mass, the lung burden (retained mass at first sacrifice point), the half time of WHO fibres, and the relative relation between these and the half time of inert material and inert non-soluble fibre material.

There is no correlation between the instilled mass and the retained mass. The retained mass is therefore used in the further evaluation.

All the measured half time values except two are placed on or below the solid line representing the inert toner material. Fibres that are known to have a low dissolution rate in vitro at both pH 7.5 and pH 4.5^{7,8} are placed close to the line for the inert material. Two measurements give higher half times than for inert toner material at a similar dose. One of these, RCF 1, was also tested at lower lung burdens, which bring the measured half time on line with the expected values for the toner material. Most of the fibres have a half time lower than expected for the toner material. In these cases macrophage mediated clearance is only one of the acting mechanisms for clearances.

If the half times are evaluated against the volume based relation no results fall above the line representing an inert non-soluble fibre material (dotted line in figure).

Two examples of measurements of the same fibre type at different instilled and retained masses are given in the table. At least for the RCF 1 there seems to exist a significant dose dependency, which exceed the dose dependency for toner. In both examples a lower retained mass gives a lower relative half time.

In conclusion, it seems that differences in the retained mass cannot be ignored in the evaluation of intratracheal data. A constant instilled mass does not ensure constant retained mass. As the clearance in the first days of the test is out of control, it is not possible to take into account the different clearance mechanisms in this period. As it is a practical problem to ensure a constant retained mass for tests of different fibre types it seems necessary to find a way to make an appropriate mass correction. This should be based on tests which are designed to elucidate the problem. Until results of such tests are available, it might be appropriate to use the half times for the tested fibre type relative to the half time for an inert material at a similar dose to characterise the biopersistence of the fibre. Other reference materials than toner may be considered, as a dose dependency of the calculated relative values for the two fibres tested twice still remains.

SØREN LUND JENSEN
MARIANNE GULDBERG
Rockwool International A/S,
DK-2640 Hedehusene,
Denmark

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Author's reply—Thank you for the opportunity to respond to the letter of Jensen and Guldborg regarding application of our proposed linear relation¹ between the elimination half time (T_i) and lung burden (m) to fibrous particles. The form of this linear relation derives from an underlying kinetic model analogous to Michaelis-Menton kinetics for enzymatic reactions. Jensen and Guldborg empirically compared the linear relation which we had reported for photocopy test toner (PTT, derived from inhalation data of Muhle *et al.*²) with values of half time and lung burden for a variety of mineral fibres instilled intratracheally into rat lungs. With minor exceptions, values of half time for the fibres were considerably smaller than those predicted by our model for PTT at a given lung burden. They concluded that inert particles such as PTT are more biopersistent than the mineral fibres, possibly due to the effects of disintegration and dissolution of the fibres in the lung.

Jensen and Guldborg did not evaluate the linear relation between half time and lung burden for the data which they presented in the table of their letter. As such an evaluation would allow more direct comparisons to be made between fibrous and non-fibrous aerosols, we performed the necessary calculations, and briefly summarise the results.

After regressing half time upon lung burden for the pooled data presented by Jensen and Guldborg in the table, we found the following relation:

$$T_i \text{ (days)} = 25.1 + 81.2 m, \quad (1)$$

with intercept $\alpha = 25.1$ days and slope $\beta = 81.2$ days/mg. Although the linear relation was highly significant ($P = 0.004$), the regression coefficient of $r = 0.63$ was considerably smaller than that which we found previously for non-fibrous insoluble particles ($r = 0.99$).¹ Furthermore, the residuals under the linear model indicated some heteroscedasticity, suggesting that the variability of half time was somewhat dose dependent. This less than optimal fit of the linear model to the pooled data could be due to differences in the various experimental protocols or the different types of fibrous

particles which were included in the table. We recommend that future applications of our model to fibrous dusts be evaluated with data covering a range of burdens for single fibre types so that differences between fibres can be evaluated.

Assuming that the estimates of $\alpha = 25.1$ days and $\beta = 81.2$ days/mg, from the pooled data, provide overall measures of fibre clearance, it is interesting to compare them with the corresponding estimates for non-fibrous aerosols. Firstly, α represents the intrinsic clearance half time for a particular dust when the burden approaches zero and the lungs are functioning normally.¹ As the intrinsic clearance half time for fibrous particles (25.1 days) was much smaller than that for non-fibrous insoluble particles (77.8 days),¹ we agree with Jensen and Guldborg that mechanisms other than physical clearance—for example, disintegration and dissolution, must have played some part in clearing fibres from the lungs. Secondly, we regard the parameter β as a measure of the potency of a particular particle for inhibiting clearance mediated by alveolar macrophages.¹ It is reasonable to expect that particles with different potentials for impairing clearance (for example, due to the cytotoxicity) would have different β s and our work provided some evidence of this behaviour for non-fibrous dusts. Comparison of the estimated β for the pooled fibrous particles (81.2 days/mg) with that for PTT (80.3 days/mg)¹ suggests that mineral fibres were about as potent as PTT in impairing clearance mediated by macrophages. Again, it would be important to estimate β for each type of fibrous particle to evaluate possible fibre-specific differences in potency.

S M RAPPAPORT
RONG CHUN YU
Department of Environmental Health Services,
UCLA School of Public Health,
Los Angeles, CA 90095

- 1 Yu RC, Rappaport SM. Relation between pulmonary clearance and particle burden: a Michaelis-Menton-like kinetic model. *Occup Environ Med* 1996;53:567-72.
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Electromagnetic fields and cancer: incorrect citations

Editor—Several articles that have appeared in the *British Journal of Industrial Medicine* (forerunner to *Occupational and Environmental Medicine*) in recent years have either been cited incorrectly or used in contexts that are misleading in other publications. As Feinstein and Spitzer¹ have mentioned, "The error is grievous if the source statement is either unsupportive or contradictory to what has been claimed for it." My letter considers misleading citations relating to alleged hazards of electromagnetic fields (EMFs).

Some incorrect citations have been summarised previously.^{2,3} Specifically, several studies⁴⁻⁹ were reported to support a positive association between exposure to EMFs and cancer. In these studies, however, no unique exposure to EMFs in electrical or telecommunication workers was mentioned by any of the authors. In most of these studies, there were not even any attempts to assess exposure, and, in fact, the studies were not

designed to investigate effects of EMFs. Factors possibly associated with cancer were: work environments where soldering was practised, the use of chemicals and solvents, and piercing and sawing asbestos plates used for thermal insulation. When other authors have cited these studies, the term "exposure to EMFs" should have been replaced by "working in electronics-related industries". This is an important distinction and not just a matter of semantics.

Articles continue to be cited incorrectly. Erren¹⁰ stated that Vågerö and Olin⁹ showed that EMFs "have been associated with lung cancer". Wilson and Stevens¹¹ summarised studies already mentioned^{4,6} and a more recent one¹² as being suggestive of an association between exposures to EMFs and cancer. Henshaw *et al.*¹³ and Miyakoshi *et al.*¹⁴ cited Guénel *et al.*¹⁵ also in support of this association. Guénel *et al.*¹⁵ however, noted that the risk "was mainly in electricians in installation works and iron foundry workers. Besides EMFs other exposures should be considered as possible aetiological agents". Fear *et al.*¹⁶ listed some of these studies^{9,15} as showing that "cancers have been previously linked with exposure to extremely low frequency EMF". Again, "working in electronics-related industries" is not equivalent simply to "exposure to EMFs".

Raabe and Wong¹⁷ noted that "electrical engineers" in one of the studies⁷ mentioned above actually consisted of people with a graduate degree in electrical engineering. As the authors noted: "An academic degree is obviously not a good measure for EMF exposure."

It is misleading to cite references that do not support the alleged associations with EMFs with cancer. Improper citations are not the fault of the original authors in the *Journal*, who reported their results with all the necessary caveats regarding correct interpretations of their findings. Hopefully, in the future, there will be fewer errors of citation of this nature. (The opinions are those of the authors and do not necessarily state or reflect those of the US government.)

JAMES R JAUCHEM
Radiofrequency Radiation Division,
Occupational and Environmental
Health Directorate,
US Air Force Armstrong Laboratory,
8308 Hawks Road,
Brooks Air Force Base, Texas
78235-5301, USA

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NOTICE

International Occupational Hygiene Association 3rd International Scientific Conference. 13-18 September 1997. Crans-Montana, Switzerland

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Further information from: Dr Alfred F Steinegger, Route Darnona, CH-3973 Venthône, Switzerland. Phone and Fax: +41 27 456 38 92. E-Mail: hsconsultant@access.ch. Currently updated information 3rd International Scientific Conference:

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BOOK REVIEW

Book review editor: R L Maynard

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Hazardous Chemicals: Desk Reference
4th ed. R J LEWIS. (Pp 1644; price £89.00.) 1997. New York: Van Nostrand Reinhold. ISBN 442 023227.

This is probably the best single volume reference work on the toxicology of chemicals currently available. The data presented have been extracted from the well known *Dangerous Properties of Industrial Chemicals*, 9th ed. Data on more than 5000 compounds and preparations are presented: each entry being in a consistent and helpful format. For the occupational physician the provision of OSHA, ACGIH, and DFG (MAK) values where available will be invaluable. Also, CAS numbers and details of current evaluations of carcinogenicity are provided. An exhaustive list of synonyms (over 100 for malathion) is given for each compound as is a short description of its physical characteristics. Some of the descriptions of physical characteristics are perhaps eccentric: few will meet ozone as "blue or violet-black solid" or even as a "dark-blue liquid"! For the physician the "safety profile" will probably be the most used part of any entry. This profile is telegraphic in style but packs in a lot of useful information. No information on case management is provided. A valuable feature of this book is that entries are provided for groups of compounds—for example, carbonates, chlorates, esters. Of course the value of a brief safety profile of a group of compounds as diverse as "esters" can be questioned but I have found these general entries informative.

The index is heavily cross referenced and occupies 367 pages each of two closely printed columns.

As to single volume competitors: the Merck Index is the most obvious. Merck offers wider coverage but less information of immediate use to the occupational physician.

As a book to turn to when asked the symptoms likely to be produced by a compound of which you have never heard this is excellent. Good value at £89.00.

R L MAYNARD