GRACE

Construction Products Division

December 4, 1986

TO: McKay Pugmire/CPD Libby

FROM: G. E. Poling

SUBJ: LTEV Idea

cc: R. J. Bettacchi
P. M. Keeffe
W. J. McCaig/CPD Libby
J. M. Ramsey
J. W. Wolters

Thank you for the idea for using LTEV as an asbestos replacement in valve packings. The Specialty Vermiculite group is aggressively pursuing numerous asbestos replacement applications using vermiculite in various forms including; expanded, ground, LTEV and dispersions. I have forwarded your idea to Paul Keeffe, Sales and Marketing Manager for Specialty Vermiculite for evaluation. I expect Paul will be in touch with you in the near future to discuss your idea further.

G. E. Poling

GEP:mg

CONSTRUCTION PRODUCTS DIVISION

IDEA RESPONSE

TO: IDEA INITIATOR McKay Pugmire

FROM: IDEA MANAGER G. E. Poling

IDEA NUMBER V-8 DATE RECEIVED 12/1/86

IDEA LTEV or Vermiculite as an asbestos replacement in valve packing and other specialty gaskets.

TYPE OF IDEA
- ☐ STRATEGIC MOVE
- ☐ COST REDUCTION
- ☐ NEW BUSINESS DEVELOPMENT
- ☐ OTHER
- ☐ CURRENT BUSINESS DEVELOPMENT

IDEA FORWARDED TO EVALUATOR P. M. Keeffe DATE SENT 12/1/86

FEASIBILITY ASSESSMENT DUE DATE 1/15/87

SIGNATURE [signature] DATE 12/1/86

CC: J. Ramsey

Evaluator's Supervisor Bill McCaig

JMR/bac
IPR-3/jmr2

10002949 .A

LTEV YTD SALE PRICE $943.24/ton = 47¢/lb

GRAPHITE (high purity) 53¢/lb to 81¢/lb

ASBESTOS (US DOLLARS) (high purity) 65¢/lb to ≈ 30¢/lb

TO: BILL McCAIG DATE: NOV 20, 1986

FROM: MCKAY PUGMIRE SUBJECT: LTEV OR VM AS AN ASBESTOS SUBSTITUTE IN VALVE PACKING & OTHER SPECIALTY GASKETS.

I WOULD PRESUME, BUT I DONT KNOW, THAT GRACE IS PURSUING OTHER SPECIALTY AREAS FOR USE & SALE OF LTEV & PLAIN VM.

IT WOULD SEEM THAT THERE ARE A NUMBER OF AREAS, ESPECIALLY IN THE GASKET INDUSTRY WHERE USE OF HIGH TEMPERATURE RESISTANT MINERALS (ASBESTOS & GRAPHITE) COULD BE REPLACED BY EITHER LTEV OR VERMICULITE.

FROM AN ECONOMIC STANDPOINT, LTEV COMPARES QUITE FAVORABLY TO GRAPHITE (SEE ATTACHED SHEETS FROM E&MJ & ROUGH HAND CALCULATIO AND HAS THE ADDED ADVANTAGE OF BEING A DOMESTIC MINERAL - NO IMPORT DUTIES

FROM THE ATTACHED ARTICLE IT CAN BE SEEN THAT GRAPHITE HAS A SERIOUS LIMITING FACTOR FOR USE IN HIGH TEMPERATURE APPLICATIONS IE IT IS SAFE IN "NON OXIDIZING ATMOSPHERES". ALSO, THERE IS A PROBLEM IN CORROSIVE ENVIRONMENTS DUE TO TRACE & ABOVE AMOUNTS OF LEACHABLE AMOUNTS OF CLORIDE WHICH CAUSES THE GRAPHITE TO LOSE ITS INTEGRITY

JUST GUESSING, WE (OR CARBORUNDUM) HAVE OBTAINED A CONSIDERABLE AMOUNT OF "OPERATING DATA" FROM USE OF LTEV (IN GASKET FORM & OTHER) WHICH MAY HELP OR INDICATE NEW POTENTIAL MARKETS IN THE VALVE PACKING, GASKET & OTHER HIGH TEMPERATURE AREAS

McKAY

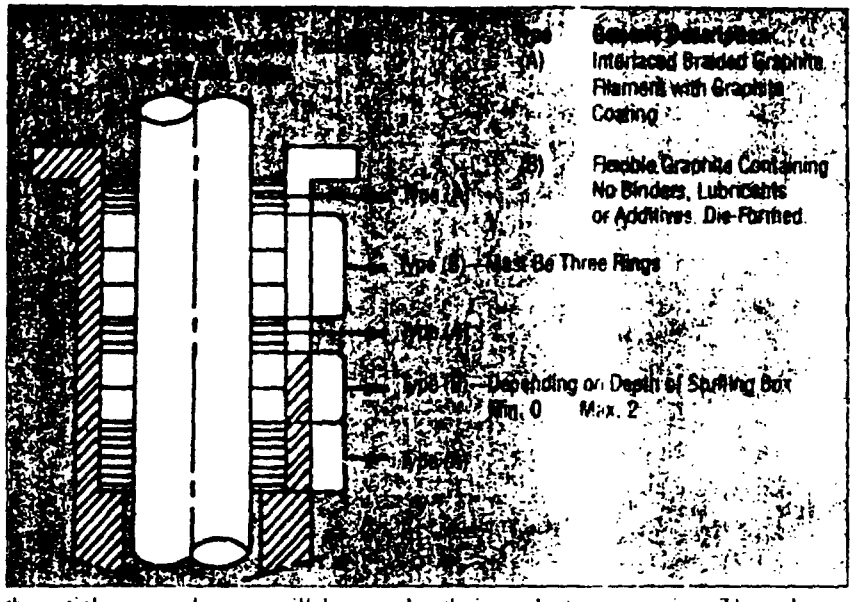
10002951

Technical Overview:

Asbestos substitutes for valve packing in the petrochemical industry

R. H. MACDONALD, Staff Engineer, Exxon Company, U.S.A.

Rudy MacDonald received his degree in Mechanical Engineering from the Higher Technical College in Haarlem, The Netherlands and his Masters degree in Business Administration from Bryant College in Smithfield, Rhode Island. During his 17 year career with Exxon, he has completed overseas assignments in Aruba, Netherlands Antilles and for Aramco in Saudi Arabia. Since 1982 he has been a member of the Exxon Engineering Standards (EXES) Subcommittee on Piping where he directed the development of the current Exxon fire-safe valve standards and fire testing procedures. Mr. MacDonald is responsible for certifying fire-safe valves for the EXES Committee and in this function has had the opportunity to experiment with various asbestos substitutes. He is currently a Staff Engineer at Exxon's Baton Rouge Refinery specializing in piping components. He is also a member of the ASME.



In recent years some well known manufacturers have removed asbestos products from their product lines. Compliance with governmental laws and regulations as well as potential liability are the reasons generally stated for such actions. It is expected that asbestos products will become less and less available in the future.

This article addresses the qualities that allow a material to be considered a true asbestos substitute and outlines the current findings of the suitability of these substitutes for valve packing applications. In addition, through the course of the article, several areas will be noted where further research or development of industry standards are required. While there are several materials claiming to be asbestos substitutes, no material exactly matches the qualities of asbestos. However, pure graphite exhibits many of the qualities considered for a true substitute.

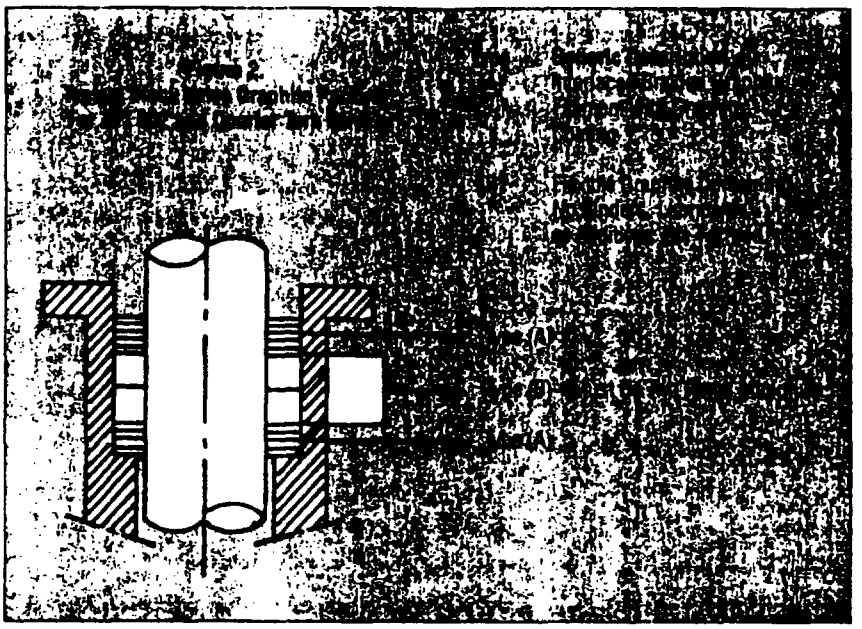
What is considered a true asbestos substitute?

To answer this question, one should consider all the positive characteristics of asbestos. A true substitute must be as good as asbestos in reliability, fire integrity, and have a wide range of service applications as well as be an economical substitute. Some potential substitutes include PTFE, graphite, aramid based, ceramic based and mica based products.

Reliability. Asbestos is a well known and dependable material with years of operating data available. Substitutes are not as well known and operating data is often not available. Furthermore, many manufacturers are reluctant to divulge their product composition. The industry would be well served by some clear specification and product application standards.

Fire integrity. This packing characteristic should be a major consideration in all flammable or hazardous material applications. Since asbestos has proven to be fire safe, it follows that its substitutes should also be fire safe. For many substitutes, this area is one in which further research is needed. Pure graphite (95 + % carbon) has however proven to be fire safe in a non-oxidizing atmosphere.

Range of Application. Asbestos is specified for a majority of refinery valve packing applications. Therefore substitutes should also exhibit a wide range of service applications. Having a product with a wide range of services provides two advantages. First, additional safety will be gained from being able to standardize packings, thereby minimizing the chances of misapplication. Second, an economic advantage will come from



minimizing packing inventories.

Economic: Finally, the asbestos substitutes must be economical to compete in the market place. Data shows that although the initial price of a substitute may be somewhat higher, it will come into parity with asbestos with widespread use. For example, valves packed with graphite were initially 5%-25% more costly than asbestos valve packing. Now, the costs are equivalent.

In summary, for a material to be considered a true asbestos substitute it must equal or exceed all the qualities outlined above. While no material can indisputably claim to be a true asbestos substitute, based on early tests, pure flexible graphite appears to be the closest to matching the requirements. Further research is needed before other materials can be considered true asbestos substitutes as outlined above.

Graphite valve packing findings

The remainder of this article will focus on the application of graphite valve packings. For refinery services, a product is considered to be graphite if it consists of more than 95% pure carbon, has no asbestos and the leachable chloride content does not exceed 50 ppm.

The next step is to determine the best packing configuration. Data indicates that the "stacked" packing configurations outlined in Figures 1 and 2 have had good results. The stacked configuration consists of graphite end rings to prevent extrusion on the top and bottom and die formed graphite rings in the middle. The end rings are made of interlaced braided carbon with a graphite coating. The die formed rings consist of compressed graphite ribbons and should not contain binders, lubricants or additives not approved by the Owners Engineer. In addition, the packing should be provided with a corrosion inhibitor to preclude stem pitting. Since several inhibitors can be used, the manufacturer should disclose which one is used. If possible, proven lab and/or field data should be included to substantiate any claims of performance.

After packing type and configuration have been resolved, the packing density needs to be specified. Installations have been successful with densities ranging from 70 to 85 lb/ft³. The higher densities are easier to work with and are preferred by the valve manufacturers. However, once densities reach 100 lb/ft³, field adjustment can become difficult. Starting with a high density may benefit the valve manufacturer, but does not give the user the packing longevity that lower densities will allow. Lower densities will also allow the user the flexibility of packing a nonstandard stuffing box without custom making each ring. It should be noted that the search for an optimum density is not over and could be the topic of a separate article.

An additional area requiring further development is the standardization of ring densities. Varying bases are used by industry to state ring densities. Some manufacturers use the density of the ribbon used to form the ring while others use the density after the ring has been compressed in the stuffing box. This is confusing and can lead to miscommunications. The density quoted here is that of the ring before it is placed in the stuffing box.

In summary, while asbestos is still an approved packing material, graphite packing is proving to meet or surpass all the positive characteristics of asbestos. Increased usage is lowering the price to the point that graphite has become competitive with asbestos. Other substitutes have advantages but to date they have not proven to be fully fire safe nor do they have the wide range of service applications. Therefore, until other substitutes can match all the positive characteristics of asbestos, it appears that graphite will continue to lead as a true asbestos substitute. ■

For a reprint of this article, circle 444 on reader service card.

(Continued from page 19)

Ferromanganese: lt, (c), (d)
Standard (78% Mn), eff. 6-28-84 — Suspended
Imported, f.o.b. Pittsburgh or Chicago, eff. 10-24-85 — $305-320

Ferromolybdenum: lb Mo, (d), 5,000-lb lots, eff. 8-14-86
Dealer export — $3.65-3.75

Ferrosilicon: lb Si, (c), (d), eff. 6-19-86
50% Si — 35.5-37¢

Ferrotungsten: lb W, (d), eff. 10-1-81
UCAR — Suspended

Ferrovanadium: lb V, packed, (d), eff. 4-1-86
Fesven — $6.30

Silicomanganese: lb, (d), eff. 7-1-86
16-18½% Si, 2% C — 18.25-18.75¢

NONMETALLIC MINERALS

Prices received vary and depend upon the characteristics of the commodity. Hence quotations can serve only as a general guide to the prices obtained by producers and dealers for their product. st—short ton, lt—long ton, (a) c.i.f. US ports, (b) f.o.b. shipping point, (c) f.o.b. mine or mill, (d) carload lots, (e) depending on grade, (f) f.o.b. vessel, (g) f.o.b. pt. of origin, US port, (n) nominal.

Asbestos: mt, (c)
Quebec, Canadian funds, eff. 1-1-83

3R	$1,764	5R	$711
3T	$1,481	6D	$521
3Z	$1,569	7D	$308
4T	$1,083	7M	$177
5D	$838	7R	$164

North Vancouver, BC, Canadian funds, eff. 1-1-82

AAA	$2,000	AY	$430-470
AA	$1,600	AZ	$330-340
A	$1,050	CP	$760
AC	$960	CT	$680
AK	$810-850	CY	$430-470
AS	$705-740	CZ	$330-340
AX	$610-670		

Morrisville, Vt., US $, eff. 2-1-83

4T	$733-863	7D	$246
5K	$669	7M	$141
5R	$483-669	7R	$129
6D	$345-471		

Barytes: unground, st
Chemical and glass grade
Hand picked, 95% $BaSO_4$, not over 1% Fe, (b), (d) — $90
Magnetic or flotation, 96-98% $BaSO_4$, not over 0.5% Fe, (b), (d) — $116
Imported drilling mud grade, specific gravity 4.20-4.30
c.i.f. Gulf ports — $26-39
Ground, st
Water ground, 95% $BaSo_4$
325 mesh, 50-lb bags, (b), (d) — $70-165
Dry ground, drilling mud grade, 83-93% $BaSO_4$
3-12% Fe, specific gravity 4.20-4.30, (b), (d) — $60-90
Imported
4.20-4.30 specific gravity, (b) — $40-55

Bauxite: mt, (d)
Imported Guyana refractory RASC grade, super calcined
f.o.b. Baltimore, Md — $164.76
f.o.b. Mobile, Ala — $164.76
f.o.b. Burnside, La — $164.76

Boron: st, bulk, (b), (d)
Anhydrous — $602

Feldspar: st, bulk, (c), (d), (e)
North Carolina
40 mesh, flotation — $57.25
20 mesh, flotation — $29.25
200 mesh, flotation — $77.80
Georgia
200 mesh — $76.50
40 mesh, granular — $57.25
Connecticut
200 mesh — $58.75
20 mesh granular — $43.00

Fluorspar: net ton, bulk, f.o.b. Ill., Ky.; CaF_2 content
Metallurgical
Pellets, 70% effective CaF_2 — $125
Ceramic, calcite and silica variable, CaF_2
88-90% — $100
95-96% — $170
97% — $165-175
In 100-lb paper bag, extra — $13.50
Acid, dry basis, 97% CaF_2
Carloads — $173
Bags, extra — $26.00
Pellets, 88% effective — $180
Wet filter cake, 8-10% moisture, sold dry content — subtract approx. $6.00
European and South African wet filter cake, 8-10% moisture, sold dry content, duty pd, mt, c.i.f. East Coast, Great Lakes, and Gulf ports, term contracts — $140-180
Mexican, st
Metallurgical, 70% effective CaF_2
Tampico, f.o.b. vessel — $80.06
Mexican border, f.o.b. cars — $75.63
Acid, 97% + CaF_2, wet filter cake, bulk, f.o.b. Mexican border — $108.33

Graphite (natural): mt, f.o.b. source
Flake and crystalline graphite, bags
Madagascar — $320-1,100
German — $450-500
Ceylon — $300-1,500
Chinese — $60-1,700
Amorphous, non-flake—cryptocrystal., 80-85% C
Mexican, bulk — $90-125
Korean, bags — $90-120

Kyanite: st, (b), Georgia, raw, bulk
35 mesh — $92
48 mesh — $102
100 mesh — $108
200 mesh — $115
325 mesh — $144
Bagged material, extra — $9

Magnesite: st, bulk
Dead burned grain, f.o.b. Luning, Nev — $228
Bagged — $249
98%, f.o.b. Maple Grove, Ohio — $479

Ochre: st, 50-lb bags, (c), (d)
Georgia #808 — $170-190
Georgia #548 — $180-205
Georgia #404 — $230-255
Virginia, #77 — $500
Virginia, #88 — $420
Virgina, #44 — $135

Phosphate rock: st, central Florida land pebble, R.O.M., washed, dried, unground bulk, f.o.b. mine

66-68%	$16-18	70-72%	$21-23
68-70%	$18-21	74-75%	$25-27

Potash: K_2O contained, bulk, muriate, 60% KCl, st
f.o.b. Carlsbad, N.M., eff. 6-16-86
Standard — $45.00
Soluble 62-63% — $76.00
Coarse — $50-51
Granular — $51.50
f.o.b. Saskatchewan, Canada, eff. 6-1-86
Standard — $38.00
Soluble 62-63% — $41.00
Coarse — $43.00
Granular — $44.50
Bags, extra — $26

Pyrites: st, f.o.b. Climax, Colo., bulk, dry
50-52% sulphur — $50.00

Quartz rock crystals:
For fusing, all sizes, st — $440-2,500
For piezo-electrical and optical use, dep. on size and grade, lb — $2.50-60.00

Silica: amorphous, st
f.o.b. Elco, Ill., 50-lb paper bags
through 200 mesh

90-95%	$71	96-99%	$72

through 325 mesh

90-95%	$73	98-99.4%	$78
96-98%	$69.50	99.5%	$95.00

99.9% passing 400 mesh — $128.00
99% below 15 microns — $137.00
99% below 10 microns — $164.00
99% below 8 microns — $196.00

Sulphur: lt, term contracts
US producers, f.o.b. vessel at Gulf ports, La. and Tex.
bright — $147.50
dark — $141.50
Export, ex terminal Holland
bright — $164.50-167.50
dark — $155

Talc: st, (c), (d), containers included unless otherwise specified
New Jersey
mineral pulp, ground (bags extra) — $18.50-20.50
Vermont
98% through 325 mesh, bulk — $70
99.99% through 325 mesh, dry processed, bags — $147
99.99% through 325 mesh, water beneficiated, bags — $213-228
New York
96% through 200 mesh — $67-75
98-99.25% through 325 mesh — $83-100
100% through 325 mesh (fluid energy ground) — $165
California
Standard — $130
Fractionated — $37-71
Micronized — $150-220
Cosmetic/steatite — $44-65
Georgia

98-200	$50.00	99-325	$60

100-325 (fluid energy ground) — $100

Tripoli: lb, paper bags, carloads
White, f.o.b. Elco, Ill.
Air floated through 200 mesh — 3.55¢
Rose and cream, f.o.b. Seneca, Mo., and Rogers, Ark.
Once ground — 2.90¢
Double ground — 2.90¢
Air float — 3.15¢

Vermiculite: st, (c)
Montana, So. Carolina — $100-$150
South Africa, crude, c.i.f.
Atlantic ports — $110-160

(For daily prices, see p 13)