Industrial Hygiene Forum

Bruce A. Hertig, Sc.D.
Department Editor

The Industrial Hygiene Forum is designed as a medium of exchange for members and readers who wish to share their "know how" with others yet avoid the necessity of preparing a full and detailed manuscript on the subject. This is your opportunity to share with others, your "know how", timely tips, new ideas etc. on any aspect of industrial hygiene. Exceptions are matters of opinion and comments on published manuscripts; these will be published elsewhere in the Journal. Submission should ordinarily not exceed four double spaced, typewritten pages. Submissions should be signed and marked for publication in the Forum.

Contributions to the Industrial Hygiene Forum will not be peer reviewed but the right is reserved to edit accepted contributions. The success of the "Forum" will of course depend upon the contributions from you, our readers.

For consideration, send your contributions directly to Bruce A. Hertig, Sc.D., 306 W. High St., Urbana, IL 61801, (217) 367-1867.

Asbestos Bulk Sampling Procedure

JOHN T. JANKOVIC
National Institute for Occupational Safety and Health,
Morgantown, WV 26505-2888

Background

In recent years various EPA programs and regulations have focused public attention on asbestos-containing building materials. (40 CFR, Part 61-National Emission Standards for Hazardous Air Pollutants, 40 CFR, Part 763-Asbestos; Friable Asbestos-Containing Materials in School; Identification and Notification). As public awareness of the potential for building materials to contain asbestos increased, a commensurate demand for material identification (bulk sample analysis for asbestos) followed.

Many of the bulk samples received in NIOSH's Division of Respiratory Disease Studies lab arrive in large quantities, enclosed within poorly constructed containers. The physical state in which many bulk samples arrive suggests a lack of sophistication on behalf of the collectors. Further, one must conclude that if disruption of asbestos-containing material can cause exposure, then the sample collector is at some risk when utilizing a disruptive sampling technique.

A review of the current asbestos hazard abatement literature provided very little information on the techniques necessary to sample building materials safely and efficiently. The few techniques that were specified (scraping with a knife and pressing a film canister into the material) as well as others, were found to be highly disruptive when performed dry (Table I).

Industrial Hygienists at NIOSH's Morgantown Lab have developed a bulk sampling technique which provides an adequate quantity of material for analysis while minimizing the disruption of the parent material. The procedure employs core sampling, which allows collection of multi-layered materials with minimum disruption.

Devices for core sampling can be fabricated from existing or easily obtainable office/laboratory equipment (Figure 1). The best coring devices are those in which the sampler also serves as the sample container. A short length of clear, acrylic tube (Figure 2) with one end sharpened and provided with caps has proven very effective.

Modified disposable syringes or cork borers serve well as reusable samplers. However, they require a separate sampling container such as a glass vial as well as cleaning between samples.

In general, any cylindrical device that is thin walled, has a sharpened edge or an edge which can be sharpened, and a diameter of 1/4" or so will make an ideal core sampler. If the sampler ends can be sealed to contain the material, so much the better, as the transfer and cleaning steps are eliminated.

Conclusions

Fiber release during dry sampling, as measured with standard air sampling techniques, can produce fiber concentrations greater than 1000 fibers per cubic centimeter in the air immediately adjacent to the sampling point (Table I). Because data available to date provide no evidence for the existence of a safe (threshold) level of exposure to asbestos, the prudent investigator should make every reasonable attempt to minimize, if not eliminate, fiber exposure during bulk sampling. The best system found for controlling fiber release during materials sampling includes: (1) wetting the material before sampling; (2) coring with a small diameter tube; (3) utilizing the coring device as the sample container; and (4) repairing the damaged surface.

TABLE I
Fiber Release 10 cm From Point of Sampling

	Fibers/cc	
Sampling Method	**Dry**	**Wet**
Cork Borer		
With Bag	7(8)[A]	0(0)
Without Bag	470(550)	9(11)
Knife	903(1056)	0(0)
Glass Vial	1847(2160)	17(20)

[A](Fibers/mm^2).

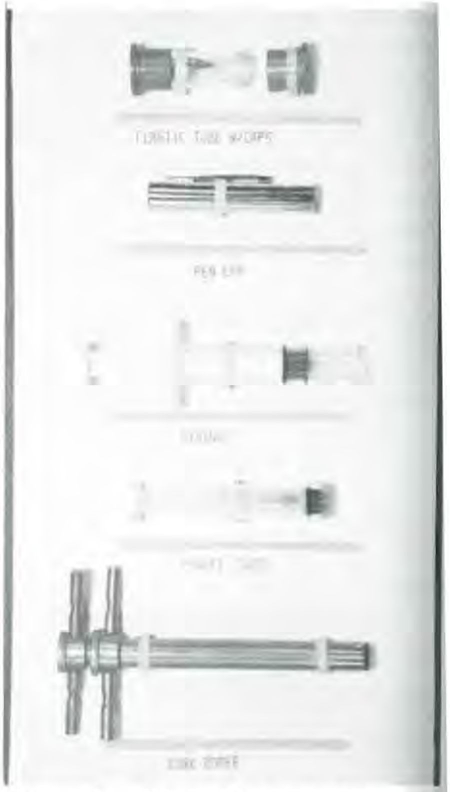

Figure 1 — Devices for core sampling.

If the material to be sampled cannot be wetted, a high efficiency particulate respirator must be worn while sampling, as well as providing some method to contain any material released during the disturbance.

Bulk Sampling Procedure

A. *What to Sample*

1. Identify areas and materials to be sampled based on building specifications and visual observations.
   a. Friable materials (easily able to crumble with light hand pressure).
   b. Exposed and deteriorating non-friable materials.
   c. Any materials which might be expected to contain asbestos which is/will be subjected to a disruptive activity.
2. Determine the number of individual random samples necessary to make up a collective "sample" for a homogeneous material.
   a. EPA recommends a minimum of 3 samples for a homogeneous material less than 1000 ft^2 in area, 5

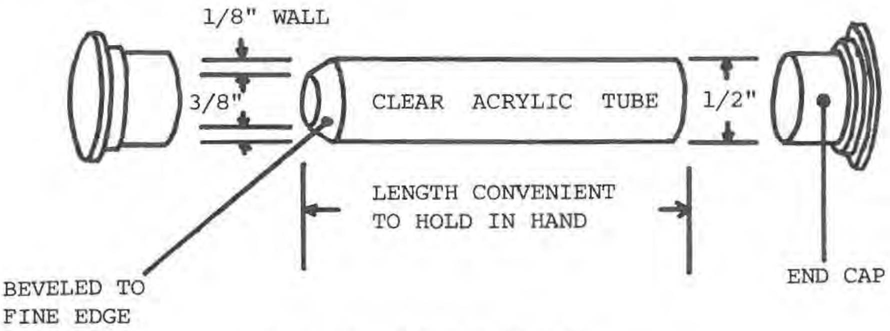

Figure 2 — Sampler/container.

samples/ 1000-5000 ft^2, 7 samples for areas greater than 5000 ft^2.

B. How to Sample

1. **Wet the Surface:** This is particularly important. Use a spray bottle to apply water. You may add a laundry detergent to serve as a wetting agent.
2. **Use a Containment Device:** If you can't wet the material, then use a containment device around the sampler, such as a plastic bag.
3. **A Respirator is Mandatory:** If you can't follow item 1 or 2; you must wear a high efficiency particulate respirator and provide a means of containing/ cleaning debris.
4. **Obtain a Representative Sample:** Slowly push the sampler into the material with a twisting motion until you penetrate the entire thickness of the material. A metal or plastic tube, 1/4" or so in diameter, works well for this. The representativeness of the coring is the major quantity setting factor. However, 1 cc or so of material will usually provide an adequate amount for analysis.
5. **Place Material in Container:** With a single-use sampler you need only wet-wipe the exterior before capping. With a reusable coring device, eject the sample into a glass vial or other similar container and wet-wipe the tube and plunger of the sampler.
6. **Label the Sample:** Use a code which can be referenced to the date, location, etc.
7. **Clean Debris:** Use wet paper towels to clean debris; discard in plastic bags.
8. **Repair the Sampler Damage:** Latex paint, dabbed on wet or dry material is acceptable for friable surfaces. Tape works well for repairing core holes left in jacketed insulation and the like. Hair spray has also been reported as an effective sealant for friable materials.
9. **Sample Shipment:** Check the requirements of your post office before attempting to ship samples by mail. Private carriers are not restricted by DOT when shipping asbestos for non-commercial use (40 CFR 173.1090).
10. **Laboratory Preparation:** At the laboratory, forced removal of the cores should be done in a hood or under 50 mL or so of distilled water in order to prevent exposure to the analyst.

Solvent Exposure from Liquid Sampling Media

C.L. MOSELEY
Hazard Evaluations and Technical Assistance Branch,
National Institute for Occupational Safety and Health,
Cincinnati, OH 45226

Use of a personal sampling method using a toluene-based solution in a midget impinger led to the suspicion that it would result in toluene exposure to the worker. Field data from three workplaces indicate that in open environments, 8-hour TWA toluene exposures range from 3.6 - 20.1 mg/m^3 with a mean of 8.9 mg/m^3. However, sampling in semi-confined spaces resulted in 8-hour TWA concentrations up to 189 mg/m^3, or 50% of the NIOSH-recommended exposure limit (375 mg/m^3). Use of this and similar wet sampling methods in confined spaces requires investigators to be aware of the degree of ventilation in the space; and suggests the need to predict potential exposures before sampling. The vapor pressure method is a rapid, safe and simple way to predict this potential exposure.

Introduction

Consideration of the potential toxicology of polymeric forms of isocyanates, and the concomitant need to evaluate worker exposure, led two organizations — the National Institute for Occupational Safety and Health and the British Occupational Medicine and Hygiene Laboratory — to develop a similar sampling and analytical method for both polymeric and monomeric forms. Bagon, *et al.*,[1] published their method in the January 1984, issue of the *AIHAJ*. The NIOSH method is in the 3rd Edition of the *Manual of Analytical Methods.*[2] The principle of both methods is the formation of an isocyanate derivative with 1-(2-methoxyphenyl)piperazine in toluene, with previous collection from workroom air by midget impinger.

Toluene has a vapor pressure of 22.3 mmHg at 21° C (70° F), which leads to the suspicion that it will be rapidly evaporated from the impinger during sampling at temperatures commonly encountered in the workplace; and with a STEL of 560 mg/m^3, could result in toluene exposure to the worker. Indirect reference to this possibility was made by Keller and Sandridge[3] in 1979; however, actual measurement of this exposure has not been undertaken until now.

Field Studies

Exposure to toluene as a result of isocyanate sampling was studied in three field situations. In addition to collecting isocyanate samples by the impinger method, charcoal tube samples to evaluate toluene exposure from the impinger solution were collected (collected and analyzed by P&CAM #127).[4]

The first workplace was a wire-enameling operation which had an average background toluene concentration of less than 0.8 mg/m^3 (n=15). This operation took place in a large, open, indoor environment and the workers were mobile. Sampling periods (for 8-hour TWA isocyanate exposure) ranged from 380 to 450 minutes; flow rate was 1.0 Lpm. The 8-hour TWA toluene exposures ranged from 4.8 to 20.1 mg/m^3, with a mean of 9.1 mg/m^3 (n=8), after subtraction of background. Environmental conditions over the 3-day sample collection period were: temperature 20-28° C, relative humidity 32-46%, and barometric pressure approximately 760 mmHg.

The second workplace was a foundry. These workers were generally less mobile than those in the previous workplace, but worked in a similar open environment. There were no sources of toluene reported. Temperature, relative humidity, and pressure

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION JOURNAL

VOLUME 46, NUMBER 2
FEBRUARY, 1985

American Industrial Hygiene Association JOURNAL (ISSN 0002-8894) is published monthly for $60 per year U.S., $70 elsewhere (prepaid, U.S. funds) by American Industrial Hygiene Association, 475 Wolf Ledges Pkwy., Akron, OH 44311-1087. Single copies in U.S. $6.00; elsewhere $7.00. Airmail available, rates on request. Second class postage paid at Akron, Ohio and additional entries. POSTMASTER: Send address changes to American Industrial Hygiene Association, 475 Wolf Ledges Parkway, Akron, OH 44311-1087.

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