

7. SPECIFICATIONS*

*Section 7 has been updated to reflect changes in Vendors, e.g., Phoenix Custom Molders, Inc., GA-MA and Associates, Inc. (March 2002)

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7. SPECIFICATIONS

7.1 OVERVIEW

This section describes materials used in some of the procedures. These materials are unique in that they are not necessarily available from the usual scientific vendors. Consequently, an attempt was made to provide all pertinent information in order to enable the user of this Manual to obtain the items referred to.

Special attention is drawn to Section 7.2 since it provides information on several items from a single vendor.

7.2 RING AND DISC MOUNTS

7.2.1 DESCRIPTION

Plastic rings and discs in nominal 1 in (2.54 cm) and 2 in (5.08 cm) diameters are molded of nylon. The 1-in units are made according to dimensions given in Figure 7.1, and the 2-in units follow the same form with an overall diameter of 2.03 in (5.16 cm).

The discs are molded as cups to allow use of the discs either for mounting solid samples using the ring or to evaporate liquid samples in the cup.

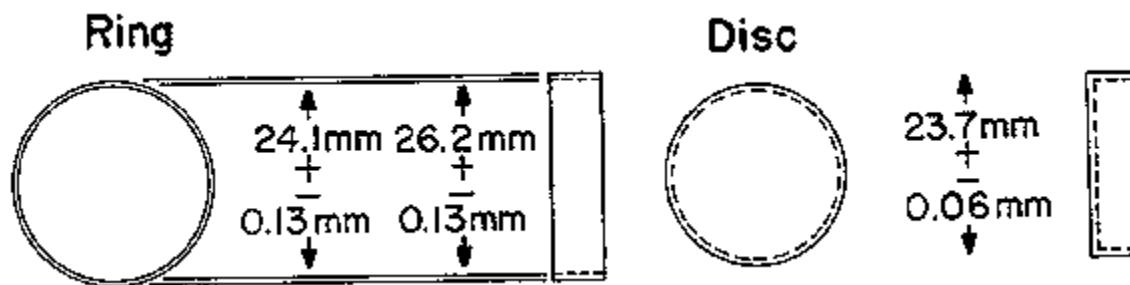


Figure 7.1. Plastic ring and disc mounts.

7.2.2 SUPPLIER

The present source of supply is:

Phoenix Custom Molders, Inc.
Five Wickers Drive
Wolfeboro, NH 03894
Phone: (603) 569-5100
Fax: (603) 569-6041

an example of the price list is reproduced and included as Specification 7.2.3.

7.2.3 COSTS

RINGS AND DISCS: Prices are per set (one set = one ring and disc) in lots of:

	<u>500</u>	<u>1000</u>	<u>2500</u>	<u>5000</u>	<u>10000</u>	<u>25000</u>
1 in dia. plain*	.70	.57	.42	.34	.32	.22
2 in dia. plain**	.70	.64	.50	.40	.36	.26
1 in dia. funnel disc and ring***	1.20	1.13	.67	.55	.42	.37

Minimum Order \$350.00

*EML Manual, Specification 7.2, PCMI 5230-01. Color Natural

**EML Manual, Specification 7.2, PCMI 5236-01. Color Natural

***EML Manual, Specification 7.12, PCMI 5229-01. Color Black

FILTERS: Prices are cents per each in lots of:

	<u>100</u>	<u>250</u>	<u>1000</u>
Polyethylene filter chimney*	4.50	2.25	1.03
Geon filter stopper**	4.50	2.25	1.03

*EML Manual, Specification 7.12, PCMI 5231-01

**EML Manual, Specification 7.13, PCMI 5232-01

PLATING CEL CAP: (20-mm thread to fit Polyethylene bottles, with brass bushing for mounting and electrical connection)

Dollars each in lot of:	<u>25</u>	<u>50</u>	<u>100</u>	<u>500</u>
	18.50	11.10	6.65	3.46

EML Manual, Specification 7.16, PCMI 5227-01

GAMMA PLANCHETS: Prices are per set in lots of:

	<u>100</u>	<u>250</u>	<u>500</u>	<u>1000</u>	<u>2500</u>	<u>5000</u>
2 in dia. x 1 in deep with .030 in disc	5.00	3.00	1.50	1.15	.91	.68

Minimum Order \$350.00

EML Manual, Specification 7.19, PCMI 5226-01

MARINELLI BEAKER AND COVER: Unit price in lots of:

	<u>100</u>	<u>250</u>	<u>500</u>	<u>1000</u>	<u>2500</u>	<u>5000</u>
Black Butyrate	4.07	3.19	2.88	2.73	2.65	2.61

Minimum Order \$350.00

EML Manual, Specification 7.22, PCMI 5237-01. Other materials and colors quoted on request.

Prices are in U.S. dollars, F.O.B. Franklin, NH. For shipments outside the U.S., add 5% to prices listed and \$45.00 for bank transferral charges. Unless otherwise specified, all items are bulk packed in poly bags. All orders are subject to \$350.00 minimum. Blanket orders welcome. Discounts available for volume buyers.

7.3 MYLAR* FILM

7.3.1 DESCRIPTION

Mylar film is used to cover precipitates to protect them during counting and storage. The film is obtained in 38.1 mm width rolls. The most useful films are .013 mm thick, weighing about 1.8 mg cm^{-2} and .006 mm thick, weighing about 0.9 mg cm^{-2} .

7.3.2 SUPPLIER

Retail quantities may be obtained from:

Spex Sample Preparation
203 Norcross Ave.
Metuchen, NJ 08840
1-800-LAB-SPEX

**Mylar is the registered trademark of E.I. du Pont de Nemours & Co. for its polyester film.*

7.4 ION EXCHANGE RESINS

7.4.1 DESCRIPTION AND SUPPLIER

Analytical grade anion and cation exchange resins are required to concentrate trace amounts of radionuclides from environmental samples. They are available from:

Bio-Rad Laboratories
2000 Alfred Nobel Drive
Hercules, CA 94547
(510) 741-1000
FAX: (510) 741-1060

or

Eichrom Industries, Inc.
8205 S. Cass Ave., Suite 107
Darien, IL 60561
(800) 422-6693
FAX: (708) 963-1928

and may be used as received.

7.5 LARGE ION-EXCHANGE COLUMNS

7.5.1 DESCRIPTION

Fabricated from borosilicate glass tubing.

7.5.2 SUPPLIER AND COST

Ace Glass, Inc.
1430 Northwest Boulevard
P.O. Box 688
Vineland, NJ 08360
(609) 692-3333

Ace Glass, Inc., supplies large ion-exchange columns as specialty items. Costs will be quoted by the supplier.

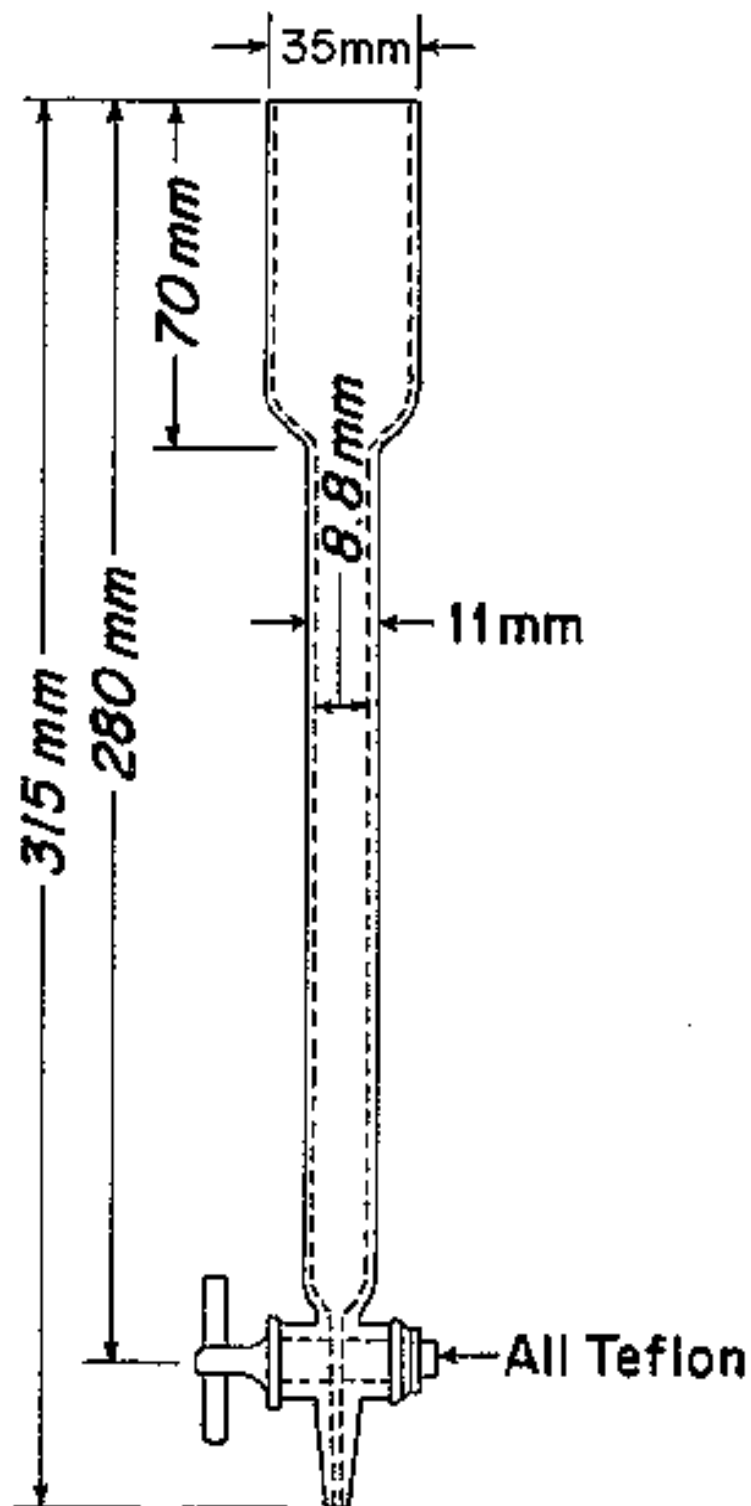


Figure 7.2 Large ion-exchange column.

7.6 SMALL ION-EXCHANGE COLUMNS

7.6.1 DESCRIPTION

Fabricated from borosilicate glass tubing.

7.6.2 SUPPLIER

Ace Glass, Inc.
1430 Northwest Boulevard
P.O. Box 688
Vineland, NJ 08360
(609) 692-3333

Ace Glass, Inc., supplies small ion-exchange columns as a specialty item. Costs will be quoted by the supplier.

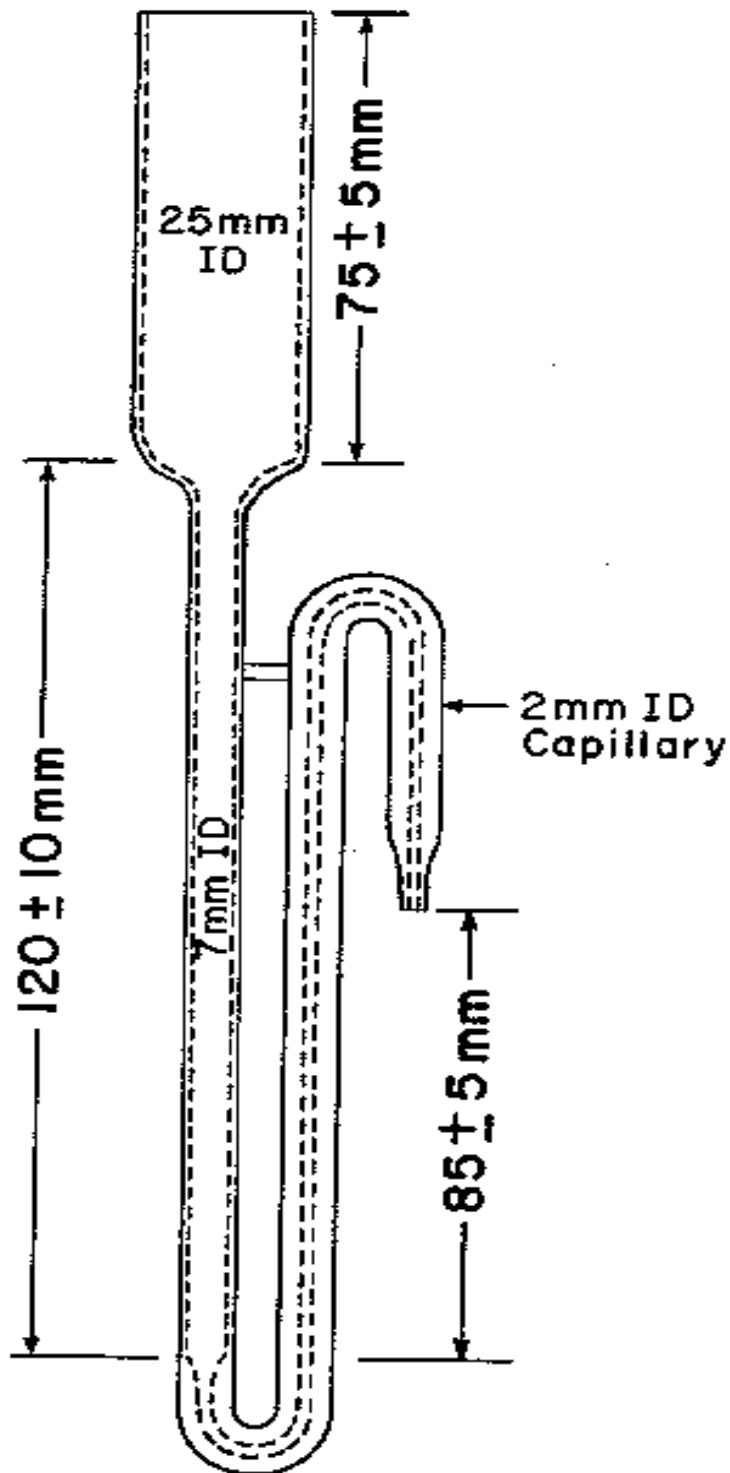


Figure 7.3 Small ion-exchange columns.

7.7 RADON BUBBLERS - PYREX

7.7.1 DESCRIPTION

1. Main chamber about 150-mm long, base to neck, with capacity about 50 mL.
2. Top of chamber to have 19/38 standard taper joint.
3. Stopcocks 2-mm bore with tapered Teflon plug - side arms 7 mm O.D.
4. All side tubing to be 7 mm (not as shown).
5. Glass rod structural support between main chamber and side tube, 15 mm in length, 4-mm diameter.
6. Medium porosity glass frit in bottom of chamber.
7. Glass tubing from stopcocks 25-mm long.

7.7.2 SUPPLIER AND COST

Ace Glass, Inc.
1430 Northwest Boulevard
P.O. Box 688
Vineland, NJ 08360
(609) 692-3333

Cost: ~ \$69.00

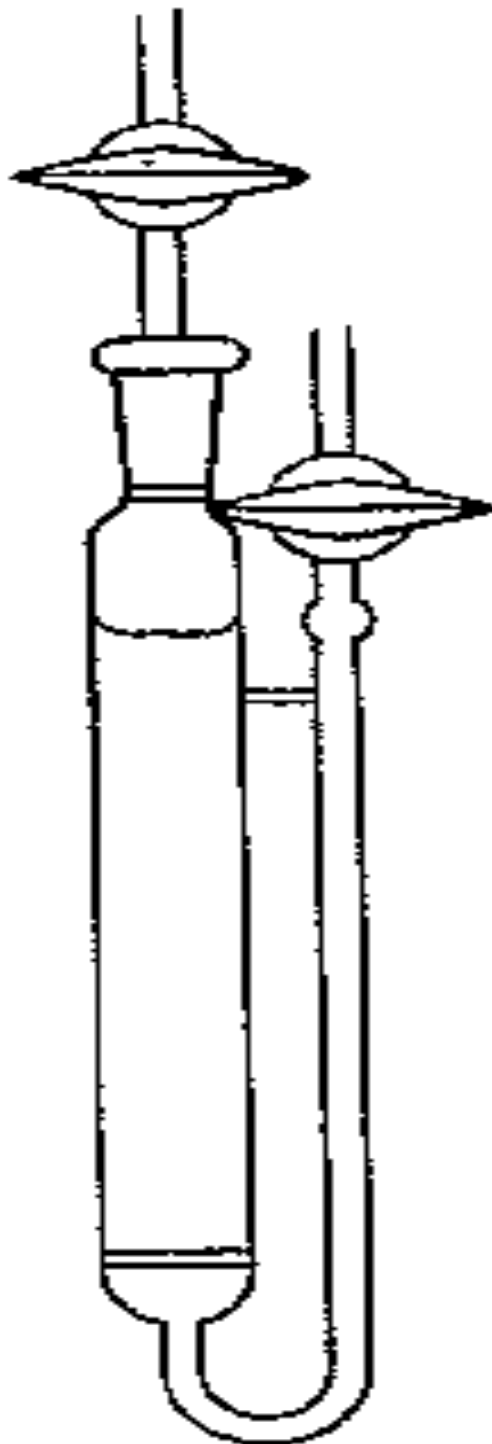


Figure 7.4 Radon bubbler.

7.8 GLASS FIBER FILTER PAPER*

7.8.1 DESCRIPTION

Two equivalent materials are available. One is No. X-934-AH made by Hurlburt Paper Company, the other is Whatman glass fiber paper GF/C. These are available from laboratory supply houses. Gelman Instrument Company sells a "Spectro Grade Type A" filter with the following typical analyses.

µg per 203 mm x 254 mm
Sheet Less Than:

Antimony	Sb	50
Arsenic	As	50
Beryllium	Be	10
Bismuth	Bi	50
Cadmium	Cd	15
Chromium	Cr	50
Cobalt	Co	15
Copper	Cu	10
Iron	Fe	400
Lead	Pb	25
Manganese	Mn	50
Mercury	Hg	100
Molybdenum	Mo	15
Nickel	Ni	100
Selenium	Se	2000
Tin	Sn	50
Titanium	Ti	15
Vanadium	V	15
Zinc	Zn	60
Water Extractable Ions	SO ₄ ⁻	150
	NO ₃ ⁻	10
	NH ₄ ⁺	10
	F ⁻	120
	Cl ⁻	1650

**Most glass fiber filters contain traces of alpha and beta activity. Any procedure where the final sample is mounted on a glass filter for counting should be carefully checked for possible interference.*

7.9 BETA PHOSPHORS

7.9.1 DESCRIPTION

This technique has been described by Harley et al. (1962). Phosphor discs .2540-mm thick and 23.8 mm in diameter and other sizes are available in lots of 1000, as NE-102 clear to as NE-102A, at about \$1.50 each.

7.9.2 SUPPLIER AND COST

Bicron Corp.
12345 Kinsman Rd.
Newbury, OH 44065
(216) 564-2251

Approximate cost: \$1,600/1000 sq. in.

REFERENCE

Harley, J. H., N. A. Hallden and I. M. Fisenne
"Beta Scintillation Counting with Thin Plastic Phosphors"
Nucleonics, Vol. 20, 1, 59-61, January (1962)

7.10 ALPHA PHOSPHOR ON MYLAR

7.10.1 DESCRIPTION

The phosphor is the standard silver-activated zinc sulfide (Sylvania Type 130 [7] or DuPont 1101 phosphor) coated on one side of a Mylar film. The material is sprayed onto the backing using the zinc sulfide as a pigment in a paint vehicle.

A fresh die-cut phosphor disc, 23.8 mm in diameter, is used for each sample. The sample filter paper is laid on a nylon disc, the phosphor is placed against the sample, a strip of .0076-mm Mylar is overlaid, and the assembly is locked together with a nylon ring.

Counting is performed with a bare phototube on either manual or automatic counters.

7.10.2 SUPPLIER AND COSTS

The phosphor is available in strips or discs from:

William B. Johnson & Associates, Inc.
P.O. Box 472
Ronceverte, WV 24970
(304) 645-6568
FAX: (304) 645-2182

The zinc sulfide is sprayed on .076-mm Mylar. The catalog numbers are:

	Price
ASP-3, 305 mm wide strip	\$27/sheet
ASP-4, 23.8 mm discs	\$32/C
ASP-5, 49.2 mm discs	\$61/C
ASP-6, 50.8 mm discs	\$61/C

7.11 POLYETHYLENE DISPENSING BOTTLES

7.11.1 DESCRIPTION

Commercially available disposable plastic transfer pipettes (DPTP), made from low density polyethylene (LDPE) are used for weighing and dispensing small aliquots of radionuclide solutions.

The DPTPs may be purchased in capacities of 1 to 10 mL. All are pre-drawn with capillary tips of various diameters. The DPTP may be completely or partially filled by squeezing the pipette to expel the air, inserting the tip under the surface of the solution and releasing the vacuum in the pipette. The pipette tip is wiped with a disposable tissue. Single drops or a larger volume may be dispensed by squeezing the pipette with the tip down. Depending on the size of the capillary tip, individual drops may range from 0.10 to 0.05 g.

A radioactive solution may be sealed in the DPTP by heating the tip of the capillary and squeezing it with forceps. The tip may then be cut below the seal when it is desired to deliver another portion of the solution.

Similar polyethylene dispensing bottles (5 cm³ ampules) were tested for loss of liquid over a storage period up to 6 months. The loss from 5.5 g of distilled water was 0.042 g. The loss from 4.0 g of ethyl alcohol was 0.136 g and the loss from 6.7 g of concentrated HCl was 0.188 g. Intermediate measurements showed a roughly linear rate of weight loss.

In general, it appears that the losses from the sealed dispensing bottles are small for short-time periods, but that they must be taken into consideration if long-time storage is required.

The stability of nuclide solutions in polyethylene bottles and possible losses through absorption on the walls have been questioned many times. A series of tests were performed to determine if appreciable losses occurred in the normal use of these bottles

for solution storage and handling. The data obtained should be considered as a guide and appropriate tests carried out as needed.

Six isotopes (^{137}Cs , ^{144}Ce , ^{95}Zr , ^{131}I , ^{106}Ru , ^{140}Ba) were obtained from Oak Ridge National Laboratory, split, diluted, and stored in sealed polyethylene dispensing bottles for a period of from 10-63 days.

In each case, duplicate samples were prepared in water, carrier (1 mg mL^{-1}) or HCl (1N) solution, except in the case of ^{131}I where Na_2SO_3 (pH at 8) was used, and ^{95}Zr where oxalic acid was used.

The samples were gamma counted in a NaI well-crystal so that a counting error of at least 1% was maintained. After the initial count, the drawn stems were cut off, the bottles rinsed four times with warm water, and then recounted. In the case of residual activity, the bottles were rewashed four times in a 1N HCl solution and recounted. The data are shown in Table 7.1. Ruthenium adsorbed appreciably on polyethylene, but the other nuclides were kept in solution with carrier or acid (Harley et al., 1963).

Testing of additional nuclides and various solution/carrier combinations were carried out in subsequent years. These results are shown in Table 7.2, where even ruthenium is kept in solution with both carrier and acid.

REFERENCE

Harley, J. H., N. A. Hallden and I. M. Fisenne
"Storage of Standardized Radioactive Solutions"
Nature, 197, 1230 (1963)

7.11.2 SUPPLIER AND COST

The DPTPs are available from several supply houses, including:

Bio-Rad Chemical Division
2000 Alfred Nobel Drive
Hercules, CA 94547
(510) 741-1000
FAX: (510) 741-1060

The most useful sizes are sold in boxes of 400 to 500/box at prices ranging from \$18 to \$30/box.

TABLE 7.1
STORAGE CONDITIONS FOR NUCLIDES IN POLYETHYLENE AMPOULES*

Nuclide	<u>% Retained after Rinse</u>			
	Carrier	Acid	Water	Acid
¹³⁷ Cs	-	-	0	
	x	-	0	
	-	x	0	
¹⁴⁴ Ce	-	-	5	0.6
	x	-	0	
	-	x	0	
⁹⁵ Zr	-	-	48	33
	x	-	0**	
	-	x	1.2	0.8
¹³¹ I	-	-	25	25
	x	-	17	17
	-	x	26	26
¹³¹ I with Na ₂ SO ₃ at pH 8			0	
¹⁰⁶ Ru	-	-	35	15
	x	-	25	26
	-	x	29	28
¹⁴⁰ Ba	-	-	0	
	x	-	0	
	-	x	-	

*Taken from Harley et al., 1963.

**With either Zr or Nb or with both as carriers.

TABLE 7.2
ADDITIONAL NUCLIDES SUCCESSFULLY STORED
IN POLYETHYLENE

Nuclide	Conditions
¹²⁵ Sb	5 µg Sb g ⁻¹ 4N HCl
²⁴¹ Am	0.1N HNO ₃
⁷ Be	0.1N HCl
¹⁰⁹ Cd	1N HCl
⁴⁵ Ca	0.1N HCl
⁵¹ Cr	1N HCl
⁶⁰ Co	0.1N HCl
²⁴⁴ Cm	3N HCl
¹⁹⁸ Au	4N HCl
⁵⁹ Fe	0.1N HCl
²¹⁰ Pb + Progeny	3N HNO ₃
⁵⁴ Mn	1N HCl
⁶³ Ni	0.1N HCl
³² P	0.1N HCl
²³⁹ Pu	0.1N HNO ₃
²¹⁰ Po	1N HNO ₃
¹⁴⁷ Pm	1N HCl
²²⁶ Ra	0.1N HCl
¹⁰⁶ Ru	25 µg Ru g ⁻¹ 1N HCl
²² Na	0.1N HCl
⁹⁰ Sr	0.1N HCl
²⁰⁴ Tl	1N HNO ₃
²²⁸ Th	3N HNO ₃
²³² U	1N HCl
⁸⁸ Y	0.1N HCl
⁶⁵ Zn	0.1N HCl

7.12 FILTER FUNNELS AND SAMPLE MOUNTS

7.12.1 DESCRIPTION

A simple and inexpensive combined filter funnel and sample mount is shown in Figure 7.5. The funnel chimney is molded of polyethylene and may be reused. It is sufficiently inexpensive that it could be discarded after each use, but the smooth surface should not retain any material to cross-contaminate the samples. The nylon funnel base is designed to be used as a sample mounting disc.

In the filtration, a double paper or glass fiber filter is used with a diameter of 23.5-24 mm. A short piece of 3.1750 mm I.D. plastic tubing is attached to the base tube and the base is put in place on a rubber stopper mounted on a standard filter flask. The rubber stopper can be bored out to about 1 cm. No seal is required between the plastic tubing and the stopper as the suction is maintained between the funnel base and the stopper. After filtration, the funnel chimney is removed and the base mounted as with the standard disc.

7.12.2 SUPPLIER

The present source of supply is:

Phoenix Custom Molders, Inc.
Five Wickers Drive
Wolfeboro, NJ 03894
Phone: (603) 569-5100
Fax: (603) 569-6041

This vendor is retaining the molds for EML. They have been instructed to accept orders from any source. They may be ordered as:

1. Polyethylene funnel chimney, and
2. Funnel disc and ring.

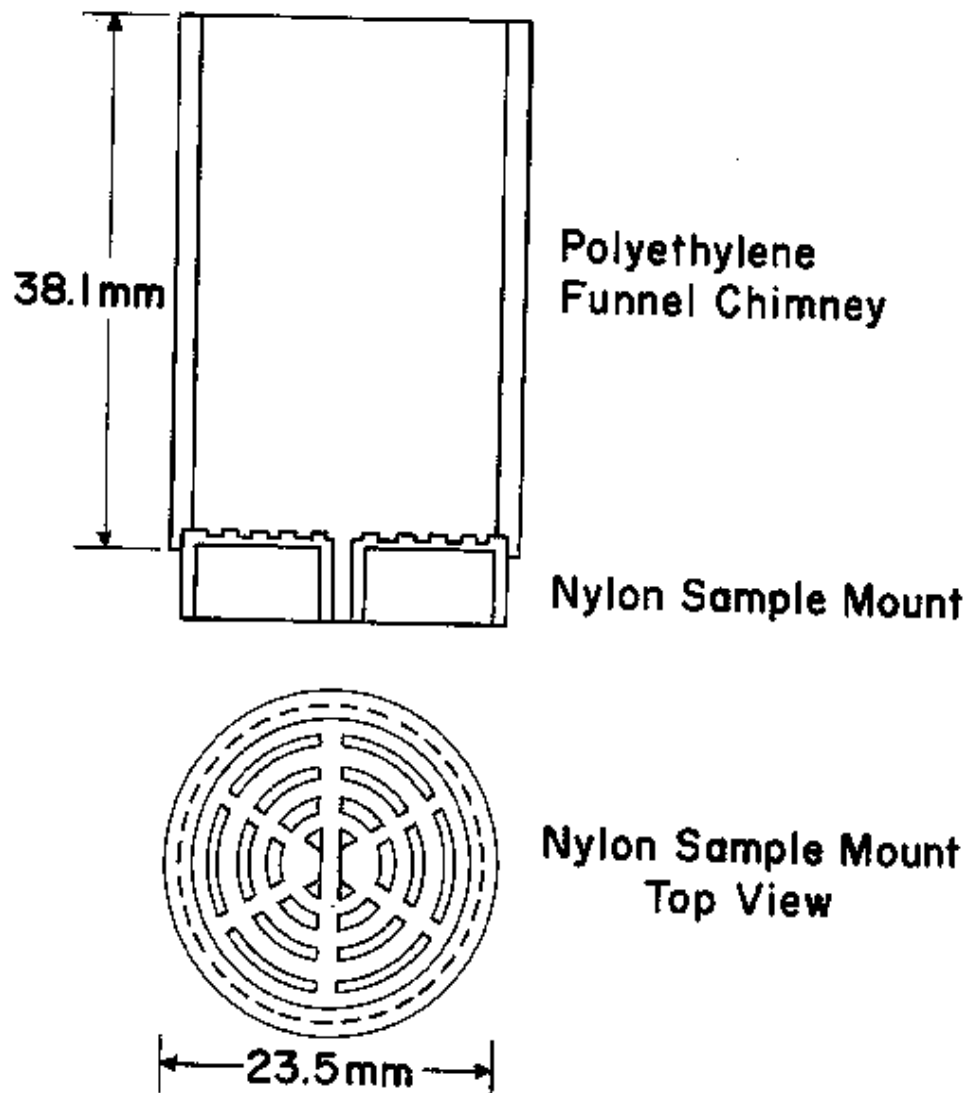


Figure 7.5 Filter funnels and sample mounts.

7.13 FILTER STOPPERS

7.13.1 DESCRIPTION

The stopper sketched below is molded from "Geon" which is reasonably inert to common chemicals. It is intended for use in supporting the filter discs described in Section 7.12.

If the filtrate is not to be saved, the stopper may be used as is with a filter flask. If the filtrate is to be saved, a length of thin plastic tubing may be attached to the bottom of the filter disc and passed through the stopper hole for use with a Fisher filtrator.

7.13.2 SUPPLIER

These stoppers are available from the supplier who furnishes the filter discs (Phoenix Custom Molders, Inc., see Specification 7.2).

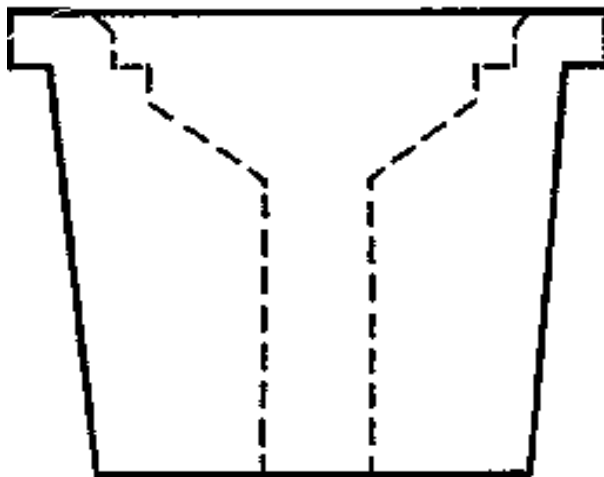


Figure 7.6 Filter stopper, twice full size (corresponds to a No. 6 rubber stopper).

7.14 ION-EXCHANGE FALLOUT COLLECTORS

7.14.1 DESCRIPTION

A schematic diagram of the ion exchange fallout collector is shown in Figure 7.7. This unit consists of a funnel, ion-exchange column, leveling device, wooden housing with a clamp, and electric heater (optional). The funnel is welded to a threaded cap which may be attached to the top of the ion exchange column. The bottom of the column is also threaded for a tapered fitting to attach the leveling tube. The device consists of a polyethylene tube extending from the bottom of the column to a T-connector above the height of the paper pulp in the column. This prevents the column from running dry during the collection period. Water flows out of the T-connector and is directed out of the wooden housing through a flexible hose. The tapered fitting and the funnel are replaced with standard bottle caps prior to shipment.

7.14.2 SUPPLIER

Aside from the housing unit and electric heater, the various components of the ion-exchange fallout collector can be obtained from

Bel-Art Products
Pequannock, NJ 07440
(201) 694-0500

Figure 7.8 is a schematic diagram showing the dimensions of the funnel, column, and tapered cap which EML uses.

We at EML assemble all of the components before placing the unit in the field.

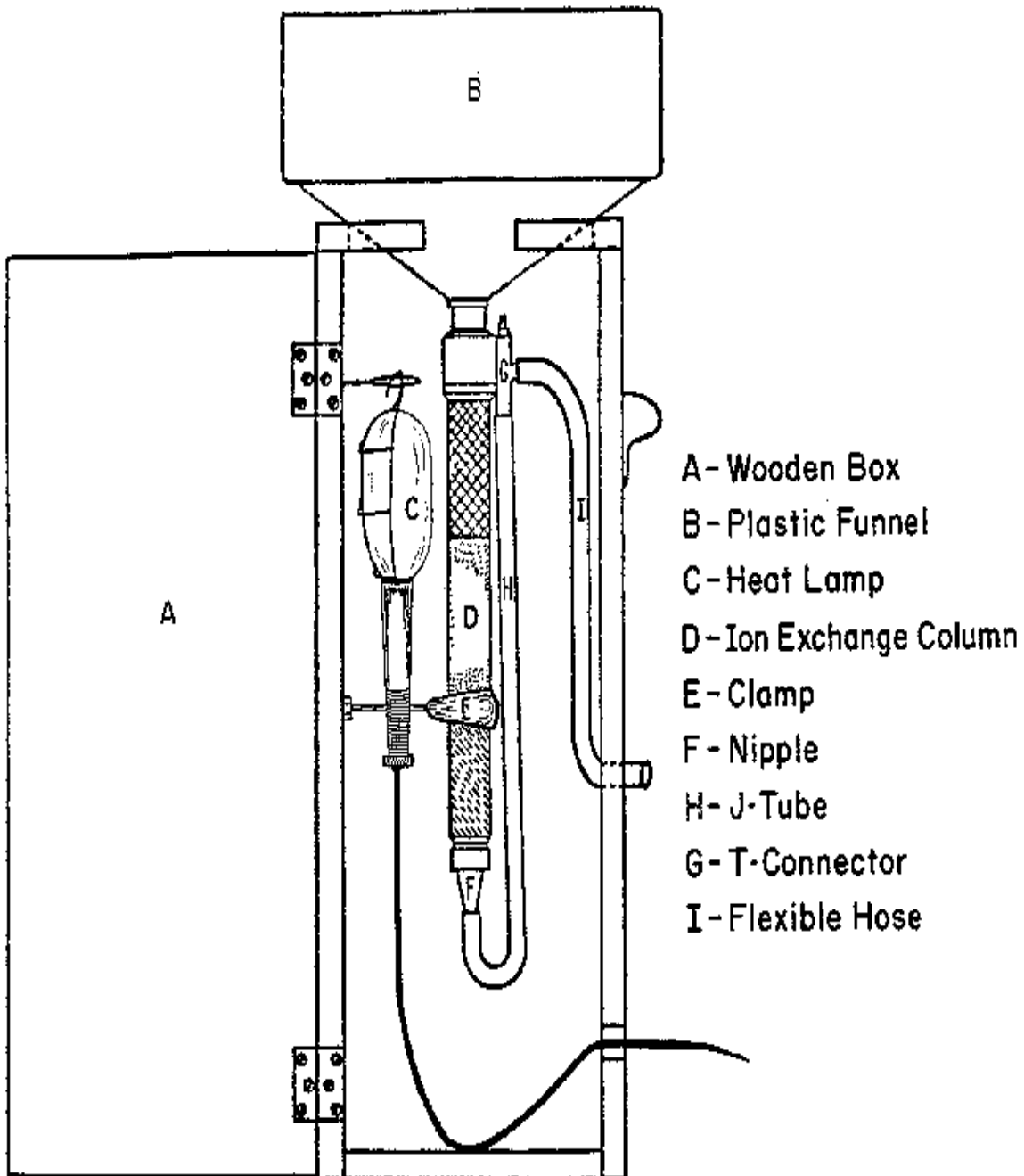


Figure 7.7 Ion-exchange fallout collector unit.

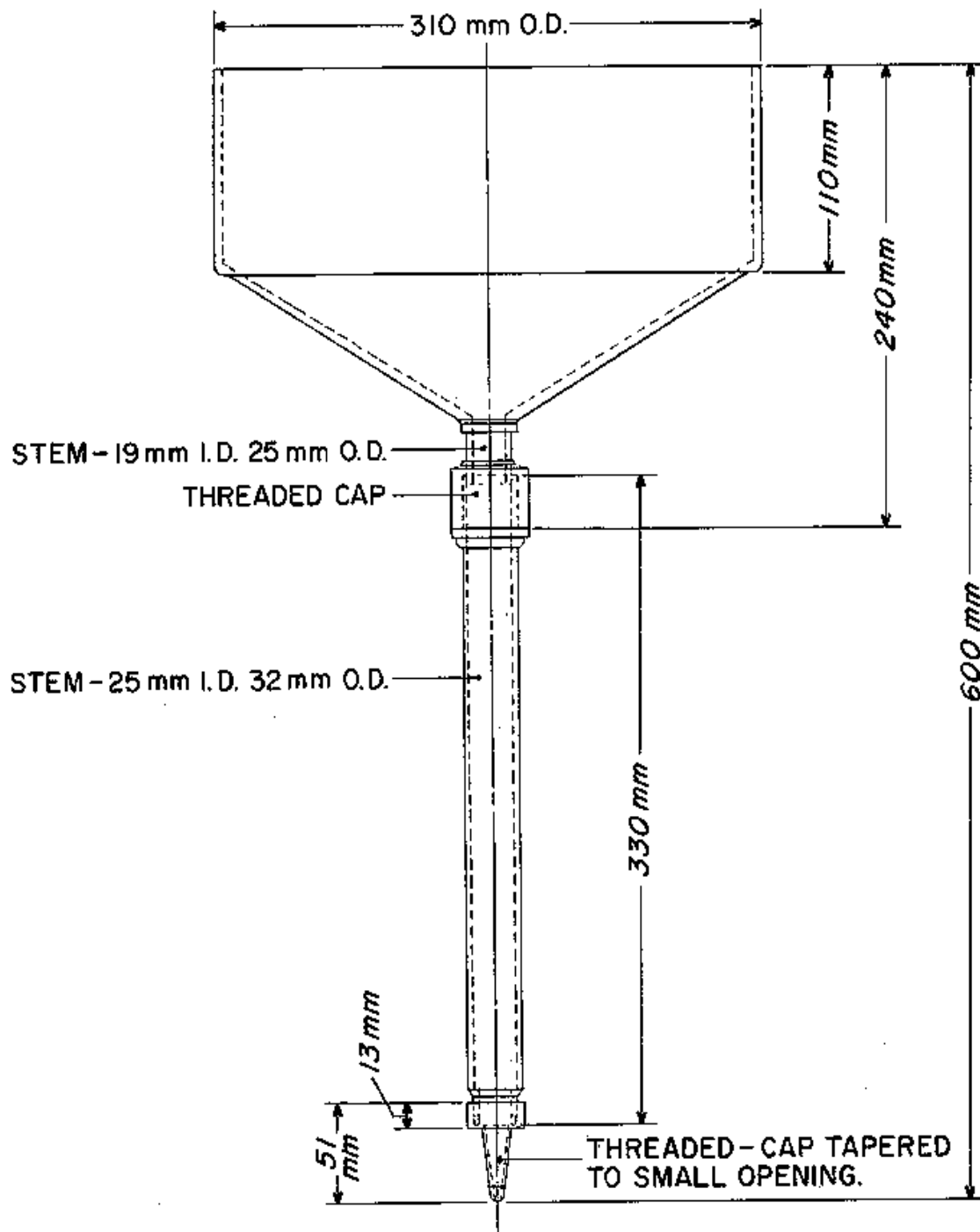


Figure 7.8 Schematic diagram of funnel, column, and tapered cap.

7.15 ELECTROLYSIS ELECTRODE

7.15.1 DESCRIPTION

The platinum electrolysis electrode is used in the electrodeposition procedure (see Figure 7.9). It is attached to a rotary motor and intended for use in the plating cell described in Specification 7.16. It is separated from the platinum electrodeposition disk by 1 cm.

7.15.2 SUPPLIER

Johnson-Matthey, Inc.
2001 Nolte Drive
West Deptford, NJ 08066
(609) 853-8000

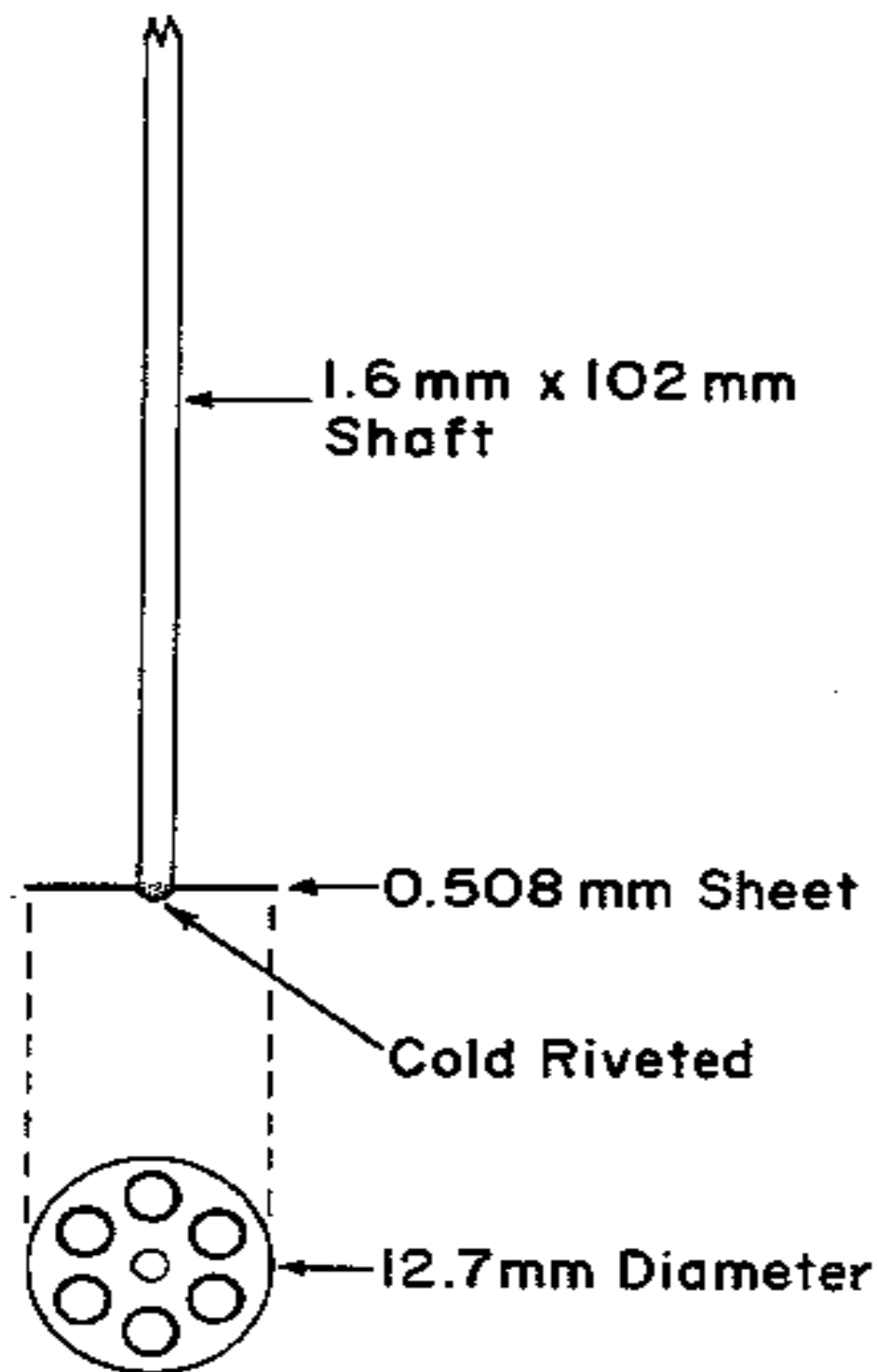


Figure 7.9 Platinum anode for electrolysis (drawn twice actual size).

7.16 PLATING CELLS

7.16.1 DESCRIPTION

The plating cell used at EML for electroplating on platinum discs is based on numerous other designs, chiefly the one used at the Laboratory of Radiation Biology, University of Washington (see Figure 7.10).

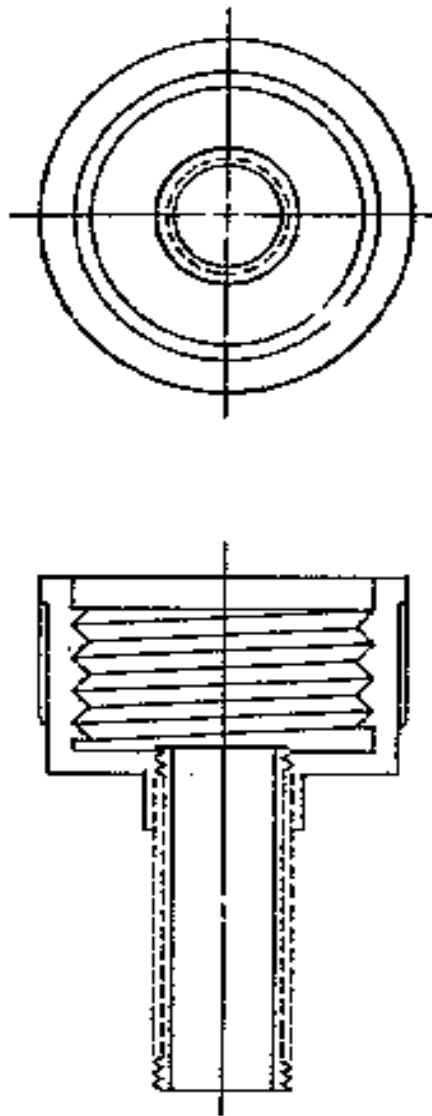


Figure 7.10 Plating cell.

The major feature of the cell is an elongated 20-mm cap for either a 30 mL (1 oz) or a 60 mL (2 oz) polyethylene bottle. This cap has space for an 18-mm diameter plating disc and has a threaded brass bushing for making electrical connection.

In use, the bottom is cut off either a 30-mL or 60-mL bottle (20-mm cap size), and any flashing or other roughness on the top of the bottle is smoothed by rubbing once or twice over a piece of sandpaper if necessary. The plating disc is placed on the cap and the bottle is screwed in firmly.

Electrical connection may be made by a clip, or by threading the bushing into a metal plate which then also acts as a support for the cell.

7.16.2 SUPPLIER

Phoenix Custom Molders, Inc.*
Five Wickers Drive
Wolfeboro, NH 03894
Phone: (603) 569-5100
Fax: (603) 569-6041

*See Specification 7.2.3.

7.17 AIR SAMPLING FILTERS

7.17.1 DYNAWEB DW7301L FILTERS

Since the end of 1992, all sites in SASP and RAMP have been supplied with Dynaweb filters. The filter is composed of a 100% polypropylene web that is 100% binderless. Three layers of this web are collated and sandwiched between two sheets of a protective DuPont Reeme (100% polyester) scrim. The top scrim is removed prior to sampling at RAMP sites because after their return to EML for analysis these samples are compressed into a pellet and the scrim hinders compression. At all other sites, the filter can be used in sampling with both the top and bottom scrim in place. The filter medium weighs about 20 mg cm^{-2} , has an ash weight ranging from 0.1-1% of the total weight, and about 65 cm^2 of the filter can be compressed to 1.3 cm^3 at 5 tons pressure. Radio-chemical analyses of blank filters for ^{90}Sr , ^{238}Pu , and ^{239}Pu indicate values that are near or below the lower limits of detection for these analyses. Gamma-ray spectrometry on blank filters indicates the absence of the gamma-ray emitting isotopes that we routinely report.

The collection efficiency of the Dynaweb filter media was determined using electrically classified monodisperse aerosols of dioctyl sebacate (DOS) liquid and sodium chloride (NaCl) solid particles. The test aerosol particle sizes and face velocities ranged from 0.015 to $0.5 \text{ }\mu\text{m}$ at 30 and 100 cm sec^{-1} NaCl, and from 0.05 to $0.5 \text{ }\mu\text{m}$ at 50 to 100 cm sec^{-1} for DOS. The submicron particle penetration data are summarized in Figure 7.11. The most penetrating particle size is in the 0.07 to $0.1 \text{ }\mu\text{m}$ range. The minimum collection efficiency, using a test aerosol of NaCl at a face velocity in the vicinity of 100 cm sec^{-1} was about 87%. The average pressure drops at face velocities of 50 and 100 cm sec^{-1} were 2.26 and 3.92 kPa , respectively.

Filter intercomparisons are conducted using Microdon LM2020 and Dynaweb DW7301L materials at EML's Regional Baseline Station at Chester, NJ, and in Barbados by the University of Miami. The filter samples collected at Chester, NJ, were measured for ^7Be and ^{210}Pb , while those from Barbados were measured for dust loading, sodium, chloride, nitrate, and non-sea salt sulfate. Statistical t-tests and Sign tests were performed on the paired data to determine if the measured differences were significant. At the 95%

probability level, in all but one case (^{210}Pb), no t-test or Sign test indicated a significant difference between the two filters.

Dynaweb DW7301L is manufactured and distributed by:

WEB Dynamics
1 Forge Road
East Stroudsburg, PA 18301

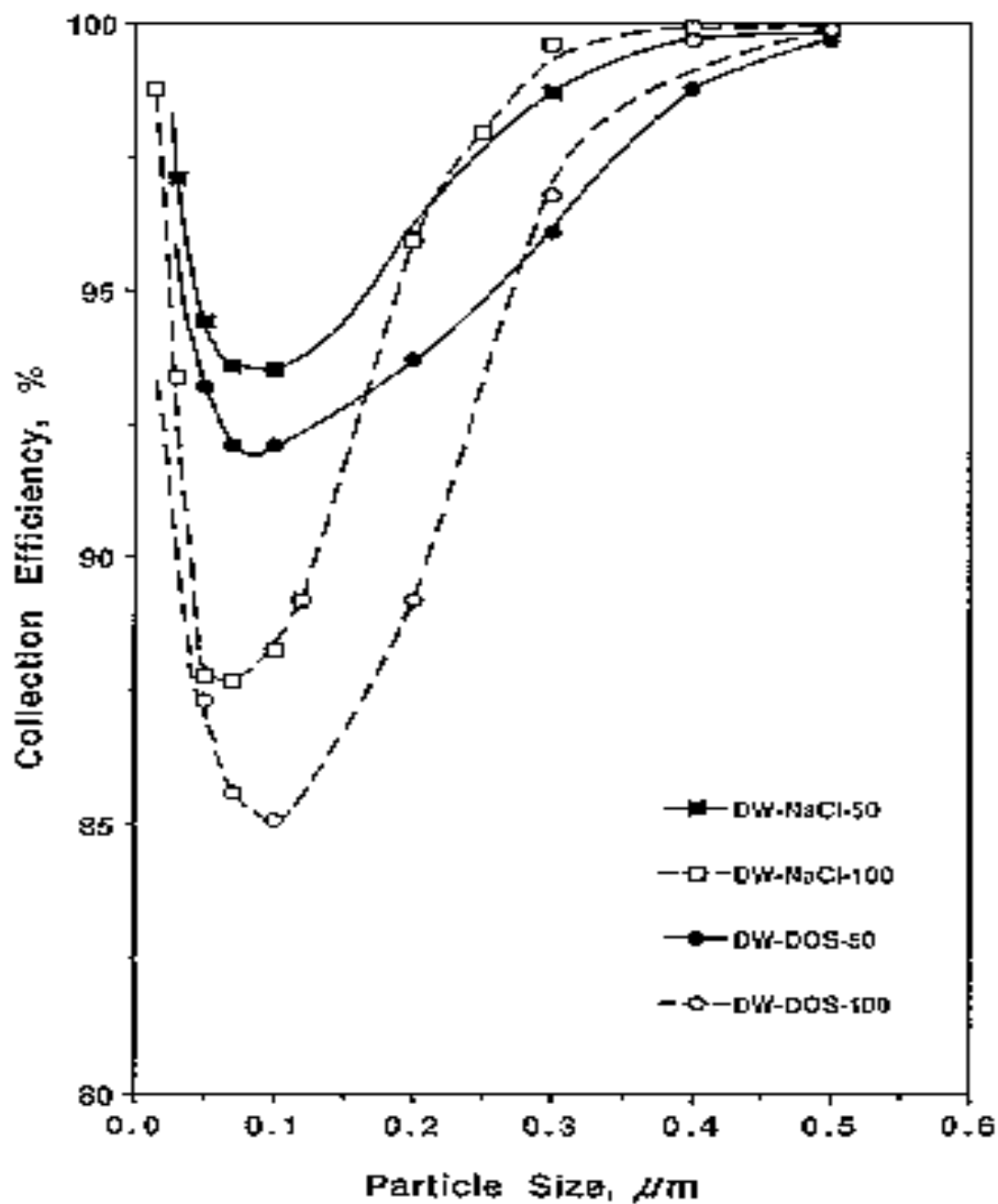


Figure 7.11 Submicron particle penetration data.

REFERENCES

Cambray, R. S. and K. Playford

Unpublished data

AERE Harwell, Oxfordshire, England, December (1985)

Lockhart, L., R. Patterson and W. Anderson

"Characteristics of Air Filter Media Used for Monitoring Airborne Radioactivity"

Naval Research Laboratory Report NRL-6054, June (1964)

7.18 AIR SAMPLERS

7.18.1 ROOTS SYSTEM

The SASP sites are equipped with a Roots Rotary Lobe Blower Type 24 AF connected to a 1 HP electric motor by a fan belt. Roots lobe pumps fall into a category of pumps where volumetric displacement is the means by which flow is induced. Lobe pumps use two counter-rotating impellers to provide flow. As each impeller passes over the inlet, a volume of air is trapped, carried through the blower to the discharge and is expelled against the discharge pressure. Figure 7.12 shows a sketch of the Roots pump and motor. Figures 7.13 and 7.14 show a detailed and field view of the Roots system. The Roots rotary is manufactured by:

Dresser Industries Incorporated
Roots Blower and Vacuum Pump Division
Connersville, IN 47331

The local distributor is:

Hayes Machine Co.
11-03 43rd Road
Long Island City, NY 11101

The electric motor which is used to drive the blower is purchased from:

Harry Lumb and Associates, Inc.
39 Golden Star
Irvine, CA 92714

The specifications on the electric motor are:

60/50 Hz, 115/230 V, 15/7.5 Amps
Single Phase, 1 HP, 1725 RPM
TEFC, Frame ELX-182T, Design B
Code J, Ambient 40°C, Insulation Class B
SF1.2, Continuous Duty

The Roots system, composed of blower, motor, frame, plumbing, and accessories costs ~ \$2500 including labor. The wooden shelter and metal stand both cost about \$500 each.

7.18.2 FUJI SYSTEM

The RAMP sites are equipped with a Fuji ring compressor Model 302P which is directly connected to a 0.5 HP electric motor. Fuji ring compressors induce flow through momentum transfer. Air enters through an inlet port and is accelerated by the impeller. Through centrifugal force, energy is imparted to the inlet air which is discharged out of the pump outlet. Figure 7.15 presents a sketch of the Fuji system. Figures 7.16 and 7.17 show a detailed and field view of the Fuji system. The Fuji Ring Compressors are manufactured by:

Fuji Electric Corp. of America
Frassetto Industrial Park
6A Frassetto Way
Lincoln Park, NJ 07035

These compressors are distributed by:

The Knotts Company, Inc.
350 Snyder Avenue
Berkeley Heights, NJ 07922

The Fuji Compressor motor has the following specifications:

50/60 Hz, 115/230V
5.0/2.5 Amp, Single Phase
0.51 HP

The Fuji system containing the ring compressor, aluminum housing, sampling manifold and accessory equipment is purchased from:

Dr. Joseph Prospero
University of Miami
Rosenstiel School of Marine and Atmospheric Science
Miami, FL 33181

The cost is ~ \$2500 per system.

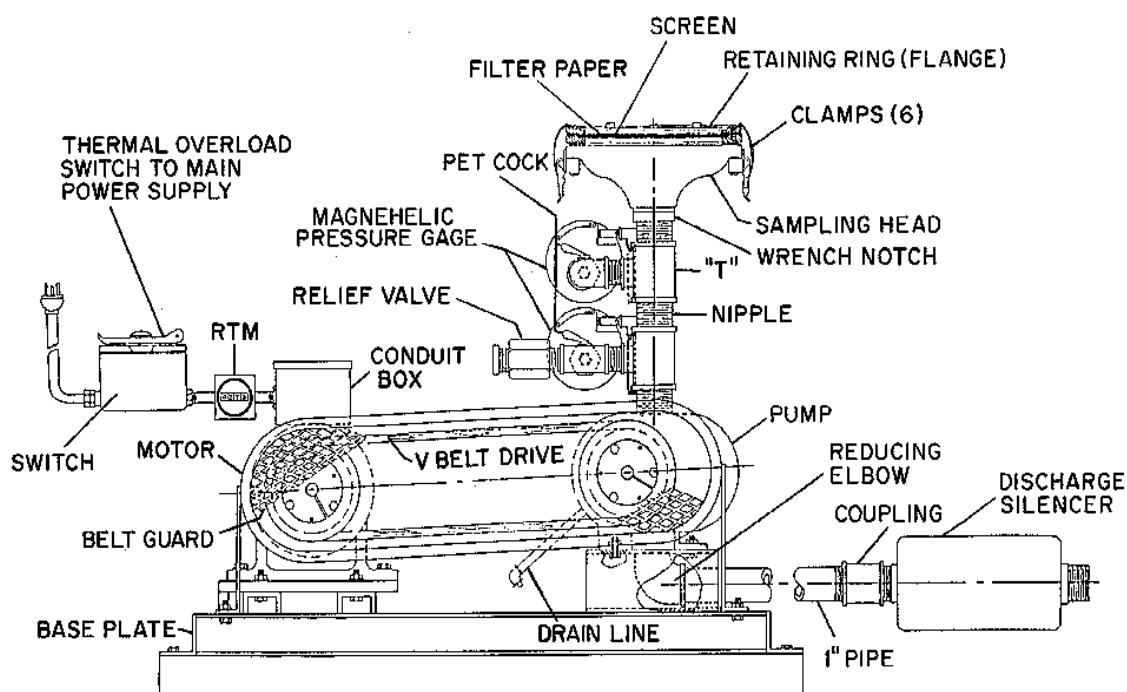


Figure 7.12 Sketch of the Roots system.

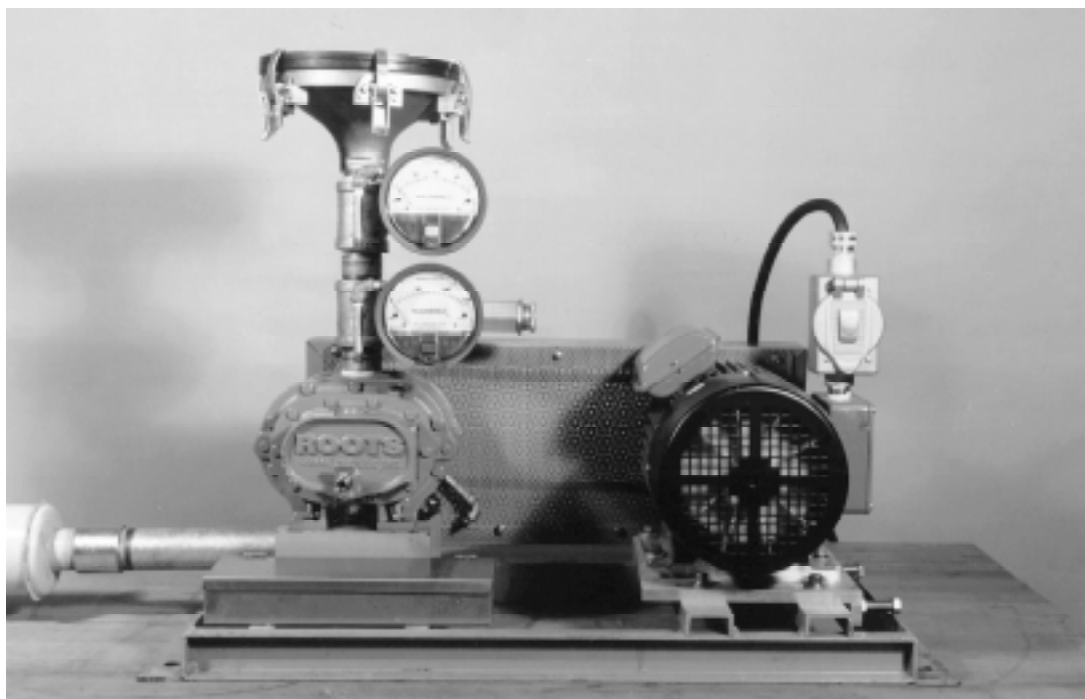


Figure 7.13 Detailed presentation of the Roots system.

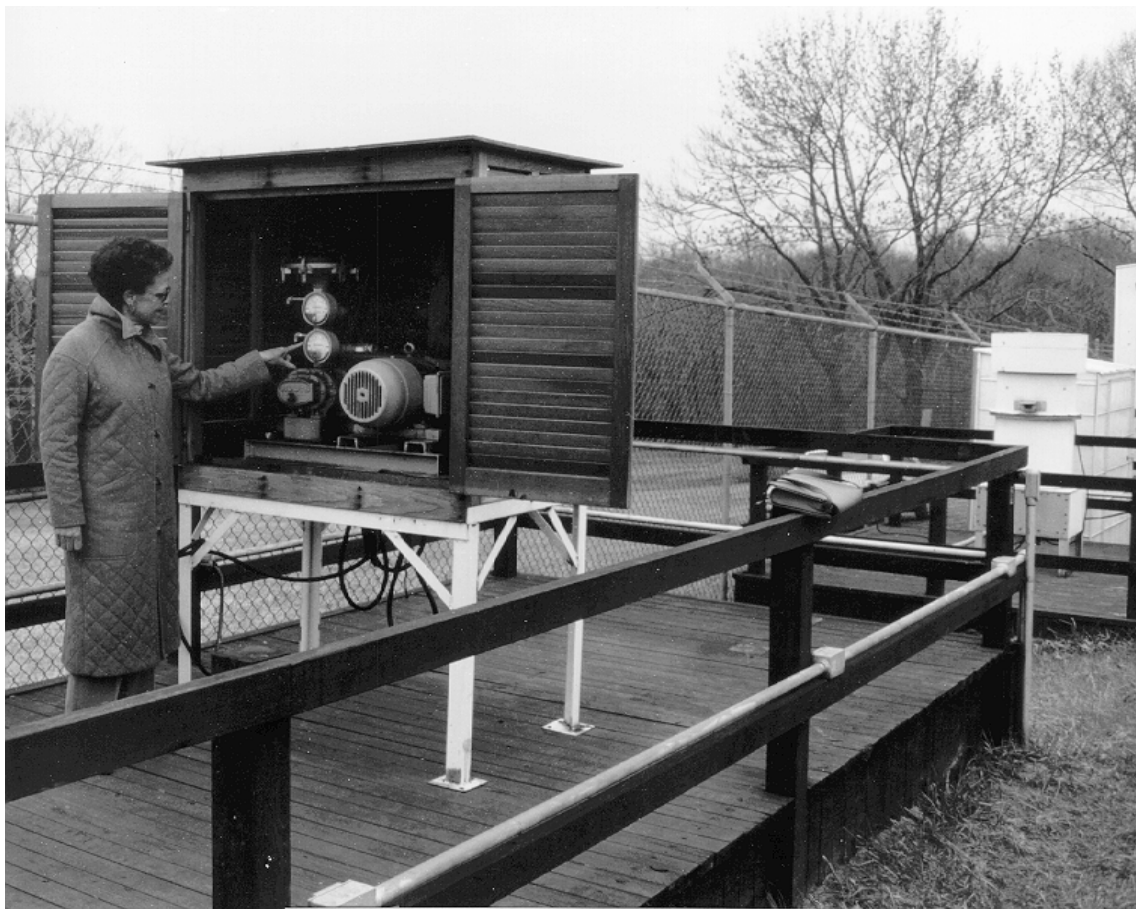


Figure 7.14 The Roots system at a field site.

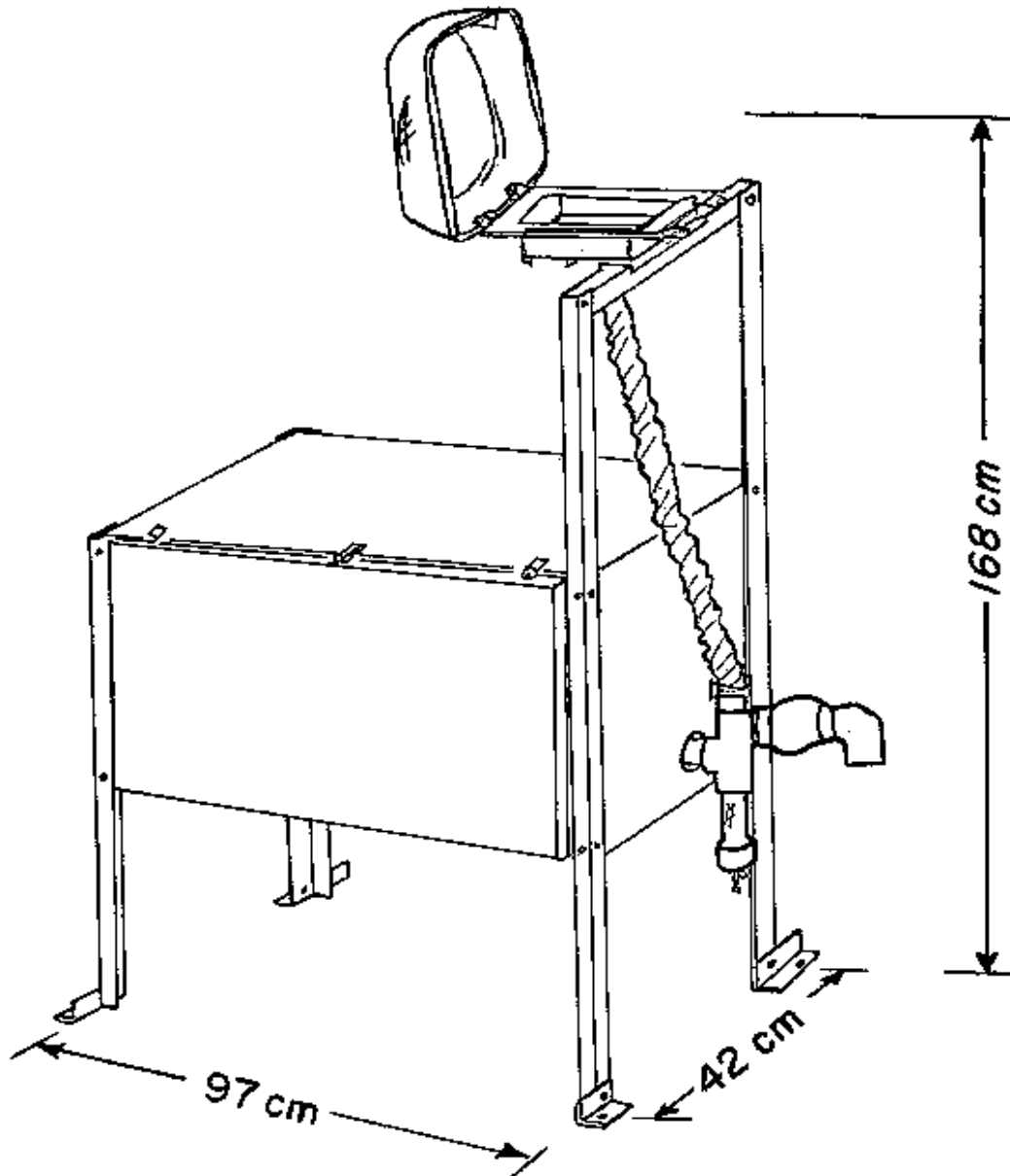


Figure 7.15 Sketch of the Fuji system.

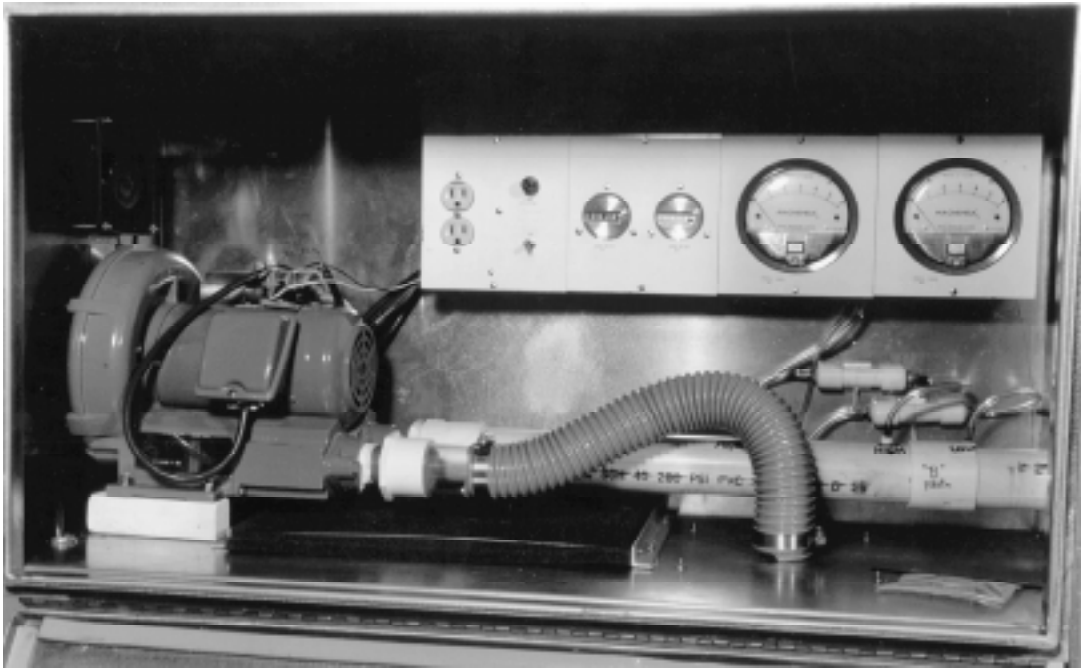


Figure 7.16 Detailed presentation of the Fuji system.



Figure 7.17 The Fuji system at a field site.

7.19 GAMMA PLANCHETS

7.19.1 DESCRIPTION

This is a planchet molded of nylon. The inside diameter is 50.8 mm, the depth is 25.4 mm, and the mean wall thickness is 0.64 mm. A flat circular cover is also provided.

These planchets are used to provide a uniform geometry for gamma counting air particulate filter samples and other similar materials. The filters are pressed into the planchet with a hand-operated hydraulic press using a steel die. When used in this way, a 6.35-mm hole is cut in the bottom of the planchet to allow the filter to be punched out for radiochemical analyses after counting.

7.19.2 SUPPLIER

The planchets are available from:

Phoenix Custom Molders, Inc.*
Five Wickers Drive
Wolfeboro, NH 03894
Phone: (603) 569-5100
Fax: (603) 569-6041

*See Specification 7.2.3.

7.20 ELECTROLYSIS CELLS*

7.20.1 DESCRIPTION

- A. This electrolysis cell was developed at New York University for the electrolytic enrichment of tritium in acid solution. The electrodes were subsequently modified at EML by replacing a coiled platinum wire with platinum sheet.

The cells that were used at EML were made by a commercial glass blower from the drawing shown in Figure 7.18, using standard glass tubing and standard taper joints.

- B. This electrolysis cell (Figure 7.19) was developed at the University of Miami by Dr. Gote Ostlund for the electrolytic enrichment of tritium in alkaline solution. The cell is also used for the final distillation of the enriched sample.

For distillation, an adapter and receiver were substituted for the funnel top.

* *No longer used at EML.*

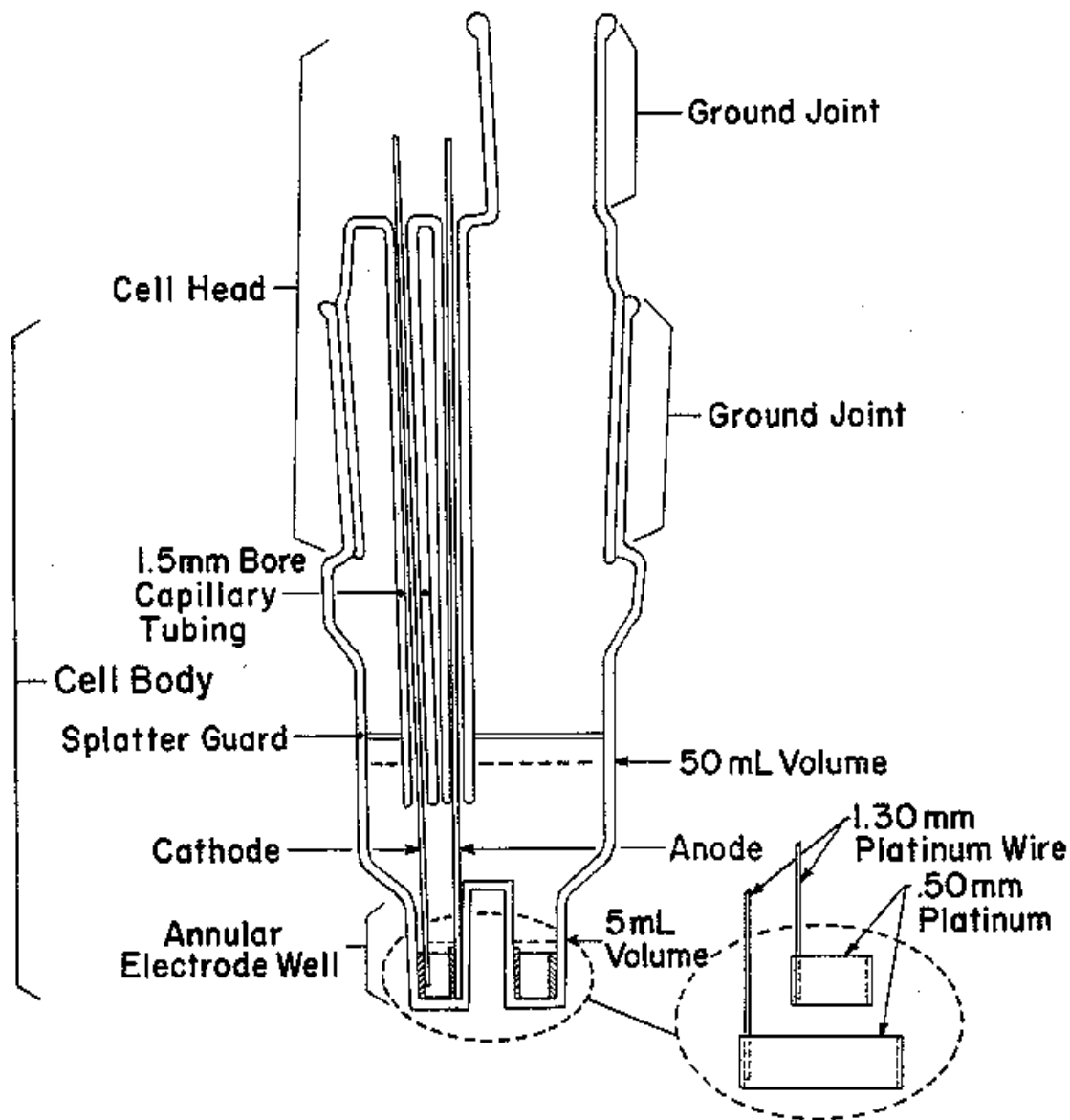


Figure 7.18 Electrolysis cell.

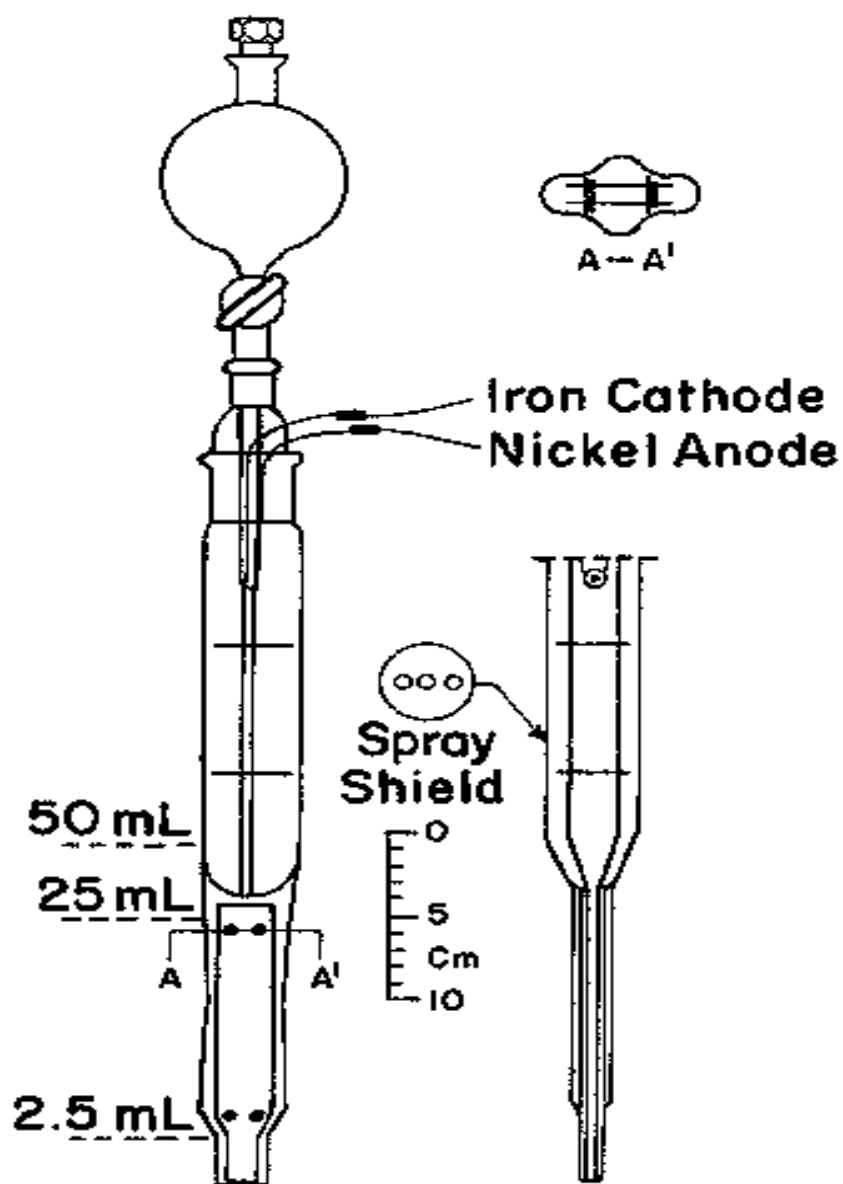


Figure 7.19 Alkaline electrolysis cell.

7.21 ALUMINUM SAMPLE CANS FOR GAMMA COUNTING

7.21.1 DESCRIPTION

The sample containers for gamma counting and gamma spectrometry measurements are drawn, straight-walled, "step shoulder" aluminum can bodies and accompanying "full panel pull out" lids. The body and lid are fabricated from .254 mm and .305 mm thickness, respectively, of various alloy-temper combinations of aluminum, and their inside surfaces are enameled.

One size is in current use. It holds about 100 mL and is about 60.325 mm by 31.8 mm. It is described as:

208 x 107 can body
209.5 lid

7.21.2 SUPPLIER

They are available from:

The Central States Can Corporation
P.O. Box 642
Massillon, OH 44648-0642
(330) 833-1011
FAX: (330) 833-9932

The device for sealing the lid to the can is the Automatic Portable Electric Can Sealer, No. EL-12253-120V available from:

Wisconsin Aluminum Foundry Co., Inc.
P.O. Box 246
838 South 16th Street
Manitowac, WI 54220
(414) 682-8627
FAX: (414) 682-4090

7.22 MOLDED MARINELLI BEAKERS

7.22.1 DESCRIPTION

The annular sample containers for gamma counting and gamma spectrometry of soil samples are molded from black Butyrate (see Figure 7.20). They are fitted with a snap cap and the wall thickness is ~ 0.18 cm. The capacity of the beaker is about 600 mL.

7.22.2 SUPPLIER

They are available from:

Phoenix Custom Molders, Inc.*
Five Wickers Drive
Wolfeboro, NH 03894
Phone: (603) 569-5100
Fax: (603) 569-6041

in lots of 100 or more.

Similar molded sample containers with 1 L and 4 L capacities (see Figure 7.21), having a 7.6 cm deep well to fit standard 7.6 cm x 7.6 cm NaI crystals are available from:

GA-MA AND ASSOCIATES, INC.
P.O. Box 2918
Ocala, FL 34478-2918
Phone: (352) 687-8840 or gama@atlantic.net

in lots of 25 or more.

These containers were specifically designed to fit the current Ge(Li) detectors. They will also fit some integral line NaI(Tl) detectors, but will not fit most of the standard crystals.

*See Specification 7.2.3.

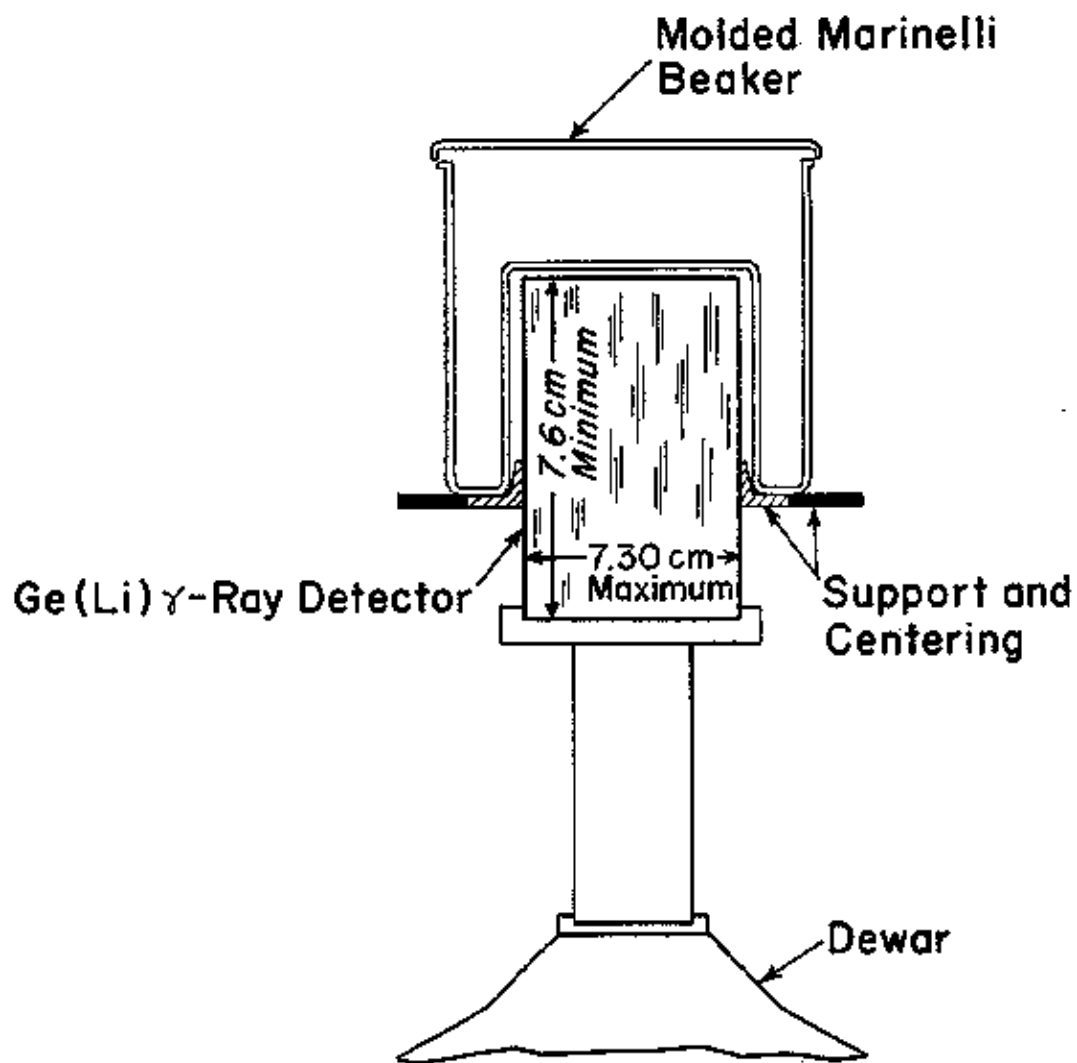


Figure 7.20 Molded Marinelli beaker.

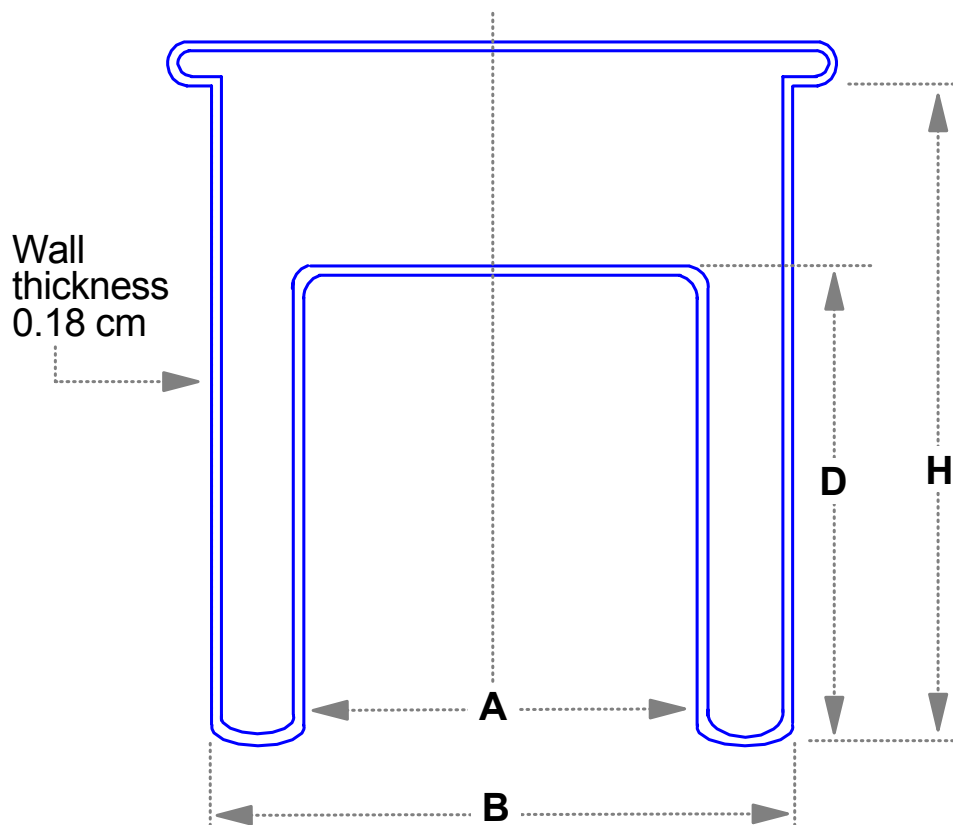


Figure 7.21. Molded Marinelli beaker.

Part* No.	Capacity (mL)	Well Dia. A-mm	Well Depth D-mm	Beaker Dia. B-mm	Beaker Height H-mm	Detectors
J762A	500	77.5	70.0	116.0	104	Most Ge(Li0; old NaI(Tl)
J762B	500	86.0	70.0	116.0	104	Newer NaI(Tl)-dia.>2 7/8
J1155	650	98.5	92.8	125.2	122	Ge(Li); NaI(Tl)

*Phoenix Custom Molders, Inc.

7.23 RADON SAMPLING AND COUNTING FLASKS

7.23.1 DESCRIPTION

Scintillation flasks are made up of methyl-methacrylate tubing and sheet. They are fitted with simple valves for flow-through samplings. The bottoms of the flasks are cemented in, while the tops slide in with O-ring seals. They range in size from 165-2.0 L. A schematic drawing and photograph of the 415-mL scintillation flask are shown in Figures 7.22 and 7.23.

7.23.2 COATING FLASKS

Materials

1. DuPont 1101 silver-activated zinc sulfide phosphor.
2. Bonding solution (caution - flammable). Dissolve 30 mL of Dow Corning 200 silicone fluid (200,000 cs) in 285 mL of reagent benzene plus 285 mL of reagent cyclohexane. This is enough for about 100 flasks.

Procedure (Use a Hood)

1. Clean the flask with a nonabrasive cleaner. A plastic cleaning foam (Ren RP-70 cleaner) has been found to be excellent.
2. Remove cover, add 50 mL of the bonding solution, close both valves, replace cover and rotate the flask slowly until all surfaces are coated. Open valves and remove cover.
3. Pour out bonding mixture into a second clean flask or return to the stock bottle. Air dry the flask for a few minutes.
4. Add 15-20 g of phosphor, close both valves and replace cover.

5. Shake gently until all surfaces are coated. Open valves and remove cover.
6. Pour the loose powder into a second flask or a clean container. Blow off excess phosphor from flask.
7. Replace cover and purge the flask with aged air or nitrogen for a few minutes. Close the valves and store the flask for use.
8. When background becomes excessive through use, wipe out phosphor with tissues, clean, and rephosphor.

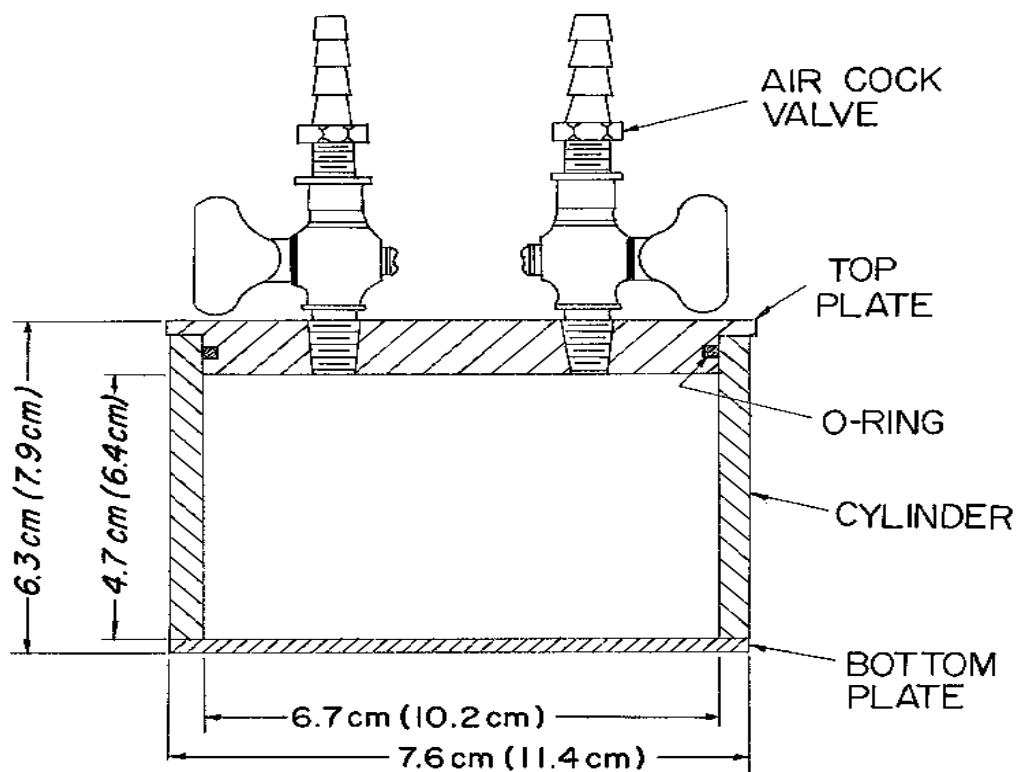


Figure 7.22 Schematic drawing of scintillation flask.

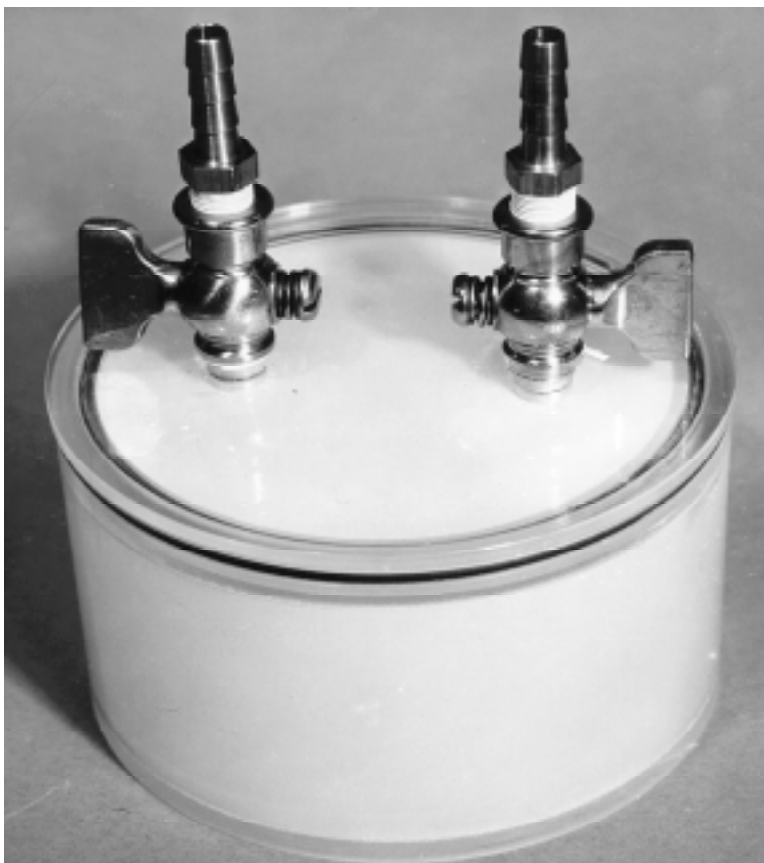


Figure 7.23 Photograph of
scintillation flask.

7.24 CONTAINERS FOR THE COLLECTION OF FALLOUT AND ATMOSPHERIC DEPOSITION

7.24.1 DESCRIPTION

Samples of atmospheric deposition that are obtained using a wet/dry collector (see Section 2.3.4) and that are to be measured for radioactive fallout or for the chemical composition of the deposited material are usually collected using a polyethylene bucket of the type that has been used by the National Atmospheric Deposition Program/National Trends Network (NADP/NTN).

These (3.5 gallon) buckets, which will hold about 13 kg of water, are constructed of high density polyethylene. The ears for the wire bail are integrally molded near the top of the container. The bucket is molded in one piece and with two reinforcing rings around the outside diameter above the ears to provide additional container strength. The body of the bucket is tapered to permit one pail to nest inside another for economical shipping and storage of empty buckets. The inner rim of the plastic cover interlocks with the upper rim of the bucket. An O-ring seal in a groove just inside of the rim of the cover presses down against the bucket rim and prevents leakage after the cover has been hammered into place, using a rubber mallet. The covers must be discarded after one use because their rims need to be cut in order to remove them from the buckets. The buckets may be cleaned and reused for most purposes. We obtain the buckets and covers from:

Southcorp Packaging Bennett Industries
Peotone, IL 60468
(708) 258-3211

We use custom made cubic fiber boxes for mailing the buckets to and from distant sampling sites. For mailing the boxes, we use a reversible, plastic covered address card, with the site address on one side and our address on the other side. We commonly glue a return address label to the box within the frame that holds the reversible address label so that the box can be returned to us even if the reversible label is lost during shipment.

There are a few problems that have been encountered in the use of these sample buckets. When the buckets are cleaned routinely for reuse, some contamination may remain in them. The cleaning process has to be designed and monitored to prevent cross contamination of samples. When the rims of the lids are cut to facilitate their removal from the buckets, care must be taken not to cut the surface of the bucket also, if the buckets are to be reused. During the NADP/NTN it has been shown that the O-rings are a potential source of contamination even if they have been cleaned before use. If the buckets are upside down or lying on their sides for some period during shipment, the water sample may dissolve small amounts of sulfate and other materials from the O-rings. For most uses to which the buckets may be put, this should not be a major problem.

7.25 FALLOUT COLLECTION AND SHIPPING CONTAINER

7.25.1 DESCRIPTION

The sampling containers for the EML wet/dry collectors are polyethylene pails (see Section 2.3.4) particularly well suited for shipping because of the design of the lip and cover. On the underside rim of the cover there is a groove with an O-ring seal. When the cover is securely hammered onto the pot with a rubber mallet, no leakage will occur. In most cases when the cover is removed back at the laboratory, it is destroyed.

The samples are shipped in fiber mailing boxes.

7.25.2 SUPPLIER

They are available from:

FIBERBILT
601 West 26th Street, 15th Floor
New York, NY 10001
(212) 675-5820

7.26 DISPOSABLE CHROMATOGRAPHIC COLUMN

7.26.1 DESCRIPTION

The column is prepared from a disposable polyethylene transfer pipette. The pipette used here (Bio-Rad Cat #223-9527, Style EE) has a working capacity of ~4.5 mL and a barrel ~100 mm long and 6.5 mL O.D.

7.26.2 SUPPLIER

Bio-Rad Laboratories
2000 Alfred Nobel Drive
Hercules, CA 94547
(510) 741-1000
FAX: (510) 741-1060