UNIVERSITY OF CONNECTICUT HEALTH CENTER
ASBESTOS AWARENESS POLICY

Introduction

The exposure to asbestos fibers have been shown to be a causative factor for lung cancer and lung disease. Asbestos containing materials are those products that have greater than 1% asbestos in them. Many materials contain asbestos and if left undisturbed will be of minimal risk. If asbestos containing materials are "friable" a potential airborne hazard could exist. "***Friable"*** means crumbled, pulverized, powdered, crushed or exposed asbestos which is capable of being released into the air by hand pressure. "***Non*-friable** means a condition in which fibers are only released by a mechanical means such as grinding or sanding. OSHA has classified thermal system insulation and surfacing materials installed prior to 1980 as asbestos containing materials (ACM) or presumed asbestos containing material (PACM). In either case, care must be taken to avoid generating fine particles that could be inhaled. Any insulation, asphalt and vinyl floor covering installed prior to 1980 must be considered as potentially containing asbestos unless proven otherwise. OSHA has published a general industry standard on asbestos (29 CFR1910.1001) that is available on the Office of Research Safety and is also appended to this policy (website http://ors.uchc.edu). Questions regarding asbestos safety may be directed to the Office of Research Safety (x 2723).

Asbestos Policy

An untrained employee, contractor, student or other individual working in or frequenting the University of Connecticut Health Center facility and/or grounds shall not perform any type of asbestos work. All removal or disturbance of asbestos containing materials (ACM) shall be performed under controlled conditions by asbestos abatement workers appropriately trained and approved by the Connecticut Department of Public Health.

Common Asbestos Containing Products

Asbestos can be found in many products. Items or materials that may contain asbestos include roofing, walls and ceilings, panels and partitions, boilers and water tanks, heaters, flues and tank insulation, decorative plaster finishes, car parts, sprayed on coatings and insulation, gaskets, ovens, kilns, lab bench counter tops, fume hood panels, floor tiles and adhesive (mastic) and insulation. The Office of Research Safety has conducted surveys of various UCHC building components to determine if they contain asbestos. Asbestos surveys and information was collected during 1985,1986,1987,1988,1989,1990,1991,1992, 1994 and has updated a comprehensive database through 2010. This database provides a listing of areas tested in the past and whether asbestos was detected or not. This database is appended to this document and any questions should be directed to the Office of Research Safety (2723). *It should be noted that areas identified as containing ACM may have been renovated since the surveys were done.* Documented asbestos containing materials at the UCHC have included insulation, roofs, floor tile, mastic, wallboard and blowers. It should be emphasized that not all of these items at the UCHC contain asbestos and those that do are of minimal hazard if left undisturbed. Contact the Office of Research Safety regarding locations of asbestos containing materials. Any suspect material should not be disturbed without contacting the Office of Research Safety at x2723.

Health Risks from Asbestos Exposure

Asbestos exposure has been shown to be a causative agent in lung cancer and lung disease. There is also an association between smoking and an increased risk of lung cancer 90 times greater than exposure to asbestos alone. The common physical effects of asbestos exposure are

Asbestosis: Asbestosis is a serious, progressive, long term non-cancer disease of the lungs.

Lung Cancer: Lung cancer is a major cause of death in those individuals who have had exposure to asbestos.

Mesothelioma- Mesothelioma is a rare form of cancer that is found in the thin lining (membrane) of the lung, chest, abdomen and heart and almost all cases are linked to asbestos exposure.

Exposure to asbestos increases your risk of developing lung disease, and that risk is made worse by smoking. OSHA requires that information be provided to all smokers with the intent of assisting them in cessation of their smoking habit. Information may be obtained by contacting the Employee Health Service (x2893), by obtaining NIH Publication No: 89-1647 (available at http://www.hoptechno.com/book43.htm) or contacting the Office of Research Safety.

Asbestos Disturbing Activities

OSHA has established a permissible concentration of asbestos fibers in air that may be breathed 8 hours per day, 5 days per week without a significant risk of developing lung cancer or lung disease. However, when an isolated disturbance of asbestos containing material occurs, there is no immediate mechanism to determine if a safe airborne concentration exists. The following activities may result in the disturbance of suspect asbestos containing materials:

Removing or repairing floor tile
Drilling into floor tile
Removing or repairing ceiling tiles
Removing pipe insulation or pipe joint compound to access pipes
Knocking holes in plaster ceilings, walls, wallboard
Removing carpet with floor tile underneath it
Drilling into lab bench tops

It should be noted that if asbestos containing materials are intact and not “friable”, there is little risk of exposure if left undisturbed (not drilled, sanded, chipped, broken, etc)..

Response to Possible Asbestos Release

If you believe there has been a disturbance involving asbestos, **STOP** what you are doing, hold your breath, notify any others in the area and exit the immediate area. Call the Office of Research Safety during normal working hours and the fire department off-hours (7777). A brief exposure is not life threatening nor is it immediately dangerous or is there a likelihood you will develop lung cancer or other lung disease. There is no need to panic in such situations.

Housekeeping Procedures

OSHA has established proper procedures for routine housekeeping operations. Following these procedures will minimize the potential for the generation of asbestos fibers. Employees who perform housekeeping operations in areas where asbestos containing materials (ACM) or potential asbestos containing materials (PACM) may be present (probably in floor tiles) should follow the following guidelines:

Sanding of ACM or PACM flooring is prohibited
Stripping shall be done using low abrasion pads
Stripping speed less than 300 rpm
Dry buffing only when ACM has sufficient finish to avoid contact with pad

Facilities Maintenance and Renovation

Individuals involved in routine facility maintenance and/or facility renovation projects must also be aware of asbestos containing materials and ensure they are not disturbed. Renovation projects require advanced planning in order to arrange for an asbestos abatement contractor to remove the asbestos safely. Contact the Office of Research Safety for information on the location of asbestos containing materials or to arrange for sampling of questionable materials.

Posting of ACM Areas

Warning signs must be placed in areas where activity is regulated because of the presence of ACM. The UCHC has no “regulated” areas. Entrances to rooms or areas in which employees reasonable can be expected to enter and which contain ACM and /or PACM, signs shall be posted which identify the material which is present with information to ensure the material will not be disturbed. Material identified as containing ACM or PACM shall be labeled with instructions not to disturb or generate dust.

Training

There are no areas at the UCHC that would require the detailed training specified by 29 CFR 1910.1001,(j),(7) as the potential for exposure above the PEL and/or excursion limit is not possible under normal operating conditions. Appropriate employees will be trained yearly on asbestos awareness as described in 1910.1001,(j),(7), (iv) and (v).

YEAR	UCHC #	WHAT TYPE OF SAMPLE	RESULTS	ROOM#
2010	71410	mastic	10-15% CHRYSOTILE	BM-006 dental prosthetics lab renov
2010	81010 inlet	pipe insulation inlet	1-3% Chrysotile	inlet pipe to coils system #78
2010	81010 outlet	pipe insulation outlet	1-3% Chrysotile	outlet pipe to coils system #78
2010	121510 A-D	countertops	NO ASBESTOS	tops found in trailer at warehouse
2008	1208-A	floor tile	2-5% chrysotile	ECC Control room CB-015
2008	1208-B	mastic	1-3% Chrysotile	ECC Control room CB-015
2008	11108-A	heat exchanger system 81	NO ASBESTOS	heat echanger #81 "C" basement
2008	11108-B	heat exchanger system 81	NO ASBESTOS	heat echanger #81 "C" basement
2008	DC1,3,5,7,8	cove molding adhesive	NO ASBESTOS	Dental clinic 1,3,5,7,8,9
2008	filecab	insl in flame proof file cab	NO ASBESTOS	400 Farmington Ave
2008	brick	fire brick incinerator lining	NO ASBESTOS	400 Farmington Ave
2008	bot	bottom cement material incinerator	NO ASBESTOS	400 Farmington Ave
2008	incin base	incinerator base	NO ASBESTOS	400 Farmington Ave
2008	10608-1	countertop adhesive	5-15% CHRYSOTILE	400 Farmington Ave-Instr rm
2008	10608-2	countertop adhesive	5-15% CHRYSOTILE	400 Farmington Ave - storage
2008	LSB-014T	floor tile	<1% chrysotile	fac mgmt conf rm - LSB-014
2008	LSB-014M	mastic	NO ASBESTOS	fac mgmt conf rm - LSB-014
2007	102207	debris found above ceiling	NO ASBESTOS	CG_042, 043
2007	102307	bulk elbow insl steam valve	NO ASBESTOS	system 79 "C" basement
2007	121207	bulk ceiling material - solid ceiling	2-3% chrysotile	Bursar's Office LM-035 C. Sargis
2006	4506	Elbow insulation	NO ASBESTOS	Condensate line ?? Contractor
2006	3706	Gasket material chilled water line	40-60% CHRYSOTILE	Blower #2
2006	31506-A	Valve insulation cold water	NO ASBESTOS	Above BL-#2
2006	31506- B,C	Floor tile and mastic	NO ASBESTOS	Radiation Oncology renovation Project
2005	121905	sheet flooring sample	NO ASBESTOS	Rad. Oncology breakroom redish color
2005	31805-A,B	Floor tile and mastic	NO ASBESTOS	H-7033 patient room previously renov.
2003	82003	Elbow insulation condensate return line	NO ASBESTOS	"C" subbase sys. #73
2003	71103	Elbow insulation roof level	NO ASBESTOS	Hosp. penthouse Sys.#80 pumps
2003	12703-A,B	Floor tile and mastic	NO ASBESTOS	BSAC Mezzanine offices
2003	21904	Insulation on safe	NO ASBESTOS	Cafeteria office safe
2002	102302-A	floor tile	3-5% Chrysotile	Public Safety dispatch
2002	102302-B	mastic	1-2% CHRYSOTILE	Public Safety dispatch
2002	9602-A,B	Floor tile and mastic	NO ASBESTOS	East Hartford Derm Clinic Rm# 1150
2002	9602-C,D	Floor tile and mastic	NO ASBESTOS	East Hartford Derm Clinic Rm# 1152
2002	8202-A	Floor tile	NO ASBESTOS	Med/surg 5 ADA project
2002	8202-B	Mastic	1-3% Chrysotile	Med/surg 5 ADA project
2002	8802-A	Floor tile	2-5% Chrysotile	CG--31A Rehab Serv
2002	8802-B	Mastic	1-3% Chrysotile	CG--31A Rehab Serv
2001	101201	Floor tile	3-5% Chrysotile	AG-062
2001	82401	Bulk Insulation - pipe	NO ASBESTOS	Chilled water line Blower #8
2001	71901-A	Elbow Insulation adjacent to auditorium	3-5% Amosite	Academic Lobby hall wall of ladies bath
2001	71901-B	Board mat'l behind radiator	30-50% CHRYSOTILE	L-7118, 7119 bathroom elevator lobby
2001	71901-C	Elbow insulation cold supply line- toilet	2-5% amosite	L-7118, 7119 bathroom elevator lobby
2001	6701	Valve insulation supply line to expansion tank	NO ASBESTOS	L-pent house Cleaver brooks Boiler#71
2001	53001	Elbow insulation cold water booster pump	NO ASBESTOS	Hosp. subbase. HSB02
2001	5901-A	1/2 pipe elbow insulation ceiling	NO ASBESTOS	L-4054 above door by hood and window
2001	5901-B	elbow insulation cold water booster pump	NO ASBESTOS	"C" sub basement booster pump

2001	42701	Elbow insulation	NO ASBESTOS	Water feed Boiler #2 "L" penthouse
2001	3101	Bulk insulation condensate return - coils	NO ASBESTOS	System #78 above hosp sump
2001	2501	Bulk mat'l between piping - spacer???	NO ASBESTOS	L-5049 grey powder in wall by hood
2001	2201	Duct insulation	20-40%Chrysotile	H-1034 kitchen ductwork Psych.
2000	113000-A	Bulk Insulation-gray concrete type	NO ASBESTOS	Floor below BL#1
2000	113000-B	Bulk Insulation - white plaster debris	NO ASBESTOS	Floor below BL#1
2000	113000-C	Bulk Insul - gritty har brown metal backing	NO ASBESTOS	Floor below BL#1
2000	112000	Valve gasket- packing	30-50%Chrysotile	Main chilled water line
2000	111000	Sprayed on Insulation	NO ASBESTOS	I-beam in old receiving-new mailroom
2000	91200-A	Elbow insulation water supply line	NO ASBESTOS	L-6055 right side facing window ctr isle
2000	91200-B	Elbow insulation water supply line	NO ASBESTOS	L-6055 left side facing window ctr isle
2000	7600-A	1 inch elbow insulation	1-3% Chrysotile	L-6002
2000	7600-B	1 inch elbow insulation	NO ASBESTOS	L-6002 fabric
2000	2400-ABCD	Pipe insulation	NO ASBESTOS	Chiller 'C" sub base morter type mat'l
1999	2599-I	Inside Insulation	NO ASBESTOS	Debis below incinerator
1999	2599-O	Outside insulation	NO ASBESTOS	Debris below incinerator
1999	3199-A	elbow insulation	<1.0% amosite	domestic hot water section #1
1999	3199-B	elbow insulation	NO ASBESTOS	domestic hot water section #2
1999	3199-C	elbow insulation	NO ASBESTOS	Section 3 water to lab air system
1999	3199-D	elbow/pipe insulation	NO ASBESTOS	Domestic hot water heater
1999	3199-E	pipe insulation	NO ASBESTOS	Hosp. pent domestic hot water
1999	12599-A	fabric cover	NO ASBESTOS	CB-003
1999	12599-B	gray coating	NO ASBESTOS	CB-003
1999	12599-C	Inside Insulation	NO ASBESTOS	CB-003
1998	111298	Insulation - End cap	NO ASBESTOS	Cleaver Brooks header 8in pipe 20ft up
1998	91098-A	Dust sample	<1.0% Chrysotile	On Exh #74 pully guard
1998	91098-B	Dust sample on certificate frame	2-3% Chrysotile	Hosp. steam boiler #2 on floor & frame
1998	91098-C	Dust sample	NO ASBESTOS	Top of Hosp. steam boiler #2
1998	91098-D	Dust sample	NO ASBESTOS	Pump controls on wall by BSAC entrance
1998	72398-A	Bulk gasket material	60-80%chrysotile	Hosp. boiler #2
1998	72398-B	Bulk gasket material	30-50% CHRYSOTILE	Hosp. boiler #2 heating element
1998	62698	Steam pipe elbow	NO ASBESTOS	CB-017
1997	5597	piece of piping material dug up ARB construction	20-40% CHRYSOTILE	East dock area
1997	12197-A,B,C	insulation steam pipe	????????	Hall outside CB-006, CM-294
1997	72897	Bulk insulation - debris	1-3% Chrysotile	Hall CG-062 reh kitchen duct
1997	32197A,B,C	Insulation Debris	NO ASBESTOS	Debris between BL#1 andBL#2
1996	91696-ABCD	IAC sound booth insulation	NO ASBESTOS	Dowling South-Rehab
1996	9496-1	Bulk Insulation	2-5% CHRYSOTILE	Inside surface Cleaver Brooks door
1996	73096-A	Bulk Insulation - ball valve	NO ASBESTOS	emergency shower outside AM-041
1996	73096-B	Bulk Insulation - bottom elbow	NO ASBESTOS	Emergency shower outside AM-048
1996	73096-C	Bulk insulation upper 90 degree elbow	NO ASBESTOS	emergency shower outside AM-048
1996	62696-1	Ceiling tile - hallway	NO ASBESTOS	by safety shower AM-040, 042, 043
1996	62696-2	Ceiling tile- hall difuser	NO ASBESTOS	Outside AM-042 Course texture
1996	22096	Pipe insulation	NO ASBESTOS	Condensate return line BL#73
1996	1596	Pipe insulation - elbow	NO ASBESTOS	Hosp. Sub sys #78 condensate return
1996	11596-A	residue from ductwork for incinerator	NO ASBESTOS	Exh 66 residue incinerator
1996	11596-B	Residue from ductwork on BL#1	NO ASBESTOS	LSB-002 incinerator
1995	101395	Insulation - bulk	NO ASBESTOS	CLAC cagewash clean condensate tank
1995	101995	Bulk Insulation - Pipe	NO ASBESTOS	1 inch copper line between cage washers

1995	1,2,3	ceiling plaster	NO ASBESTOS	HG-062 mens room
1995	4 and 6	ceiling plaster	55% Chrysotile	Hallway CG-229
1995	5	ceiling plaster	60% Chrysotile	Hallway CG-229
1995	7, 8 and 9	ceiling plaster	60% Chrysotile	Kitchen CG-228D
1995	11895	insulation	NO ASBESTOS	Johnson valve C-1051 Rec.area DC8&9
1994	41194A	Elbow Insulation	NO ASBESTOS	BL#7 chilled water line
1994	41194B	Elbow Insulation	NO ASBESTOS	BL#63 chilled water line
1994	134	ceiling plaster	NO ASBESTOS	LG-096 Function Room
1994	135,136,137	ceiling plaster	NO ASBESTOS	Old Function Room
1994	101294-1	Pipe insulation-elbow	NO ASBESTOS	Make-up water 150hp Cleaver Brooks PH
1994	101294-2	elbow insulation	NO ASBESTOS	Make-up line condens rec. Cleaver Brook
1994	92894-1	Floor Tile-double door threshold	NO ASBESTOS	BSAC lower level by six bank elevator
1994	92894-2	Floor tile by elevator door	NO ASBESTOS	BSAC lower level by six bank elevator
1994	92994-A	Floor tile	Neg. <1.0% chrysotile	C-2063 Lab Med Hematology
1994	83094-A	Ceiling mat. Debis	2-3% amosite	Library Computer Area
1994	32594-A	Pipe insulation	NO ASBESTOS	CLAC clean hot water feed heat exchanger
1994		ceiling plaster	NO ASBESTOS	Chiller room
1994	12094-A	ceiling plaster	5-10% CHRYSOTILE	library ceiling
1994	21094-1	cement like ceiling mat'l	NO ASBESTOS	Chiller room above railing
1994	21094-2	cement like ceiling mat'l	NO ASBESTOS	Chiller room main sprinler line hanger
1994	21094-3	cement like ceiling mat'l	NO ASBESTOS	chiller ceiling by bypass valve #1
1993	102793 1T	Floor Tile	NO ASBESTOS	C-1032B
1993	102793 1M	mastic	NO ASBESTOS	C1032B
1993	102793 2T	Floor Tile	NO ASBESTOS	C1157
1993	102793 2M	Mastic	NO ASBESTOS	C1157
1993	102793 3T	Floor tile	NO ASBESTOS	DC#3 entrance
1993	102793 3M	Mastic	1-2%	DC#3 entrance
1993	83193C	Tile and Mastic	Neg then retest pos.??	AB025
1993	83193F	Tile and Mastic	2-3%	AB025 by janitors closet
1993	83193G	Tile and Mastic	NO ASBESTOS	AB025 by SL-4 stairway
1993	7193A	Insulation	POSITIVE 30 -40%	Exh #66
1993	7193B	Elbow Insul lower	NO ASBESTOS	BL#47 by BL#70
1993	7193C	Elbow Insulation	NO ASBESTOS	BL#47
1993	80493A	Insulation Pipe	NO ASBESTOS	"C" subbasem by CP-1 heat exh #7
1993	2993A	Elbow Insulation	1-3% AMOSITE	L-2049
1993	2993B	Elbow Insulation (canvas cover)	NO ASBESTOS	L-2049
1993	2993C	Elbow Insulation above door-back lab	1-3% AMOSITE	L-2005 3/4 in cold line
1993	2993D	Elbow Insulation above door- back lab	1-3% AMOSITE	L-2005 3/4 in hot line
1993	2993E	Elbow Insulation Left side lab	1-3% AMOSITE	L-2038 1/2 cold line
1993	2993F	Elbow Insulation above door	NO ASBESTOS	L-2051/52 1/2 hot line
1993	2993G	Elbow Insulation above door	NO ASBESTOS	L-2051/52 1/2 cold line
1993	12293-1T	Floor tile	NO ASBESTOS	L-6032 9 feet from hood by wall
1993	12293-1M	mastic	1-2% CHRYSOTILE	Same
1993	12293-2T	floor tile	NO ASBESTOS	L-6032 Below right window under counter
1993	12293-2M	mastic	2-5% CHRYSOTILE	same
1992	3692	air samples	NO ASBESTOS	BB#4
1992	71392	insulation by valve tag 300	NO ASBESTOS	pipe - loading dock door

1992	12292A	insulation - duct	20-40% ASBESTOS	Russ Jacobson's office - Anatomic Pathology
1992	12292B	insulation - duct	20-40% ASBESTOS	Russ Jacobson's office - Anatomic Pathology
1992	12292C	floor tile mastic	NO ASBESTOS	anaesthesiology
1992	12292D	floor tile mastic	NO ASBESTOS	anaesthesiology
1992	20392A	ceiling tile acousticl no foil backing	NO ASBESTOS	7th floor 2 bank elevator
1992	20392B	ceiling tile acousticl foil backed	NO ASBESTOS	7th floor 2 bank elevator
1992	20392C	Celing tile debris	NO ASBESTOS	7th floor 2 bank elevator
1992	20392D	insulation above light	NO ASBESTOS	7th floor 2 bank elevator
1992	20392E	waste insulation foil backed	NO ASBESTOS	7th floor 2 bank elevator
1992	31292A	floor tile	1-2% ASBESTOS	AM031
1992	31292B	mastic	NO ASBESTOS	AM031
1992	42492A	Roofing "C"	NO ASBESTOS	C bldg clinics mid-roof sectn 2
1992	42492B	Roofing "C"	NO ASBESTOS	C bldg hospital mid-roof sectn 3
1992	72392-1	Roofing "C" ED Entrance	NO ASBESTOS	C bldg roof over emerg. ent walkway
1992	72392-2	Flashing "F" lot	15-25% CHRYSOTILE ASB	C bldg roof over MRI entrance
1992	91092A	insulation frm hztl sect rt genrtr	40-60% ASBESTOS	D-399 Gen #1 Exh
1992	91092B	same as A	40-60% ASBESTOS	D-399 Gen #1 Exh
1992	91092C	insulation frm vtl sect abv genrtr	40-60% ASBESTOS	D-399 Gen #1 Exh
1992	121892A	Insul. Right side	20-40% Chrysotile	CLAC Autoclave door
1992	121892B	Insul by wall where pipe enters	20-40% Chrysotile	CLAC Autoclave door
1992	121892C	Insul front lower left looking at door	10-20% Amosite	CLAC Autoclave door
1992	121892D	Insul right side by grate damage	NO ASBESTOS	CLAC Autoclave door
1991	9391	elbow to drain water	NO ASBESTOS	courtyard - library
1991	12391	insulation above PBQC electrical panel	NO ASBESTOS	Hot water supply - below Keller
1991	82391	insulation covering pipe elbows crtyd drain	NO ASBESTOS	Carpentry Shop
1991	112191	duct - Anat. Path.	30-50% ASBESTOS	above Russ Jacobsons office
1991	10991A	by the pull box #5	NO ASBESTOS	"L" Penthouse Façade
1991	10991B	by the pull box #5	2-5% ASBESTOS	"L" Penthouse Façade
1991	10991C	by the pull box #5	3-5% ASBESTOS	"L" Penthouse Façade
1991	4491A	elbow below city water line	NO ASBESTOS	Blower 47
1991	4491B	elbow above city water line	NO ASBESTOS	Blower 47
1991	4491C	insulation frm lowest elbow nxt to thermo	NO ASBESTOS	Blower 47 - chilled water
1991	72391A	black electrical wires on exh 24	NO ASBESTOS	
1991	72391B	black electrical wires on exh 24	NO ASBESTOS	
1991	7991A	floor tile	NO ASBESTOS	AM-034A
1991	7991B	mastic from A	NO ASBESTOS	
1991	7991C	floor tile	NO ASBESTOS	AM-034C
1991	7991D	mastic from C	NO ASBESTOS	AM-034C
1991	7991E	floor tile	NO ASBESTOS	CG-122 reception
1991	7991F	mastic from E	NO ASBESTOS	Hallway CG-122
1991	82991A	Mastic type mat	NO ASBESTOS	Exterior - Below grade - Dock
1991	82991B	Board - insul	NO ASBESTOS	Exterior - Below grade - Dock
1991	82991C	Insulation Backing	NO ASBESTOS	Exterior - Below grade - Dock
1991	9491A	waterproofing on foundation hosp walls	NO ASBESTOS	Exterior - Receiving
1991	9491B	waterproofing on foundation hosp walls	NO ASBESTOS	Exterior - Receiving
1990	1	blwr 38	NO ASBESTOS	
1990	2	blwr 38	NO ASBESTOS	
1990	3	blwr 38	1-3% AMOSITE	

1990	4	blwr 38	NO ASBESTOS	
1990	5	blwr 38	3-5% AMOSITE	
1990	8690	Insul of duct work	NO ASBESTOS	BG-004
1990	101290F	floor tile	POSITIVE	LG-017
1990	101690A	uppr lft elbow insulation abve Jhnsn vlve	NO ASBESTOS	
1990	101690B	Elbow above Jhsn valve	NO ASBESTOS	Blower 44 subbase
1990	101690C	Elbow right side	NO ASBESTOS	Blower 44 subbase
1990	101690D	Elbow outer insul	NO ASBESTOS	Blower 44 subbase
1990	101690E	Elbow lower right	NO ASBESTOS	Blower 44 subbase
1990	10290A	floor tile	NO ASBESTOS	fac mgmt conf rm
1990	10290B	floor tile	NO ASBESTOS	C-2055 lab med
1990	10290C	floor tile	NO ASBESTOS	C-2055 lab med
1990	10290D	mastic frm samples B&C loctn	<1% CHRYSOTILE	C-2055
1990	10290E	mastic frm sample A lctn	1-2% CHRYSOTILE	
1990	10290E	Mastic	NO ASBESTOS	fac mgmt conf rm
1990	10290F	floor tile	NO ASBESTOS	LG-017 doorway
1990	417-1	frm dct wk abv blwr 2	NO ASBESTOS	Blower #2
1990	417-2	insulation on top of blwr 38	3-5% CHRY, 30-40% AMOSITE	Blower #38 - remnants
1990	417-3	insulation arnd dct abv blwr 2	NO ASBESTOS	Blower #2
1990	4690-2	uppr rt wndw	NO ASBESTOS	Dr Clark's office L-3056
1990	4690-3	office wndw casing	NO ASBESTOS	Dr Padula's L-3060
1990	5390-1	insulation of blwr 38	NO ASBESTOS	Top of blower #38
1990	5390-2	insulation of uppr prtn of blwr 38	NO ASBESTOS	Top of blower #38
1990	5390-3	dust frm uppr prtn of blwr 38	1-3% AMOSITE	Top of blower #38
1990	5390-4	dust frm lwr prtn of blwr 38	NO ASBESTOS	
1990	5390-5	dust frm dct wk blw incnrtr dct	3-5% AMOSITE	Below incin. Duct
1990	82090A	chilled water blower #9	NO ASBESTOS	LSB-003
1990	82090B	same as A	NO ASBESTOS	LSB-003
1990	82090C	same as A	NO ASBESTOS	LSB-003
1990	82190D	pnthse,scnd elbow frm flr on blwr 24	NO ASBESTOS	Blower #24 Penthouse
1990	83090A	Elbow insul above hood	NO ASBESTOS	L-4048
1990	83090B	punch sample of elbow above hood	NO ASBESTOS	L-4048
1990	83090C	mtl ontop of chemical hood in	NO ASBESTOS	L-4048
1990	83090D	uppr pltfrm follwng nw dctwk nr exh 21	10-20% CHRYSOTLE	Exh #21 Penthouse
1990	89090E	same as 8990D	NO ASBESTOS	Penthouse
1990	8990A	on cat wlk btwn exh 21 and exh 24	2-10% CHRYSOTILE	Penthouse
1990	8990B	sme as 8990A	NO ASBESTOS	Penthouse - new roof penetration
1990	8990C	sme as 8990A	2-5% CHRY, 20-30%AMOSITE	Penthouse - new roof penetration
1990	8990D	on cat wlk abve exh 45	NO ASBESTOS	Penthouse - new roof penetration
1990	8990E	same as 8990D	NO ASBESTOS	
1990	8990F	same as 8990D	NO ASBESTOS	Penthouse - new roof penetration
1990	8990G	on cat wlk abve exh 44	NO ASBESTOS	Penthouse - new roof penetration
1990	91190A	floor tile	NO ASBESTOS	bldg 5 conf rm
1990	91190B	floor tile	NO ASBESTOS	bldg 5 doorway
1990	91190C	floor tile	NO ASBESTOS	bldg 5 office 19
1990	91190D	floor tile	NO ASBESTOS	bldg 5 entrance
1989	1	autocl insulation	NO ASBESTOS	CSS rm CB-004
1989	2	insulation	NO ASBESTOS	CSS bck rm
1989	53089	blwr 59	NO ASBESTOS	Elec Shp
1989	81589	insulation frm parafin melter	NO ASBESTOS	Clin Eng - equipment

1989	102389	frm dmgd oven	10-15% CHRYSOTILE	
1989	21689-1	interior back panel	NO ASBESTOS	C-2024 hood
1989	21689-2	bck pnl	20-40% CHRYSOTILE	C-2024 hood
1989	2389-1	T fitting by thermo	NO ASBESTOS	CLAC - cage wash
1989	2389-2	sm as 1 but elbw undr shck asrbr	.1% AMOSITE	CLAC - cage wash
1989	2389-3	sm as 1	NO ASBESTOS	CLAC - cage wash
1989	2389-4	hrzntl rw btwn washers	NO ASBESTOS	B022
1989	41889-1	pipe elbw	1-2% AMOSITE	by elctl shp
1989	42789-1		NO ASBESTOS	bsmnt at intrsctn adcnt to elctl shp
1989	42789-2	elbow at sme plc as 1	2-5% AMOSITE	
1989	4489-4		NO ASBESTOS	
1989	5989-1	pip insulation	NO ASBESTOS	Mr Sullivan's office BG-004
1989	5989-2	elbow	NO ASBESTOS	Public Safety Office BG-004
1989	5989-3	sm as 2	NO ASBESTOS	BG-004
1989	6889-1	HVAC mixing box Insul	NO ASBESTOS	Dr Clark's office L-3056
1989	92189A	chllr return line	NO ASBESTOS	LSB-014 Fac Mgmt - Secretary
1988	2402 9259-9 (1988)	vlv insulation blwr20	NO ASBESTOS	subbsmnt B bldg
1987	1987		NO ASBESTOS	Fac Mgmnt office
1987	33187A	Countertops	NO ASBESTOS	rm 389 frm Capitol Region Mental HC
1987	33187B	Countertops	NO ASBESTOS	rm 389 frm Capitol Region Mental HC
1987	42187-1	Wall Mat'l ceiling	NO ASBESTOS	OR #2
1987	42187-2	I-Beam Insulation	NO ASBESTOS	OR #2
1987	42187-3	Conduit - Ceiling between #1 & #2	NO ASBESTOS	OR #2
1987	42187-4	Material above ceiling	NO ASBESTOS	OR #2
1987	42187-5	Material above ceiling	NO ASBESTOS	OR #2
1987	42187-6	I-Beam Insulation OR 2 & 3	NO ASBESTOS	OR #2
1987	51487-1		NO ASBESTOS	Central Sterile Supply
1987	51487-2	asbestos board marked A	5-10% CHRYSOTILE	Central Sterile Supply
1987	51487-3	same as 2 but marked B	10-20% CHRYSOTLE	Central Sterile Supply
1987	51487-4	same as 1	NO ASBESTOS	CSS
1987	51487-5		NO ASBESTOS	CSS - CB-011A
1987	51487-6	asbestos wallboard marked C	10-20% CHRYSOTLE	CSS
1987	51487-7	same as 6 but marked D	10-20% CHRYSOTLE	CSS
1987	62387A		NO ASBESTOS	
1987	62387B		NO ASBESTOS	
1987	7787A	Countertops BB#5	5-10% CHRYSOTILE	bldg 5
1987	7787B	Countertops BB#5	10-20% CHRYSOTLE	bldg 5
1987	7787C	Countertops BB#5	5-10% CHRYSOTILE	bldg 5
1987	7787D	Countertops BB#5	10-20% CHRYSOTLE	bldg 5
1987	7787E	Countertops BB#5	10-20% CHRYSOTLE	bldg 5
1987	7787F	Countertops BB#5	5-10% CHRYSOTILE	bldg 5
1986	8681-9	vlv insulation frm pnths boilr abv Unit 16	NO ASBESTOS	Penthouse boiler heater #16
1986	8682-7	value insulation	NO ASBESTOS	Penthouse boiler heater #16
1986	8683-5	elbw insulation abv boilr #2	NO ASBESTOS	hosp subbsmnt - Dom. Hot water
1986	8684-5	top elbw insul. 90°	NO ASBESTOS	hosp subbsmnt - Dom. Hot water
1986	8685-0	lwr elbw of 3 btwn fbr-glss and fbrc	NO ASBESTOS	
1986	8686-8	cntr tp	2-5% CHRYSOTILE	Anatomical Pathology
1985	1	incntr dct srfc	10-20% AMOSITE	subbsmnt blw patho inctr - BL2
1985	2	sm plc as 1 but srfc ct of dct	20-30% CHRYSOTILE	subbsmnt blw patho inctr - BL2

1985	3	sm as 2	20-40% CHRYS, 2-5% AMOSITE	subbsmnt blw patho inctr - BL2
1985	4	stnding on blwr 2 inctntr dct sfc ct	30-50% CHRYSOTILE	subbsmnt blw patho inctr
1985	5	sm as 4 but mtl	20-40% AMOSITE	subbsmnt blw patho inctr - lath wk
1985	6	insulation ontp of blwr 2 - debris	NO ASBESTOS	subbsmnt blw patho inctr
1985	7	mtl frm lath wk frm incntr dct ovr blwr 1	10-30% CHRYSOTILE	subbsmnt blw patho inctr
1985	8	sm as 7	30-50% CHRYSOTILE	subbsmnt blw patho inctr
1985	9	incin. Duct top	NO ASBESTOS	pathological incin. bsmnt level
1985	10	sm as 9	40-60% CHRYSOTILE	
1985	11	sm as 9 - bottom	NO ASBESTOS	
1985	12	bottom of fan	20-50% CHRYSOTILE	cremation room
1985	13	door seal 9	NO ASBESTOS	chamber - cremator

1910.1001 - Asbestos.

- **Standard Number:** 1910.1001
- **Standard Title:** Asbestos.
- **SubPart Number:** Z
- **SubPart Title:** Toxic and Hazardous Substances

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Produced by USDOL OSHA - Directorate of Safety Standards &AMP
                         Directorate of Health Standards
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This mandatory appendix specifies the procedure for analyzing air samples for asbestos and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods (such as Appendix B of thier regulation, the most current version of the OSHA method ID-160, or the most current version of the NIOSH Method 7400). All employers who are required to conduct air monitoring under paragraph (d) of the standard are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

Sampling and Analytical Procedure

1. The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos counting. See below for rejection of blanks.
2. The preferred collection device shall be the 25-mm diameter cassette with an open-faced 50-mm electrically conductive extension cowl. The 37-mm cassette may be used if necessary but only if written justification for the need to use the 37-mm filter cassette accompanies the sample results in the employee's exposure monitoring record. Do not reuse or reload cassettes for asbestos sample collection.
3. An air flow rate between 0.5 liter/min and 2.5 liters/min shall be selected for the 25-mm cassette. If the 37-mm cassette is used, an air flow rate between 1 liter/min and 2.5 liters/min shall be selected.
4. Where possible, a sufficient air volume for each air sample shall be collected to yield between 100 and 1,300 fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.
5. Ship the samples in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface (e.g., expanded polystyrene) cannot be used because such material can cause loss of fibers to the sides of the cassette.
6. Calibrate each personal sampling pump before and after use with a representative filter cassette installed between the pump and the calibration devices.
7. Personal samples shall be taken in the "breathing zone" of the employee (i.e., attached to or near the collar or lapel near the worker's face).
8. Fiber counts shall be made by positive phase contrast using a microscope with an 8 to 10 X eyepiece and a 40 to 45 X objective for a total magnification of approximately 400 X and a numerical aperture of 0.65 to 0.75. The microscope shall also be fitted with a green or blue filter.
9. The microscope shall be fitted with a Walton-Beckett eyepiece graticule calibrated for a field diameter of 100 micrometers (+/-2 micrometers).
10. The phase-shift detection limit of the microscope shall be about 3 degrees measured using the HSE phase shift test slide as outlined below.

    a) Place the test slide on the microscope stage and center it under the phase objective.
    b) Bring the blocks of grooved lines into focus.

NOTE: The slide consists of seven sets of grooved lines (ca. 20 grooves to each block) in descending order of visibility from sets 1 to 7, seven being the least visible. The requirements for asbestos counting are that the microscope optics must resolve the grooved lines in set 3 completely, although they may appear somewhat faint, and that the grooved lines in sets 6 and 7 must be invisible. Sets 4 and 5 must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails to meet these requirements has either too low or too high a resolution to be used for asbestos counting.

c) If the image deteriorates, clean and adjust the microscope optics. If the problem persists, consult the microscope manufacturer.

11. Each set of samples taken will include 10 percent blanks or a minimum of 2 field blanks. These blanks must come from the same lot as the filters used for sample collection. The field blank results shall be averaged and subtracted from the analytical results before reporting. A set consists of any sample or group of samples for which an evaluation for this standard must be made. Any samples represented by a field blank having a fiber count in excess of the detection limit of the method being used shall be rejected.
12. The samples shall be mounted by the acetone/triacetin method or a method with an equivalent index of refraction and similar clarity.
13. Observe the following counting rules.
    a) Count only fibers equal to or longer than 5 micrometers. Measure the length of curved fibers along the curve.
    b) In the absence of other information, count all particles as asbestos that have a length-to-width ratio (aspect ratio) of 3:1 or greater.
    c) Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle, shall receive the count of one half (1/2). Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area.
    d) Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of an individual fiber.
    e) Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields; stop counting at 100 fields regardless of fiber count.
14. Blind recounts shall be conducted at the rate of 10 percent.

Quality Control Procedures

1. Intralaboratory program. Each laboratory and/or each company with more than one microscopist counting slides shall establish a statistically designed quality assurance program involving blind recounts and comparisons between microscopists to monitor the variability of counting by each microscopist and between microscopists. In a company with more than one laboratory, the program shall include all laboratories and shall also evaluate the laboratory-to-laboratory variability.

2.a. Interlaboratory program. Each laboratory analyzing asbestos samples for compliance determination shall implement an interlaboratory quality assurance program that as a minimum includes participation of at least two other independent laboratories. Each laboratory shall participate in round robin testing at least once every 6 months with at least all the other laboratories in its interlaboratory quality assurance group. Each laboratory shall submit slides typical of its own work load for use in this program. The round robin shall be designed and results analyzed using appropriate statistical methodology.

2.b. All laboratories should also participate in a national sample testing scheme such as the Proficiency Analytical Testing Program (PAT), or the Asbestos Registry sponsored by the American Industrial Hygiene Association (AIHA).

3. All individuals performing asbestos analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos dust or an equivalent course.
4. When the use of different microscopes contributes to differences between counters and laboratories, the effect of the different microscope shall be evaluated and the microscope shall be replaced, as necessary.
5. Current results of these quality assurance programs shall be posted in each laboratory to keep the microscopists informed.

[57 FR 24330, June 8, 1992; 59 FR 40964, Aug. 10, 1994]

Matrix	
Matrix:	
OSHA Permissible Exposure Limits:	
Time Weighted Average	0.1 fiber/cc
Excursion Level (30 minutes)	1.0 fiber/cc
Collection Procedure:	
A known volume of air is drawn through a 25-mm diameter cassette containing a mixed-cellulose ester filter. The cassette must be equipped with an electrically conductive 50-mm extension cowl. The sampling time and rate are chosen to give a fiber density of between 100 to 1,300 fibers/mm(2) on the filter.	
Recommended Sampling Rate	0.5 to 5.0 liters/minute (L/min)
Recommended Air Volumes:	
Minimum	25 L
Maximum	2,400 L

Analytical Procedure: A portion of the sample filter is cleared and prepared for asbestos fiber counting by Phase Contrast Microscopy (PCM) at 400X.

Commercial manufacturers and products mentioned in this method are for descriptive use only and do not constitute endorsements by USDOL-OSHA. Similar products from other sources can be substituted.

1. Introduction

This method describes the collection of airborne asbestos fibers using calibrated sampling pumps with mixed-cellulose ester (MCE) filters and analysis by phase contrast microscopy (PCM). Some terms used are unique to this method and are defined below:

Asbestos: A term for naturally occurring fibrous minerals. Asbestos includes chrysotile, crocidolite, amosite (cummingtonite-grunerite asbestos), tremolite asbestos, actinolite asbestos, anthophyllite asbestos, and any of these minerals that have been chemically treated and/or altered. The precise chemical formulation of each species will vary with the location from which it was mined. Nominal compositions are listed:

Chrysotile	Mg(3)Si(2)O(5)(OH)(4)
Crocidolite	Na(2)Fe(3)(2)(+)Fe(2)(3)(+)Si(8)O(22)(OH)(2)
Amosite	(Mg,Fe)(7)Si(8)O(22)(OH)(2)
Tremolite-actinolite	Ca(2)(Mg,Fe)(5)Si(8)O(22)(OH)(2)
Anthophyllite	(Mg,Fe)(7)Si(8)O(22)(OH)(2)

Asbestos Fiber: A fiber of asbestos which meets the criteria specified below for a fiber.

Aspect Ratio: The ratio of the length of a fiber to it's diameter (e.g. 3:1, 5:1 aspect ratios).

Cleavage Fragments: Mineral particles formed by comminution of minerals, especially those characterized by parallel sides and a moderate aspect ratio (usually less than 20:1).

Detection Limit: The number of fibers necessary to be 95% certain that the result is greater than zero.

Differential Counting: The term applied to the practice of excluding certain kinds of fibers from the fiber count because they do not appear to be asbestos.

Fiber: A particle that is 5 um or longer, with a length-to-width ratio of 3 to 1 or longer.

Field: The area within the graticule circle that is superimposed on the microscope image.

Set: The samples which are taken, submitted to the laboratory, analyzed, and for which, interim or final result reports are generated.

Tremolite, Anthophyllite, and Actinolite: The non-asbestos form of these minerals which meet the definition of a fiber. It includes any of these minerals that have been chemically treated and/or altered.

Walton-Beckett Graticule: An eyepiece graticule specifically designed for asbestos fiber counting. It consists of a circle with a projected diameter of 100 + or - 2 um (area of about 0.00785 mm(2)) with a crosshair having tic-marks at 3-um intervals in one direction and 5-um in the orthogonal direction. There are marks around the periphery of the circle to demonstrate the proper sizes and shapes of fibers. This design is reproduced in Figure 1. The disk is placed in one of the microscope eyepieces so that the design is superimposed on the field of view.

1.1. History

Early surveys to determine asbestos exposures were conducted using impinger counts of total dust with the counts expressed as million particles per cubic foot. The British Asbestos Research Council recommended filter membrane counting in 1969. In July 1969, the Bureau of Occupational Safety and Health published a filter membrane method for counting asbestos fibers in the United States. This method was refined by NIOSH and published as P & CAM 239. On May 29, 1971, OSHA specified filter membrane sampling with phase contrast counting for evaluation of asbestos exposures at work sites in the United States. The use of this technique was again required by OSHA in 1986. Phase contrast microscopy has continued to be the method of choice for the measurement of occupational exposure to asbestos.

1.2. Principle

Air is drawn through a MCE filter to capture airborne asbestos fibers. A wedge shaped portion of the filter is removed, placed on a glass microscope slide and made transparent. A measured area (field) is viewed by PCM. All the fibers meeting defined criteria for asbestos are counted and considered a measure of the airborne asbestos concentration.

1.3. Advantages and Disadvantages

There are four main advantages of PCM over other methods:

(1.) The technique is specific for fibers. Phase contrast is a fiber counting technique which excludes non-fibrous particles from the analysis.
(2.) The technique is inexpensive and does not require specialized knowledge to carry out the analysis for total fiber counts.
(3.) The analysis is quick and can be performed on-site for rapid determination of air concentrations of asbestos fibers.
(4.) The technique has continuity with historical epidemiological studies so that estimates of expected disease can be inferred from long-term determinations of asbestos exposures.

The main disadvantage of PCM is that it does not positively identify asbestos fibers. Other fibers which are not asbestos may be included in the count unless differential counting is performed. This requires a great deal of experience to adequately differentiate asbestos from non-asbestos fibers. Positive identification of asbestos must be performed by polarized light or

electron microscopy techniques. A further disadvantage of PCM is that the smallest visible fibers are about 0.2 um in diameter while the finest asbestos fibers may be as small as 0.02 um in diameter. For some exposures, substantially more fibers may be present than are actually counted.

1.4. Workplace Exposure

Asbestos is used by the construction industry in such products as shingles, floor tiles, asbestos cement, roofing felts, insulation and acoustical products. Non-construction uses include brakes, clutch facings, paper, paints, plastics, and fabrics. One of the most significant exposures in the workplace is the removal and encapsulation of asbestos in schools, public buildings, and homes. Many workers have the potential to be exposed to asbestos during these operations.

About 95% of the asbestos in commercial use in the United States is chrysotile. Crocidolite and amosite make up most of the remainder. Anthophyllite and tremolite or actinolite are likely to be encountered as contaminants in various industrial products.

1.5. Physical Properties

Asbestos fiber possesses a high tensile strength along its axis, is chemically inert, non-combustible, and heat resistant. It has a high electrical resistance and good sound absorbing properties. It can be weaved into cables, fabrics or other textiles, and also matted into asbestos papers, felts, or mats.

2. Range and Detection Limit

2.1. The ideal counting range on the filter is 100 to 1,300 fibers/mm(2). With a Walton-Beckett graticule this range is equivalent to 0.8 to 10 fibers/field. Using NIOSH counting statistics, a count of 0.8 fibers/field would give an approximate coefficient of variation (CV) of 0.13.

2.2. The detection limit for this method is 4.0 fibers per 100 fields or 5.5 fibers/mm(2). This was determined using an equation to estimate the maximum CV possible at a specific concentration (95% confidence) and a Lower Control Limit of zero. The CV value was then used to determine a corresponding concentration from historical CV vs fiber relationships. As an example:

```
Lower Control Limit (95% Confidence) = AC - 1.645(CV)(AC)

Where:

AC = Estimate of the airborne fiber concentration (fibers/cc)
     Setting the Lower Control Limit = 0 and solving for CV:
0  = AC - 1.645(CV)(AC)
CV = 0.61

  This value was compared with CV vs. count curves. The count at which CV
= 0.61 for Leidel-Busch counting statistics or for an OSHA Salt Lake
Technical Center (OSHA-SLTC) CV curve (see Appendix A for further
information) was 4.4 fibers or 3.9 fibers per 100 fields, respectively.
Although a lower detection limit of 4 fibers per 100 fields is supported
by the OSHA-SLTC data, both data sets support the 4.5 fibers per 100
fields value.
```

3. Method Performance -- Precision and Accuracy

Precision is dependent upon the total number of fibers counted and the uniformity of the fiber distribution on the filter. A general rule is to count at least 20 and not more than 100 fields. The count is discontinued when 100 fibers are counted, provided that 20 fields have already been counted. Counting more than 100 fibers results in only a small gain in precision. As the total count drops below 10 fibers, an accelerated loss of precision is noted.

At this time, there is no known method to determine the absolute accuracy of the asbestos analysis. Results of samples prepared through the Proficiency Analytical Testing (PAT) Program and analyzed by the OSHA-SLTC showed no significant bias when compared to PAT reference values. The PAT samples were analyzed from 1987 to 1989 (N = 36) and the concentration range was from 120 to 1,300 fibers/mm(2).

4. Interferences

Fibrous substances, if present, may interfere with asbestos analysis.

Some common fibers are:

```
Fiberglass
Anhydrite
Plant Fibers
Perlite Veins
Gypsum
Some Synthetic Fibers
Membrane Structures
Sponge Spicules
Diatoms
Microorganisms
Wollastonite
```

The use of electron microscopy or optical tests such as polarized light, and dispersion staining may be used to differentiate these materials from asbestos when necessary.

5. Sampling

5.1. Equipment

5.1.1. Sample assembly (The assembly is shown in Figure 3). Conductive filter holder consisting of a 25-mm diameter, 3-piece cassette having a 50-mm long electrically conductive extension cowl. Backup pad, 25-mm, cellulose. Membrane filter, mixed-cellulose ester (MCE), 25-mm, plain, white, 0.4 to 1.2-um pore size.

Notes: (a) Do not re-use cassettes.

(b) Fully conductive cassettes are required to reduce fiber loss to the sides of the cassette due to electrostatic attraction.

(c) Purchase filters which have been selected by the manufacturer for asbestos counting or analyze representative filters for fiber background before use. Discard the filter lot if more than 4 fibers/100 fields are found.

(d) To decrease the possibility of contamination, the sampling system (filter-backup pad-cassette) for asbestos is usually preassembled by the manufacturer.

(e) Other cassettes, such as the Bell-mouth, may be used within the limits of their validation.

5.1.2. Gel bands for sealing cassettes.

5.1.3. Sampling pump.

Each pump must be a battery operated, self-contained unit small enough to be placed on the monitored employee and not interfere with the work being performed. The pump must be capable of sampling at the collection rate for the required sampling time.

5.1.4. Flexible tubing, 6-mm bore.

5.1.5. Pump calibration.

Stopwatch and bubble tube/burette or electronic meter.

5.2. Sampling Procedure

5.2.1. Seal the point where the base and cowl of each cassette meet with a gel band or tape.

5.2.2. Charge the pumps completely before beginning.

5.2.3. Connect each pump to a calibration cassette with an appropriate length of 6-mm bore plastic tubing. Do not use luer connectors -- the type of cassette specified above has built-in adapters.

5.2.4. Select an appropriate flow rate for the situation being monitored. The sampling flow rate must be between 0.5 and 5.0 L/min for personal sampling and is commonly set between 1 and 2 L/min. Always choose a flow rate that will not produce overloaded filters.

5.2.5. Calibrate each sampling pump before and after sampling with a calibration cassette in-line (Note: This calibration cassette should be from the same lot of cassettes used for sampling). Use a primary standard (e.g. bubble burette) to calibrate each pump. If possible, calibrate at the sampling site.

Note: If sampling site calibration is not possible, environmental influences may affect the flow rate. The extent is dependent on the type of pump used. Consult with the pump manufacturer to determine dependence on environmental influences. If the pump is affected by temperature and pressure changes, correct the flow rate using the formula shown in the section "Sampling Pump Flow Rate Corrections" at the end of this appendix.

5.2.6. Connect each pump to the base of each sampling cassette with flexible tubing. Remove the end cap of each cassette and take each air sample open face. Assure that each sample cassette is held open side down in the employee's breathing zone during sampling. The distance from the nose/mouth of the employee to the cassette should be about 10 cm. Secure the cassette on the collar or lapel of the employee using spring clips or other similar devices.

5.2.7. A suggested minimum air volume when sampling to determine TWA compliance is 25 L. For Excursion Limit (30 min sampling time) evaluations, a minimum air volume of 48 L is recommended.

5.2.8. The most significant problem when sampling for asbestos is overloading the filter with non-asbestos dust. Suggested maximum air sample volumes for specific environments are:

Environment	Air vol. (L)
Asbestos removal operations (visible dust).....	100
Asbestos removal operations (little dust).....	240
Office environments.....	400 to 2,400

Caution: Do not overload the filter with dust. High levels of non-fibrous dust particles may obscure fibers on the filter and lower the count or make counting impossible. If more than about 25 to 30% of the field area is obscured with dust, the result may be biased low. Smaller air volumes may be necessary when there is excessive non-asbestos dust in the air.

While sampling, observe the filter with a small flashlight. If there is a visible layer of dust on the filter, stop sampling, remove and seal the cassette, and replace with a new sampling assembly. The total dust loading should not exceed 1 mg.

5.2.9. Blank samples are used to determine if any contamination has occurred during sample handling. Prepare two blanks for the first 1 to 20 samples. For sets containing greater than 20 samples, prepare blanks as 10% of the samples. Handle blank samples in the same manner as air samples with one exception: Do not draw any air through the blank samples. Open the blank cassette in the place where the sample cassettes are mounted on the employee. Hold it open for about 30 seconds. Close and seal the cassette appropriately. Store blanks for shipment with the sample cassettes.

5.2.10. Immediately after sampling, close and seal each cassette with the base and plastic plugs. Do not touch or puncture the filter membrane as this will invalidate the analysis.

5.2.11. Attach and secure a sample seal around each sample cassette in such a way as to assure that the end cap and base plugs cannot be removed without destroying the seal. Tape the ends of the seal together since the seal is not long enough to be wrapped end-to-end. Also wrap tape around the cassette at each joint to keep the seal secure.

5.3. Sample Shipment

5.3.1. Send the samples to the laboratory with paperwork requesting asbestos analysis. List any known fibrous interferences present during sampling on the paperwork. Also, note the workplace operation(s) sampled.

5.3.2. Secure and handle the samples in such that they will not rattle during shipment nor be exposed to static electricity. Do not ship samples in expanded polystyrene peanuts, vermiculite, paper shreds, or excelsior. Tape sample cassettes to sheet bubbles and place in a container that will cushion the samples in such a manner that they will not rattle.

5.3.3. To avoid the possibility of sample contamination, always ship bulk samples in separate mailing containers.

6. Analysis

6.1. Safety Precautions

6.1.1. Acetone is extremely flammable and precautions must be taken not to ignite it. Avoid using large containers or quantities of acetone. Transfer the solvent in a ventilated laboratory hood. Do not use acetone near any open flame. For generation of acetone vapor, use a spark free heat source.

6.1.2. Any asbestos spills should be cleaned up immediately to prevent dispersal of fibers. Prudence should be exercised to avoid contamination of laboratory facilities or exposure of personnel to asbestos. Asbestos spills should be cleaned up with wet methods and/ or a High Efficiency Particulate-Air (HEPA) filtered vacuum.

Caution: Do not use a vacuum without a HEPA filter -- It will disperse fine asbestos fibers in the air.

6.2. Equipment

6.2.1. Phase contrast microscope with binocular or trinocular head.

6.2.2. Widefield or Huygenian 10X eyepieces (Note: The eyepiece containing the graticule must be a focusing eyepiece. Use a 40X phase objective with a numerical aperture of 0.65 to 0.75).

6.2.3. Kohler illumination (if possible) with green or blue filter.

6.2.4. Walton-Beckett Graticule, type G-22 with 100 plus or minus 2 um projected diameter.

6.2.5. Mechanical stage.

A rotating mechanical stage is convenient for use with polarized light.

6.2.6. Phase telescope.

6.2.7. Stage micrometer with 0.01-mm subdivisions.

6.2.8. Phase-shift test slide, mark II (Available from PTR optics Ltd., and also McCrone).

6.2.9. Precleaned glass slides, 25 mm X 75 mm. One end can be frosted for convenience in writing sample numbers, etc., or paste-on labels can be used.

6.2.10. Cover glass #1 1/2.

6.2.11. Scalpel (#10, curved blade).

6.2.12. Fine tipped forceps.

6.2.13. Aluminum block for clearing filter (see Appendix D and Figure 4).

6.2.14. Automatic adjustable pipette, 100- to 500-uL.

6.2.15. Micropipette, 5 uL.

6.3. Reagents

6.3.1. Acetone (HPLC grade).

6.3.2. Triacetin (glycerol triacetate).

6.3.3. Lacquer or nail polish.

6.4. Standard Preparation

A way to prepare standard asbestos samples of known concentration has not been developed. It is possible to prepare replicate samples of nearly equal concentration. This has been performed through the PAT program. These asbestos samples are distributed by the AIHA to participating laboratories.

Since only about one-fourth of a 25-mm sample membrane is required for an asbestos count, any PAT sample can serve as a "standard" for replicate counting.

6.5. Sample Mounting

Note: See Safety Precautions in Section 6.1. before proceeding. The objective is to produce samples with a smooth (non-grainy) background in a medium with a refractive index of approximately 1.46. The technique below collapses the filter for easier focusing and produces permanent mounts which are useful for quality control and interlaboratory comparison.

An aluminum block or similar device is required for sample preparation.

6.5.1. Heat the aluminum block to about 70 deg. C. The hot block should not be used on any surface that can be damaged by either the heat or from exposure to acetone.

6.5.2. Ensure that the glass slides and cover glasses are free of dust and fibers.

6.5.3. Remove the top plug to prevent a vacuum when the cassette is opened. Clean the outside of the cassette if necessary. Cut the seal and/or tape on the cassette with a razor blade. Very carefully separate the base from the extension cowl, leaving the filter and backup pad in the base.

6.5.4. With a rocking motion cut a triangular wedge from the filter using the scalpel. This wedge should be one-sixth to one-fourth of the filter. Grasp the filter wedge with the forceps on the perimeter of the filter which was clamped between the cassette pieces. DO NOT TOUCH the filter with your finger. Place the filter on the glass slide sample side up. Static electricity will usually keep the filter on the slide until it is cleared.

6.5.5. Place the tip of the micropipette containing about 200 uL acetone into the aluminum block. Insert the glass slide into the receiving slot in the aluminum block. Inject the acetone into the block with slow, steady pressure on the plunger while holding the pipette firmly in place. Wait 3 to 5 seconds for the filter to clear, then remove the pipette and slide from the aluminum block.

6.5.6. Immediately (less than 30 seconds) place 2.5 to 3.5 uL of triacetin on the filter (Note: Waiting longer than 30 seconds will result in increased index of refraction and decreased contrast between the fibers and the preparation. This may also lead to separation of the cover slip from the slide).

6.5.7. Lower a cover slip gently onto the filter at a slight angle to reduce the possibility of forming air bubbles. If more than 30 seconds have elapsed between acetone exposure and triacetin application, glue the edges of the cover slip to the slide with lacquer or nail polish.

6.5.8. If clearing is slow, warm the slide for 15 min on a hot plate having a surface temperature of about 50 deg. C to hasten clearing. The top of the hot block can be used if the slide is not heated too long.

6.5.9. Counting may proceed immediately after clearing and mounting are completed.

6.6. Sample Analysis

Completely align the microscope according to the manufacturer's instructions. Then, align the microscope using the following general alignment routine at the beginning of every counting session and more often if necessary.

6.6.1. Alignment

(1) Clean all optical surfaces. Even a small amount of dirt can significantly degrade the image.

(2) Rough focus the objective on a sample.

(3) Close down the field iris so that it is visible in the field of view. Focus the image of the iris with the condenser focus. Center the image of the iris in the field of view.

(4) Install the phase telescope and focus on the phase rings. Critically center the rings. Misalignment of the rings results in astigmatism which will degrade the image.

(5) Place the phase-shift test slide on the microscope stage and focus on the lines. The analyst must see line set 3 and should see at least parts of 4 and 5 but, not see line set 6 or 6. A microscope/microscopist combination which does not pass this test may not be used.

6.6.2. Counting Fibers

(1) Place the prepared sample slide on the mechanical stage of the microscope. Position the center of the wedge under the objective lens and focus upon the sample.

(2) Start counting from one end of the wedge and progress along a radial line to the other end (count in either direction from perimeter to wedge tip). Select fields randomly, without looking into the eyepieces, by slightly advancing the slide in one direction with the mechanical stage control.

(3) Continually scan over a range of focal planes (generally the upper 10 to 15 um of the filter surface) with the fine focus control during each field count. Spend at least 5 to 15 seconds per field.

(4) Most samples will contain asbestos fibers with fiber diameters less than 1 um. Look carefully for faint fiber images. The small diameter fibers will be very hard to see. However, they are an important contribution to the total count.

(5) Count only fibers equal to or longer than 5 um. Measure the length of curved fibers along the curve.

(6) Count fibers which have a length to width ratio of 3:1 or greater.

(7) Count all the fibers in at least 20 fields. Continue counting until either 100 fibers are counted or 100 fields have been viewed; whichever occurs first. Count all the fibers in the final field.

(8) Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle shall receive a count of 1/2. Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area. If a fiber touches the circle, it is considered to cross the line.

(9) Count bundles of fibers as one fiber unless individual fibers can be clearly identified and each individual fiber is clearly not connected to another counted fiber. See Figure 1 for counting conventions.

(10) Record the number of fibers in each field in a consistent way such that filter non-uniformity can be assessed.

(11) Regularly check phase ring alignment.

(12) When an agglomerate (mass of material) covers more than 25% of the field of view, reject the field and select another. Do not include it in the number of fields counted.

(13) Perform a "blind recount" of 1 in every 10 filter wedges (slides). Re-label the slides using a person other than the original counter.

6.7. Fiber Identification

As previously mentioned in Section 1.3., PCM does not provide positive confirmation of asbestos fibers. Alternate differential counting techniques should be used if discrimination is desirable. Differential counting may include primary discrimination based on morphology, polarized light analysis of fibers, or modification of PCM data by Scanning Electron or Transmission Electron Microscopy.

A great deal of experience is required to routinely and correctly perform differential counting. It is discouraged unless it is legally necessary. Then, only if a fiber is obviously not asbestos should it be excluded from the count. Further discussion of this technique can be found in reference 8.10.

If there is a question whether a fiber is asbestos or not, follow the rule:

"WHEN IN DOUBT, COUNT."

6.8. Analytical Recommendations -- Quality Control System

6.8.1. All individuals performing asbestos analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos or an equivalent course.

6.8.2. Each laboratory engaged in asbestos counting shall set up a slide trading arrangement with at least two other laboratories in order to compare performance and eliminate inbreeding of error. The slide exchange occurs at least semiannually. The round robin results shall be posted where all analysts can view individual analyst's results.

6.8.3. Each laboratory engaged in asbestos counting shall participate in the Proficiency Analytical Testing Program, the Asbestos Analyst Registry or equivalent.

6.8.4. Each analyst shall select and count prepared slides from a "slide bank". These are quality assurance counts. The slide bank shall be prepared using uniformly distributed samples taken from the workload. Fiber densities should cover the entire range routinely analyzed by the laboratory. These slides are counted blind by all counters to establish an original standard deviation. This historical distribution is compared with the quality assurance counts. A counter must have 95% of all quality control samples counted within three standard deviations of the historical mean. This count is then integrated into a new historical mean and standard deviation for the slide.

The analyses done by the counters to establish the slide bank may be used for an interim quality control program if the data are treated in a proper statistical fashion.

7. CALCULATIONS

7.1. Calculate the estimated airborne asbestos fiber concentration on the filter sample using the following formula:

Where:

AC = Airborne fiber concentration

$$AC = \frac{\left[\left(\frac{FB}{FL}\right) - \left(\frac{BFB}{BFL}\right)\right] \times ECA}{1000 \times FR \times T \times MFA}$$

FB = Total number of fibers greater than 5 um counted
FL = Total number of fields counted on the filter
BFB = Total number of fibers greater than 5 um counted in the blank
BFL = Total number of fields counted on the blank
ECA = Effective collecting area of filter (385 mm(2) nominal for a 25-mm filter.)
FR = Pump flow rate (L/min)

```
MFA   = Microscope count field area (mm(2)). This is 0.00785 mm(2) for a
        Walton-Beckett Graticule.
T     = Sample collection time (min)
1,000 = Conversion of L to cc
```

Note: The collection area of a filter is seldom equal to 385 mm(2). It is appropriate for laboratories to routinely monitor the exact diameter using an inside micrometer. The collection area is calculated according to the formula:

Area = pi(d/2)(2)

7.2. Short-cut Calculation

Since a given analyst always has the same interpupillary distance, the number of fields per filter for a particular analyst will remain constant for a given size filter. The field size for that analyst is constant (i.e. the analyst is using an assigned microscope and is not changing the reticle).

For example, if the exposed area of the filter is always 385 mm(2) and the size of the field is always 0.00785 mm(2), the number of fields per filter will always be 49,000. In addition it is necessary to convert liters of air to cc. These three constants can then be combined such that ECA/(1,000 X MFA) = 49. The previous equation simplifies to:

$$AC = \frac{\left(\frac{FB}{FL}\right) - \left(\frac{BFB}{BFL}\right) \times 49}{FR \times T}$$

7.3. Recount Calculations

As mentioned in step 13 of Section 6.6.2., a "blind recount" of 10% of the slides is performed. In all cases, differences will be observed between the first and second counts of the same filter wedge. Most of these differences will be due to chance alone, that is, due to the random variability (precision) of the count method. Statistical recount criteria enables one to decide whether observed differences can be explained due to chance alone or are probably due to systematic differences between analysts, microscopes, or other biasing factors.

The following recount criterion is for a pair of counts that estimate AC in fibers/cc. The criterion is given at the type-I error level. That is, there is 5% maximum risk that we will reject a pair of counts for the reason that one might be biased, when the large observed difference is really due to chance.

Reject a pair of counts if:

$$\left| \sqrt{AC_2} - \sqrt{AC_1} \right| > 2.78 \times \left(\sqrt{AC_{AVG}} \right) \times CV_{FB}$$

)

Where:

AC1 = lower estimated airborne fiber concentration
AC2 = higher estimated airborne fiber concentration
ACavg = average of the two concentration estimates
CV(FB) = CV for the average of the two concentration estimates

If a pair of counts are rejected by this criterion then, recount the rest of the filters in the submitted set. Apply the test and reject any other pairs failing the test. Rejection shall include a memo to the industrial hygienist stating that the sample failed a statistical test for homogeneity and the true air concentration may be significantly different than the reported value.

7.4. Reporting Results

Report results to the industrial hygienist as fibers/cc. Use two significant figures. If multiple analyses are performed on a sample, an average of the results is to be reported unless any of the results can be rejected for cause.

8. References

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8.3. Bayer, S.G., Zumwalde, R.D., Brown, T.A., Equipment and Procedure for Mounting Millipore Filters and Counting Asbestos Fibers by Phase Contrast Microscopy, Bureau of Occupational Health, U.S. Dept. of Health, Education and Welfare, Cincinnati, OH, 1969.

8.4. NIOSH Manual of Analytical Methods, 2nd ed., Vol. 1 (DHEW/ NIOSH Pub. No. 77-157-A). National Institute for Occupational Safety and Health, Cincinnati, OH, 1977. pp. 239-1-239-21.

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8.7. Asbestos, Tremolite, Anthophyllite, and Actinolite, Code of Federal Regulations 1910.1001. 1988. pp 711-752.

8.8. Criteria for a Recommended Standard -- Occupational Exposure to Asbestos (DHEW/NIOSH Pub. No. HSM 72-10267), National Institute for Occupational Safety and Health NIOSH, Cincinnati,OH, 1972. pp. III-1-III-24.

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8.10. Dixon, W.C., Applications of Optical Microscopy in Analysis of Asbestos and Quartz, Analytical Techniques in Occupational Health Chemistry, edited by D.D. Dollberg and A.W. Verstuyft. Wash. D.C.: American Chemical Society, (ACS Symposium Series 120) 1980. pp. 13-41.

Quality Control

The OSHA asbestos regulations require each laboratory to establish a quality control program. The following is presented as an example of how the OSHA-SLTC constructed its internal CV curve as part of meeting this requirement. Data is from 395 samples collected during OSHA compliance inspections and analyzed from October 1980 through April 1986.

Each sample was counted by 2 to 5 different counters independently of one another. The standard deviation and the CV statistic was calculated for each sample. This data was then plotted on a graph of CV vs. fibers/mm(2). A least squares regression was performed using the following equation:

```
CV = antilog1(10)[A(log(10)(x))(2)+B(log(10)(x))+C]

where:

  x = the number of fibers/mm(2)

Application of least squares gave:

  A = 0.182205
  B = -0.973343
  C = 0.327499

Using these values, the equation becomes:

  CV = antilog(10)[0.182205(log(10)(x))(2)-0.973343(log(10)(x))+0.327499]
```

Sampling Pump Flow Rate Corrections

This correction is used if a difference greater than 5% in ambient temperature and/or pressure is noted between calibration and sampling sites and the pump does not compensate for the differences.

$$Q_{act} = Q_{cal} \times \sqrt{\left(\frac{P_{cal}}{P_{act}}\right) \times \left(\frac{T_{act}}{T_{cal}}\right)}$$

)

```
Where:

Q(act) = actual flow rate
Q(cal) = calibrated flow rate (if a rotameter was used, the rotameter
         value)
P(cal) = uncorrected air pressure at calibration
P(act) = uncorrected air pressure at sampling site
T(act) = temperature at sampling site (K)
T(cal) = temperature at calibration (K)
```

Walton-Beckett Graticule

When ordering the Graticule for asbestos counting, specify the exact disc diameter needed to fit the ocular of the microscope and the diameter (mm) of the circular counting area. Instructions for measuring the dimensions necessary are listed:

(1) Insert any available graticule into the focusing eyepiece and focus so that the graticule lines are sharp and clear.

(2) Align the microscope.

(3) Place a stage micrometer on the microscope object stage and focus the microscope on the graduated lines.

(4) Measure the magnified grid length, PL (um), using the stage micrometer.

(5) Remove the graticule from the microscope and measure its actual grid length, AL (mm). This can be accomplished by using a mechanical stage fitted with verniers, or a jeweler's loupe with a direct reading scale.

(6) Let D = 100 um. Calculate the circle diameter, d(c)(mm), for the Walton-Beckett graticule and specify the diameter when making a purchase:

$$d(c) = \frac{AL \times D}{PL}$$

Example: If PL = 108 um, AL = 2.93 mm and D = 100 um, then,

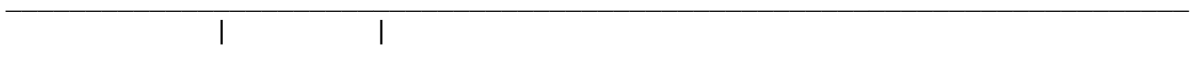
$$d(c) = \frac{2.93 \times 100}{108} = 2.71\text{mm}$$

(7) Each eyepiece-objective-reticle combination on the microscope must be calibrated. Should any of the three be changed (by zoom adjustment, disassembly, replacement, etc.), the combination must be recalibrated. Calibration may change if interpupillary distance is changed. Measure the field diameter, D (acceptable range: 100 plus or minus 2 um) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine the field area (mm(2)).

Field Area = pi(D/2)(2)
If D = 100 um = 0.1 mm, then
Field Area = pi(0.1 mm/2)(2) = 0.00785 mm(2)

The Graticule is available from: Graticules Ltd., Morley Road, Tonbridge TN9 IRN, Kent, England (Telephone 011-44-732-359061). Also available from PTR Optics Ltd., 145 Newton Street, Waltham, MA 02154 [telephone (617) 891-6000] or McCrone Accessories and Components, 2506 S. Michigan Ave., Chicago, IL 60616 [phone (312)-842-7100]. The graticule is custom made for each microscope.

Counts for the Fibers in the Figure



Structure No.	Count	Explanation
1 to 6.....	1	Single fibers all contained within the circle.
7.....	1/2	Fiber crosses circle once.
8.....	0	Fiber too short.
9.....	2	Two crossing fibers.
10.....	0	Fiber outside graticule.
11.....	0	Fiber crosses graticule twice.
12.....	1/2	Although split, fiber only crosses once.

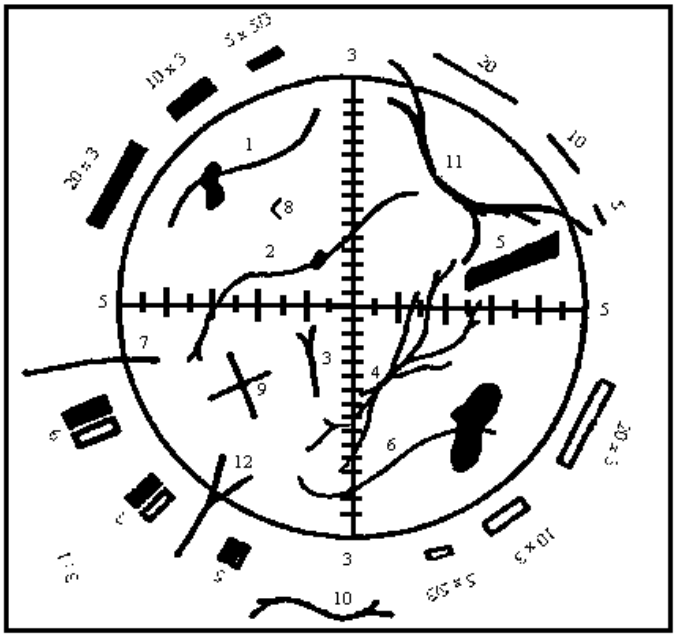


Figure 1: Walton-Beckett Graticule with some explanatory fibers.

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[57 FR 24330, June 8, 1992; 59 FR 40964, Aug. 10, 1994; 60 FR 33972, June 29, 1995]

This mandatory appendix contains the medical questionnaires that must be administered to all employees who are exposed to asbestos above permissible exposure limit, and who will therefore be included in their employer's medical surveillance program. Part 1 of the appendix contains the Initial Medical Questionnaire, which must be obtained for all new hires who will be covered by the medical surveillance requirements. Part 2 includes the abbreviated Periodical Medical Questionnaire, which must be administered to all employees who are provided periodic medical examinations under the medical surveillance provisions of the standard.

Part 1

INITIAL MEDICAL QUESTIONNAIRE

1. NAME _____

2. SOCIAL SECURITY NUMBER # _____

3. CLOCK NUMBER _____

4. PRESENT OCCUPATION _____

5. PLANT _____

6. ADDRESS _____

7. _____
   (Zip Code)

8. TELEPHONE NUMBER _____

9. INTERVIEWER _____

10. DATE _____

11. Date of Birth _____
    Month Day Year

12. Place of Birth _____

13. Sex
    1. Male ___
    2. Female ___

14. What is your marital status?
    1. Single ___
    2. Married ___
    3. Widowed ___
    4. Separated/ Divorced ___

15. Race
    1. White ___
    2. Black ___
    3. Asian ___
    4. Hispanic ___
    5. Indian ___
    6. Other ___

16. What is the highest grade completed in school? _____

(For example 12 years is completion of high school)

OCCUPATIONAL HISTORY

17A. Have you ever worked full time (30 hours per week or more) for 6 months or more? 1. Yes ___ 2. No ___

IF YES TO 17A:

B. Have you ever worked for a year or more in any dusty job? 1. Yes ___ 2. No ___ 3. Does Not Apply ___

Specify job/industry _____ Total Years Worked _____

Was dust exposure: 1. Mild _____ 2. Moderate _____ 3. Severe _____

C. Have you ever been exposed to gas or chemical fumes in your work? 1. Yes ___ 2. No ___

Specify job/industry _____ Total Years Worked ___

Was exposure : 1. Mild _____ 2. Moderate _____ 3. Severe _____

D. What has been your usual occupation or job -- the one you have worked at the longest?

1. Job occupation _____

2. Number of years employed in this occupation _____

3. Position/job title _____

4. Business, field or industry _____

(Record on lines the years in which you have worked in any of these industries,