Japan EMF Information Center
Rapid Response Group**

Professor Michael H. Repacholi*

Public Review 16 June 2016

Report: Report of Partial Findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposures). Draft 5-19-2016

Authors: US National Toxicology Program report. bioRxiv preprint first posted online May. 26, 2016; doi: http://dx.doi.org/10.1101/055699.

Introduction: The US National Toxicology Program (NTP) has completed a study where mice and rats were exposed to radiofrequency fields (RF) similar to the fields used by cell phone. NTP has reported part of their results, before full publication at the end of 2017, because of widespread global use of RF in mobile communications devices among users of all ages.

The NTP study was designed to evaluate potential, long-term health effects of whole-body RF exposures. Studies were carried out at the IIT Research Institute (IITRI) in Chicago on rats and mice using exposure systems with two RF signals [Code Division Multiple Access (CDMA) and Global System for Mobile Communications (GSM)] at two frequencies (900 MHz for rats and 1900 MHz for mice). The exposure groups were: no RF exposure for the control group, or calculated whole-body RF exposures of 1.5 W/kg, 3 W/kg or 6 W/kg for the exposed groups. These exposures are normally well above those experienced by people.

Exposures: RF exposures of rats started *in utero* with exposure of pregnant dams. After birth, dams and pups were exposed in the same cage through weaning. Then the dams were removed and exposure of 90 pups per sex per group was continued for up to 106 weeks. Control and RF-exposed groups were populated with more than 3 pups per sex per litter. All RF exposures were conducted over a period of approximately 18 hours using a continuous cycle of 10 minutes on (exposed) and 10 minutes off (not exposed), for a total daily exposure time of approximately 9 hours a day, 7 days/week. A single, common group of unexposed animals of each sex served as controls for both CDMA and GSM exposed groups. Control rats were housed in identical reverberation chambers with no RF signal generation.

Results: No malignant gliomas or glial cell hyperplasia was observed in controls even though the historical incidence rates for gliomas in male rats was 2% on average, and within the range from 0-8%. There was no difference between the incidences of gliomas in exposed male rats compared to control males for any of the GSM or CDMA RF groups. However, NTP report a statistically significant positive trend in the incidence of malignant glioma only for CDMA exposures, but not for GSM exposures. This trend was based on no gliomas found in any group except 3 gliomas were found in the 6 W/kg group.

In females exposed to GSM RF, a malignant glioma was observed in a single rat exposed to 6 W/kg, and glial cell hyperplasia was observed in a single rat exposed to 3 W/kg. In females exposed to CDMA RF, malignant gliomas were observed in two rats exposed to

1.5 W/kg. Glial cell hyperplasia was observed in one female in each of the CDMA-exposure groups (1.5, 3, and 6 W/kg). There was no glial cell hyperplasia or malignant glioma observed in any of the control females, even though the historical incidence rates were 0.18% and within the range 0-2%.

Cardiac schwannomas were observed in male rats in all exposed groups of both GSM- and CDMA RF, while none were observed in controls. For both GSM and CDMA exposures there was a significant positive trend in the incidence of schwannomas of the heart. Also, the incidence of schwannomas in the 6 W/kg exposed males was significantly higher in CDMA RF-exposed males compared to controls. The incidence of schwannomas in the 6 W/kg GSM RF-exposed males was higher, but not statistically significant compared to controls.

In female rats, there was no statistically significant or apparent exposure-related effect on the incidence of schwannomas in the heart or the combined incidence in the heart or other sites

No significant increase in cancers was observed in any of the mouse exposure groups.

Discussion: This $25 million NTP study investigating the effects of RF whole-body exposure from two commonly-used cell or mobile phone signals on the development of cancer in rats and mice.

The NTP study used the highest possible RF exposures that could be tolerated by rats and mice, so that no significant temperature increase would occur in the animal's body. However, exposures to these rodents are much higher than would occur to humans from base stations or cell phones. It is known that rodents thermo-regulate differently, depending on their size. At the highest RF exposures (6 W/kg) male rats would not tolerate this heating as well as female rats, and mice would handle the heating easily. Therefore, one cannot rule out the possibility that any effects found were due to lifetime thermoregulation-induced stress and not from any specific actions of the RF field.

Despite being the most expensive ever conducted by NTP, and one the best conducted animal experiments investigating the long-term carcinogenic potential of RF, the results are inconclusive, with serious limitations discussed below. Aside from the concerns about rodent thermoregulation and use of RF exposures well in excess of those normally encountered by people, the following summarizes other concerns related to this study:

1. Historical incidence rates of malignant gliomas among this strain of rat is, on average, about 2%, so the study should normally have seen 1-2 rats with these lesions in the controls and in each exposure group. However, one reviewer of the report conducted a test of significance of these glioma results by assuming there was one glioma in the controls (below the average number expected). When this was done, none of the glioma results was significant. If one rat glioma in the controls could change the results from positive to no effect from RF exposure, the results are not very convincing.
2. NTP reports a trend to higher incidence of gliomas in the CDMA but not the GSM exposed rats. However, this result is also not convincing since the number of lesions (shown in brackets), were; controls (0), 1.5 W/kg (0), 3 W/kg (0), and 6 W/kg (3), especially since the historical incidence rates suggest there can be between 0-7 rats in each group of 90 rats.

3. When one control with schwannoma was added to the schwannoma results, the results still remained marginally significant. Again, the number of rats in each group is still too low to produce meaningful results.
4. Another concern is the lower survival rate in the controls than the RF exposed groups. The Report notes that malignant gliomas are a late-developing tumour, so the absence of these tumours in the control group may be due to their shorter survival rates compared to exposed rats. This is supported by the fact that the Report states that most of the gliomas were observed in animals that died late in the study.

Conclusions: Given the significant concerns described above, the available data do not alter the balance of evidence on health effects in relation to human exposure to RF fields from cell phones. This means that the current international standards limiting RF exposure to workers and the public are still safe. As one of the designated reviewers of the Report states “I am unable to accept the authors’ conclusions” (Lauer, reviewer in Report page 37). This study provides no reason to change existing international standards limiting exposure to RF.

---

* Professor Michael H. Repacholi
・ Department of Information Engineering, Electronics and Telecommunications,
"La Sapienza" University of Rome, Italy.
・ Former Team Leader of the Radiation and Environmental Health Unit, World Health Organization (WHO) .

** Rapid Response Group (RRG): The RRG provides a rapid response on the analysis of newly published scientific studies that JEIC considers important and in need of expert scientific review to provide information for all stakeholders. The RRG is composed of a coordinator and experts in all areas of science appropriate for reviewing and assessing scientific studies. Prof. M. H. Repacholi has served as the coordinator from the time of launch of RRG in 2010.