11/79

Asbestos
Rule - Steve thought you would want this

[redacted]

ASBESTOS - A PROFILE

Asbestos - A Profile

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I. INTRODUCTION:

Asbestos has been recorded in literature from the days of the Romans, but it was not mined and used in large quantities until the deposits in Canada were made available in 1878. Gradual increases in production and use occurred during the next 50 years, followed by accelerated use more recently.

The report was initiated in August, 1978 with a survey of asbestos containing products used Wilmington Works. The purpose of this report is to answer questions such as - What is asbestos? Why is it a matter of concern? Where does the Wilmington Works stand in relation to the broader perspective and what should be done?

Every effort was made to tap all possible information sources and the results have been compiled in this report. To understand the seriousness of the problem, it is essential to read the complete report.

Some of the information included is very interesting and is contrary to general belief. It is useful not only at work, but in our day to day life.

II. MINERALOGY AND PHYSICAL/CHEMICAL PROPERTIES

Asbestos is a generic term applied to thirty fibrous silicates minerals. There are two groups and six common varities.

GROUP	VARIETY	CHEMICAL FORMULA
Serpentine	Chrysolite (White Asbestos)	$Mg_3\ Si_2\ O_5\ (OH)_4$
Amphiboles	Crocidolite (Blue Asbestos)	$Na_2\ Fe_5\ Si_8\ O_{22}\ (OH)_2$
	Amosite	$(FeMg)_6\ Si_8\ O_{22}\cdot(OH)_2$
	Anthophyllite	$(FeMg)_7\ Si_8\ O_{22}\ (OH)_2$
	Tremolite	$Ca_2\ Mg_5\ Si_8\ O_{22}(OH)_2$
	Actinotile	$(CaMgFe)_6\ Si_8\ O_{22}\ (OH)_2$

Discussion of Properties: The important physical, chemical and mineralogical properties are included in the Table 1. The other important properties are as follows and are also briefly discussed.

1. Resistance to heat.
2. Resistance to acid and alkalis
3. Tensile strength
4. Thermal decomposition and thermal insulation.
5. Surface area
6. Filtration properties
7. Bond strength.

1. Resistance to heat: All forms of asbestos progressively breakdown to simpler components, such as pyroxenes and silica, when heated to temperatures in the range of 1100°F to 1800°F. It may be noted that asbestos fibers as such do not have a melting point. It is the products of decomposition which melt.

2. Resistance to Acids and Alkalis: The reactivity of asbestos minerals towards acids and alkalis is fairly well known. Strong acids rapidly decompose Chrysolite with removal of all Mgo and H_2O content, amounting to about 58% weight, but amphibole fibres show various degrees of resistance to reaction with acids. All varieties of asbestos will resist prolonged attack by strong alkalis, such as 5 ON NaOH, at lease up to 212°F.

3. Tensile Strength: This is the most important and most commonly quoted, physical properties of asbestos fibres. There is however, considerable diversity in the published values of tensile strength of the various fibres. Under the influence of heat, the onset of detectable decomposition of asbestos fibres begin above 900°F. However, between 400°F and 900°F, their tensile strength decreases. For example, for Chrysolite the percentage of original tensile strength at 600°F is 92%, at 800°F it is 73%, 1000°F is 59% and 1200°F is 32%. This property plays a significant role in the reinforcing effects of asbestos fibers in asbestos cement, reinforced plastics and similar products.

4. Thermal Decomposition and Thermal Insulation: All varieties of asbestos fibers break down progressively through a series of internal reactions which may begin as low as 400°F. This does not mean their properties as heat insulators are diminished. Whether compounded partially or wholey into heat insulating materials, asbestos fibers posses ablative properties in that the products of decomposition at a hot surface form a poorly conductive layer which provide protection to the succeeding layers of insulation. The insulating properties of asbestos depend much more on its fibrous nature and on the poor thermal conductivity of individual fibres than on limitations arising from its thermal decomposition. There are some organic and inorganic materials which can be classified as better insulating agents heat (and electricity) than asbestos. However, asbestos posseses a combination of different properties which makes it particularly suitable for heat insulation. Asbestos-phenolic molded plastic insulators are used in rockets and missles where temperature ranges from 3000 to 20,000°F are encountered for short durations such as seconds to minutes.

5. Surface Area and Surface Properties: While tensile strength is the most important intrinsic physical property of asbestos fibres, their surface area is the most important parameter in all their industrial applications. The ability of asbestos fibres to open or split into finer fibres through suitable treatment is one of their most valuable properties.

6. Filtration Properties: The surface per unit weight of asbestos is 10 times as great as that of organic and inorganic fibers. Because of this characteristic filtering through asbestos makes it possible to retain much finer precipitates. The asbestos filters are used for wines, fruit juices, beers, pharmaceuticals, sugar, blood plasma and other liquids or gases. The conventional dust filters such as electrostatic precipitators, wet and dry filters show a high efficiency for separation of particle from 1 micron (1 millionth of an inch) and larger. They are ineffective in the range of .2 to .1 micron. Asbestos fibers play an important role in the range.

ASTM GRADE CLASSIFICATION FOR ASBESTOS:

GRADE	% ASBESTOS BY WEIGHT	TEMP. LIMIT (°F)
Commercial	75 - 80	400
Under-writers	80 - 85	450
A	85 - 90	550
AA	90 - 95	600
AAA	95 - 99	750
AAAA	99 - 100	900

PHYSICAL, CHEMICAL AND MINERALOGICAL PROPERTIES OF ASBESTOS

Table I

PROPERTY	CHRYSOLITE	CROCIDOLITE	AMOSITE	ANTHOPHYLITE	TREMOLITE	ACTINOLITE
Essential Composition	Hydrous silicates of Magnesia	Silicates of sodium & iron with some water	Silicates of iron & magnesium higher iron than Anthophylite	Magnesium silicates with iron	Calcium & Magnesium silicates with some water	Calcium & magnesium iron silicates, water up to 5%
Resistance to acids	Poor	Good	-	-	Good	Good
Veining	Cross & slip fibers	Cross fiber	Cross Fiber	Slip mass fiber, unoriented & interlacing	Slip or mass fiber	Slip or mass fiber
Color	Green, Gray, Amber to White	Blue	Gray, Yellow to dark brown	Yellowish brown, Grayish white	Gray-White, greenish yellowish, bluish	Greenish
Hardness, Mohs	2.5 - 4.0	4	5.5 - 6.0	5.5 - 6.0	5.5	6
Flexibility	High	Good	Good	Poor	Poor	Poor
Spinnability	Very good	Fair	Fair	Poor	Poor	Poor
Tensile strength lbs/sq. in.	824,000 max.	876,000 max.	16,000-90,000	4,000 and less	1,000 - 8,000	1,000 and less
Youngs Modulous	23.57	27.14	23.57	-	-	-
Fusion Point °F	2770	2180	2550	2675	2400	2540
Specific Heat BTU/lb - °F	.266	.201	.193	.210	.212	.217
Electric Charge	Positive	Negative	Negative	Negative	Negative	Negative
Volume Resitivity Megahom-Cm	.003-0.15	2.5 - 7.5	up to 500	0.2 - 0.5	-	-
Filtration Properties	Slow	Fast	Fast	Medium	Medium	Medium
Sp. Gravity	2.4 - 2.6	3.2 - 3.3	3.1 - 3.25	2.85 - 3.1	2.9 - 3.2	3.0 - 3.2

PROPERTY	CHRYSOLITE	CROCIDOLITE	AMOSITE	ANTHOPHYLITE	TREMOLITE	ACTINOLITE
Resistance to Destruction by heat	Good, brittle at high temp.	Poor, fuses	good, brittle @ high temp.	Very good	Fair to good	-
Temp. @ ignition loss °F	1800	1200	1600 - 1800	1800	1800	-
Magnetite Content %	.0 - 0.5	3.0 - 5.9	-0-	-0-	-0-	-
Crystal Structure	Fibrous & asbestiform	Fibrous	Prismatic lamellar to fibrous	Long & thin columnar to fibrous	Long & thin columnar to fibrous	
Crystal System	Monoclinic and orthorhombic	Monoclinic	Monoclinic	Orthorhombic	Monoclinic	Monoclinic

III. THE ASBESTOS INDUSTRY

The Asbestos Inventory

In 1977, the world wide asbestos industry mined and processed approximately 6 million tons of all kinds of asbestos. The breakdown is as follows:

	Approximate Percentage
Iron Curtain Countries	45
Canada	34
South Africa	8
U. S. A.	2
Other Countries	11

The U. S. Supply and Demand pattern is shown in Table 2. Chrysolite accounts for approximately 97% of all asbestos used in industry.

MINING & MILLING

U. S.: The amount of mining in U. S. is small as compared to the rest of the world. The mines in U. S. are in California, Vermont, Arizona and North Carolina (Yancy County).

CANADA: Canada is the biggest supplier of asbestos in the free world.

SOUTH AFRICA: Most of the amphibole asbestos e.g. amosite and crocidolite are mined in South Africa.

U. S. SUPPLY AND DEMAND PATTERN - 1976

WORLD MINE PRODUCTION	X 1,000 TONS	%
U. S. A.	115	2
Rest of World	4885	98
TOTAL	5000	

U. S. SUPPLY PATTERN		
Domestic	125	14
Imports	762	86
TOTAL	887	

DISTRIBUTION OF U. S. SUPPLY		
Industry Stock Dec. 31	115	13
Exports	47	5
Industry Demands	725	82
TOTAL	887	

U. S. DEMAND PATTERN		
Floor Products	113	16
Asbestos Cement Pipe	140	19
Roofing Products	253	35
Friction Products	64	9
Asbestos Cement Sheets	23	3
Packing & Gaskets	20	3
Insulation	9	1
Paper Products	31	4
Textiles	7	1
Others	65	9
Total...	725	

MILLING PROCESS

The fiber extraction process is of four successive steps:

1. Ore Preparation: Crushing, sizing, sorting and drying

2. Rock Lines: Sequence of impact crushing, fiberizing and air-lifting of asbestos on shaking screens.

3. Fiber Lines: Air lifted fiber from "rock lines" is dedusted in cyclones, fiberized, sized and cleaned (and mixed), ready for packaging.

4. Dust Treatment: Further screening, pulverizing and sizing of all dust in the bagroom to recover salable short fibers.

MANUFACTURING INDUSTRIES

Industrial Uses: Asbestos has been a known health hazard for almost 36 years and yet, during the same period, the use of asbestos has risen at an accelerating rate. The basic reason is asbestos has astonishing physical properties such as resistance to high temperature, resistance to acids and other chemicals, excellent absorbtion and filtration properties, flexible fibers with very high tensile strength, important surface properties and reinforcing quality

There are well over 3000 recorded uses of asbestos. A summary of common industrial uses is given in Table 3.

Consumer Usage: It is surprising to note how asbestos is an integral part of our present society. A review of asbestos use in consumer product was completed by the Consumer Product Safety Commission in April, 1978 - See Table 4.

COMMON INDUSTRIAL USES OF ASBESTOS - TABLE 3

1. ASBESTOS-CEMENT MATERIALS

Flat sheets and wallboard, all thicknesses converted to 1/4 in. basis
Slabs
Corrugated sheets
Pipes
Corrugated tiles for roofs in industry, agriculture and dwellings
Planks for platforms in buildings under construction
Balcony canopies
Rain gutters
Interior walls
Ventilating shafts
Air conditioning assemblies
Pressure piping (for underground drinking water distribution systems, fuel gas and sewage)
Cooling towers (electricity-generating stations)
Asbestos felts
    Roofing-asphalt or tar saturated
    Other
Other asbestos and asbestos-cement products, including millboard and pre-fabricated housing components.

2. ASBESTOS SHINGLES AND CLAPBOARD

Siding shingles and clapboard, including accessories
Roofing shingles

3. ASBESTOS FRICTION MATERIALS

Brake Linings
    Woven, containing asbestos yarn, tape or cloth
    Molded, including all nonwoven types
Clutch Facing
    Woven, containing asbestos yarn, tape or cloth

4. ASBESTOS TEXTILES

Yarn, cord and thread
Cloth
Other asbestos textiles, including roving, lap, wick, rope, tape, carded fibers, etc.

5. GASKETS AND INSULATION

Gaskets, all types
Gaskets(for sealing nonmoving parts)
    Asbestos, asbestos-metallic and asbestos-rubber
Packing(except leather, rubber and metal) and asbestos insulations
    Asbestos compressed sheet
Packing (for sealing moving parts)
    Asbestos, asbestos-metallic and asbestos-rubber)
Insulation materials containing asbestos pipe insulation(cellular and laminated)
    85% magnesia
    Diatomaceous silica, calcium silicate, expanded silica and asbestos fiber
Other block insulation, including cellular and laminated
All other asbestos insulation

6. ASBESTOS BOARDS AND PAPERS

Boards
- Filtering and clarifying
- Coverings, coatings, casings and jacketings for all kinds of surfaces
- Manufacturing of welders' and melters' shields
- Slideways in the glass industry
- Handles and fire doors
- Auto parts
- Safes
- Protective walls
- Curtains, etc.

Sheets
- Inner/outer linings of furnaces and heating vessels, drying ovens, incubators, heaters, climate-controlled spaces, etc.

Plates
- Insulating buildings against vibrations(aluminum-asbestos)
- Solar-heat reflecting surfaces (70% of solar heat)

Special Asbestos Papers
- Filters

7. ASBESTOS PLASTICS

Flooring tiles (asbestos-asphalt tiles and increasingly, asbestos-polymers of vinyl)
Pressed or molded (thermal insulation and in electrical machinery)
Resinated asbestos felt(Manufacturing of wings and firing of missles and expansion cones for nozzles of boost motors). Other uses in aircraft industry:
- Nozzles for motor tubes, missile tailpipes and missile-heat barriers, fuselages for guided missiles, fuel tanks for fighter bombers, cabin floors, etc.

8. ASBESTOS ACID-RESISTANT COMPOSITIONS

Used mostly in chemical industry

REVIEW OF ASBESTOS USE IN CONSUMER PRODUCTS - TABLE 4

A/C Pipe Joint Sealant
Acoustical Ceiling Tile
Acoustical Material, Sprayed
Adhesives: Glue
Epoxies
Mastics
Air Conditioners
Air duct joint sealing cement
Aluminized Cloth(Asbestos)
Aluminum Roof Coating
Arm Protectors
Asbestos Cement Pipe (Water and Sewer)
Asbestos Cement Pipe Airduct
Asbestos Cement Sheet

Ash Trays
Automotive Mufflers
Automotive Undercoating
Awnings

Baking Sheets
Barbecue Firebed Materials
Bearings
Berets
Blackboards
Blankets
Blocks
Boards
Brake Linings
Buffing & Polishing Compounds

Canal Liners
Candle Wicks
Caps
Catalytic Heater Mantles
Caulking Compounds & Putties
Cement Boards
Cement Partitions
Cement Roofing
Cement Sewer Pipe

Cement Tile
Ceramic and Quarry Floor Tile
Chalk Boards
Cigarette Lighter Wick
Clapboard
Cloth (Asbestos)
Clothing
Clutch Facings
Components for Erector Set Housing
Composition for Lighting Campfires (Heating Comp.)
Composition for patching plywood
Conveyor Belting
Cord, (Asbestos
Cord (Electrical)
Corrugated Roofing
Corrugated Sheet
Curling Irons
Curtains (Theatre)
Custom Auto Body Filler

Dehumidifying Apparatus
Diaphragm
Discs
Draperies
Drier Felt (Asbestos)
Drilling Fluids
Electric Blankets
Erector Set parts
Fabrics
Felt
Fertilizer sticks
Fiber and Cement Pipe
Fiberglass polishing cloth
Filler and Reinforcement in plastics
Filler for shoe soles
Fillers
Filter, Auto emission
Filtering Materials, Filters
Filters for Tobacco smoke
Firebox in fireplaces(stage sets)
Fire door
Fire fighting composition
Fireplace Ash and Logs
Fire-starters and Barbeque lighters
Flashing cement
Floats
Flooring
Flower pots
Furnace cements
Gaskets
Glazing compount
Gloves

Graphic Paper
Grinding Wheels
Gun grips

Hats
Hair dryers
Heater Cord
Heating pads
Helmets
Hoods
Ink storage composition
Iron cords
Ironer rolls
Ironing board pads & covers
Joint Cement
Kilns, potters
Kitchen counter surfaces
Kitchen towels
Laboratory Table tops
Lamp mantles
Lamp sockets
Latex paints
Lining (Radiator Covers)
Linings for safes & filing cabinets
Lumber
Mantles (Lantern)
Mastic
Mats (for gas stove burners)
Metal deadener
Metallic cloth
Millboard
Mittens
Molded plastics
Movie, sets
Oil well packing fluids
Overgaitors

Packaging Film
Packing
Paints
Paints, texture
Panels
Paper (asbestos)
Patching compound
Phenolic laminates
Pigmented asbestos coating systems
Pipe and boiler coverings
Pipe insulation
Plastic covering
Plastic fillers
Plastic shingles
Plywood patch
Polishing cloth
Polishing wheel cement
Pot holders & oven mitts
Potters kilns (home bobby)
Pottery
Powder (asbestos)
Pressure sensitive tape
Protected metals
Puttys
Radiator(home)insulation
Radiator sealant
Ranges
Refractory
Refrigerant Cement
Relief pictures
Resins
Rheostat backing
Rocket propellant
Roof cements
Roof coating
Roofing felts

Roof patch
Roof preservative
Rope
Rotisserie broilers
Rubber
Safety Equipment
Scrap
Sealants
Sheet flooring
Sheeting
Shingles
Shorts (asbestos
Siding
Sleeves
Slow cookers
Smokers bib
Soil erosion preventative
Spackling
Stains
Stove Linings (gas and electric)
Stove mats
Stoves (coal and wood burning
Suits
Tape
Tape joint cement
Tent grommets
Textiles
Texture coating
Textured vault spray
Thermal insulation & spray
Toasters
TV sets
Twine
Umbrella
Undercoating
Varnish
Vases
Vibration dampening mat.
Wadding, amunition
Wallpaper
Welders headgear and electrodes
Welding rods
Wick packing
Wipers(felt)
Wood filler
Woven asbestos tape (or listing)

IV. OCCUPATIONAL EXPOSURE TO ASBESTOS

The exposure levels of some of the common manufacturing industries are discussed. The basic purpose is to present comparative data.

MINING & MILLING: Average of asbestos fiber exposures (daily weighted average range from .04 to 24.8 f/ml (greater than 5 micron in length). This is one of the most difficult areas of dust control.

ASBESTOS-CEMENT PRODUCTION: High dust exposure during mixing operation. Per a survey by NIOSH, it was shown that the highest means of 6.3 f/ml was obtained in mixing and the lowest mean of 0.5 f/ml in miscellaneous operation.

INSULATION AND CONTRUCTION INDUSTRIES: Spraying of asbestos insulation and removal of old lagging materials, commonly in confined spaces may produce high dust concentration. Very high fiber concentration has been found in Naval dock yards. In insulation plants the highest means of 74.4 F/CC was obtained in mixing and the lowest mean of 16.6 F/CC in miscellaneous operations. A concentration of 66.0 f/cc was obtained from an area sample taken 20 feet from the nozzle during spraying operation. Dust concentration in Naval dock yards during removal of blue sprayed asbestos varied from 112-1906 and the bagging of asbestos debris ranged from 106 - 3,815.

FRICTION MATERIALS: Per a survey by NIOSH of plants manufacturing brake linings and clutch faces, the highest mean of 14.4 f/cc in a cutting and drilling operation and the lowest of 2.2 f/cc in miscellaneous operations.

SERVICING OF BRAKE SHOES: Per a study by NIOSH average peak asbestos air concentration during the blow out operation of the drum brake was 10.5 f/cc within 10 feet of the operator.

FLOOR TILE INSTALLATION: Per a study dust concentration during sanding operation prior to installation of new floor coverings was 1.3 f/cc.

TEXTILE PRODUCTS: In a British textile factory, based on a static sampler, yearly mean dust levels (f/ml) ranged from 8 for carding operation to .5 for weaving operation.

MACHINING PROCESS USING INSULATION BOARD

OPERATION	f/ml
Drilling Vertical Structures	2-5
Sanding and surforming	6-20
Scribing and breaking	1-5
Hand sawing	5-12
Machine sawing without effective local exhaust ventilation:	
Jig Saw	5-20
Circular Saw	20 upwards
Unloading deliveries of board, short term sampling - Cut pieces	5-15
Standard sizes	1-5

V. NON OCCUPATIONAL EXPOSURE TO ASBESTOS

Asbestos is wide spread in the environment because of its extensive use in industry and the home. Because of this wide usage, it may be difficult at times to determine if a disease arising from asbestos is occupational in origin. For example, the air of some relatively new apartment buildings has been found to contain more asbestos fibers than the maximum recommended levels in industry. The source of the fiber is the insulating material used in the ventilating system. A recent study of street dust in Washington D. C. showed approximately 50,000 fibers per gram, much of which appear to come from brake linings. Autopsies of New York City residents with no known occupational exposure, showed 24 of 28 lung samples to contain asbestos fibers, perhaps resulting from asbestos from brake linings and the flaking of sprayed asbestos insulation material.

Some of the sources for non-occupational exposures are discussed below:

ENVIRONMENTAL EXPOSURE DUE TO MINING

ASBESTOS EXPOSURES IN HOUSES, OFFICES AND OTHER BUILDINGS

There is minimal dust exposure from materials incorporating asbestos (e.g. wall-board, ceiling tiles, etc.) in the house, office or other buildings. However, sprayed acoustic and thermal insulation, if not properly sealed, can become friable and constitute a potential long term health hazard, especially if the asbestos covered surface is present in the air supply system of the occupied buildings. Some studies have shown the range of concentrations varying from .26 - 11.89 f/cc. Asbestos was used in spray insulation in buildings between 1950 and 1972. One report states that half of the new (1958 to 1970) office buildings in U. S. were fire proofed with asbestos material. It was also shown that significant fiber counts have only been found where directly visible damaged to the sprayed material was evident.

ENVIRONMENTAL POLLUTION FROM BRAKE SHOES

COMMUNITY EXPOSURE FROM ASBESTOS ASPHALT PAVEMENTS

Asbestos is added to asphalt (2 and 3% by weight) to obtain an improved pavement overlay with increased cohesion and abrasion resistance. This type of paving has been applied extensively in California, where it is estimated that more than 20% of the population resides in proximity to asbestos-asphalt paving. The procedure is becoming increasingly popular elsewhere, especially on turnpikes. The asbestos in asphalt is never completely locked in and it is suspected that due to increased vehicular activity, some fibers may be separated and are likely to be airborne in due course.

EXPOSURE FROM WASTE DISPOSAL

VI. ASBESTOS IN WATER AND BEVERAGES

The recent discovery of submicron asbestos fibers in beer, wine and drinking water has resulted in public concern that a health hazard exists. It is also suspected that the gastrointestinal (GI) tract receives most of the inhaled and subsequently ingested fibers that may cause GI cancer.

One of the most well known examples of water pollution is in Duluth, Minnesota. In the past 20 years, the Reserve Mining Company has dumped approximately 200 million tons of tactonite tailings into Lake Michigan. Asbestiform fibers in the drinking water of Duluth is at a level of 12 million fibers per litre.

Asbestos fibers in beverages has been attributed to the asbestos filters used by the industry. As per one study, the samples showed the following levels:

	Millions of Fibers per Litre
Beer -	2.0
Italian Vermooth	11.7
Ginger Ale	12.2

VII. ASBESTOS DUST CONTROL

Asbestos dust arising from the various process outlined earlier must obviously be controlled to the greatest extent possible. Local ventilation and control of the air around dust creating operations is the most widely used of all control operations. It is however, an expensive process and not always totally effective or practical. Control by nonventilation processes are often cheaper and more effective in places where they can be used.

I. Non-ventilation control processes

II. Ventilation

I. NON VENTILATION CONTROL PROCESSES

1. Substitution: The asbestos dust problem would be solved if safe and acceptable substitutes could be found. However, it is not always possible to find effective substitutes.

   An industry survey was made to find substitutes for materials used at Wilmington Works. The results were compiled in a separate report. The list of industries surveyed is included in Appendix I. To find suitable substitutes the following sources were contacted:

   a. Editors of various trade journals

   b. Editors of various trade journals

   c. In-house B & W personnel.

   Appendix II includes a list of these sources.

   Table 5 describes some of the common asbestos substitutes. To find specific substitutes is beyond the scope of work of the Facilities Engineering Department. However, an effort was made to locate the possible substitutes. The information compiled during the industry survey will be forwarded to Design Engineering.

2. Treatment:

a) Locked in asbestos products, such as rubberized sheets, plasticized or aluminized cloths, reduced to a great extent and in some cases, virtually eliminate the dust hazard.

b) Wet brushed or resin treatment minimizes fiber release during handling operations.

3. Wetting: Wet processing, considerably reduces the possibility of dust creation.

4. Avoid High Speed Machining: Millboard should be cut with a sharp knife instead of a saw. Asbestos textiles should be mechanically cut, clicked or sheared to avoid tearing.

5. Bagging: Proper bagging or packaging techniques minimize dust production during handling.

II. VENTILATION:

The basic control method for asbestos dust is ventilation. Local ventilation is more effective and cheaper, is preferred dilution ventilation whenever possible.

ASBESTOS SUBSTITUTES

TABLE 5

ASBESTOS CONTAINING MATERIAL	ASBESTOS FREE ALTERNATIVES	COMMENTS
Board & Sheet	Ceramic fiber-board & sheet	Higher ceiling temperature, 2300°F than asb. material, expensive.
Rope	1. Glas fiber rope	1. Ceiling temperature 932°F
	2. Ceramic fiber rope	2. Ceiling temp. 2300°F expensive
	3. Silica fiber rope	3. Ceiling temp. 1800°F very expen.
	4. Ceramic fiber felt strip	4. Maybe cheaper alternative to ceramic rope in some cases.
Cloth, tape, string Yarn, etc.	1. Glass fiber fabrics & Yarn	1. Ceiling temperatures up to 932°F depending on type of glass, some cloths may be difficult to handle.
	2. Ceramic fiber & Yarn	2. Ceiling temp. 2300°F, expensive
	3. Silica Fiber & Yarn	3. Ceiling temp. 1800°F. very expen.

VIII. SUMMARY OF OSHA ASBESTOS STANDARDS

The standard is divided into eight major sections.

1. 1910 . 1001 (b) - PERMISSABLE EXPOSURE LIMITS

   Sets maximum allowable asbestos fiber concentration in the work place air.

2. 1910 . 1001 (c) - METHODS OF COMPLIANCE

   Recommends procedures to meet permissable exposure limits.

3. 1910 . 1001 (d) - PERSONAL PROTECTIVE EQUIPMENT

   Specifies types of personal protective equipment and defines circumstances under which they are required.

4. 1910 . 1001 (e) - METHOD OF MEASUREMENT

   1910 . 1001 (f) - MONITORING

   Specifies monitoring procedures to determine if work places meet permissable exposure limits.

5. 1910 . 1001 (g) - CAUTION SIGNS AND LABELS

   States when caution signs and labels are required and wording to be used.

6. 1910 . 1001 (h) - HOUSEKEEPING

   Specifies results to be obtained from housekeeping and methods of waste disposal.

7. 1910 .1001 (i) - RECORD KEEPING

   Specified type and duration of monitoring record keeping. States requirements for employee notification of monitoring results if exposure is in excess of permissible exposure limits and of corrective action being taken.

8. 1910 . 1001 (j) - MEDICAL EXAMINATIONS

   Details requirement of medical examinations and duration of medical record keeping.

SPECIFIC COMMENT

- "Asbestos fiber" means asbestos fiber longer than 5 micrometers.
- The OSHA standard maximum permissable exposure limits of asbestos fibers in the work place are:

  a. 8-hour time weighed average: 2 fibers longer than 5 micrometers per cubic centimeter

SPECIFIC COMMENT - cont'd

b. Ceiling Concentration: 10 fibers, longer than 5 micrometers, per cubic centimeter.

IX. QUESTIONS AND ANSWERS ABOUT EXPOSURE TO ASBESTOS

1. Who may be at risk of developing asbestos-related diseases?

Workers in many occupations, particularly in asbestos mining and processing, shipyards, construction, and workers in automotive brake lining repair commonly are exposed to asbestos, and may inhale or perhaps swallow dusts contaminated with concentrations of this substance.

Risks of disease due to asbestos exposures have not been defined clearly for all occupational groups known to have significant exposure. Firm scientific data is available only for heavily exposed workers employed in asbestos mining, manufacturing and insulation. Over the past several years, evidence has accumulated that asbestos insulation workers previously employed in shipyards and elsewhere are experiencing asbestosis, a progressive and disabling lung disease, and asbestos insulation materials used in shipyards also have increased asbestos related disease.

There is evidence that the problem may be more widespread than previously believed. Workers from a variety of trades who have been employed in shipyards, presumably in or near areas contaminated by asbestos dust, are now beginning to show signs of X-ray abnormalities in the lungs typical of asbestos exposure. These include painters, electricians, carpenters, machinists, boilermakers, and welders who may not realize they were exposed.

Large numbers of persons worked around asbestos in shipyards during and since World War II. During the peak war years, 1940-1944, an estimated 4.5 million persons worked in shipyards in the United States, and even those not directly exposed to asbestos dust may have a higher risk of asbestos-related disease. In the last 15 years, the number of shipyard workers has stabilized to an annual workforce of approximately 200,000. Because of the high turnover in jobs during the war and afterward, no one really knows how many people experienced significant asbestos exposure in their work in the shipyards.

The total number of workers exposed to asbestos since the beginning of World War II, including shipyard workers is estimated between eight and eleven million.

2. What diseases may be caused by asbestos?

Asbestos can cause asbestosis and certain forms of cancer. Amont some groups of workers who were heavily exposed to asbestos, as much as 20-25 percent of all deaths are due to lung cancer. This rate is much higher than would be expected from the effects of cigarette smoking alone. In the general adult population, about 4-5 percent of all deaths are due to lung cancer. In addition, asbestos workers are an increased risk of mesothelioma, an otherwise uncommon type of cancer not associated with smoking and rarely observed in the general population. Above-average rates of cancers of the digestive system (esophagus, stomach, colon, rectum) have been found in groups of asbestos workers. Cancers of a number of other body sites also are thought to be associated with occupational exposure to asbestos, but these are less common.

QUESTIONS AND ANSWERS ABOUT EXPOSURE TO ASBESTOS

3. What is the role of cigarette smoking?

Asbestos and cigarette smoking together produce more lung cancer than either factor acting alone. For example, investigators at the Mt. Sinai School of Medicine in New York City, together with epidemiologists at the American Cancer Society, have found that asbestos workers who smoke have a risk of lung cancer 8 times the risk of smokers in the general population. Cigarette smoking also increases the risk of other types of cancer and disabling lung diseases (emphysema, bronchitis).

Some information suggests that quitting smoking can reduce this extremely high risk in asbestos workers.

Although nonsmoking asbestos workers have more lung cancer than nonsmokers in general, their risk is not as high as workers who smoke. They do not experience the extremely high risk of lung cancer of asbestos workers who smoke. However, they still are at increased risk of other asbestos-induced disease, including asbestosis, mesothelioma and gastrointestinal cancers.

4. How does asbestos cause disease?

The answer is not known. Asbestos fibers too fine to be seen by the human eye become airborne during various industrial processes and are inhaled and subsequently may be swallowed. Scientists believe the most harmful fibers are so fine that an electron microscope is needed to see them. Because of their size and shape, asbestos fibers can penetrate body tissues. Because of their durability, they remain in the body for many years after entry.

5. How much asbestos exposure is hazardous?

The answer is not known. In the case of asbestosis and lung cancer, the risk increases with increasing amount of exposure. Asbestos induced disease is not likely to appear until 15 to 35 or more years after first exposure. The time between first exposure and the appearance of disease appears related both to the amount and duration of exposure: more intense exposure sometimes results in asbestos-related disease within 15 years. However, one study of workers in an asbestos plant showed that some workers who were exposed only a month or two have developed asbestos-related diseases many years later.

Typically, the first 10 to 15 years after initial exposure are free of signs or symptoms. Early X-ray changes may appear in lung tissue after 10 to 15 years, but may not be accompanied by other significant symptoms. Some investigators have reported evidence of impaired lung function in workers with less than 10 years of exposure to asbestos.

6. What are the signs and symptoms of asbestosis?

Asbestosis is a chronic lung disease whose signs and symptoms result from permanent changes in lung tissue due to asbestos exposure. The earliest and most prominent sign is shortness of breath or exertion.

It rarely becomes apparent until at least a decade after first exposure. The disease process usually has to be rather advanced to produce shortness of breath, however.

A dry, crackling sound (rales), coming from the lungs during inhalation, is the most characteristic physical sign of asbestosis. Clubbing of the fingers is sometimes found, usually late in the disease. A bluish discoloration of the skin and the lining of the mouth and of the tongue also may occur in the later stages of the disease. A physical exam with X-rays will show diffuse scarring of the lungs as asbestosis develops, and lung function tests will show impairment of the maximum volume of air a worker can inhale.

7. Does asbestosis lead to lung cancer?

Scientists do not believe asbestosis necessarily leads to lung cancer, but the presence of this disease does indicate that a worker received considerable asbestos exposure and has a greater risk of developing asbestos-associated cancers than an unexposed person.

Both types of disease can be caused by the same environmental agent, and the development of each may be independent of the other.

8. What is mesothelioma?

Mesothelioma is an extremely rare cancer in the general population, but is more common among asbestos workers. It affects the pleura, a membrane lining in the chest cavity, or the peritoneum, a similar membrane lining in the abdominal cavity. A large proportion of mesothelioma cases can be traced to prior asbestos exposure.

Only 120 cases of mesothelioma of the pleura and peritoneum were reported in the National Cancer Institute's Third National Cancer Survey of 1969-71, compared to 24,049 cases of lung cancer. The nine areas surveyed represented approximately 10 percent of the United States population. There is some indication from recent scientific reports that mesothelioma is becoming a more common diagnosis.

9. What can be done to treat diseases that may be associated with asbestos?

Asbestosis: Most deaths from asbestosis are due to superimposed respiratory infections such as pneumonia and bronchitis, rather than to direct effects of the disease itself. These infections usually can be treated, but it is important to get medical attention early.

Lung and Esophageal Cancer: Treatment of these cancers depends on the type and amount of tissue affected. Lung cancer may be treated by surgery, drugs, radiation, or combinations of these treatments. Esophageal cancer is treated most often with radiation. As with most cancers, the treatment must be tailored to the individual patient.

Cancer of the Colon and Rectum: Surgery is curative in many cases and early diagnosis increases the likelihood of cure. Methods are available to improve the frequency of early diagnosis.

Mesothelioma of the Pleura or Peritoneum: Effective treatment is not yet available. Research is underway in the United States, Great Britain, and France to improve the treatment.

Cancer of the Stomach: Detection has been improved by development of the flexible gastroscope and gastric camera. Treatment is usually by surgery. New treatment regimens using drugs are improving the outlook for patients with this cancer.

Cancers of the Kidney, Larynx, and Oropharynx: Physician awareness of the possibility of occurrence improves chances for early diagnosis. These cancers often can be treated effectively by surgery and/or radiation therapy.

X. ASBESTOS -AT WILMINGTON WORKS

The asbestos at Wilmington Works is divided in the following categories:

1. Stock items: Discussed in the Table #6.
2. Standard Gaskets: Purchased for contract only. See Appendix 4.
3. Special gaskets manufactured per drawing at Wilmington Works. No list was developed.
4. Special gasket manufactured per drawing purchased from outside vendors. No list was developed.
5. Asbestos product used by M & C.
6. Asbestos gloves

OTHER INFORMATION INCLUDED IS:

1. Drawing numbers of asbestos containing product (stock items). See Table 6
2. Asbestos survey (shop input) See Appendix 5.

Table 6

ITEM			INVENTORY		INVENTORY COST($)								
PRODUCT	MFGR.	FOLIO	ANNUAL	ON HAND	UNIT PRICE	ANNUAL	ON HAND	STORAGE LOCATION	CONTAINER	WARNING LABEL	ASB/ NO ASB.	TREATED/ NOT TREATED	REMARKS
Insulation *	48 INS	512019	10,197 SF					C & D	Ctn	Yes	No asb.	N. A.	
"	"	512020	4,759 SF					C & D	Ctn	Yes	No asb.	N. A.	
"	"	512021	1,196 SF					C & D	Ctn	Yes	No asb.	N. A.	
"	Holmes	512031	2,325 SF					C & D	Ctn	No	No asb.	N. A.	
"	48 INS	512033	186 SF					C	Ctn	Yes	No asb.	N. A.	
"	Keene	512035	750 SF					C	Ctn	No	No asb.	N. A.	
"	48 INS	512037	192 SF					C	Ctn	Yes	No asb.	N. A.	
"	Keene	512039	2 SF					C	Ctn	No	No asb.	N. A.	
"	Keene	512041	391 SF					C	Ctn	Yes	No asb.	N. A.	
"	Keene	512043	270 SF					C	Ctn	Yes	No asb.	N. A.	
Insul.Cement	AP Green	512070	1,110					D	Bag	No	No asb.	N. A.	Mineral Base
Mortar HiTemp	B & W	512096		2,500#	.167			D	Bag				
Asb. M. Brd 1/8x42x 48	JM	512118	30	42 SF	.444	13.32	18.65	B	Ctn	Yes	Asb.	Not	
Asb.M.Brd 1/4 x 42 x 48	JM	512120	308	1,403SF	.520	160.16	729.56	B	Ctn	Yes	Asb.	Not	
Asb.M Brd 1/2 x 42 x 48	JM	512122	273	393SF	.576	157.25	226.37	B	Ctn	Yes	Asb.	Not	
Gskt HH Stl Asb.	--	526026	93	351ea	.294	27.34		A	Loose	No	Asb		
Gskt HH SPRL WND TP304	JM	526034	1	17ea	.333	.33		A	Loose	No	Asb.		
"	JM	526038	-	55ea	.75			A	Loose	No	Asb.		
Gskt CPRS ASB 60 x 63 x 1/8	--	526586	101	34SF	1.397	141.10		A	Loose	No	Asb.	Yes	
Pkg. Ring	JM 398	526601	48	109ea	1.214	58.27	132.33	A	Loose	No	Asb.	Not	
"	JM 398	526602	309	300ea	.808	249.67		A	Loose	No	Asb.		
"	JM 398	526605	96	100ea	.124	11.90		A	Loose	No	Asb.		
"	JM 398	526606	18	54ea	1.298	23.36	70.09	A	Loose	No	Asb.		
"	JM 398	526609	120	195ea	.615	73.80	119.93	A	Loose	No	Asb.	Not	
Pkg. Ring BRD	Garlock	526616	128	218ea	1.238	158.46		A	Loose	No	Asb.		
Ins.	B & W	512001	8350					D	Ctn	No	No asb.	N. A.	Ceramic fibre
"	B & W	512002	210					D	Ctn	No	No asb.	N. A.	Ceramic fibre
REFC	B & W	512003	253,300					D	Bag	No	No asb.	N. A.	
Ins.	48 Ins.	512005	1109					C	Ctn	Yes	No asb.	N. A.	Rock Wool

*ASTM Has removed all asbestos from all specifications of insulation materials

ITEM			INVENTORY		INVENTORY COST($)								
PRODUCT	MFGR.	FOLIO	ANNUAL	ON HAND	UNIT PRICE	ANNUAL	ON HAND	STORAGE LOCATION	CONTAINER	WARNING LABEL	ASB/ NO ASB.	TREATED/ NOT TREATED	REMARKS
REFC	B & W	512007	9100					D	Bag	No	No Asb.	N. A.	
Ins.	B & W	512008	575					C&D	Ctn	No	No Asb.	N. A.	Ceramic Fibre
Ins. Board	JM	512012	572					C	Ctn	No	No Asb.	N. A.	Fibre Glass
Refc	B & W	512017	7000					D	Bag	No	No Asb.	N. A.	
Ins. Block	48 Ins.	512046	1564					C	Ctn.	Yes	No Asb.	N. A.	
REFC	JM	512078	5000					D					
"	B & W	512106	6300					D	Bag	No	No asb.	N. A.	
Gskt	Armco	526241	67					A	Loose	No	No asb.	N. A.	Steel
"	"	526245	27					A	Loose	No	No asb.	N. A.	"
"	"	526247	16					A	Loose	No	No asb.	N. A.	"
"	"	526249	24					A	Loose	No	No asb.	N. A.	
Pkg. Sq. Asb. Brd.	GAR 234	526443	703	253 LF	.242	170.13		A	Loose	No	Asb.	Yes	
Pkg. Rnd. Asb. Brd.	MS 15308	526449	59	76 LF	.180	10.62	13.68	A	Loose	No	Asb.	Not	
Pkg. Rnd. Asb. TW	JM 1000	526453		15 LF	.170		2.55	A	Loose	No	Asb.	Not	
Pkg. Sq. Asb. Brd.	JM C13	526456	492	500 LF	.403	198.28		A	Roll	No	Asb.	Yes	
Pkg. Sq. Asb. Brd.	GAR 234	526457	214	306 LF	.493	105.50		A	Roll	No	Asb.	Yes	
Pkg. Rnd. Asb. TW	JM 1000	526465	1407	437 LF	.351	493.86	153.39	A,B	Ctn.	Yes	Asb.	Not	
Pkg. Sq. Asb. Brd.	Gar. 234	526469	1508	799 LF	1.093	1648.24		A,B	Roll	No	Asb.	Yes	
Pkg. Sq. Asb. Brd.	JM 787	526471	124	174 LF	.541	67.08	94.13	A	Loose	No	Asb.	Not	
Pkg. Rnd. Asb. Brd.	MS 15308	526480	208	36 LF	.424	88.19	15.26	A,B	Loose	No	Asb.	Not	
Pkg. Rnd Asb. TW	JM 1000	526482	679	449 LF	.502	340.86	225.40	A,B	Ctn.	Yes	Asb.	Not	
Pkg.Rnd. Asb. TW	JM 1000	526490	460	236 LF	.416	191.36	98.18	A,B	Ctn.	Yes	Asb.	Not	
Pkg.Sq.Asb. Brd.	JM CTI	526494	6	6 LF	2.323	13.94		A	Loose	No	Asb.	Yes	
Gskt Cprs 60x63x1/32	Garlock	526525	18	49 LF	.65 SF	11.7		A	Roll	No	Asb.	Yes	
Gskt Cprs 1 1/4 x 1/16	--	526536	0 LF	-				A	Ctn	No	Asb.	Yes	
Gskt Asb. WI 1/16 x 48	--	526537	20	16 SF	2.225	44.50		A	Roll	No	Asb.	Yes	
Gskt Cprs 1/32	Chestron	526541	167	285 SF	.712	118.90		A	Roll	No	Asb.	Yes	

ITEM			INVENTORY		INVENTORY COST($)								
PRODUCT	MFGR.	FOLIO	ANNUAL	ON HAND	UNIT PRICE	ANNUAL	ON HAND	STORAGE LOCATION	CONTAINER	WARNING LABEL	ASB/ NO ASB.	TREATED/ NOT TREATED	REMARKS
Pkg. Strp Fab	Raybestos	526553	123	390 LB	.443	54.49		A	Roll	No	Asb.	Yes	
Pkg. Tape Asb WN	JM 122	526558	240	275 LB	.157	37.68		A	Loose	No	Asb.	Yes	
Pkg. Tap Asb. WI	JM 121	526572	182	249 LB	.524	95.37		A	Loose	No	Asb.	Yes	
Pkg. Strp Fab	JM	526570	588	609 LB	1.932	1136.02		A	Loose	No	Asb.	Yes	
Pkg. Tape Asb WN	JM 122	526574	51	75 LB	.490	25.00	36.75	A	Loose	No	Asb.	Not	
Pkg. Tape Asb WN	JM122AAA	526575	340	294 LB	.648	220.32		A	Loose	No	Asb.	Yes	
Gskt ASB WI	Anchor	526582	234	250 SH	2.904	679.54		A,B	Roll	No	Asb.	Yes	
Gskt HH Stl Asb.	--	526069	784	900 ea	.157	119.95		A	Loose	No	Asb.	Yes	
Gskt HH Stl Asb.	--	526107	70					A	Loose	No	Asb.	Yes	
Gskt HH Stl Asb.	--	526126	39	11 ea	.303	11.82		A	Loose	No	Asb.	Yes	
Gskt HH Srl Asb.	--	526147	192	87	.203	38.98		A	Loose	No	Asb.	Yes	
Gskt AMB Sild	--	526170	2	-	-								
Gskt CPRS Asb	Oriental	526182	1387	1267 ea	.040	55.48		A	Loose	No.	Asb.	Yes	
Gskt CPRS Asb	Akron	526184	1071	183 ea	.055	58.91		A	Loose	No	Asb.	Yes	
Gskt CPRS Asb	Akron	526186	198	152 ea	.104	20.59		A	Loose	No	Asb.	Yes	
Gskt CPRS Asb	Akron	526188	522	250 ea	.092	48.02		A	Loose	No	Asb.	Yes	
Gskt CPRS Asb	Akron	526190	3140	1469 ea	.063	197.82		A,B	Ctn, Loose	No	Asb.	Yes	
" " "	Akron	526197	61	100 ea	.219	13.36		A	Loose	No	Asb.	Yes	
" " "	Akron	526198	42	19 ea	.187	7.85		A	Loose	No	Asb.	Yes	
" " "	Akron	526203	47	80 ea	.183	8.60		A	Loose	No	Asb.	Yes	
" " "	Akron	526209	67	56 ea	.240	16.08		A	Loose	No	Asb.	Yes	
" " "	"	526213	25	56 ea	.201	80.80		A	Loose	No	Asb.	Yes	
" " "	"	526221	12	48 ea	.108	1.30		A	Loose	No	Asb.	Yes	
" " "	Carolina	526229	6	48 ea	.254	1.52		A	Loose	No	Asb.	Yes	
" " "	Cinn.	526263	408	107 ea	.040	16.32		A	Loose	No	Asb.	Yes	
" " "	--	526230	-	4 ea	.289			A	Loose	No	Asb.	Yes	
Gskt ASB WI	Akron	526291	75	81 ea	2.111	158.33		A	Loose	No	Asb.	Yes	
Gskt COP Asb	"	526294	77	93 ea	3.752	288.90		A	Loose	No	Asb.	Yes	
Gskt COP Asb	Ohio	526328	24	8 ea	15.602	374.45		A	Loose	No	Asb.	Yes	
Gskt CPRS Asb	Carolina	526349	166	60 ea	.174	28.88		A	Loose	No	Asb.	Yes	
Gskt ASB WI	Akron	526355	81	52 ea	.809	65.33		A	Loose	No	Asb.	Yes	
Gskt AMB Sild	Akron	526359	96	22 ea	.395	37.92	8.69	A	Loose	No	Asb.	Not	
Gskt ASB WI	Akron	526361	10	12 ea	.830	8.30		A	Loose	No	Asb	Yes	
" " "	Carolina	526370	45	25 ea	.536	24.12		A	Loose	No	Asb.	Yes	

Table 6 cont'd

ITEM			INVENTORY		INVENTORY COST($)								
PRODUCT	MFGR.	FOLIO	ANNUAL	ON HAND	UNIT PRICE	ANNUAL	ON HAND	STORAGE LOCATION	CONTAINER	WARNING LABEL	ASB/ NO ASB.	TREATED/ NOT TREATED	REMARKS
Gskt MH ASB WI	Akron	526377	792	132 ea	2.721	2155.03		A	Loose	No	Asb.	Yes	
Gskt MH Spirl Wnd TP 304	--	526379	66	69 ea	2.916	192.45		A	Loose	No	Asb.	Yes	
Pkg. Rnd Asb. Brd.	JM 702	526425	709	3147 LF	.129	91.46	405.96	A	Ctn,Loose	Yes	Asb.	Not	
Pkg. Rnd Asb TW	GAR 117	526431	1224	937 LF	.120	146.88		A	Ctn	Yes	Asb.	Yes	Graphited
Pkg Rnd Asb. TW	JM 1000	526439	78	318 LF	.049	3.82	15.58	A	Loose	No	Asb.	Not	
Gskt MH Sprl Wnd TP304	JM	526380		12	3.345			A	Loose	Yes	Asb.	Yes	
Asb. CPRS Asb	JM	526187		52	.219			A	Loose	No	Asb.	Yes	
Pkg. Tape Asb UN	JM 122	526577	3200	228	.587	1878.40		A	Loose	No	Asb.	Yes	
Gskt CPRS Asb	JM	526234	-	500	.506			A	Loose	No	Asb.	Yes	
Gskt MH Sprl UND	JM	526074	10	14	.383	3.83		A	Loose	No	Asb.	Yes	
Pkg. Ring	Calock	526607	60	24	1.117	67.02		A	Loose	No	Asb.	Yes	
Gskt	Gar7021	526005	-	100	.226			A	Loose	No	Asb.	Yes	
Gskt	Gar7021	526008	400	710	.042	16.80		A	Loose	No	Asb.	Yes	
Gskt CPRS Asb	Akron	526231	60	55	.29	17.40		A	Loose	No	Asb.	Yes	
Pkg. Ring Raja	JM	526622	--	66	1.652			A	Loose	No	Asb.	Yes	
Gskt CPRS Asb	Gar 7021	526015	5000	1299	.102	510.00		A	Loose	No	Asb.	Yes	
Gskt CPRS Asb	Gar 7021	526178	90	61	.234	21.06		A	Loose	No	Asb	Yes	
" " "	"	526019	50	269	.044	2.44		A	Loose	No	Asb.	Yes	
Gskt COP SJ	JM	526330						A	Loose	No	Asb.	Yes	Copper
" " "	"	526353	10	75	.386	3.86		A	Loose	No	Asb.	Yes	
Pkg. Ring	GAR	526614	150	137	.633	94.95		A	Loose	No	Asb.	Yes	
Gskt MH Flexi tallic	-	354228	-	2	2.328			A	Loose	No	Asb.	Yes	
Pkg Ring JC C06	J Crane	526634	1000	740	.506	506.00		A	Loose	No	Asb.	Yes	
Pkg Ring JC C06	J. Crane	526635	800	927	.307	245.60		A	Loose	No	Asb.	Yes	
" " "	"	526636	-	39	.691				Loose	No	Asb.	Yes	
Pkg. Rnd Asb. Brd	Raybestos	526463		606	.316		191.50	A	Loose	No	Asb	Not	
			Total...		$ 14487.17		$2558.00						

DRAWING NUMBERS OF ASBESTOS CONTAINING PRODUCTS (STOCK ITEMS)

	DESCRIPTION	ID OR WD	OD. LG.	THICK	FOLIO	DWG
•	GSKT AMB	42 in.	48 in.	1/8 in.	512118	NONE
•	GSKT AMB	42 in.	48 in.	1/4 in.	512120	NONE
•	GSKT AMB	42 in.	48 in.	1/2 in.	512122	NONE
•	GSKT HH STL ASB				526026	5293C
•	GSKT HH SPIRAL WOUND TP304 ASB				526034	5292C
•	GSKT HH SPIRAL WOUND TP304 ASB				526038	5292C
	GSKT HH STL ASB				526047	5293C
	GSKT HH SJ MON ASB				526066	SS141001
•	GSKT HH STL ASB				526069	5293C
	GSKT HH SPIRAL WOUND TP316L ASB				526073	MS228340
•	GSKT HH STL ASB				526107	5294C
•	GSKT HH STL ASB				526126	5294C
•	GSKT HH STL ASB				526147	5294C
	GSKT HH STL ASB				526168	5294C
•	GSKT AMB SILD	13 1/2"	1/4 in.	13 1/2"	526170	29212A
			NA		526175	
•	GSKT CPRS ASB	1 1/2"	2 in.	1/16"	526182	12237A
•	GSKT CPRS ASB	2 in.	2 5/8"	1/16"	526184	12237A
•	GSKT CPRS ASB	2 in.	2 13/32"	1/16"	526186	C300429
•	GSKT CPRS ASB	2 3/8"	3 in.	1/16"	526188	77863A
•	GSKT CPRS ASB	3 in.	3 7/16	1/16"	526190	77863A
•	GSKT CPRS ASB	1 1/2"	3 3/4"	1/32"	526197	77863A
•	GSKT CPRS ASB	3 3/8"	4 in.	1/16"	526198	77863A
•	GSKT CPRS ASB	2 in.	4 3/8"	1/32"	526203	77863A
•	GSKT CPRS ASB	2 1/2"	5 1/8"	1/32"	526209	77863A
•	GSKT CPRS ASB	3 in.	5 7/8"	1/32"	526213	77863A
•	GSKT CPRS ASB	4 in.	7 in.	1/32"	526221	77863A
	GSKT CPRS ASB	5 17/32"	8 3/4"	1/32"	526227	12039A
•	GSKT CPRS ASB	6 in.	9 7/8"	1/32"	526229	77863A
•	GSKT CPRS ASB	1/4 in.	3/4 in.	1/8 in.	526263	24865C
•	GSKT CPRS ASB	7 in.	1/16"	7 in.	526230	93175A
	GSKT COP ASB	45/64"	1 11/64"	3/32" NA	526276	35519A
	GSKT ASB WI	26 in.	1/8 in.	39 in.	526286	65626D
	GSKT ASB WI	18 in.	1/8 in.	20 1/2"	526287	
•	GSKT ASB WI	15 3/4"	1/8 in.	19 3/4"	526291	69112A
•	GSKT COP ASB	25 in.	26 3/4"	1/16"	526294	62126A
•	GSKT CPRS ASB	4 5/8"	5 1/8"	1/8 in.	526349	12237A
•	GSKT ASB WI	4 1/2"	5 1/2"	1/8 in.	526355	49069A
•	GSKT ASB WI	6 1/2"	7 5/8"	1/16"	526356	76299B
•	GSKT AMB SILD	6 1/4"	1/4 in.	6 3/4"	526359	51908C
	GSKT ASB WI	6 5/8"	8 3/4"	1/8"	526360	77865A
•	GSKT ASB WI	6 in.	8 1/2"	1/8"	526361	104869D
•	GSKT ASB WI	3 3/4"	(POKE HOLE)		526370	18008A
•	GSKT MH ASB WI	12 in.	16 in.		526377	D104944
•	GSKT MH SPIRAL WOUND TP304 ASB				526379	D104944
•	GSKT MH SPIRAL WOUND TP304 ASB				526380	D104944
			NA		526390	
			NA		526395	
	GSKT CPRS ASB	60 in.	1/32"	63 in.	526525	NONE
	LF GSKT CPRS ASB	1/14"	1/16"		526536	NONE
	GSKT ASB WI			1/16"	526537	NONE
	GSKT CPRS ASB	60 in.	63 in.	1/16"	526541	NONE
•	GSKT ASB WI	48 in.		1/8 in.	526582	NONE
•	GSKT CPRS ASB	60 in.	63 in.	1/8 in.	526586	NONE
•	GSKT ARMCO	2 1/8"	4 3/8"	1/32"	526241	77866A
•	GSKT ARMCO	2 7/8"	3 21/32"	1/32"	526245	77866A
•	GSKT ARMCO	3 3/8"	4 5/8"	1/32"	526247	77866A

DRAWING NUMBERS OF ASBESTOS CONTAINING PRODUCTS
(STOCK ITEMS)

	DESCRIPTION	ID OR WD	OD. LG.	THICK	FOLIO	DWG
•	LF PKG RND ASB BRD JM702	1/8 in.			526425	
•	LF PKG RND ASB TW GAR117	3/16"			526431	(GRAPHITED)
•	LF PKG RND ASB TW JM1000	1/4 in.			426439	
•	LF PKG SQ. ASB BRD GAR234	1/4 in	1/4 in.		526443	
•	LF PKG RND ASB BRD MS15308	3/8 in.			526449	
•	LF PKG SQ. ASB BRD JM C13	3/8 in.	3/8 in.		526456	(MICALUB)
•	LF PKG SQ. ASB BRD GAR234	3/8 in.	3/8 in.		526457	
•	LF PKG RND ASB TW JM1000	1/2 in.			526465	
•	LF PKG SQ ASB BRD GAR234	1/2 in.	1/2 in.		526469	
•	LF PKG SQ ASB BRD JM787	1/2 in.	1/2 in.		526471	
	LF PKG SQ ASB BRD MTLC	1/2 in.	1/2 in.		526473	
•	LF PKG RND ASB BRD MS15308	5/8 in.			526480	
•	LF PKG RND ASB TW JM1000	5/8 in.			526482	
•	LF PKG RND ASB TW JM1000	3/4 in.			526490	
•	LF PKG SQ ASB BRD JMCTI	5/8 in.	5/8 in.		526494	
•	LF PKG STRIP FABRIC	1 in.	1/8 in.		526553	SS235203
•	LF PKG TAPE ASB WN JM122	1 in.	1/8 in.		526558	
•	LF PKG TAPE ASB WI JM121	2 in.	1/16"		526572	
•	LF PKG STRIP FABRIC	2 1/2"	1/8 in.		526570	
•	LF PKG TAPE ASB WN JM122	4 in.	1/8 in.		526574	
•	LF PKG TAPE ASB WN JM122AAA	2 in.	1/8 in.		526575	
•	PKG RING JM398	1 3/4"	2 1/4"	1/4 in.	526601	
•	PKG RING JM398	1 15/16"	2 11/16"	3/8 in.	526602	
•	PKG RING JM398	1 1/8"	1 7/8"	3/8 in.	526605	
•	PKG RING JM398	1 1/4"	2 in.	3/8 in.	526606	
•	PKG RING JM398	7/8 in.	1 5/8"	3/8 in.	526609	
•	PKG RING BRD	3 13/16"	5 13/16"	1/2 in.	526616	
•	LF PKG RND ASB. TW	3/8 in.			526453	
•	GSKT. COP ASB.	25 in.	26 3/4 in.	1/16"	526328	85869A
•	GSKT CPRS ASB.	2"	4 1/8"	1/8"	526187	77863A
•	PKG TAPE ASB WN JM 122AAA	3"	1/8"		526577	
					526234	
•	GSKT HH SPRL WND TP316L ASB				526074	44466A
					526607	
•	GSKT GAR 7021	1 3/4	1/8		526005	64758A
•	GSKT GAR 7021	1 3/4	1/8		526008	30560A
•	GSKT CPRS ASB	4 1/2	7 1/8	1/16	526231	77863A
•	PKG RING RAJAH	2 9/16	3 9/16	1/2	526622	JM2
•	GSKT GAR 7021	1 3/4	1/16		526015	116997A
•	GSKT GAR 7021	13/16	1 1/8	3/32	526019	91804A
•	GSKT COP SJ	3 5/16	4	1/16	526330	MS222737
•	GSKT COP SJ	4 7/16	6 3/8	1/16	526353	49080A
•	PKG RING GAR 234	2 3/8	3 1/8	3/8	526614	201319A
					354228	
•	PKG RING JC C06	1 1/2	1 7/8	3/16	526634	116204A
•	PKG RING JC C06	1 3/4	2 1/8	3/16	526635	116204A
•	PKG RING JC C06	2 7/8	3 1/4	3/16	526636	116204A
•	PKG RND ASB BRD MS 1530B	1/2			526463	

• THESE ITEMS ARE PRESENTLY STOCKED

DRAWING NUMBERS OF ASBESTOS CONTAINING PRODUCTS
(STOCK ITEMS)

5292C
5293C
5294C
12039A
12237A
18008A
201319A
24865C
29212A
30560A
35519A
49060A
49080A
44466A
51908C
62126A
64758A
65626D
69112A
76299B
77863A
77865A
77866A
85869A
91804A
93175A
104869D
116204A
116997A
C300429
D104944
MS 222737
MS 228340
SS 141001
SS 235203

XI. CONCLUSIONS & RECOMMENDATIONS

Conclusions:

1. Asbestos dust is a serious health hazard and should be treated as such.

2. Control dust from asbestos millboard should be the top priority.

3. Control of dust from untreated ropes, tapes and packing should be the next priority.

4. Substitution of asbestos products should be our on-going policy.

5. The total annual inventory cost for asbestos containing items is approximately $15,000. The cost of untreated items presently in the storeroom is approximately $2600.

Recommendations:

Implemented Items:

1. Dispose of the homemade food heating ovens throughout the shop with asbestos millboard insulation.

2. A non-asbestos substitute glove has been satisfactory tested and will be used as a replacement for asbestos gloves in 1979.

3. The use of asbestos coated weld rods has been discontinued.

Top Priority Items:

4. Asbestos Millboard: The AMB should be replaced with a substitute product immediately. A few potential substitute products have been located and will be evaluated by the Design Engineering. The other alternative is to purchase precut and treated AMB gaskets. Design Engineering has issued a letter to this effect to Graphics. If we continue to saw and machine AMB in our shops, we must install ventilation equipment and take measures to comply with the applicable OSHA standards. In the absence of ventilation, sawing should not be allowed. The AMB should be wetted and a sharp knife used for cutting to minimize dust generation.

5. Ropes & Packing: Find substitutes for asbestos ropes and packings.

6. Untreated asbestos product in stock: The untreated asbestos product in the stock room such as ropes, tapes and packing should be disposed of.

CONCLUSIONS AND RECOMMENDATIONS cont'd...

Control of Dust (Material)

7. All asbestos type gaskets and packing material for stock or contract must be "wet brushed or resin treated". These instructions were issued on June 21, 1976. Steps should be taken that they are strictly followed.

8. Locked in fibers: A number of asbestos fabrics with locked in fibers are available on the market. These items should be evaluated and used whenever possible.

Control of Dust (process)

9. The asbestos containing product should be wetted whenever possible before machining.

10. Asbestos textiles should be mechanically cut, clicked or sheared to avoid tearing or fraying. Use of sharp knife instead of sawing.

11. Precut gaskets

12. Bagging to minimize dust generation by handling.

13. Housekeeping and wast disposal.

M & C Related Items

14. Brake lining repairs.

15. Cement and grout should be asbestos free.

16. Asbestos floor tile replacement. Proper precautions should be taken.

17. Substitutes are available for most of the asbestos containing products used by M & C. Every effort should be made to use these.

Other:

18. Substitute Gaskets: We should be on the look-out for the new non-asbestos textiles coming on the market. At least two vendors have expressed interests in substitute gaskets, however, they need specific application information.

19. Isolate storage area for asbestos products.

20. Designate special work areas for cutting of asbestos products.

21. New Constructions - Efforts should be made so as not to use asbestos containing products with health hazard.

XII. APPENDIX

1. List of industries surveyed for asbestos substitute
2. List of sources contacted for asbestos substitute
3. References
4. List of standard purchased gaskets not in stock
5. Asbestos survey (shop input)
6. Asbestos O.S.H.A. Standard 1910 . 1001

APPENDIX 1

LIST OF INDUSTRIES SURVEYED FOR ASBESTOS SUBSTITUTES

MILLBOARD:

1. Eaglepitcher Industries, Cincinnati, Ohio 45202
2. Refractory Products Company, Carpentersville, Illinois 60110
3. Cem-Fil Corporation, Nashville, Tennessee 37210
4. Pars Manufacturing Company, Ambler, Pennsylvania 19002
5. Johns - Manville
6. Babcock & Wilcox

TEXTILES

1. Brenton Industries, Amsterdam, New York 12010
2. Chicago Contractors Supply, Inc., Chicago, Ill. 60612
3. Haveg Industries, Inc., Wilmington Del. 19808
4. HITCO, Gardenia, California 90249
5. J. P. Stevens & Company, New York, New York 10036
6. W. S. Libbey Co., Lewiston, Maine 04240
7. Garlock, Inc., Birmingham, Ala. 35209
8. Newtex Industries, Victor, New York 14564
9. R. M. Industrial Products Co, North Charleston, S. C. 29406
10. Southern Textile Corporation, Charlotte, N. C. 28232
11. Carborandum Co, Niagara Falls, New York 14302

ROPE, PACKINGS, SEALS, GASKETS

1. Garlock, Inc. Birmingham, Ala 35209
2. Pars Manufacturing Company, Ambler, Pennsylvania, 19002
3. Brenton Industries, Inc., Amsterdam, New York 12010.
4. A. W. Chesterton Company, Stoneham, Mass. 02180

ROPE, PACKINGS, SEALS, GASKETS cont'd

5. Flexitallic Gasket Company, Camden, New Jersey 08101

6. John Manville, Houston, Texas 77008

7. Phoenix Gasket & Packing Mfg. Co., Garwood, N. J. 07027

8. W. L. Gore & Associates, Inc., Elkton, Maryland 21921

GLOVES

1. Steel Grip Safety Apparel Company, Danville, Illinois 61832

2. 3-M, St. Paul, Minn. 55101

3. Newtex Industries, Victor, New York

4. Pars Manufacturing Company, Ambler, Penna. 19002

5. A-Best Products, Cleveland, Ohio 44111

LIST OF INDUSTRIES WHICH ARE INTERESTED IN ACTIVELY PURSUING ASBESTOS SUBSTITUTE GASKETS

1. Brenton Industries, Amsterdam, New York, 12010

2. Pars Manufacturing Company, Ambler, Pennsylvania 19002

3. Akron Gasket

4. Flexitallic Gasket Co., Inc. (spiral wound gaskets only)
Camden, New Jersey 08101

APPENDIX 2

LIST OF SOURCES CONTACTED FOR ASBESTOS SUBSTITUTES

REGULATORY AND GOVERNMENTAL AGENCIES

1. NIOSH, Atlanta, Georgia 30323
2. U. S. Consumer Product Safety Commission, Washington, D. C. 20207
3. Bureau of Mines, Washington, D. C. 20241
4. U. S. EPA, Washington, D. C.
5. U. S. EPA, Atlanta, Georgia 30308
6. U. S. EPA, Research Triangle Park, N. C. 27711
7. Amer. Conference of Governmental Industrial Hygienists, Lansing Mich. 48901
8. Department of Health, Education & Welfare, Atlanta, Ga. 30323
9. Office of Toxic Substances, Washington, D. C.

INDUSTRIAL JOURNALS

1. Power Engineering, Barrington, Illinois 60010
2. Power, New York, New York 10020
3. Plant Engineering, Barrington, Illinois 60010
4. M/C Design, Cleveland, Ohio 44114

INDUSTRIAL SOCIETIES

1. A. B. M. A. - Arlington, Virginia 22209
2. A. S. M. E. - New York, New York 10017
3. A. S. T. M. - Philadelphia, Pennsylvania 19103

APPENDIX 2 cont'd

IN-HOUSE SOURCES

Group:	1. O. J. Fisher
	2. S. E. Singleton
	3. M. L. Ruthrauff
FPGD:	4. H. H. Jenson
	5. W. E. Livesay
	6. F. W. McCollum
I&M:	7. Neil Hooker
	8. W. E. Longfield
	9. R. E. Lawrence
	10. P. B. King
	11. Joe Baumgartner
B & W Refractory:	12. Larry Long
Wilmington:	13. Larry Johnson
	14. J. B. Stokley
	15. J. R. Kutrow
	16. W. B. Norton

APPENDIX 3

REFERENCES:

1. Rajhans, G. S., and G. M. Bragg - Engineering Aspects of Asbestos Dust Control - AnArbor Science Publishers, Ann Arbor, Michigan, 1978.

2. McRae A., L. Whelchel and H. Rowland - Toxic Substances Control Source Book. Aspen Publications, Germantown, Maryland, 1978

3. Rosato, D. V. Asbestos, It's Industrial Applications, Reinhold Publishing Corporation, New York, 1959.

4. Hogson, A. A., Fibrous Silicates The Royal Institute of Chemistry, London, 1965.

5. Clifton, R. A. Asbestos - 1977, U. S. Dept. of Interior, Bureau of Mines, 1977.

6. "Review of Asbestos Use in Consumer Products", U. S. Consumer Products Safety Commission, 1978

7. "Asbestos Exposure - A Desk Reference for Communicators", DHEW Publication N-. (NIH) 78-1622, 1978

8. "Recommended Work Practices - Use and Handling of Asbestos Textile Products", Asbestos Information Association, Arlington, Virginia

9. "Current Intelligence Bulletin 5" DHEW (NIOSH) Publication No. 78-127, 1978.

10. "OSHA Safety & Health Standards" (29CFR1910), U. S. Department of Labor.

11. "Recommended Work Practices - Shop & Field Fabrication of Asbestos Sheet Products", Asbestos Information Association, Arlington, Virginia

APPENDIX 4

LIST OF STANDARD PURCHASED GASKETS NOT IN STOCK

STANDARD MATERIAL LIST
FINISHED PRODUCTS - ITEMS STARTING WITH G

UM	DESCRIPTION	ID OR WD	OD-THK	LG-THK	FOLIO	M S	DRAWING	MARK OR PATTERN
	GSKT ASB WI PER DWG				526172	S	936588	1
	GSKT ASB WI PER DWG				526027	S*	130209B	1
	GSKT ASB WI PER DWG					P	130293B	1
	GSKT ASB WI	3/8 ID	1 1/4	1/4		P	77865A	1236
	GSKT ASB WI	1 IN. ID	2 1/2	1/8		P	4534E	6
	GSKT ASB WI	1 IN. ID	2 1/2	1/8		P	4515E	9
	GSKT ASB WI	1 1/16 ID.	2	1/8		P	4535E	9
	GSKT ASB WI	1 1/2 ID	2 1/2	1/8	526289	S	77865A	1019
	GSKT ASB WI	2 1/8 ID	6	1/8	526371	S*	99846A	1
	GSKT ASB WI	3 3/4 ID (POKE HOLE)			526370	S	18008A	68
	GSKT ASB WI	4 IN. ID	8 1/8	1/16		P	77865A	1152
	GSKT ASB WI	4 1/2 ID	5 1/2	1/8	526365	S	49069A	58
	GSKT ASB WI	4 1/2 ID	6 7/8	1/16		P	77865A	1226
	GSKT ASB WI	4 1/2 ID	6 7/8	1/8		P	77865A	1235
	GSKT ASB WI	5 IN. ID	10 1/8	1/16		P	77865A	1153
	GSKT ASB WI	5 1/8 ID	6 1/8	1/8		P	77865A	1234
	GSKT ASB WI	5 1/4 ID	6 1/2	1/8	526351	S	140309A	1
	GSKT ASB WI	5 9/16 ID	7 3/4	1/8	526358	S	77865A	1187
	GSKT ASB WI	5 5/8 ID	6 5/8	1/8		P	77865A	1337
	GSKT ASB WI	6 IN. ID		1/8 14 1/4		P	KS 67069	4
	GSKT ASB WI	6 IN. ID	8 1/2	1/8	526361	S	104869D	D19
	GSKT ASB WI	6 IN. ID	11 1/8	1/16		P	77865A	1154
	GSKT ASB WI	6 1/4 ID	9 1/4	1/8		P	77865A	1229
	GSKT ASB WI	6 1/4 ID	9 1/4	1/8	526372	S	77863A	1252
	GSKT ASB WI	6 1/2 ID	7 5/8	1/16	526355	S	76299B	3
	GSKT ASB WI	6 5/8 ID	8 3/4	1/8	526360	S	77865A	1227
	GSKT ASB WI	7 IN. ID	12 1/8	1/16		P	77865A	1155
	GSKT ASB WI	7 5/8 ID	10 3/4	1/8		P	77865A	1179
	GSKT ASB WI	8 IN. ID	10 3/4	1/8		P	104869D	D19A
	GSKT ASB WI	8 IN. ID	13 1/4	1/16		P	77865A	1156
	GSKT ASB WI	8 1/4 ID	10 7/8	1/8		P	77865A	1230
	GSKT ASB WI	8 3/8 ID	10 3/4	1/8		P	77865A	1160

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THE BABCOCK AND WILCOX CO.
POWER GENERATION DIVISION

STANDARD MATERIAL LIST
FINISHED PRODUCTS - ITEMS STARTING WITH G

UM	DESCRIPTION	FOR ID	M S	DRAWING	MARK OR PATTERN
	ID OR OD OD-INC [illegible]				
	GSKT ASB WI 9 1/8 11		P	96542A	1
	GSKT ASB WI 9 IN. ID 14 1/4 1/16		P	77865A	1157
	GSKT ASB WI 9 3/4 ID 22 1/16		P	81460A	1143
	GSKT ASB WI 10 IN. ID 13 1/16		P	102695A	1292
	GSKT ASB WI 10 IN. ID 15 1/4 1/16		P	77865A	1158
	GSKT ASB WI 10 IN. ID 16 1/16		P	81460A	1142
	GSKT ASB WI 10 1/2 1/8 15		P	70261A	1B
	GSKT ASB WI 10 1/2 1/8 21 1/2		P	4178C	B
	GSKT ASB WI 10 7/8 ID 13 1/2 1/16		P	77865A	1175
	GSKT ASB WI 10 7/8 ID 18 11/16 1/16		P	77865A	1177
	GSKT ASB WI 11 1/8 11		P	99791A	1
	GSKT ASB WI 11 1/8 15		P	KS 63304	6
	GSKT ASB WI 11 IN. ID 16 1/2 1/16		P	77865A	1159
	GSKT ASB WI 11 1/8 ID 17 3/4 1/16		P	77865A	1125
	GSKT ASB WI 11 1/4 1/8 12 1/2		P	70451A	
	GSKT ASB WI 12 1/8 22		P	77867A	1010
	GSKT ASB WI 12 IN. ID 17 1/2 1/16		P	77865A	1160
	GSKT ASB WI 12 IN. ID 17 3/4 1/16		P	77865A	1124
+	GSKT ASB WI 12 3/8 1/8 13 1/4		P	70525A	1
	GSKT ASB WI 12 1/2 1/8 14		P	KS 64054	2C
	GSKT ASB WI 12 1/2 1/8 15 1/2		P	KS 63297	2
	GSKT ASB WI 12 3/4 ID 15 1/2 1/16		P	77865A	1220
	GSKT ASB WI 12 3/4 ID 16 1/8 1/8		P	77865A	1188

STANDARD MATERIAL LIST
FINISHED PRODUCTS - ITEMS STARTING WITH 6

UM	DESCRIPTION	ID OR WD	OD-THK	LG-THK	FOLIO	M S	DRAWING	MARK OR PATTERN
	GSKT ASB WI	12 3/4 ID	16 1/4	1/16		P	77865A	1086
	GSKT ASB WI	12 3/4 ID	17 3/4	1/16		P	77865A	1087
	GSKT ASB WI	13	1/8	22		P	77868A	1011
	GSKT ASB WI	13	1/8	22		P	4006C	A
	GSKT ASB WI	13 1/8	1/8	13 1/2		P	30789A	1
	GSKT ASB WI	13 1/4 ID	16 1/2	1/16		P	77865A	1161
	GSKT ASB WI	13 3/4 ID	17	1/8		P	77865A	1181
	GSKT ASB WI	14	1/8	22		P	395278	C
	GSKT ASB WI	14 IN. ID	16 5/8	1/16		P	77865A	1172
	GSKT ASB WI	14 IN. ID	18	1/8		P	57443C	K
	GSKT ASB WI	14 1/8 ID	18 1/2	1/16		P	77865A	1173
	GSKT ASB WI	14 1/8 ID	18 11/16	1/16		P	77865A	1261
	GSKT ASB WI	14 1/8 ID	20	1/8		P	139837A	1330
+	GSKT ASB WI	14 1/8 ID	22	1/8		P	143109A	1338
	GSKT ASB WI	14 1/4 ID	17	1/16		P	96537A	1293
	GSKT ASB WI	14 1/4 ID	19 1/2	1/16		P	77865A	1162
	GSKT ASB WI	14 1/2	1/8	17		P	85878A	1080
	GSKT ASB WI	14 1/2	1/8	17		P	131346A	1
	GSKT ASB WI	15	1/8	52		P	96543A	1
	GSKT ASB WI	15 1/4 ID	18 11/16	1/8		P	77865A	1329
	GSKT ASB WI	15 1/4 ID	18 11/16	1/16		P	77865A	1252
	GSKT ASB WI	15 1/4 ID	20 1/2	1/16		P	77865A	1163
	GSKT ASB WI	15 1/4 ID	20 1/2	1/8		P	77865A	1247
	GSKT ASB WI	15 5/8	1/8	16 5/8		P	30344A	1
	GSKT ASB WI	15 3/4	1/8	19 3/4	526294	S	62126A	P216
	GSKT ASB WI	16 IN. ID	18 3/4	1/16		P	77865A	1083
	GSKT ASB WI	16 IN. ID	20 3/4	1/16		P	77865A	1084
	GSKT ASB WI	16 IN. ID	22	1/16		P	81460A	1200
	GSKT ASB WI	16 3/16ID	22	1/8		P	139837A	1331
	GSKT ASB WI	16 3/16ID	24	1/16		P	77865A	1148
+	GSKT ASB WI	16 3/16 ID	24	1/8		P	143109A	1339
	GSKT ASB WI	16 1/4 ID	20 1/2	1/16		P	77865A	1164
	GSKT ASB WI	16 1/4 ID	21 1/2	1/16		P	77865A	1324
	GSKT ASB WI	16 1/2	1/8	25 1/2		P	214930E	C
	GSKT ASB WI	16 11/16ID	18 11/16	1/16		P	77865A	1178

THE BABCOCK AND WILCOX CO.
POWER GENERATION DIVISION

STANDARD MATERIAL LIST
FINISHED PRODUCTS - ITEMS STARTING WITH G

UM	DESCRIPTION	ID OR WD	OD-THK	LG-THK	FOLIO	M S	DRAWING	MARK OR PATTERN
	GSKT ASB WI	17	1/8	25 1/4		P	214931E	C
	GSKT ASB WI	17	1/8	25 1/4		P	214932E	C
	GSKT ASB WI	17 1/4 ID	18 5/8	1/16		P	77865A	1176
	GSKT ASB WI	17 1/4 ID	20 1/2	1/16		P	77865A	1244
	GSKT ASB WI	17 1/4 ID	20 1/2	1/8		P	77865A	1248
	GSKT ASB WI	17 1/4 ID	22 1/2	1/16		P	77865A	1165
	GSKT ASB WI	17 1/4 ID	22 1/2	1/8		P	77865A	1250
	GSKT ASB WI	18	1/8	20 1/2	526291	S	69112A	
	GSKT ASB WI	18	1/8	21		P	88451A	1141
	GSKT ASB WI	18	1/8	22		P	77864A	1009
	GSKT ASB WI	18 IN. ID	19 3/4	1/16		P	77865A	1291
	GSKT ASB WI	18 IN. ID	20 1/2	1/16		P	77865A	1284
	GSKT ASB WI	18 IN. ID	20 5/8	1/8	526013	S	KS 58451	40
	GSKT ASB WI	18 IN. ID	20 3/4	1/16		P	77865A	1085
	GSKT ASB WI	18 IN. ID	21 5/8	1/8		P	77865A	1174
	GSKT ASB WI	18 IN. ID	22 3/4	1/16		P	77865A	1273
	GSKT ASB WI	18 1/8 ID	23	1/8		P	77865A	1325
	GSKT ASB WI	18 1/8 ID	24	1/8		P	137531A	1326
	GSKT ASB WI	18 3/16 ID	24	1/8		P	139837A	1332
	GSKT ASB WI	18 3/16 ID	26	1/8		P	143109A	1340
	GSKT ASB WI	18 1/4 ID	23 1/2	1/16		P	77865A	1166
	GSKT ASB WI	19 1/4 ID	22 1/2	1/8		P	77865A	1251
	GSKT ASB WI	19 1/4 ID	22 3/4	1/16		P	77865A	1274
	GSKT ASB WI	19 1/4 ID	24 1/2	1/16		P	77865A	1167
	GSKT ASB WI	19 1/4 ID	24 1/2	1/8		P	77865A	1271
	GSKT ASB WI	20	1/8	26 1/2		P	87705A	7G
	GSKT ASB WI	20 IN. ID	22 1/2	1/16		P	77865A	1285
	GSKT ASB WI	20 IN. ID	22 3/4	1/16		P	77865A	1316
	GSKT ASB WI	20 1/4 ID	25 1/2	1/16		P	77865A	1168
	GSKT ASB WI	20 1/4 ID	28	1/8		P	143109A	1341
	GSKT ASB WI	21	1/8	24		P	90452A	1215
	GSKT ASB WI	21 1/4 ID	23 1/2	1/16		P	77865A	1289
	GSKT ASB WI	20 1/4 ID	26	1/8		P	139837A	1333
	GSKT ASB WI	21 1/4 ID	24 1/2	1/8		P	77865A	1270
	GSKT ASB WI	21 1/4 ID	26 1/2	1/16		P	77865A	1169
	GSKT ASB WI	21 1/4 ID	26 1/2	1/8		P	77865A	1322

STANDARD MATERIAL LIST
FINISHED PRODUCTS - ITEMS STARTING WITH G

UM	DESCRIPTION	ID OR WD	OD-THK	LG-THK	FOLIO	M S	DRAWING	MARK OR PATTERN
	GSKT ASB WI	22	1/16	30		P	86537A	1150
	GSKT ASB WI	22	1/8	22		P	81444A	1103
	GSKT ASB WI	22 IN. ID	26	1/8		P	77865A	1199
	GSKT ASB WI	22 1/4 ID	23 1/2	1/8		P	77865A	1336
	GSKT ASB WI	22 1/4 ID	27 1/2	1/16		P	77865A	1170
	GSKT ASB WI	22 1/4 ID	28	1/8		P	139837A	1334
+	GSKT ASB WI	22 1/4	30	1/8		P	143109A	1342
	GSKT ASB WI	22 1/2	1/16	22 1/2		P	81459A	1140
	GSKT ASB WI	23	1/8	23		P	81446A	1104
	GSKT ASB WI	23 1/4 ID	26 1/2	1/8		P	77865A	1323
	GSKT ASB WI	23 1/4 ID	28 1/2	1/16		P	77865A	1171
	GSKT ASB WI	23 1/4 ID	28 1/2	1/8		P	77865A	1231
	GSKT ASB WI	24 IN. ID	26 13/16	1/16		P	77865A	1088
	GSKT ASB WI	24 IN. ID	28 1/2	1/16		P	77865A	1135
	GSKT ASB WI	24 IN. ID	28 3/4	1/8		P	77865A	1110
	GSKT ASB WI	24 1/4 ID	30	1/8		P	139837A	1335
+	GSKT ASB WI	24 1/4	32	1/8		P	143109A	1343
	GSKT ASB WI	24 3/4 ID	27 11/16	1/8		P	86823A	1287
	GSKT ASB WI	25 1/4 ID	26 1/2	1/16		P	77865A	1245
	GSKT ASB WI	25 1/4 ID	28 1/2	1/8		P	77865A	1249
	GSKT ASB WI	25 1/2	1/16	33 1/2		P	81458A	1145
	GSKT ASB WI	26	1/16	30		P	91555A	1216
	GSKT ASB WI	26	1/8	39	526286	S	65626D	C
	GSKT ASB WI	26 1/4	1/8	26 1/4		P	29304C	3
	GSKT ASB WI	28	1/8	56		P	96544A	1
	GSKT ASB WI	28 IN. ID	30 3/4	1/16		P	77865A	1267
	GSKT ASB WI	29	1/8	38		P	159793E	28
	GSKT ASB WI	29 5/16 ID	31	1/8		P	77865A	1140
	GSKT ASB WI	30	1/16	34 1/2		P	130724A	1290
	GSKT ASB WI	30 IN. ID	32 11/16	1/16		P	77865A	1266
	GSKT ASB WI	32 IN. ID	36 1/2	1/8		P	86815A	1204
	GSKT ASB WI	34 1/4	1/8	64 1/2		P	96545A	1
	GSKT ASB WI	36 IN. ID	42 1/2	1/8		P	86815A	1205
	GSKT ASB WI	39 3/4 ID	42 11/16	1/16		P	77865A	1122
	GSKT ASB WI	40 IN. ID	42 3/4	1/16		P	77865A	1260
	GSKT ASB WI	41 3/4 ID	44 5/8	1/8		P	77865A	1151

THE BABCOCK AND WILCOX CO.
POWER GENERATION DIVISION

STANDARD MATERIAL LIST
FINISHED PRODUCTS - ITEMS STARTING WITH G

UM	DESCRIPTION	ID OR WD	OD-THK	LG-THK	FOLIO	MS	DRAWING	MARK OR PATTERN
	NOTE - THE FOLLOWING COPPER GASKETS ARE ANNEALED.							
	GSKT COP	33/64ID	5/8	1/32		P	75546A	1108
	GSKT COP	45/64ID	1 11/64	1/8	526280	S	MS262238	74
	GSKT COP	13/16ID	1.125	.098		P	75546A	1139
	GSKT COP	1 3/8 ID	1 5/8	.012	526001	S	75499A	125
	GSKT COP	1 11/16ID	2 3/32	1/16	526003	S	C 34789	CHY1
	GSKT COP	2 1/8 ID	2 29/32	1/32		P	75546A	1146
	GSKT COP	2 7/8 ID	3 21/32	1/32		P	75546A	1147
	GSKT COP	4 1/4 ID	5 1/32	1/32		P	75546A	1148
	GSKT COP ASB	45/64ID	1 11/64	3/32	526276	S	35519A	169
	GSKT COP ASB	13 1/2 ID	22	1/16		P	135348A	1328
	GSKT COP ASB	14 IN. ID	20	1/16		P	135347A	1327
	GSKT COP ASB	25 IN. ID	26 3/4	1/16	526328	S	85869A	114
	GSKT COP SJ	3 5/16ID	4	1/16	526330	S*	MS222737	C
	GSKT COP SJ	4 7/16ID	6 3/8	1/16	526353	S	49080A	15
	GSKT COP SJ	19 3/8 ID	20 7/8	1/16	526396	S	MX261282	108
	GSKT COP SJ	23 7/8 ID	25 3/8	1/16	526406	S	49076A	114
	GSKT COP 2 HOLE	9/16DIA	1.732	.105	526007	S	MS216487	14

STANDARD MATERIAL LIST
FINISHED PRODUCTS - ITEMS STARTING WITH G

	UM	DESCRIPTION	ID OR WD	OD-THK	LG-THK	FOLIO	H S	DRAWING	MARK OR PATTERN
		GSKT CPRS ASB	1/4 ID	3/4	1/8	526263	S	248650	1
		GSKT CPRS ASB	27/32ID	1 7/8	1/16		P	77863A	1279
		GSKT CPRS ASB	27/32ID	2 1/8	1/16		P	77863A	1280
Δ									
		GSKT CPRS ASB	1 1/16ID	2 1/4	1/16		P	77863A	1278
		GSKT CPRS ASB	1 1/16ID	2 5/8	1/16		P	77863A	1281
		GSKT CPRS ASB	1 5/16ID	1 13/16	1/16		P	77863A	1321
		GSKT CPRS ASB	1 5/16ID	2 5/8	1/16	526177	S	77863A	1200
		GSKT CPRS ASB	1 5/16ID	2 7/8	1/16		P	77863A	1127
		GSKT CPRS ASB	1 1/2 ID	2	1/16	526182	S	12237A	2
		GSKT CPRS ASB	1 1/2 ID	3 3/4	1/32	526197	S	77863A	1020
		GSKT CPRS ASB	1 21/32ID	3	1/16		P	77863A	1232
		GSKT CPRS ASB	1 21/32ID	3 1/4	1/16		P	77863A	1113
		GSKT CPRS ASB	1 11/16ID	2 1/2	1/16		P	77863A	1221
		GSKT CPRS ASB	1 3/4	1/16	6 1/8	526181	S	100365A	1
Δ		GSKT CPRS ASB	1 7/8	1/16	3 1/2		P	35539A	85A
		GSKT CPRS ASB	1 29/32ID	3 3/8	1/16		P	77863A	1070
		GSKT CPRS ASB	1 29/32ID	3 3/4	1/16		P	77863A	1262
		GSKT CPRS ASB	2 IN. ID	2 13/32	1/16	526186	S	C 300429	
		GSKT CPRS ASB	2 IN. ID	2 5/8	1/16	526184	S	12237A	3
		GSKT CPRS ASB	2 IN. ID	4 1/8	1/8	526187	S	77863A	1069
		GSKT CPRS ASB	2 IN. ID	4 3/8	1/32	526203	S	77863A	1021
		GSKT CPRS ASB	2 1/4 ID	3 3/8	1/16	526204	S	77863A	1105
		GSKT CPRS ASB	2 3/8 ID	3	1/16	526188	S	77863A	1022
		GSKT CPRS ASB	2 3/8 ID	4 1/8	1/16	526189	S	77863A	1071
		GSKT CPRS ASB	2 3/8 ID	4 3/8	1/16		P	77863A	1192
		GSKT CPRS ASB	2 3/8 ID	6	1/16		P	81442A	1094
		GSKT CPRS ASB	2 1/2 ID	5 1/8	1/32	526209	S	77863A	1024
		GSKT CPRS ASB	2 3/4 ID	5 5/16	1/16		P	77863A	1089
		GSKT CPRS ASB	2 7/8 ID	4 7/8	1/16		P	77863A	1072
		GSKT CPRS ASB	2 7/8 ID	5 1/8	1/16		P	77863A	1214
		GSKT CPRS ASB	2 7/8 ID	7	1/16		P	81442A	1095

THE BABCOCK AND WILCOX CO.
POWER GENERATION DIVISION

STANDARD MATERIAL LIST
FINISHED PRODUCTS - ITEMS STARTING WITH 6

UM	DESCRIPTION	ID OR WD	OD-THK	LG-THK	FOLIO	M S	DRAWING	MARK OR PATTERN
	GSKT CPRS ASB	3		1/16 5		P	131353A	1
	GSKT CPRS ASB	3 IN. ID	3 7/16	1/16	526190	S	77863A	1025
	GSKT CPRS ASB	3 IN. ID	5 7/8	1/32	526213	S	77863A	1026
	GSKT CPRS ASB	3 1/16 ID	5 3/8	1/32		P	77863A	1318
	GSKT CPRS ASB	3 3/8 ID	4	1/16	526198	S	77863A	1027
	GSKT CPRS ASB	3 3/8 ID	4 1/8	1/8		P	77863A	1223
	GSKT CPRS ASB	3 1/2 ID	4 1/8	1/16	526022	S	12237A	4
	GSKT CPRS ASB	3 1/2 ID	4 1/2	1/16	526200	S	77863A	1225
	GSKT CPRS ASB	3 1/2 ID	5 3/8	1/16		P	77863A	1073
	GSKT CPRS ASB	3 1/2 ID	5 7/8	1/16		P	77863A	1210
	GSKT CPRS ASB	3 1/2 ID	7 1/2	1/16		P	81442A	1096
	GSKT CPRS ASB	4 IN. ID	6 3/8	1/16		P	77863A	1246
	GSKT CPRS ASB	4 IN. ID	6 1/2	1/16		P	77863A	1283
	GSKT CPRS ASB	4 IN. ID	7	1/32	526221	S	77863A	1028
	GSKT CPRS ASB	4 1/32 ID	6 7/8	1/32		P	77863A	1319
	GSKT CPRS ASB	4 1/2 ID	6 7/8	1/16	526178	S	77863A	1074
	GSKT CPRS ASB	4 1/2 ID	7 1/8	1/16	526231	S	77863A	1079
	GSKT CPRS ASB	4 1/2 ID	7 5/8	1/16		P	77863A	1092
	GSKT CPRS ASB	4 1/2 ID	8 1/8	1/16		P	77863A	1195
	GSKT CPRS ASB	4 1/2 ID	9	1/16		P	81442A	1097
	GSKT CPRS ASB	4 5/8 ID	5 1/8	1/8	526349	S	12237A	1
	GSKT CPRS ASB	4 3/4		1/16 7 1/2		P	120220A	1
	GSKT CPRS ASB	5 1/16 ID	5 9/16	1/8		P	12237A	5
	GSKT CPRS ASB	5 1/16 ID	7 3/4	1/32		P	77863A	1320
	GSKT CPRS ASB	5 1/4 ID	5 13/16	1/8		P	77863A	1051
	GSKT CPRS ASB	5 3/8		1/8 8		P	75541A	1093
	GSKT CPRS ASB	5 1/2		1/8 17 1/4		P	30252A	1
	GSKT CPRS ASB	5 17/32ID	8 3/4	1/32	526227	S	12034A	3
	GSKT CPRS ASB	5 9/16ID	7 3/4	1/16		P	77863A	1043
	GSKT CPRS ASB	5 9/16ID	8 1/2	1/16		P	77863A	1182
	GSKT CPRS ASB	5 9/16ID	9 1/2	1/16		P	77863A	1194
	GSKT CPRS ASB	5 7/8 ID	6 5/8	1/16		P	77863A	1222

STANDARD MATERIAL LIST
FINISHED PRODUCTS - ITEMS STARTING WITH G

UM	DESCRIPTION	ID OR WD	OD-THK	LG-THK	FOLIO	MS	DRAWING	MARK OR PATTERN
	GSKT CPRS ASB 6		1/16 10		526176 S		95751A	
	GSKT CPRS ASB 6		1/8 15			P KS	64054	3
	GSKT CPRS ASB 6 IN. ID	9 7/8	1/32		526229 S		77863A	1029
	GSKT CPRS ASB 6 IN. ID	10	1/32			P KS	63307	5
	GSKT CPRS ASB 6 1/8 ID	8 3/4	1/32			P	77863A	1207
	GSKT CPRS ASB 6 5/8 ID	7 3/4	1/16			P	77863A	1112
	GSKT CPRS ASB 6 5/8 ID	8 3/4	1/16			P	77863A	1045
	GSKT CPRS ASB 6 5/8 ID	9 7/8	1/16			P	77863A	1183
	GSKT CPRS ASB 6 5/8 ID	10 1/2	1/16			P	77863A	1193
	GSKT CPRS ASB 6 5/8 ID	11	1/16			P	81442A	1098
	GSKT CPRS ASB 6 7/8 ID	8 5/8	1/16			P	77863A	1060
	GSKT CPRS ASB 7		1/16 7		526230 S		93175A	
	GSKT CPRS ASB 7 IN. ID	11	1/32			P KS	64018	5
	GSKT CPRS ASB 8 IN. ID	11	1/32			P	77863A	1038
	GSKT CPRS ASB 8 IN. ID	12 1/8	1/32			P	77863A	1044
	GSKT CPRS ASB 8 IN. ID	11	1/8			P	77863A	1256
	GSKT CPRS ASB 8 5/8 ID	11	1/16			P	77863A	1046
	GSKT CPRS ASB 8 5/8 ID	12 1/8	1/16			P	77863A	1203
	GSKT CPRS ASB 8 5/8 ID	13 1/2	1/16			P	81442A	1099
	GSKT CPRS ASB 8 3/4 ID	14	1/32			P	77863A	1030
	GSKT CPRS ASB 8 7/8 ID	10 7/8	1/16			P	77863A	1061
	GSKT CPRS ASB 10 IN. ID	13 1/4	1/32			P	77863A	1240
	GSKT CPRS ASB 10 3/4 ID	13 3/8	1/16			P	77863A	1047
	GSKT CPRS ASB 10 3/4 ID	14 1/4	1/16			P	77863A	1184
	GSKT CPRS ASB 10 3/4 ID	16	1/16			P	81442A	1100
	GSKT CPRS ASB 11		1/8	11	526150 S		100391A	1
	GSKT CPRS ASB 11 IN. ID	13 1/4	1/16			P	77863A	1062
	GSKT CPRS ASB 11 IN. ID	15	1/8			P KS	62348	2
+	GSKT CPRS ASB 11 3/4 ID	17 3/4	1/16			P	77863A	1346
	GSKT CPRS ASB 12 1/2		1/8 15	1/2		P KS	63297	2
	GSKT CPRS ASB 12 3/4 ID	16 1/8	1/16			P	77863A	1048
	GSKT CPRS ASB 12 3/4 ID	16 5/8	1/16			P	77863A	1091
	GSKT CPRS ASB 12 3/4 ID	19	1/16			P	81442A	1101

THE BABCOCK AND WILCOX CO.
POWER GENERATION DIVISION

STANDARD MATERIAL LIST
FINISHED PRODUCTS — ITEMS STARTING WITH G

UM	DESCRIPTION	THICKNESS	FOLIO	H S	DRAWING	MARK OR PATTERN
		ID OR WD OD-THK · LG-THK				
	GSKT CPRS ASB 13 IN. ID 16	1/16		P	77863A	1063
	GSKT CPRS ASB 13 IN. ID 17 1/2	1/8		P	KS 63596	2
	GSKT CPRS ASB 13 3/4	1/8 21 3/4	526152	S	116248A	1
	GSKT CPRS ASB 14 IN. ID 17 3/4	1/16		P	77863A	1049
	GSKT CPRS ASB 14 IN. ID 19 1/8	1/16		P	77863A	1136
	GSKT CPRS ASB 14 1/4 ID 17 5/8	1/16		P	77863A	1064
	GSKT CPRS ASB 16 IN. ID 20 1/4	1/16		P	77863A	1115
	GSKT CPRS ASB 16 IN. ID 21 1/8	1/32		P	77863A	1102
	GSKT CPRS ASB 16 IN. ID 21 1/4	1/16		P	77863A	1137
	GSKT CPRS ASB 16 1/4 ID 20 1/8	1/16		P	77863A	1065
	GSKT CPRS ASB 18 IN. ID 21 5/8	1/16		P	77863A	1076
	GSKT CPRS ASB 18 1/8 ID 20 3/4	1/16		P	77863A	1050
	GSKT CPRS ASB 18 5/16 ID 21 1/2	1/16		P	77863A	1066
	GSKT CPRS ASB 20 IN. ID 23 7/8	1/16		P	77863A	1077
	GSKT CPRS ASB 20 5/16 ID 23 3/4	1/16		P	77863A	1067
	GSKT CPRS ASB 20 1/2	1/8 23 1/2		P	KS 81549	3
	GSKT CPRS ASB 20 1/2	1/8 23 1/2		P	131655B	1
	GSKT CPRS ASB 23 3/4	1/16 26 11/16		P	77863A	1311
	GSKT CPRS ASB 24 IN. ID 26 1/4	1/16		P	77863A	1190
	GSKT CPRS ASB 24 3/8 ID 28 1/8	1/16		P	77863A	1068
	GSKT CPRS ASB 26 IN. ID 30 1/2	1/16		P	77863A	1264
	GSKT CPRS ASB 26 1/8 ID 28 3/4	1/16		P	77863A	1138
	GSKT CPRS ASB 27 1/2 ID 32 IN.	1/16		P	77863A	1269
	GSKT CPRS ASB 40 IN. ID 45	1/16		P	77863A	1228
	GSKT CPRS ASB 41 3/4 ID 44 11/16	1/16		P	77863A	1312
	GSKT CPRS ASB 42 IN. ID 48	1/16		P	77863A	1241

STANDARD MATERIAL LIST
FINISHED PRODUCTS - ITEMS STARTING WITH G

UM	DESCRIPTION	ID OR WD	OD-THK	LG-THK	THICKNESS	FOLIO	MS	DRAWING	MARK OR PATTERN
	GSKT GAR7021	13/16ID	1 1/8	3/32		526019	S	91804A	1
	GSKT GAR7021	1 21/32ID	3	1/8		526024	S	111524A	1275
	GSKT GAR7021 T JET		1 3/4	1/8		526005	S*	64758A	1
	GSKT GAR7021 DUAL FLOW		1 3/4	1/16		526015	S	116997A	1
	GSKT GAR7021 DUAL FLOW		1 3/4	1/8		526008	S	30560A	1
+	GSKT GAR7021 PRL FLOW		3 1/8			526023	S	102648A	1
	GSKT GAR7021 XLGE ATOM		2 1/4	1/8			P	30628A	1
	NOTE - GAR8452 IS A NITRILE GASKET.								
	GSKT GAR8452	1 5/16ID	2 5/8	1/8			P	97113A	1263
	GSKT GAR8452	1 5/16ID	2 7/8	1/8			P	97113A	1258
	GSKT GAR8452	1 21/32ID	3	1/8		526031	S	97113A	1310
	GSKT GAR8452	1 29/32ID	3 3/8	1/8		526039	S	97113A	1259
	GSKT GAR8452	2 3/8ID	4 1/8	1/8		526020	S*	97113A	1254
	GSKT GAR8452	2 3/8ID	4 3/8	1/8			P	97113A	1260
	GSKT GAR8452	2 3/8ID	6	1/8			P	103305A	1294
	GSKT GAR8452	2 3/8ID	6 1/2	1/8		526033	S	103306A	1302
	GSKT GAR8452	2 7/8ID	7	1/8			P	103305A	1295
	GSKT GAR8452	2 7/8ID	7 1/2	1/8			P	103306A	1303
	GSKT GAR8452	3 1/2ID	5 3/8	1/8		526021	S	97113A	1255
	GSKT GAR8452	3 1/2ID	7 1/2	1/8		526029	S*	133305A	1296
	GSKT GAR8452	3 1/2ID	8 1/4	1/8			P	133306A	1304
	GSKT GAR8452	4 IN.ID	5 1/2	1/8			P	97113A	1345
	GSKT GAR8452	4 1/2ID	9	1/8			P	133305A	1297
	GSKT GAR8452	4 1/2ID	10	1/8			P	133306A	1305
	GSKT GAR8452	5 1/4 X	1/8 X	8		526025	S	130214B	1
	GSKT GAR8452	6 7/8 ID	7 3/4	1/8		526028	S	97113A	1288
	GSKT GAR8452	6 5/8 ID	11	1/8			P	133305A	1298
	GSKT GAR8452	6 7/8 ID	12 1/2	1/8			P	133306A	1306
	GSKT GAR8452	6 5/8 ID	11 1/2	1/8			P	133305A	1299
	GSKT GAR8452	8 5/8 ID	15	1/8			P	133306A	1307
	GSKT GAR8452	10 3/4 ID	14	1/8			P	133305A	1300
	GSKT GAR8452	10 3/4 ID	17 1/2	1/8			P	133306A	1308
	GSKT GAR8452	12 3/4 ID	19	1/8			P	133305A	1301
	GSKT GAR8452	12 3/4 ID	20 1/2	1/8			P	133306A	1309
	GSKT GAR8452	13 IN. ID	14 1/2	1/8			P	97113A	1344
+	GSKT GAR31018-0346 OR EQL 24 IN.ID					526004	S*	27 IN. OD X 1/8 THK	
+	GSKT GAR31018-0346	26 ID	30 OD	1/8 THK		526040	S	146177B	1

THE BABCOCK AND WILCOX CO.
POWER GENERATION DIVISION

STANDARD MATERIAL LIST
FINISHED PRODUCTS - BOILER ENCASING WITH G

DESCRIPTION	THICKNESS	FOLIO	S	DRAWING	MARK OR PATTERN
GSKT HH COP		526070	S*	52920	40-9
GSKT HH COP		526146	S*	52920	70-9
GSKT HH COP SJ ASB		526045	S*	MS16716A	20
GSKT HH KLINGERITE (AVAILABLE FROM B&W MARINE WAREHOUSE)		464154			41
GSKT HH SJ MON ASB		526123	S*	55176330	40
GSKT HH SJ MON ASB		526046	S*	55141001	60
GSKT HH SJ MON ASB		526104	S*	C 24825	70
GSKT HH SPIRAL WOUND TP304 ASB		526072	S	MS22830	24 (0-9990)
GSKT HH SPIRAL WOUND TP304 ASB		526049	S	MS22830	28 (0-9990)
GSKT HH SPIRAL WOUND TP304 ASB		526074	S*	52920	40-7(0-9990)
GSKT HH SPIRAL WOUND TP304 ASB		526076	S	52920	48-7(0-9990)
GSKT HH SPIRAL WOUND TP304 ASB		526073	S	52920	70-7(0-9990)
GSKT HH SPIRAL WOUND TP316L ASB		526073	S*	MS22830	60 (0-9990)
GSKT HH SPIRAL WOUND TP316L ASB		526074	S	44466A	40-7(INC UP)
GSKT HH STL ASB		526005	S	52930	26-1
GSKT HH STL ASB		526047	S	52930	28-1
GSKT HH STL ASB		526069	S	52930	60-1
GSKT HH STL ASB		526009	S*	52930	61-1
GSKT HH STL ASB		526107	S	52940	67-1
GSKT HH STL ASB		526126	S	52940	68-1
GSKT HH STL ASB		526147	S	52940	70-1
GSKT HH STL ASB		526168	S	52940	70-1

STANDARD MATERIAL LIST
FINISHED PRODUCTS - ITEMS STARTING WITH G

UM	DESCRIPTION	ID OR WD	OD-THK	LG-THK	FOLIO	M S	DRAWING	MARK OR PATTERN
	GSKT MH ASB WI	11	X 15		526375	S	SS141015	
	GSKT MH ASB WI	12	X 16		526377	S	D 104944	1-1
	GSKT MH SPIRAL WOUND TP304 ASB				526379	S	D 104944	2-3
	GSKT MH SPIRAL WOUND TP304 ASB				526380	S	D 104944	3-3
	GSKT MH SPIRAL WOUND TP304 ASB				526395	S	D 104944	4-3
	GSKT MH SPIRAL WOUND TP304 ASB				526396	S	D 104944	5-3
	GSKT MH SPIRAL WOUND TP304 ASB					P	D 104944	6-3
	GSKT MH SPIRAL WOUND TP304 ASB					P	D 104944	7-3
	GSKT MH SPIRAL WOUND TP304 ASB					P	D 104944	8-3
	GSKT MH SPIRAL WOUND TP304 ASB					P	D 104944	9-3
	GSKT NITRILE - GSKT GAR8452 IS ALSO NITRILE.							
	GSKT NITRILE	9	1/4	10		P	133344A	1
	GSKT NITRILE	10	1/8	10	526000	S	99849A	1
	GSKT NITRILE	10	1/8	12	526530	S	99847A	1
	GSKT NITRILE	10	1/4	10	526531	S	99849A	2
	GSKT RING JT OCT R770					P	86786A	1076
	GSKT RING JT OVAL R24					P	86786A	1114
	NOTE - GSKT FOLIO 526283 IS FOR RELIANCE WATER GAGE.							
	GSKT RBR	11/16ID	1 3/16	7/16	526283	S	(BG403R8)	
	GSKT RBRSIL10D	1 15/16ID	2 5/8	1/8	526310	S	12231A	2
	GSKT RBRSIL10D	2 1N. ID	3 3/8	3/8		P	12231A	4
	GSKT RBRSIL40D	7/32ID	11/16	1/8		P	12231A	1
	GSKT RBRSIL70D	7/8 ID	1 1/2	1/8	526208	S	12231A	3
	GSKT SILICONE	1 11/16ID	2 1/2	1/8		P	97097A	1238
	GSKT SILICONE	3 1/2 ID	5	1/8		P	97097A	1239
	GSKT SILICONE	5 1/4 ID	6 3/4	1/4	526527	S	95779A	1
	GSKT SILICONE	16	1/4	16	526151	S	116247A	1
	GSKT SILICONE	16	1/4	17 7/8	526532	S	93631B	1

THE BABCOCK AND WILCOX CO.
POWER GENERATION DIVISION

STANDARD MATERIAL LIST
FINISHED PRODUCTS — ITEMS STARTING WITH G

UM	DESCRIPTION	THICKNESS	FOLIO	M S	DRAWING	MARK ON PATTERN
	NOTE — TEFLON GASKET DWG 75496A MK 81 FOLIO 526416 IS GLASS FLOX FILLED.					
		ID OR WD OD-THK LG-THK				
	GSKT TEFLON 17/32ID 1 1/4 1/8			P	86794A	1196
	GSKT TEFLON 2HOLE 5/8ID 1 3/4 1/8		526422	S	30103A	1
	GSKT TEFLON 11/16ID 1.015 3/32		526416	S	75496A	81
†	GSKT TEFLON 11/16ID 111/64 5/32		526417	S	12283A	1
	GSKT TEFLON 7/8 ID 2 1/8 1/16			P	86794A	1130
	GSKT TEFLON 1 7/8 1/16 3 1/2		526418	S	35539A	85T
	GSKT TEFLON 2 IN. ID 3 3/8 1/16			P	86794A	1132
	GSKT TEFLON 2 IN. ID 4 3/8 1/16			P	86794A	1133
	GSKT TEFLON 3 1/8 ID 5 1/16			P	86794A	1131
	GSKT TEFLON 3 IN. ID 6 1/4 1/16			P	86794A	1126
	GSKT TEFLON 4 IN. ID 7 1/8 1/16			P	86794A	1134
	GSKT TEFLON 4 5/16ID 6 1/4 1/16			P	86794A	1123
	GSKT TEFLON 4 1/2 ID 6 7/8 1/16			P	86794A	1128
		ID OR WD OD-THK LG-THK				
	GSKT VEG FBR 1 1/4 ID 3 1/32			P	77861A	1002
	GSKT VEG FBR 2 IN. ID 2 7/8 1/32			P	77861A	1032
	GSKT VEG FBR 3 1/16 5			P	131353A	1
	GSKT VEG FBR 3 1/2 ID 5 1/32			P	77861A	1005
	GSKT VEG FBR 4 1/2 ID 9 1/32			P	77861A	1090
	GSKT VEG FBR 6 1/8 8			P	77869A	1012
	GSKT VEG FBR 8 7/8 ID 14 1/32			P	77861A	1242
	GSKT VEG FBR 9 1/4 ID 12 3/4 1/32			P	77861A	1233
	GSKT VEG FBR 20 1/2 1/8 23 1/2			P	131655B	1
	GSKT VLV SEAT RUB W/MTL		526641	S	KS 58451	12

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

APPENDIX 5

Asbestos Survey (Shop Input)

To
SUPERINTENDENTS/MANAGERS

From
K. C. KOCHHAR - SR. FACILITIES ENGINEER

80S 663-6

Cust.

File No. or Ref.

Subj.
ASBESTOS SURVEY

Date
AUGUST 8, 1978

This letter to cover one customer and one subject only.

A survey is being made for the asbestos products which are used at Wilmington Works. The purpose is to identify all the purchased or stock items containing asbestos. The ultimate objective is to eliminate the usage of asbestos product from the facility.

A suggested list of products containing asbestos is enclosed. Please supply appropriate information in the attached form. If you have any additional information regarding substitution, please advise.

Please treat this on a "High Priority Basis". The information is required by August 16, 1978.

K. C. KOCHHAR

KCK:el
Attachment

cc: J. D. Coleman
L. Johnson
B. R. McGinnis
F. Munka

EXAMPLE OF INFORMATION REQUIRED

Name of Product -	Gaskets
Manufacturer -	ABC Company
Stock/Purchase	Stock
Application -	Manhole cover for drums
How Used -	Is there any machining done - eg. sawing, grinding, drilling, etc.
Annual Usage -	Rough estimate of quantity in lbs., number of pieces, ~~as~~ cubic feet, etc.
Frequency of usage -	Daily, # times/week, #times/month, etc
Usage Location -	Bay, Building and approximately column location.
Storage Location -	Which storeroom
Handling -	Type of container, Type of disposal of the waste product.

ASBESTOS SURVEY - WILMINGTON WORKS

ITEM									HANDLING		
PRODUCT	MFGR.	STOCK/ PUR'D	APPLICATION	HOW USED	ANNUAL USAGE	FREQ. OF USAGE	USAGE LOCATION	STORAGE LOCATION	TYPE OF CONTAINER	DISPOSAL	REMARKS
608 - 616 SHOP - BUILDING 12, - D. J. BLAND											
Millboard	JM	512-122	Insulator for Burner	Sawing	48 sq.ft.	Quarterly	Col 3-N	Storeroom Bay 1	Pallett	Paper Waste	
Blankets		526-572	Insulator for fire eye scanner	Scissors	9 sq.ft.	Yearly	Col. 7-N	Storeroom Bay 1	Loose	Paper Waste	
Stm Pack. Braids		526-634 526-635	Atomizer	Precut	1500 sq. ft.	Daily	Col 6,7,8-N	Storeroom Bay 1	Box	None	
Gasket		526-370	Door, Regulator Cover Pl.	Scissors	12 sq.ft	Quarterly	Col 3,4-N	Storeroom Bay 1	Paperbag	Paper Waste	
Gasket		526-184	Lighter Sleeve	Precut	Hundreds	Daily	Col 6,7,8-N	Storeroom Bay 1	Paperbag	None	
Rope		526-456	Insulation for door	Shear	Hundreds ft.	Monthly	Col 6,7,8-N	Storeroom Bay 1	Paperbag	Paper Waste	
Rope		526-469	Air Register Assembly	Shear	Hundreds ft.	Monthly	Col 2,3,4-N	Storeroom Bay 1	Paperbag	Paper Waste	
Rope		526-633	FPG Lighter Assembly	Precut	Hundreds ft.	Daily	Col 6,7,8-N	Storeroom Bay 1	Cardboard Box	None	
611 SHOP, BUILDING 10 - E. B. COLEY											61
Millboard	JM	Stock	Boiler Assembly	Cut 4" Strip	50	1 per wk.	611 Shop	611 Storeroom	Pallet	Dumpster	
Gloves		Pur'g	Burning	Wear	12 dz.	3 per wk.	611 Shop	Shop Office	Box	Dumpster	
Gaskets		Stock	Manway Cover	Precut	200	8 per wk.	611 Shop	611 Storeroom	Box	-	
Gaskets		Stock	Access Door Covers	Precut	50	1 per wk.	611 Shop	611 Storeroom	Box	-	

ASBESTOS SURVEY - WILMINGTON WORKS

ITEM									HANDLING		
PRODUCT	MFGR.	STOCK/ PUR'D	APPLICATION	HOW USED	ANNUAL USAGE	FREQ. OF USAGE	USAGE LOCATION	STORAGE LOCATION	TYPE OF CONTAINER	DISPOSAL	REMARKS
648 SHOP - PLANT WIDE - F. W. KUMPEL											
Grout		Stock	Grout under Equipment	Mixing		Monthly	Shop Wide	M&C Garage	Bag	Dumpster	
Brake Lining	Wagner	Stock	Cranes		20 sets	Monthly	Shop Wide	M&C Balcony	Box	Dumpster	
Gloves		Pur'g.	Burning	Wear		Daily	Shop Wide	M&C Storeroom	Box	Dumpster	
PURCHASING DEPARTMENT - J. B. STOKLEY											
Gloves	A-Best.	Pur'g.	Burning		30 doz.	Daily	602,611,615 616	Shop Cabinets	Box	Dumpster	
QUALITY ASSURANCE - W. HUFHAM											
Electrode E7010-A1	B&W	Stock		Welding	10,000#	Daily	Shop Wide		Metal	Dumpster	

APPENDIX 6

ASBESTOS OSHA STANDARD 1919 . 1001

The value of E_m shall not exceed unity (1).

(ii) To illustrate the formula prescribed in subdivision (i) of this subparagraph, consider the following exposures:

Material	Actual concentration of 8-hour exposure	8-hour time weighted average exposure limit
Acetone (Table Z-1)	500 p.p.m.	1,000 p.p.m.
2-Butanone (Table Z-1)	45 p.p.m.	200 p.p.m.
Toluene (Table Z-2)	40 p.p.m.	200 p.p.m.

Substituting in the formula, we have:

$$E_m = \frac{500}{1,000} + \frac{45}{200} + \frac{40}{200}$$
$$E_m = 0.500 + 0.225 + 0.200$$
$$E_m = 0.925$$

Since E_m is less than unity (1), the exposure combination is within acceptable limits.

(e) To achieve compliance with paragraph (a) through (d) of this section, administrative or engineering controls must first be determined and implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or any other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in this section. Any equipment and/or technical measures used for this purpose must be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with § 1910.134.

1910.1001—ASBESTOS

(a) Definitions.

For the purpose of this section.

(1) "Asbestos" includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

(2) "Asbestos fibers" means asbestos fibers longer than 5 micrometers.

(b) Permissible exposure to airborne concentrations of asbestos fibers.

(1) Standard effective July 7, 1972. The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed five fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(2) Standard effective July 1, 1976. The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(3) Ceiling concentration. No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(c) Methods of compliance.

(1) Engineering methods.

(i) Engineering controls. Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation, and dust

collection, shall be used to meet the exposure limits prescribed in paragraph (b) of this section.

(ii) Local exhaust ventilation.

(a) Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2–1971, which is incorporated by reference herein.

(b) See § 1910.6 concerning the availability of ANSI Z9.2–1971, and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(iii) Particular tools. All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems in accordance with subdivision (ii) of this subparagraph.

(2) Work practices.

(i) Wet methods. Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits prescribed in paragraph (b) of this section, unless the usefulness of the product would be diminished thereby.

(ii) Particular products and operations. No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos shall be removed from bags, cartons, or other containers in which they are shipped, without being either wetted, or enclosed, or ventilated so as to prevent effectively the release of airborne asbestos fibers in excess of the limits prescribed in paragraph (b) of this section.

(iii) Spraying, demolition, or removal. Employees engaged in the spraying of asbestos, the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, and in the removal or demolition of asbestos insulation or coverings shall be provided with respiratory equipment in accordance with paragraph (d)(2)(iii) of this section and with special clothing in accordance with paragraph (d)(3) of this section.

(d) Personal protective equipment.

(1) Compliance with the exposure limits prescribed by paragraph (b) of this section may not be achieved by the use of respirators or shift rotation of employees, except:

(i) During the time period necessary to install the engineering controls and to institute the work practices required by paragraph (c) of this section;

(ii) In work situations in which the methods prescribed in paragraph (c) of this section are either technically not feasible or feasible to an extent insufficient to reduce the airborne concentrations of asbestos fibers below the limits prescribed by paragraph (b) of this section; or

(iii) In emergencies.

(iv) Where both respirators and personnel rotation are allowed by subdivisions (i), (ii), or (iii) of this subparagraph, and both are practicable, personnel rotation shall be preferred and used.

(2) Where a respirator is permitted by subparagraph (1) of this paragraph, it shall be selected from among those approved by the Bureau of Mines, Department of the Interior, or the National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare, under the provisions of 30 CFR Part 11 (37 F.R. 6244, Mar. 25, 1972), and shall be used in accordance with subdivisions (i), (ii), (iii), and (iv) of this subparagraph.

(i) Air purifying respirators. A reusable or single use air purifying respirator, or a

respirator described in subdivision (ii) or (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed no more than 10 times those limits.

(ii) Powered air purifying respirators. A full facepiece powered air purifying respirator, or a powered air purifying respirator, or a respirator described in subdivision (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average concentrations of asbestos fibers are reasonably expected to exceed 10 times, but not 100 times, those limits.

(iii) Type "C" supplied-air respirators, continuous flow or pressure-demand class. A type "C" continuous flow or pressure-demand, supplied-air respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed 100 times those limits.

(iv) Establishment of a respirator program.

(a) The employer shall establish a respirator program in accordance with the requirements of the American National Standard Practices for Respiratory Protection, ANSI Z88.2-1969, which is incorporated by reference herein.

(b) See § 1910.6 concerning the availability of ANSI Z88.2-1969 and the maintenance of an historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(c) No employee shall be assigned to tasks requiring the use of respirators if, based upon his most recent examination, an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by his use of a respirator. Such employee shall be rotated to another job or given the opportunity to transfer to a different position whose duties he is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay he had just prior to such transfer, if such a different position is available.

(3) Special clothing: The employer shall provide, and require the use of, special clothing, such as coveralls or similar whole body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos fibers, which exceed the ceiling level prescribed in paragraph (b) of this section.

(4) Change rooms:

(i) At any fixed place of employment exposed to airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, the employer shall provide change rooms for employees working regularly at the place.

(ii) Clothes lockers: The employer shall provide two separate lockers or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

(iii) Laundering:

(a) Laundering of asbestos contaminated clothing shall be done so as to prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(b) Any employer who gives asbestos-contaminated clothing to another per-

son for laundering shall inform such person of the requirement in (*a*) of this subdivision to effectively prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(*c*) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (g) of this section.

(e) *Method of measurement.*

All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400–450 × (magnification) (4 millimeter objective) with phase contrast illumination.

(f) *Monitoring.*

(1) Initial determinations. Within 6 months of the publication of this section, every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine whether every employee's exposure to asbestos fibers is below the limits prescribed in paragraph (b) of this section. If the limits are exceeded, the employer shall immediately undertake a compliance program in accordance with paragraph (c) of this section.

(2) Personal monitoring.

(i) Samples shall be collected from within the breathing zone of the employees, on membrane filters of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) Sampling frequency and patterns. After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater then 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph (b) of this section.

(3) Environmental monitoring.

(i) Samples shall be collected from areas of a work environment which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone of employees. Samples shall be collected on a membrane filter of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) Sampling frequency and patterns. After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than 6 months for employees whose exposures to asbestos may reasonably be foreseen to exceed the exposure limits prescribed in paragraph (b) of this section.

(4) Employee observation of monitoring. Affected employees, or their representatives, shall be given a reasonable opportunity to observe any monitoring required by this paragraph and shall have access to the records thereof.

(g) Caution signs and labels.

(1) Caution signs.

(i) Posting. Caution signs shall be provided and displayed at each location where airborne concentrations of asbestos fibers may be in excess of the exposure limits prescribed in paragraph (b) of this section. Signs shall be posted at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Signs shall be posted

at all approaches to areas containing excessive concentrations of airborne asbestos fibers.

(ii) Sign specifications. The warning signs required by subdivision (i) of this subparagraph shall conform to the requirements of 20" x 14" vertical format signs specified in § 1910.145(d)(4), and to this subdivision. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in this subdivision.

Legend	*Notation*
Asbestos	1" Sans Serif, Gothic or Block.
Dust Hazard	1" Sans Serif, Gothic or Block.
Avoid Breathing Dust	1/4" Gothic.
Wear Assigned Protective Equipment.	1/4" Gothic.
Do Not Remain In Area Unless Your Work Requires It.	1/4" Gothic.
Breathing Asbestos Dust May Be Hazardous To Your Health.	14 point Gothic.

Spacing between lines shall be at least equal to the height of the upper of any two lines.

(2) Caution labels.

(i) Labeling. Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section will be released.

(ii) Label specifications. The caution labels required by subdivision (i) of this subparagraph shall be printed in letters of sufficient size and contrast as to be readily visible and legible. The label shall state:

CAUTION

Contains Asbestos Fibers
Avoid Creating Dust
Breathing Asbestos Dust May Cause
Serious Bodily Harm

(h) Housekeeping.

(1) Cleaning. All external surfaces in any place of employment shall be maintained free of accumulations of asbestos fibers if, with their dispersion, there would be an excessive concentration.

(2) Waste disposal. Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, consigned for disposal, which may produce in any reasonably foreseeable use, handling, storage, processing, disposal, or transportation airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

(i) Recordkeeping.

(1) Exposure records. Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 20 years and shall be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health, and to authorized representatives of either.

[41 F.R. 11504, March 19, 1976.]

(2) Employee access. Every employee and former employee shall have reasonable access to any record required to be maintained by subparagraph (1) of this paragraph, which indicates the employee's own exposure to asbestos fibers.

(3) Employee notification. Any employee found to have been exposed at any time to airborne concentrations of asbestos fibers in excess of the limits prescribed in paragraph (b) of

this section shall be notified in writing of the exposure as soon as practicable but not later than 5 days of the finding. The employee shall also be timely notified of the corrective action being taken.

(j) *Medical examinations.*

(1) *General.* The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos required by this paragraph.

(2) *Preplacement.* The employer shall provide or make available to each of his employees, within 30 calendar days following his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination, which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(3) *Annual examinations.* On or before January 31, 1973, and at least annually thereafter, every employer shall provide, or make available, comprehensive medical examinations to each of his employees engaged in occupations exposed to airborne concentrations of asbestos fibers. Such annual examination shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(4) *Termination of employment.* The employer shall provide, or make available, within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(5) *Recent examinations.* No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with this paragraph within the past 1-year period.

(6) *Medical records.*

(i) *Maintenance.* Employers of employees examined pursuant to this paragraph shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

(ii) *Access.* The contents of the records of the medical examinations required by this paragraph shall be made available, for inspection and copying, to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of NIOSH, to authorized physicians and medical consultants of either of them, and, upon the request of an employee or former employee, to his physician. Any physician who conducts a medical examination required by this paragraph shall furnish to the employer of the examined employee all the information specifically required by this paragraph, and any other medical information related to occupational exposure to asbestos fibers.

1910.1002—COAL TAR PITCH VOLATILES; INTERPRETATION OF TERM

As used in § 1910.1002 (Table Z–1), coal tar pitch volatiles include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum, wood , and other organic matter.

[37 F.R. 24749, November 21, 1972.]

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

To
B. R. MC GINNIS - MANAGER MANUFACTURING SERVICES

From
K. C. KOCHHAR - SR. FACILITIES ENGINEER

BDS 663-6

Cust.

File No. or Ref.

Subj.
ASBESTOS REPORT

Date
MARCH 1, 1979

This letter to cover one customer and one subject only.

Per your request, enclosed is Asbestos Report. An effort was made to be comprehensive. It discusses asbestos as an important mineral and as a hazardous substance. The methods to minimize or eliminate the hazards are also discussed.

K C Kochhar
K. C. KOCHHAR

KCK:el
Enclosure

cc: E. S. Gaffney
R. H. Otis