FILE NAME: Brakes (BRK)

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Atmospheric Environment 12: 2030-31 (1978)

range 0.5 to 2.0 depending upon atmospheric stability (Schwartz and Newman, 1978). For $n = 1$ the rate expressions become respectively

$$\frac{df}{dt} \propto t$$

and

$$\frac{df}{dt} \propto t^2.$$

Adherence to the suggested mechanisms would therefore be indicated by linearity in graphs of

f vs. t^2 (zero order)

and

f^2 vs. t^3 (minus-first order)

Inspection of Fig. 2 shows that these mechanisms may readily be excluded.

In conclusion, we continue to feel that the use of the graphical method of analysis that we have developed presents a highly valuable tool for elucidating the order of reactions in stack plumes. However, we recognize that obtaining averages from a set of data is a procedure to be employed with caution and we thank Dr. Overton for calling attention to this point.

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REFERENCES

Newman L., Forrest J. and Manowitz B. (1975) The application of an isotopic ratio technique to a study of the atmospheric oxidation of sulfur dioxide in the plume from an oil-fired power plant. *Atmospheric Environment* 9, 959–968.

Schwartz S. E. and Newman L. (1978) Processes limiting the oxidation of sulfur dioxide in stack plumes. *Environ. Sci. Technol.* 12, 67–73.

Lusis M. A. and Wiebe H. A. (1976) The rate of oxidation of sulfur dioxide in the plume of a nickel smelter stack. *Atmospheric Environment* 10, 793–798.

AIRBORNE ASBESTOS IN THE VICINITY OF A FREEWAY*

The paper by Alste *et al.* which has recently appeared in this journal raises an important question concerning the contribution disintegrated brake lining dust might make to ambient asbestos fiber levels. These authors have made several important observations: chrysotile asbestos fiber survives the braking process and is present in brake drum debris; asbestos fiber in such debris appears to be reduced in length only, with minimum alteration in crystallinity; measurable concentrations of asbestos fibers have been found in areas in which braking operations are common; these concentrations exceed those measured in areas where there is comparatively little braking action.

These findings are so significant that we wish to amplify and to extend them with some recent observations made in our Laboratory and in others:

(1) Identifiable chrysotile asbestos fiber does indeed survive braking operations. The content of chrysotile in brake drum dust, in samples examined from New York City, has been observed to range from 2 to 15%, as determined by X-ray diffractometry (Rohl *et al.*, 1976). Confirmation of the presence of free fiber was obtained by transmission electron microscopy, selected area electron diffraction and electron microprobe analysis. Similar findings were made on 20 European and Australian brake dust samples (Rohl *et al.*, 1977). Therefore, what has been found in Australia appears to be the case in other areas of the world. Observations demonstrating chrysotile present in disintegrated brake linings have also been made in Great Britain (F. Pooley, personal communication), France (P. Sebastien, personal communication) and South Africa (M. Skikine, personal communication). We include the caveat that clumps of chrysotile fiber exist in the binder particulates and are not considered free fiber *per se*. These binder particulates hold most of the chrysotile liberated from the disintegrated brake shoe.

(2) Free asbestos fibers (as distinguished from binder particulates) constitute a small proportion of the total brake drum debris. However, in New York City, brake repair and brake maintenance facilities' practices are such that both fibrous and non-fibrous particulates are made airborne, where they have been shown to persist in local work environments (Rohl *et al.*, 1976). It is important to note, in these occupational circumstances, that the levels of asbestos detected were considered conservative in that binder particulates were not included in the air analysis.

(3) Limited studies of automotive maintenance workers have demonstrated radiographically discernible asbestosis and measurable pulmonary function loss in some 25% of those studied (Lorimer *et al.*, 1976). More important, recent reports have noted that mesothelioma occurs in garage workers in Canada and Great Britain (Newhouse and Thomson, 1965; McDonald *et al.*, 1970; Greenberg and Davies, 1974).

(4) Recently, a study in the United States demonstrated that asbestos fiber present in brake lining dust appears to range in crystallinity from unaltered to completely recrystallized fiber (Seshan, 1977). The relative proportions of each of these phases is currently under study.

Alste *et al.* have demonstrated that asbestos fiber is liberated during braking operations. In occupational circumstances, where high concentrations of brake drum dust are encountered, asbestos disease may occur. Several years ago, in an unpublished report, we found that "higher than ambient" concentrations of asbestos fiber were measured at the entrance of a large river-crossing tunnel in New York City. These concentrations were recorded at low nanogram levels. In a recent paper by Bruckman *et al.* (1977) mesothelioma was reported in a Connecticut toll booth collector, and these investigators found higher concentrations of asbestos in the vicinity of highway toll booths than in the ambient air of Connecticut cities.

Asbestos exposure in brake lining maintenance and repair workmen may be a significant problem. In addition to degraded brake drum materials, they also install new linings, and "recondition" old linings. These processes invariably led, under conditions which have existed, to asbestos exposure as well.

Recent reports thus indicate that fiber is liberated during braking operations. These reports differ primarily in the relative magnitude of fiber release. The importance of the fibers, their concentrations and sizes, is now open for study. We believe this a fruitful area of exploration by air pollution scientists in our country, and among other motorized societies.

*Alste J., Watson D. and Bagg J. (1976) *Atmospheric Environment* 10, 583–589.

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REFERENCES

Bruckman L., Rubine R. A. and Christine B. (1977) Asbestos and mesothelioma incidence in Connecticut. *J. Air Pollut. Control Ass.* 27, 121–126.

Greenberg M. and Lloyd-Davies T. A. (1974) Mesothelioma register, 1967–68. *Br. med. J.* 31, 91–104.

McDonald A. D., Harper A., El Attar O. A. and McDonald J. C. (1970) Epidemiology of primary malignant mesothelial tumors in Canada. *Cancer* 26, 914–919.

Newhouse M. and Thompson M. (1965) Mesothelioma of the pleura and peritoneum following exposure to asbestos in the London area. *Br. J. ind. Med.* 22, 261–269.

Lorimer W. V., Rohl A. N., Miller A., Nicholson W. J. and Selikoff I. J. (1976) Asbestos exposure of brake repair workers in the United States. *Mount Sinai J. Med.* 43, 207–218.

Rohl A. N., Langer A. M., Wolff M. S. and Weisman I. (1976) Asbestos exposure during brake-lining maintenance and repair. *Envir. Res.* 12, 110–128.

Rohl A. N., Langer A. M., Klimentidis R., Wolff M. S. and Selikoff I. J. (1977) Asbestos content of dust encountered in brake maintenance and repair. *Proc. R. Soc. Med.* 70, 33–37.

Seshan K. (1978) On the utility of dark field electron microscopy in the determination of the degree of deformation in chrysotile asbestos. *Envir. Res.* 16.

AIRBORNE ELECTRICAL AND MICROPHYSICAL MEASUREMENTS IN CLOUDS AND MARITIME AND URBAN ENVIRONMENTS*

The authors are to be complimented on their attempts to explain the previously noted precipitation anomaly in and east of Bombay. Their earlier findings add to a growing literature pointing to urban–industrial effects on precipitation, generally resulting in additional cloudiness and rainfall in and beyond large urban areas. Of particular importance in their findings is the fact that if true, a large city in a tropical monsoonal climate exhibits the same degree of effect on convective precipitation as has been noted in studies of mid-latitude cities of North America and Europe.

However, the reader should be cautioned about his interpretation of the findings in this particular paper. First, findings relate only to sampling of fair weather cumuliform clouds which may or may not reflect conditions found in rain-producing cumulus clouds in the area. More importantly, the results must be taken with a great deal of caution, primarily because of the extremely small sample size, particularly for cloud phenomena whose incloud characteristics are known to exhibit great natural variability between clouds. The large size of the standard deviations presented, relative to the means and averages, reflect on this sampling concern. The authors should concern themselves with determining the probability that the differences are due to anything but chance. If the evidence presented is a representative sample, it does suggest that all suspect influences including electrical, microphysical and dynamic influences are present and potentially act together to enhance clouds and precipitation in an urban area. This agrees with the findings being derived from the METROMEX studies of St. Louis, a mid-latitude city.

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AUTHORS' REPLY

The authors would like to thank Professor Stanley A. Changnon for his valuable comments on their paper.

The extensive studies undertaken at St. Louis under the research Program "METROMEX" have greatly helped to delineate the existence and causes of urban-induced climatic changes (Semonin and Changnon, 1974). The key climatic effects of the St. Louis studies (Changnon, 1977) are the increased cloudiness (up 10%), the increased summer rainfall (up 30%) and increased severe storm activity (up 10 to 100%). These increases were noticed east of St. Louis over a 4000 km^2 area. The results also suggested that urban generated large condensation nuclei help initiate coalescence process and thus make more clouds produce rain.

The authors would like to clarify that the results presented in their paper did not relate to sampling of fair weather cumuliform clouds as mentioned in the comments of Professor Changnon. All measurements were made during the summer monsoon season (June–September). During the period of observations the region was under the influence of active monsoon conditions due to favourable synoptic conditions. The in-cloud measurements reported are representative of the cloud conditions prevailing during the summer monsoon. However, as pointed out by Professor Changnon, "the results must be taken with a great deal of caution, particularly because of the extremely small sample size".

In this context it may be of interest to note the results of the two studies which were reported earlier (Mary Selvam *et al.*, 1976a; 1976b). The rainfall recorded in the downwind vicinity of a thermal power plant showed increases up 25% after the construction of stacks (Mary Selvam *et al.*, 1976a). Also, airborne electrical microphysical and dynamical observations showed differences in the downwind and upwind regions of a thermal power plant (Mary Selvam *et al.*, 1976b). It is gratifying to note that our results have been further corroborated by the METROMEX results which showed that the clouds downwind of fossil-fuel power plant are altered by the pollution (Changnon, 1977).

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REFERENCES

Changnon Jr., S. A. (1977) Impacts of urban-modified precipitation on man's activities. *J. Weather Modific.* 9, 8–18.

Mary Selvam A., Manohar G. K. and Ramana Murty Bh. V. (1976a) Rainfall variations around a thermal power station. *Atmospheric Environment* 10, 963–968.

Mary Selvam A., Ramachandra Murty A. S., Vijayakumar R. and Ramana Murty Bh. V. (1976b) Airborne electrical and microphysical observations in the environment of a thermal power station. *Atmospheric Environment* 10, 957–961.

Semonin R. G. and Changnon S. A., Jr. (1974) METROMEX: Summary of 1971–72 results. *Bull. Am. met. Soc.* 55, 95–100.

* Selvam A. M., Murty A. S. R., Paul S. K., Vijayakumar R. and Murty V. R. (1978) *Atmospheric Environment* 12, 1097–1101.