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Research Triangle Park NC 27711

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Project Summary

Feasibility of Using Radioactive Sulfur in Long-Range Transport Experiments

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An evaluation has been made of the feasibility of the use of radioactive ^{35}S as a tracer in long-range transport experiments. This report discusses a conceptual experiment that places quite stringent restraints upon the use of the material. On the basis of the background concentrations of ^{35}S, the amount of material required to be released for detection at 1000 km., public health considerations as prescribed in Federal regulations, the capability of current technology to produce the required material, and the availability of sampling and detection techniques, it is concluded that the use of ^{35}S is technically feasible. On the other hand, it appears that the use of stable isotopes of sulfur would be severely constrained because of the magnitude and variability of the occurrence of these isotopes in the sulfur already being emitted by anthropogenic sources.

This Project Summary was developed by EPA's Atmospheric Sciences Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

An important objective of the National Acid Deposition Assessment Program is to determine how much deposition in a sensitive region is attributable to anthropogenic sources in other regions of the country. A key experimental tool would be the use of tracers. In the past, nonreactive tracers have been used to define air motion on the subcontinental scale, however, since removal processes such as dry deposition, clear air chemical transformations, and wet scavenging depend upon the chemical nature of the transported material, the use of tracers that mimic the pollutant of interest would provide a great step forward. Because radioactive ^{35}S has a very low natural occurrence and, indeed, would undergo the same transformations as the sulfur emitted from sources, it would be an ideal tracer. An examination has been made to determine the feasibility of using this substance in long-range transport experiments.

Conclusions

A conceptual experiment consisting of continual releases of ^{35}S over a one-year time period was specified in order to have conditions as stringent as possible. A simple transport model estimate of the release rate that would be required for detection at 1000 km was approximately 180 Ci per week. The results obtained by using a wind rose Gaussian plume model indicated that the air concentrations near the release point would be below the levels that have been set by Federal regulations to protect public safety. Production of the radioactive material by the exposure of ^{35}Cl to neutrons in a nuclear reactor is within existing capability; the costs of material for the extreme conceptual experiment would be substantial (on the order of one million dollars), but are considered not so great as to be disqualifying. The sampling and detection techniques would require the use of state-of-the-art technology and an investment of about one half of that needed for

the tracer material. The general conclusion was that the use of ^{35}S was technically feasible. However, the study did not include consideration of the public perception of the use of radioactive material on this scale. It is likely that a reasonable public education effort would be required before approval for such experiments could be obtained.

The use of stable sulfur isotopes, ^{34}S and ^{36}S, was considered briefly. The natural occurrence of these isotopes is so large, and so variable, that very large release rates would be required (on the order of 3 tonnes of ^{34}S per hour); it was concluded that the use of stable isotopes would require the development of new technology at very great expense. Until new production techniques are proven, the use of these isotopes as tracers was considered not feasible.

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The complete report, entitled "Feasibility of Using Radioactive Sulfur in Long-Range Transport Experiments," (Order No. PB 86-160 280/AS; Cost: $9.95, subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650
The EPA Project Officer can be contacted at:
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