

# Conclusions from the DMF Workshop on Dosimetry, Munich 25./26. July 2006

## 1. What has been achieved by the projects?

- When using cellular phones a temperature increase in the skin of human beings up to 3 - 5 °C is possible. Previous findings, that this is primarily due to reduced convection and not RF exposure, have been confirmed.
- Temperature increase in inner organs of the head or the trunk when using customary transmitters close to the body are found to be in the order of 0.1 °C and below.
- Substantial progress has been made in understanding real exposure from transmitters in environmentally relevant situations. Open questions remain in complex mixed scenarios such as for example combined exposures from sources far away and very close to the body.
- Exposure assessment for EPI-Studies around cellular base stations is in general a very challenging task that is still not solved satisfyingly. Computational methods can help to preselect probably high or low exposed subjects. Additional difficulties are with accommodating broadcast transmitters, historical exposures and personal devices (phones etc) in a total exposure metric. Some of those difficulties can possibly be tackled by means of newly developed exposimeters.
- We now have an improved understanding of general public exposures in well defined scenarios. Open questions remain in complex scenarios as for example on workplaces with high-field sources.
- Although, there are contrasting examples, new technologies and applications in general tend to increase public exposure. On average, exposure of the public is still well below current limits.
- Cooperation between disciplines in health related studies has been further improved. State of the art dosimetric capabilities have been used to good effect in refining exposure systems during these projects.

## 2. Where do we still have gaps?

- Development of models for children and pregnant women is promising while models for obese people and babies are still missing. Tools to change the postures of models are needed, in particular in case of evaluations of specific exposure scenarios of workers.

For discussion during the final workshop:

Whether safety standards should be based on “median” person, a 95th percentile person, or some other standard person is of fundamental importance.

- Newly developed personal dosimeters / exposimeters have to be investigated in detail and further improved. Parameters like accuracy, isotropicity, crosstalk, sensitivity etc. are of interest in this context.

- This seems to be an issue for the final workshop:  
Pre market “monitoring” of maximal and typical exposures of emerging, new technologies should be addressed by national authorities and used for information of the general public.
- Efforts in microdosimetry on the cellular level and modeling of complex exposure scenarios in in-vitro research are worth doing. This aspects are of importance especially in research concerning non thermal effects.

### 3. Can we define minimum standards for future work?

- Minimal requirements have been defined for in vitro, in vivo and human studies. However, specifying standards could lead to an unnecessary restriction impeding innovative solutions. Depending on biological requirements deviations from standards are verified as long as all exposure conditions are definable and reproducible in terms of the relevant exposure metric.
- Higher homogeneity needed (and possible) in *in vitro* experiments. 30% or better is recommended.
- For compliance testing simple dosimetric models can be used. However, detailed technical rationales demonstrating the conservatism of simple dosimetric models used for compliance testing should be published. For scientific research projects more exact ones are needed.
- Temperature has to be assessed and controlled in all biological experiments, as it could confound the results of experiments. SAR is the central dosimetric quantity.

### 4. Are there findings that have an impact on guidelines or on standard settings?

- There is no direct impact on guidelines or on standard settings for the general public. The findings are relevant for compliance testing e.g. by indicating high exposure conditions. Results from some studies on localised SARs raise questions about the temperature rises that could occur at occupational basic restriction values. Guidelines should be reviewed in this respect.

This needs to be discussed at the final workshop.

- From the viewpoint of dosimetry, guidelines in the high frequency range should still be based on the SAR concept. Temperature as a basic quantity was not recommended, because:
  - SAR can be calculated more precisely (thermal calculations are not equally sophisticated, metabolism and blood circulation should be included more precisely).
  - Non-thermal effects still can not be completely excluded.
  - More knowledge on thermophysiology is needed.

This is also an issue for the final discussion

- Concerning the averaging mass for the SAR limitation 1g is more conservative than 10g, but for thermal consideration 10g seems to be conservative enough at least for frequencies covered by the projects of this workshop (400 MHz - 5 GHz).
- Averaging over contiguous tissue elements should be preferred compared to averaging over a cube. Practicability, however, would favor the cube as averaging volume. For reviewing guidelines this issue needs to be deepened.
- For compliance measurements in the vicinity of GSM and UMTS base stations proposals for measurement standards taking into account the demands of the 26. BImSchV have been developed.