysis, EC has funded the **Multibiodose** project which aims to develop multi-parametric assays for population triage (http://www.multibiodose.eu). In Multibiodose, assays are mainly based on biological samples (blood, skin), but it also includes analysis of inert materials (electronic components and mineral glass) from mobile phones by optically stimulated luminescence (OSL)[1] and electron paramagnetic resonance (EPR) spectroscopy[2].

Materials and methods:

Glass and ceramics contained in electronic components **acquire paramagnetic or luminescent properties under irradiation.** 75 mobile phones of different types and trademarks were purchased. Samples were irradiated at 10 Gy to check the radiation sensitivity. Measurement were performed before irradiation, just after irradiation and 10 days later to estimate the stability of the radio-induced signals.



OSL results:

- 5 types of EC identified as dosimeters
- **All phones have at least one type of EC**
- **No OSL signal before irradiation**
- **Minimal detectable dose below 200 mGy**
- All EC exhibit signal fading (i.e. correction is needed for dose assessment)

Type (number of items for 1 meas.)	Minimum detectable dose (mGy)	% of signal 10 days after irradiation	Availibility over the 75 phones (%)
Resistor 402 (10)	30 [17-55]	53 ± 5	100
Resistor 201 (20)	80 [70-100]	50 ± 3	50
Capacitor (1-5)	200 [80-300]	53 ± 3	50
Inductor 402 (10)	8 [1-15]	53 ± 10	90
Inductor 201 (20)	24 [9-36]	74 ± 4	30

EPR results:

- 5 types of glass identified: 3 found in LCD, 1 in touch screen of smart phones (n=24), and 1 in both
- From 2 to up 4 glass plates found in mobile phones
- In most of mobile phones, glass plates are of different types
- **86% of mobile phones have at least one glass plate sensitive to radiation**
- **Very good signal stability**
- Evaluation of minimal detectable dose in progress

Type of glass	Use	Radiation sensitive (Y/N)?	Radiation specific (Y/N)?
Sodalime	LCD and touch screen	Y	Y
Boron silicate	LCD	Y	N
Lime alumino silicate	LCD	Y	N
Soda alumino silicate	Touch screen	Y	Y
Non identified	LCD	N	-

Conclusions:

- Significant progress in the understanding of EC and glass properties
- Common procedure among laboratory involved in MultiBiodose are being developed for each method
- An **European intercomparison** is organized in the frame of EURADOS to disseminated the procedures
- These new assays are implemented in the **new EC project RENEB** aiming to develop a **European network**

References:
1 Woda C., Greilich S. and Beerten K. 2008 On the OSL curve shape and preheat treatment of electronic components from portable electronic devices, Radiation Measurements, 45,746-748.
2 Trompier F., Della Monaca S., Fattibene P., Clairand I. 2011 EPR dosimetry on glass substrate of mobile phone LCDs, Radiation Meaurements, 46 827-831.