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Makers of gaskets, packing, try asbestos replacements

U.S. and foreign manufacturers are using such materials as flexible graphite for packing; chlorite/graphite sheet for spiral-wound gaskets; and mica, glass fibers and others.

Effective Jan. 1, 1987, asbestos will be banned from gaskets and packing in Sweden. And Norway, Denmark and Finland are expected to follow suit. The switch to more-expensive substitutes will cost the petrochemical industry alone up to \$2 million, according to the Swedish Assn. of Chemical Industries.

U.S. industry faces no such immediate threat, but gasket and packing manufacturers are busily touting a variety of asbestos substitutes, prodded by increasingly strict regulations, legal actions, an inability to get liability insurance, and the U.S. Environmental Protection Agency's proposed total ban on asbestos (see story on p. 18).

The smorgasbord of replacements includes flexible graphite, carbon, and graphite yarn, glass fibers, aramid, polybenzimidazole (PBI), polytetrafluoroethylene (PTFE), ceramics, mica and various metals.

No single material matches asbestos' strength, chemical resistance and flexibility over a wide temperature range, says Richard White, director of research and development with Garlock Inc. (Palmira, N.Y.). But equal or superior properties are obtainable by combining two or three materials, he told a seminar on asbestos-substitute gasket and packing materials, held in Houston in early August. (The meeting featured speakers representing producers and users of gaskets and packing.)

STILL THE CHOICE—In the push to encourage substitutes, John Crane Houdaille Inc. (Morton Grove, Ill.) last year stopped making its 187-J braided asbestos packing, long considered an industry standard. And several other manufacturers have ceased production of similar products.

Despite this, U.S. industry spokesmen calculate that asbestos still has well over 50% of the packing and gasket market, compared to the traditional 80-90% (pipe flanges are the biggest

application for sealing material in chemical process plants, the others being valves, pumps, compressors and pressure vessels). Users are reluctant to change to costlier materials they don't have experience with, say manufacturers.

"Many valve manufacturers throughout the world still use asbestos as the standard material for gaskets and packing," observes Donald Glover, head of the piping and technical section with Santa Fe Brazer, Inc. (Alhambra, Calif.). Industry spokesmen report that valvemakers stocked up on asbestos braided packing before Crane and other companies stopped making it, but those supplies are starting to run low.

ONE CONTENDER—At the Houston seminar, the virtues of one particular material—flexible or expanded graphite—were extolled by several speakers. Flexible graphite can withstand temperatures of more than 5,000°F (compared with about 1,200°F for asbestos), say suppliers, while cautioning that it is limited to about 750-850°F in the presence of oxygen, and to around 1,200°F in steam.

"Graphite packing is proving to meet or surpass all the positive characteristics of asbestos," the Houston meeting was told by Rudy MacDonald, a piping component specialist with Exxon Co. U.S.A. (Baton Rouge, La.). To date, it is the only non-asbestos material that Exxon has found to be fire-safe, he says, "and a refinery cannot have leaking flanges in a fire." Most data on asbestos substitutes focus on process compatibility, he adds, and fire-resistant data are virtually nonexistent.

Flexible graphite, developed by Union Carbide Corp. about 20 years ago, was little used until recently because it costs too much. Now it has around 5-10% of the packing market, up from 1-2% a year or two ago, says Peter Petrulich, manager of customer technical service with Union Carbide Elec-



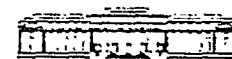
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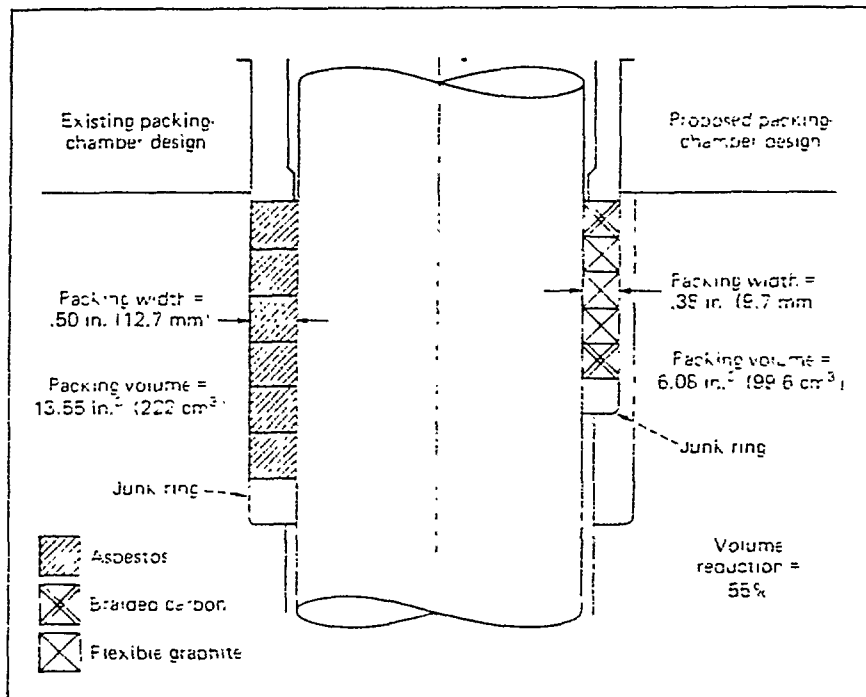
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tronics Div.'s Specialty Products Group (Cleveland).

Petrunic explains that the material is made from natural flake graphite, rather than from textile threads. The graphite is expanded several hundred times into a light, fluffy material by mixing it with sulfuric or nitric acid, then calendered into a sheet (without

graphite the standard packing for small, forged steel valves (up to 4 in.). The company plans to use the material in all valves.

Rockwell has partially offset the higher cost by redesigning its valves to use fewer and smaller packing rings than with asbestos. Braided carbon rings are placed on either end of the



How asbestos packing can be replaced by other materials

binders or additives). Although price has been dropping, the product still costs 30-50% more than asbestos packing, says Petrunic. But he claims that it seals better and lasts 5-10 times longer than asbestos.

One drawback is that graphite, an electrical conductor, can enhance galvanic corrosion in stainless steel. Zinc, a common sacrificial inhibitor, has the limitation of melting at 787°F. So, Carbide now offers a phosphorus-based inhibitor that Petrunic says is more effective. He also points out that impurities in asbestos can cause corrosion problems.

One valve manufacturer that has done extensive testing of flexible graphite is Rockwell International's Measurement & Flow Control Div. (Pittsburgh, Pa.). Rockwell reports better performance than asbestos in seals at higher temperatures, and has made

ring assembly to prevent extrusion of the flexible-graphite sealing rings.

While the material attracted much attention at the Houston meeting, several others are also favored by packing and gasket makers.

"Only the top of the line is made from flexible graphite," says Gariok's White, adding that his firm hasn't made asbestos packing for five years. A typical Gariok design is to put glass fibers in the core for strength, carbon around that (for heat transfer and thermal stability), and PBI on the outside. The latter material, though it costs 40 times as much as asbestos, he notes, can stand more than 1,200°F without burning or melting, and resists most chemical products.

"We use glass a lot," says George McKillop, product manager for John Crane Houdaille's Packing Div. "The cost is slightly higher than asbestos,

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but it has good strength and chemical resistance. We recommend it up to 1,200°F.

FOR GASKETS—In the gasket area, chlorite/graphite sheet, on the market since 1988, is the most popular non-asbestos filler for spiral-wound gaskets, according to Samuel Thomas, vice-president of Flexitallic Gasket Co., (Bellmawr, N.J.). This mixture matches asbestos' performance at a comparable cost, he says. Spiral-wound gaskets that have a flexible-graphite filler offer superior sealing and cyclic thermal- or pressure-loading properties, he adds, but cost 50-100% more.

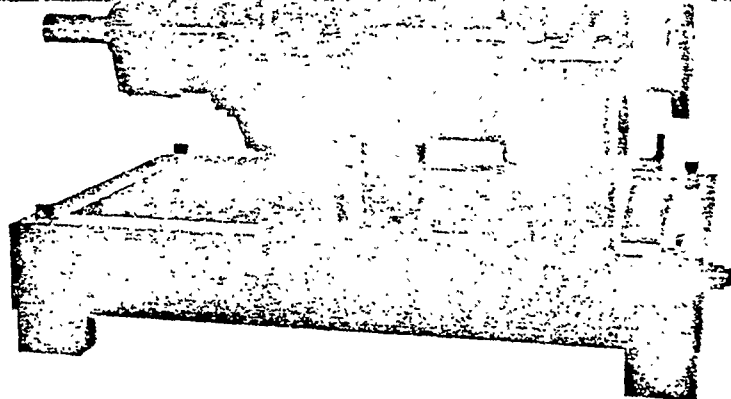
Flexitallic Ltd. (Heckmondwike, England) markets a company-developed mica-chlorite-based spiral-wound gasket that it claims matches asbestos products for a similar price. (This company and Flexitallic Inc. are owned by Turner and Newall PLC, Manchester, England.) Cohn Gee, general manager of the firm's Flexicarb Div., estimates that asbestos still has more than 50% of the British gasket market, but feels that a new asbestos-labeling regulation will accelerate substitution.

In compressed gaskets—conventional asbestos encapsulated in a rubber binder—aramid, glass fibers and mica are being used as reinforcement, while such materials as talc, barium sulfate, clay and mica are fillers. Jack Harris, vice-president of Durable Manufacturing Co. (Lionville, Pa.), says the performance of non-asbestos materials equals asbestos for moderate conditions, but the gaskets cost 50-100% more and cannot handle temperatures above 600°F or certain chemical environments. For this application, flexible graphite is several times more costly than asbestos, he says, partly because the gaskets are cut from sheets and much material is wasted.

"In sheet material for gaskets, we are having a difficult time finding a substitute that has anywhere near the temperature qualities of asbestos," adds a spokesman for another leading gasket maker. "We would like an 800°F material and we are looking at a couple of fibers now," he says, "but most high-temperature fibers are inorganic and don't have crush resistance."

The Swedish forest-industry standardization group is recommending that aramid-reinforced mineral gaskets

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not be used above 150°C. Jan Dahlgren, technical specialist with the group, says that although manufacturers claim that their products will withstand much higher temperatures, tests have shown they don't always meet requirements, especially with sudden steam-pressure surges up to 15 bar.

Hans Wernborg, technical specialist with the Swedish Assn. of Chemical Industries, adds that expanded graphite gaskets are brittle and hard to handle, especially for large flanges. He notes that flanges used for batch cookers in pulp mills can be as big as 8.5 m dia.

PTFE has "unequaled" chemical resistance as a gasket material, a temperature range from -460°F to 500°F, and good dielectric strength and impact resistance, according to David Lingard, manager of applications engineering with Garlock. However, it has poor wear resistance and a tendency to creep relaxation or cold flow. The latter

can be reduced, he says, by using fillers, such as glass or carbon fibers, bronze, ceramics or barium sulfate.

However, expanded PTFE has only 17-60% creep relaxation, compared to as much as 400% for full-density PTFE gaskets, claims Roger Davis, of W. L. Gore & Associates (Elkton, Md.). Gerald Parkinson, Contributor: Robert Skole, McGraw-Hill World News (Stockholm)

Study tracks energy to the year 2000

In a new study, "World Energy Outlook Through 2000," Conoco (Wilmington, Del.), the Du Pont subsidiary, arrives at conclusions that have wide implications for the energy industries in the U.S. and worldwide.

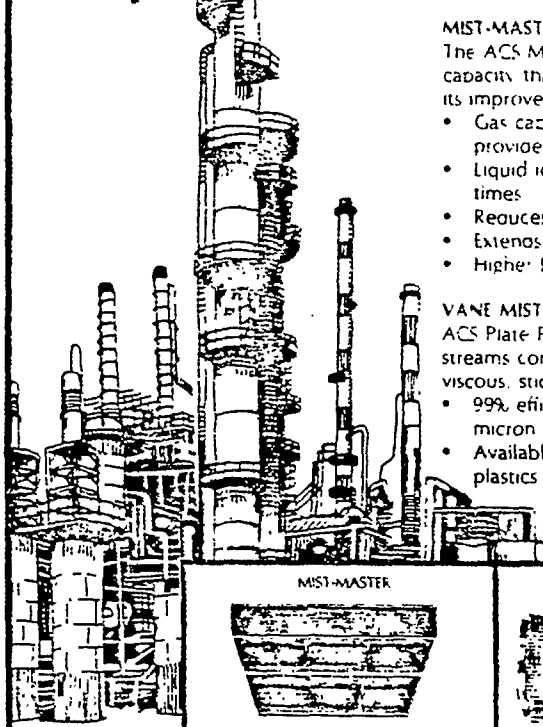
For example, the firm predicts that

crude-oil and petroleum product exports will rise from 26% of U.S. demand in 1985 to 41% by 1990, and 56% by turn of the century. That means nearly 11 million bbl will be brought into the U.S. daily in the year 2000, compared with just over 4 million in 1985. OPEC's share of world oil supply is expected to reach 60% by 2000, up from 38% in 1985, the study predicts.

Noting that the world's oil resources are concentrated in regions having significant potential for supply disruptions, Conoco's outlook warns that increasing import dependence means: (1) higher risk of economically damaging shortfalls, (2) reduced flexibility in formulating and implementing foreign policy, and (3) greater military obligations to safeguard vital supply lines. At the same time, the ability to respond with an increase in domestic supply will become greatly diminished, the report.

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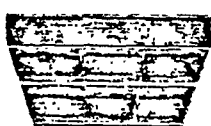
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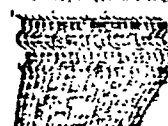
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