Are present efforts to eliminate episodes showing any promise? Is episode elimination a possible alternative to year round improvements in air quality? Does the hazard in episodes make short term average concentrations more meaningful to standards setting than yearly averages?

Dr. MIDDLETON. You see there are several questions involved.

I guess the first would be, is air pollution getting worse? The answer to this would be that the air pollution problem is really spreading out and thus affecting increasing numbers of people for longer time periods. As the size of the urban areas increase, and as industry builds new facilities in the outlying areas—in other words, with the spreading out of metropolitan areas, the attendant transportation, traffic patterns reach the suburbs so people can work in all these areas—the size of the area affected increases, and in this way the magnitude of the air pollution problem increases.

This is to say that the more people are affected—and moreover they are not affected solely while they are in downtown areas, but also while they are now in residential sections. So the air pollution blanket is spreading out.

As to your question about short-term versus long-term averages, you really need both measurement systems. You need them for different reasons. The long-term averages, which relate to pollution dosage, reflect the chronic exposure to routine levels of pollution.

And the short-term averages show the extent and the frequency of relatively high levels that will affect persons already ill, including not just those with emphysema but also, as Dr. Landau mentioned, the asthmatic patient and others.

Mr. CARPENTER. Would you expect that a locality in setting standards, ambient air standards which would then lead to emission source restrictions, would use both a long- and a short-term criterion?

Dr. MIDDLETON. Well——

Mr. CARPENTER. And are these such that they would lead to roughly the same emission-source restrictions?

Dr. MIDDLETON. Let's be sure we understand that there is a very intimate relationship of short-term exposure to the long-term exposure. They are mathematically related. The average on an annual basis is an integration of all the peaks of the short-term exposures.

So, I would suggest that you can't really separate them, except on the basis of specific effects you may look to.

Would a locality or a State elect to have short-term or long-term numbers as standards? I would think that they may wish to have, for very practical reasons, a standard of ambient air quality that is on a 24-hour basis. Simply for regulatory purposes one needs to know day to day what is happening. This number, I would suggest, would be something that wouldn't be violated more than a certain percent of the time.

I think the same agency would see the wisdom in having a longer term average so they could have their sights fixed on what achievements are being made or what changes are taking place. So also they would have a basis then to see whether they should be concerned about the chronic effects as well.

Mr. CARPENTER. Now in terms of prospective environmental epidemiological research, would your emphasis on the short-term standard allow the researcher to perform experiments and confirm the chosen