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The NIOSHI charcoal tube and other solid sorbent sampling tube certification program

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The NIOSH charcoal tube and other solid sorbent sampling tube certification program

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The Occupational Safety and Health Act of 1970, Section 20 (a) (5), authorizes the Secretary of Health, Education, and Welfare to prescribe regulations requiring employers to measure, record, and make reports on the exposure of employees to substances or physical agents which may endanger the safety or health of employees. In order for the Secretary to prescribe such regulations, it is necessary and proper that the Secretary be able to provide or suggest to employers sampling and analytical methods of suitable accuracy for making measurements of employee exposure. These sampling methods are generally personal samples which are collected in the breathing zone of the worker. In order for a sampling device to be used as a personal sampler, it should be lightweight, small, and convenient. Most solid sorbent type sampling devices meet these criteria.

In 1964, a solid sorbent tube was described[1] for sampling solvent vapors on activated charcoal and then eluting the sample off the charcoal with carbon disulfide. In 1970, a specific size of charcoal tube was recommended[2] as a sampling device which contained 20/40 mesh activated coconut shell charcoal. Today, many thousands of charcoal tubes are used annually by federal, state, and non-government industrial hygienists to sample for approximately 100 different contaminants. Most of the existing data on capacity, breakthrough volume, and desorption efficiencies has been developed on a particular size charcoal tube containing a specific type and mesh of charcoal. Recent discrepancies between data generated by different researchers[3] warranted a closer look at the content and quality of the charcoal tube. Also, the charcoal tube is used in determining compliance or noncompliance and so the entire sampling and analytical method must be proven to be valid within certain limits. Differences in the amount, mesh size, and most importantly, the type of charcoal used in the tube result in wide variations in the results of samples.[4] These same parameters of type, mesh, and quantity can be critical for other solid absorbents used in sampling tubes. Therefore a program was initiated at NIOSH to develop specific design and performance specifications for solid sorbent sampling tubes, starting with the charcoal tube, and to write a set of regulations which would govern a certification program for these tubes. The effect of this proposed certification program would be to establish minimum requirements for solid sorbent tubes.

The proposed certification regulations for solid sorbent tubes would plan to follow the general outline of 42 CFR 84 for the certification of detector tubes. A general outline for these planned regulations can be found in Table I. It is expected that these regulations would contain three main parts.

Section A would contain general information concerning definitions, applicants, issuance of certificates, required information, changes after certification, withdrawal of certification, conduct of tests, certification seals, material for record, incorporations by reference, and fees. Section B would contain general design and performance requirements for solid sorbent tubes. Specific performance and design requirements for individual solid sorbent tubes would be specified at a later date once the basic regulations for certification are finalized. Section C would contain requirements for a quality con-

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TABLE I
Solid Sorbent Sampling Tubes
Regulation Outline

A. GENERAL PROVISIONS
  1. Purpose
  2. Definitions
  3. Applicants
  4. Issuance of Certificates
  5. Certification Seals
  6. Required Information
  7. Conduct of Tests
  8. Changes after Certification
  9. Material Record
  10. Withdrawal of Certfication
  11. Incorporation by Reference
  12. Fees
B. CONSTRUCTION AND PERFORMANCE REQUIREMENTS
C. QUALITY CONTROL
  1. Filing Quality Control Plans
  2. Contents of Quality Control Plans
  3. Approval of Plan
  4. Quality Control Records

trol program which would have to be implemented if a manufacturer plans to have his tubes certified.

Once all the regulations are finalized, the first tube that is planned to be certified is the charcoal tube. The basic design of the charcoal tube is outlined in Figure 1. The planned certification design specifications are based on this tube. In addition, the charcoal tubes will have to meet certain performance tests of breakthrough capacity, desorption efficiency, pressure drop through the tube, and blank content. Both the desorption efficiency and breakthrough capacity will be determined at various loadings/concentrations of four or five different organic solvents. The solvents chosen for testing and the concentration at which they will be tested were determined so as to test the charcoal tubes over a wide range of applicability. Specific testing protocol is being developed so that manufacturers may duplicate the performance test if desired.

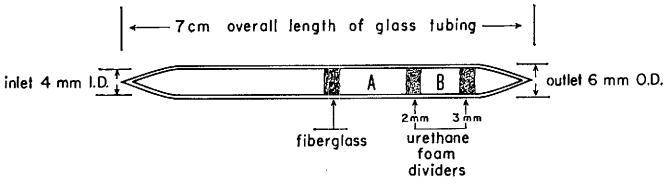
Since there are instances where a charcoal tube with more capacity than the one described here may be needed in industrial hygiene applications, provisions are planned to certify classes of charcoal tubes. The first class would include the standard charcoal tube described in Figure 1.

Another class of charcoal tubes may be certified for charcoal tubes larger than the standard tube but still meeting the same minimum performance requirements. In this way, when tubes are certified, they may be referred to as a "NIOSH Certified Charcoal Tube, Class X" and still allow the necessary variety of tubes for different sampling situations.

Other solid sorbent sampling tubes are planned to be certified in the future once specific design and performance specifications can be developed for a sampling tube that has proven itself through laboratory and field use.

Also, there must be a compatible, accurate, and sensitive analytical procedure available for a sampling tube before it can be certified. Some examples of solid sorbent tubes now under consideration include a silica gel tube for aromatic and aliphatic amines,[5] a silvered chromosorb P/carbosieve B tube for total mercury vapor,[6] a Tenax GC tube for nitrate esters,[7] a carbosieve B tube for acrylonitrile[7] and a sodium acetate tube for hydrogen flouride.[8]

The basic regulations governing the certification of solid sorbent tubes will be published in the Federal Register as "Proposed Regulations" allowing 30 days for public comment on the regulations. After comments have been received and considered, the regulations will be published as valid regulations. At some time after the regulations have been finalized, a notice will be published in the Federal Register, regarding certification of specific tubes, when these tubes must be received, and



A - 100 mg 20/40 mesh activated coconut shell charcoal
B - 50 mg 20/40 mesh activated coconut shell charcoal

The ends of the glass tube are flame sealed to ensure circular breakage of 2mm diameter and to restrict contamination of the chorcoal prior to sampling.

Figure 1—Charcoal tube specifications.

how much it will cost the applicant. The actual certification testing will be implemented at the NIOSH Testing and Certification Laboratory located in Morgantown, West Virginia. It is planned that this certification program be in operation by 1976.

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