low-sulfur fuel toward the smaller low-level sources. The best short-run strategy for reducing community exposure to episodic or localized occurrences of high SO_2 levels seems to be still an open question.

If our conclusions were misapplied by a utility or by anyone else, we are sorry. Facts can be misused. To their chagrin, scientists have had ample opportunity to learn this in the last few years.

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Alas

Hamlet spoke of a single skull. McMahon was referring to a single scull (see 23 July, p. 350, table 1).

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Climate Change

The report by Rasool and Schneider (9 July, p. 138) presents quantitative relationships between atmospheric carbon dioxide and aerosol concentrations which may be useful. However, two of their conclusions with respect to the effects of aerosols may be misleading.

Their statement that "the surface temperature falls precipitously with increasing opacity" is a consequence of the use of a logarithmic scale in presentation of the results. A replot of their figure 2b, using linear scales, indicates that the decline in surface temperature is linear with optical thickness and hence with aerosol concentration, at least to the accuracy with which I was able to read their curves.

In the projection of possible future events, they appear to neglect the effect of naturally produced aerosols. The authors of the SCEP report (*1*), which Rasool and Schneider cite as their first reference, concluded that, at present, the man-made tropospheric particulate component averaged over the globe amounts to about one part in five by weight and by number. Thus, the projected increase in the next 50

years would amount to a factor closer to 2 than to 4 and a temperature change more like 1°K than 3.5°K. When combined with the effects of carbon dioxide, the net change would be less than 1°K.

Increased particulate production rates are not an inescapable consequence of increased energy production even from fossil fuels, since emission cleanups are within the range of known technology and probably also within the range of costs which could be accepted by the economies of those highly developed countries which are the major power producers.

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Reference

1. Report of the Study of Critical Environmental Problems (SCEP), *Man's Impact on the Global Environment* (M.I.T. Press, Cambridge, Mass., 1970).

The report by Rasool and Schneider (9 July, p. 138) on potential climatic effects of atmospheric particulate matter was of great interest to me but has also caused me considerable distress. I have studied this same problem, using a somewhat different mathematical model, and have obtained results which are in good agreement with those of Rasool and Schneider; I find that the present particulate loading would have to be increased by a factor of 5 to produce a 3°C drop in mean planetary surface temperature. This work was done in November and December of 1969 and was presented before the International Solar Energy Society in Melbourne, Australia, on 4 March 1970. At the request of the editor of that society's journal, *Solar Energy*, the paper was submitted for publication and accepted, with minor revisions, in September 1970. However, because of unexpected delays, it will not appear until later this year.

A partial publication of my results appears in a Department of Commerce publication (*1*).

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Reference

1. E. W. Barrett, R. F. Pueschel, H. K. Weickmann, P. M. Kuhn, *Inadvertent Modification of Weather and Climate by Atmospheric Pollutants* (Technical Report ERL 185 APCL-15, Environmental Science Services Administration, Research Laboratories, Government Printing Office, Washington, D.C., 1970), pp. 30–35.