Comments on "Adjusting Lung Cancer Risks for Temporal and Spatial Variations in Radon Concentrations in Dwellings in Gansu Province, China" by Lubin *et al.* (*Radiat. Res.* 163, 571–579, 2005)

Author(s): Jochen Tschiersch and Thomas Haninger
Source: Radiation Research, 166(1):120-120.
Published By: Radiation Research Society
DOI: http://dx.doi.org/10.1667/RR3566.1
URL: http://www.bioone.org/doi/full/10.1667/RR3566.1

RADIATION RESEARCH **166**, 120–121 (2006)
0033-7587/06 $15.00

LETTERS TO THE EDITOR

Comments on "Adjusting Lung Cancer Risks for Temporal and Spatial Variations in Radon Concentrations in Dwellings in Gansu Province, China" by Lubin *et al.* (*Radiat. Res.* 163, 571–579, 2005)

Jochen Tschiersch[a,1] and Thomas Haninger[b]

[a]*GSF-National Research Center for Environment and Health, Institute of Radiation Protection, and* [b]*Official Personnel Monitoring Service, 85764 Neuherberg, Germany*

We read with interest the latest analysis of radon concentration measurements in Chinese dwellings by Lubin *et al.* (*1*) in which uncertainties in radon dosimetry of a large case–control study (*2*) were examined. The conclusion in the abstract that "temporal variation represented the single largest source of uncertainty" motivated us to send comments on this paper.

Three sources of uncertainty of the exposure estimates were identified in the study of Lubin *et al.* (*1*), among which the measurement errors of the detector were rated as "small" and were ignored. The detectors applied in the study were α-particle-track detectors placed in unsealed diffusion containers with filter-covered openings (TechOps-Landauer, Glenwood, IL).

In our opinion, the measurement uncertainty connected with this type of detector is not small. The GSF-Research Center has been running a certified radon monitoring service with PADC track-etch detectors for many years. According to our experience and international intercomparison studies (*3–5*) with track-etch detectors of the same type as used in the study (*1*), the measurement uncertainty of the detector is in the range of 25%. A considerable part of that uncertainty is attributed to the variability of the quality of the track-etch substrate, which may vary from batch to batch. In the study (*1*), coefficients of variation for co-located (duplicate) detectors were determined with values up to 0.6, which indicates significant detector uncertainties. One measurement period shows extremely low concentration readings and strikingly higher coefficients of variation, which may indicate that different batches of the track-etch substrate were used from period to period. In our opinion, a discussion of the detector errors cannot be ignored in an uncertainty study.

This is especially true when thoron (^{220}Rn) may affect the radon (^{222}Rn) measurement. In the last few years, it has been found that elevated thoron concentrations are common in the dwellings at the Chinese great loess plateau (e.g. Gansu province) (*6–8*). Extremely high concentrations were measured close to the wall (*9*); they decrease toward the center of the room because of the diffusion time of the thoron gas and its short half-life of 56 s. The mean indoor thoron concentrations are much lower than concentrations at the wall but in many cases are still significant. Track-etch detectors without a diffusion barrier as were used in the study of Lubin *et al.* (*1*) register the thoron α-particle decays as well, and there is no way to discriminate between thoron and radon. Thus thoron may contribute to the radon measurement (*10*). Depending on the location of the detector (close to the wall or in the center of the room), this additional signal can vary from dominating to negligible, which causes a great uncertainty in the radon measurement. Even worse, due to the spatial inhomogeneity of thoron, even the total exposure (radon + thoron) of the inhabitants of the dwellings is highly uncertain.

In our opinion, the measurement uncertainties of the applied detectors discussed above represent the most important and largest source of uncertainty of the exposure estimate. It is essential to include them in the uncertainty analysis of the study (*1*).

[1] Address for correspondence: Institute of Radiation Protection, GSF-National Research Center for Environment and Health, D-85764 Neuherberg, Germany; e-mail: tschiersch@gsf.de.

Received: January 27, 2006

References

1. J. H. Lubin, Y. Z. Wang, L. D. Wang, J. D. Boice, Jr., H. X. Cui, S. R. Zhang, S. Conrath, Y. Xia, B. Shang and R. A. Kleinerman, Adjusting lung cancer risks for temporal and spatial variations in radon concentration in dwellings in Gansu Province, China. *Radiat. Res.* **163**, 571–579 (2005).
2. J. H. Lubin, Y. Z. Wang, J. D. Boice, Jr., Z. Y. Xu, W. J. Blot, L. D. Wang and R. A. Kleinerman, Risk of lung cancer and residential radon in China: Pooled results of two studies. *Int. J. Cancer* **109**, 132–137 (2004).
3. T. Beck, H. Buchröder, E. Foerster and V. Schmidt, *Interlaboratory Comparison 2005 of Passive Instruments to Measure Radon Activity Concentration or Exposure to Radon.* Bundesamt für Strahlenschutz, Fachbereich Strahlenschutz und Umwelt, Salzgitter, 2005. [in German]
4. R. D. Hopper, F. Steinhäusler and M. Ronca-Battista, IAEA/EPA international climatic test program for integrating radon detectors. *Health Phys.* **77**, 303–308 (1999).
5. C. B. Howarth and J. C. H. Miles, *Results of the 2001 NRPB Intercomparison of Passive Radon Detectors.* NRPB-W21, National Radiological Protection Board, Chilton, UK, 2002.
6. J. Wiegand, S. Feige, X. Quingling, U. Schreiber, K. Wieditz, C. Wittmann and L. Xiarong, Radon and thoron in cave dwellings (Yanan, China). *Health Phys.* **78**, 438–444 (2000).
7. S. Tokonami, Q. Sun, S. Akiba, W. Zhuo, M. Furukawa, T. Ishikawa, C. Hou, S. Zhang, Y. Narazaki and Y. Yamada, Radon and thoron exposures for cave residents in Shanxi and Shaanxi provinces. *Radiat. Res.* **162**, 390–396 (2004).
8. B. Shang, B. Chen, Y. Gao, H. Cui and Z. Li, Thoron levels in traditional Chinese residential dwellings. *Radiat. Environ. Biophys.* **44**, 193–199 (2005).
9. J. Tschiersch and M. Müsch, Radon exposures in homes: Is the contribution of ^{220}Rn (Thoron) to dose always negligible? In *9th International Conference on Health Effects of Incorporated Radionuclides (HEIR 2004)* (U. Oeh, P. Roth and H. G. Paretzke, Eds.), pp. 214–220. GSF-Bericht 06/05, GSF, Neuherberg, Germany, 2005.
10. S. Tokonami, M. Yang and T. Sanada, Contribution from thoron on the response of passive radon detectors. *Health Phys.* **80**, 612–615 (2001).