THE USE OF HUMAN BIOLOGICAL MONITORING IN ENVIRONMENTAL HEALTH PROTECTION

Zoran Lapčević [1], S. Mandić-Rajčević [2], M. Jovanović [3]

[1] Public Enterprise „Obrenovac“
[2] Innovation Center of Faculty of Technology and Metallurgy, University of Belgrade
[3] Faculty of Technology and Metallurgy, University of Belgrade and Academy of Engineering Sciences of Serbia

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Disasters

- „An unforseen event that causes great damage, destruction, and human suffering“
- Usually overwhelms local capacity – requires external assistance
- Most common events:
  - Civil unrest, war, economic ccrisis, hazardous material or transportation incident (chemical spills), explosions
  - Hurricane, drought, epidemic, earthquake, fire, flood…

Disasters by the UN

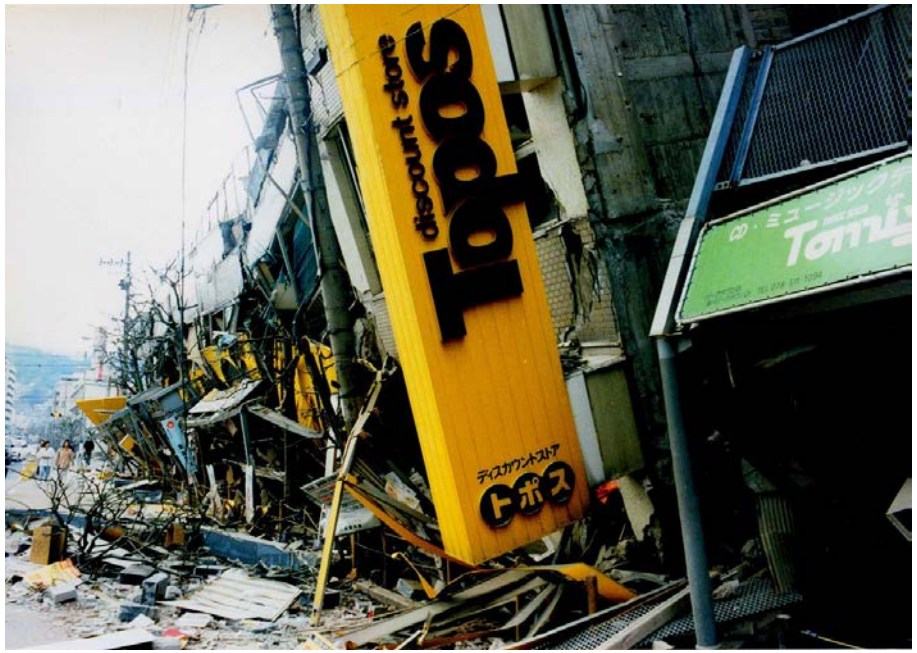
- UN International Strategies for Disaster Reduction
- Classification
  - Natural
    - Hydrometeorological (floods, storms, droughts)
    - Geophysical (earthquakes, tsunamis, volcanos)
    - Biological (epidemics, insects)
  - Technological
    - Industrial accidents (chemical spills, collapses, fires, radiation)
    - Transportation accidents
  - Manmade (economic crisis and violence)

Natural disasters

- Able to generate most serious consequences
- The number of natural disasters is increasing, mostly due to hydrometeorological disasters
- Floods are the most commonly occuring disaster in the world (last 20 yearss
- Next in line: droughts, epidemics, earthquakes, tsunamis

Kobe earthquake (natural disaster)

- January 17, 1995, Hyogo prefecture in Japan
- Moment magnitude scale: 6.9 points
- 6,000 people lost their lives
- 400,000 buildings irreparably damaged
- 300 fires started



Chernobyl (Industrial/Technological disaster)

- Sarcophagus containment structure around Chernobyl power plant
- Effects less deadly in the moment of occurence compared to natural disasters
- Contamination of food, water, and air with adverse effects on human health

Slow disasters

- Air pollution
- Chemical spills
- Radiation
- Heavy metals
- Asbestos
- Influence human physical, intellectural, behavioral development

Biological monitoring

- Widely used method for exposure and risk assessment
- Useful for identifying exposures and risk when a disaster occurs, but also to prevent „slow“ disasters
- Allows identifying small changes in the biological system
- Represents the measurement of the concentration of various biomarkers in biological specimens

Biomarkers and specimens

- Specimens
  - Blood, urine, saliva, breast milk, meconium, nails, hair
- Biomarkers (of exposure or effect)
  - Original chemicals, metabolites of chemicals, products of the interaction between the chemicals and the body
- Routes of exposure
  - Inhalation, dermal exposure, ingestion, pre-natal exposure (placenta)
- Biomonitoring covers all routes of exposure!!!

Advantages of biological monitoring

Advantage	Explanation
Proof of exposure	The ability to detect a (verified) biomarker in a biological specimen confirms that exposure has actually occurred.
Dose estimate	The levels measured are proportional to the internal dose of the chemical, thus integrating exposures from all sources and pathways.
Surveillance	Measuring levels of biomarkers in the general population can help identify vulnerable populations and sub-populations and alert that a higher-than-usual exposure is occurring for some reason.
Pre- and post-exposure	Biomonitoring before and after a specific event can show the difference between a baseline and “after-exposure” concentrations, or even follow the time trend.
Effectiveness of measures	Through monitoring biomarker levels before and after a specific risk management measure it is possible to evaluate the effects of the said measure.
Prioritize research/interventions	These methods can help define research needs, but also the most important points in which to develop interventions

Common problems with biomonitoring

Disadvantage	Explanation
Non detection	The detection of a biological biomarker in a human biological specimen depends on many factors, and the non-detection does not necessarily mean the exposure had no occurred. It is therefore necessary to know the biomarker characteristics, and follow a strict procedure in order to claim that non-detection is actually due to no or low exposure.
Health effects	Even when a biomarker of exposure is detected, it does not necessarily mean that health effects would occur, or that the detected levels should be considered dangerous to human health.
Ignorant of the exposure pathway	Having in mind that human biological monitoring provides an integrated estimate of exposure, it is necessary to keep in mind that all pathways of exposure are included, and it is in the majority of cases impossible to identify the most important pathway of exposure. This makes the definition of necessary health interventions extremely difficult. Nevertheless, knowing the exposure sources, the environmental and/or occupational exposure scenario, as well as the ADME help resolve this issue.

Case study 1: Lead exposure in children

- Lead contamination: slow technological disaster
- Children especially susceptible – health effects for life
- In Serbia: Zajača lead battery recycling plant
- Blood lead levels found LARGELY (4 times) above the 5 micrograms limit set by the Centre for Disease
- Result: impressive pressure to monitor the working and living conditions in the two villages near the battery smelter – finally the plant closed

Case study 2: Obrenovac floods

- May 2014, „Yvette“ cause heavy rains to fall on Serbia – in a week equivalent of 3 months of rain
- Flash floods affecting many regions of Serbia, with Obrenovac most severely impacted
- Effect of the floods on the environment and health of the populationn is difficult (impossible?) to estimate
- Water engulfed the industrial zone of Obrenovac, old and new buildings, the landfill
- No biomonitoring campaign has been conducted to date

Conclusions and future work

- Biological monitoring can help estimate the extent of exposure, but also to identify unknown exposures (slow chemical spills – example: illegal dangerous waste storage/disposal)
- Various exposures/goals: adequate biomarker and sampling window
- Price/benefit analysis
- Important and useful method for environmental health protection

Thank you for your kind attention

stefan@tmf.bg.ac.rs