Shell Oil Company
Interoffice Memorandum

AUGUST 27, 1984

PRIVATE AND CONFIDENTIAL

FROM: R. W. RAPP

TO: R. E. NORDSTROM

SUBJECT: ASBESTOS-CONTAINING VS. NON-ASBESTOS-CONTAINING VALVE STEM PACKINGS AND FLANGE GASKETS

On several occasions over the last few years Engineering Services has been asked to review the technical and commercial aspects of changing from asbestos-containing valve stem packings and flange gaskets to non-asbestos-containing valve stem packings and flange gaskets in Shell Oil.

SHELL EGS SPECIFICATIONS

For a large majority of our piping services our current piping EGS recommend (1) for valve steam packing, braided asbestos with Inconel wire insert around resilient asbestos core, graphite impregnated (John Crane 187-I is basically the industry standard); (2) for gaskets in Classes 150 and 300 flanged piping systems, compressed sheet asbestos; and (3) for gaskets in Classes 600 and higher flanged piping systems, stainless steel spiral wound gaskets with asbestos filler. These materials are specified because they are widely available, are generally satisfactory for the intended services, and are cost effective.

ENGINEERING SERVICES' POSITION

With regard to the concerns about the continued use of asbestos-containing products that has surfaced in recent years, Engineering Services has taken the position that we will continue to use asbestos-containing stem packings and asbestos-containing flange gaskets as long as these products meet the following criteria: (1) they can be safely handled; (2) they are legally available; (3) they are satisfactory for the intended service; and (4) they are cost effective. Also, we have stated that if we can find non-asbestos-containing alternatives to the above asbestos-containing products that (1) are as effective as the equivalent asbestos-containing products at no significant cost increase to Shell or (2) are so demonstratably superior to the asbestos-containing products that a significant cost increase to Shell can be justified, then we would make the switch to non-asbestos-containing products.

In light of the above we have again reviewed the availability of non-asbestos-containing valve steam packings and flange gaskets in the market place and Shell's experience with these products. The results are as follows:

SPIRAL WOUND GASKETS

With respect to spiral wound gaskets, Flexitallic Gasket Company, Lamons Metal Gasket Company, and Sepco Metallic Gasket Corporation have spiral wound gaskets with non-asbestos-containing filler on the market. Flexitallic's trade name for its spiral wound gasket with non-asbestos-containing filler is "Flexite Super" and the filler is chlorite mineral paper with 30% graphite (Attachment 1). Lamons uses a mica filler in its non-asbestos-containing spiral wound gasket. Sepco's trade name for its spiral wound gasket with non-asbestos-containing filler is "Verdi Flex" and the filler is mica (Attachment 2).

Deer Park has purchased some $55,000 worth of "Flexite Super" gaskets for installation in various services and has reported that the "Flexite Super" gaskets are superior in sealing ability to the asbestos-filled spiral wound gaskets and have replaced more expensive 100% graphite-filled spiral wound gaskets in certain services. Geismar has recently standardized on the "Flexite Super" gasket for stock (Attachment 3). Also the "Flexite Super" gasket has been incorporated into the piping specifications for the cumene project at Deer Park.

The only concern about the new "Flexite Super" gaskets was the question of possible galvanic attack between the stainless steel windings and the graphite in the non-asbestos-containing filler in aqueous solutions. Westhollow Research Center has recently run tests on this for Deer Park and determined that this is not a problem (Attachment 4).

We are not aware of any significant Shell experience with the mica-filled spiral wound gaskets from Lamons and Sepco. Lamons' local representative has stated that he does not know of any refinery users of his mica-filled spiral wound gasket. Lamon's mica-filled spiral wound gasket costs about 12.5% more than their asbestos-filled spiral wound gasket. Sepco's mica-filled spiral wound gasket costs about 16% more than their asbestos-filled spiral wound gasket.

On the basis of the Deer Park experience and in light of our stated position above, we recommend changing our piping EGS recommendation to include spiral wound gaskets with non-asbestos-containing filler, "Flexite Super" or equal, in addition to asbestos-filled spiral wound gaskets for most piping services in pressure Classes 600 and above. At this time we have no proven equal to the "Flexite Super" gasket.

The cost to make this change varies with location. Norco and Wood River have blanket MRO orders with Flexitallic distributors. Therefore, since the cost of the "Flexite Super" is the same as the standard Flexitallic asbestos-filled spiral wound gasket, there would be no cost adder to make this change at these two locations. Deer Park has blanket MRO orders with Lamons and Sepco which are 35% and 30% respectively below Flexitallic (Attachment 5). The cost to upgrade the Lamons and Sepco asbestos-filled spiral wound gaskets to non-asbestos filled Lamons or Sepco spiral wound gaskets (which are not proven by Shell experience) would be 12-to-15% and would be 30-to-35% to upgrade to the "Flexite Super" gasket. In the past twelve months Deer Park has purchased about $160,000 worth of asbestos-filled spiral wound gaskets from Lamons ($90M) and Sepco ($70M) and about $55,000 worth of "Flexite Super" spiral wound gaskets from Flexitallic. Martinez has its blanket MRO order with Lamons for spiral wound gaskets which are about 10% lower in cost than Flexitallic. Martinez has purchased about $40,000 worth of spiral wound gaskets in the last 12 months. Wilmington has its blanket MRO purchase order for spiral wound gaskets with Lamons. At Wilmington the price of Lamons gaskets was about the same as Flexitallic the last time the blanket order was bid. In the last twelve months Wilmington has purchased about $84,000 worth of spiral wound gaskets.

COMPRESSED SHEET GASKETS

With respect to compressed sheet gaskets, we do not have an acceptable across-the-board alternative to compressed sheet asbestos gaskets at this time unless we want to go to all spiral wound gaskets with non-asbestos-containing filler. This change would be perhaps three times more expensive than using compressed sheet asbestos gaskets. Wood River and Deer Park have some experience with Garlock's non-asbestos-containing sheet gaskets (trade name "Blue Gard"). Wood River's experience is limited but good. Deer Park's experience is somewhat more extensive, but the results are somewhat mixed and documentation of results is not very good. Also, Garlock's non-asbestos-containing sheet gasket is more expensive than the compressed sheet asbestos gasket (Attachment 6). Per Garlock's local salesman, the Garlock Blue Gard 3400 still carries a 100% price premium over the Garlock 7021 compressed sheet asbestos gasket in the Houston area.

Without additional test data and documentation on the use of compressed non-asbestos-containing sheet gaskets, we recommend no change be made at this time in the piping EGS with respect to the use of compressed sheet asbestos gaskets.

VALVE STEM PACKINGS

Deer Park has considerable and very good experience with premium priced non-asbestos-containing valve stem packings. Deer Park has repacked many valves in which the asbestos-containing John Crane 187-I stem packing did not give good service life with a combination Garlock 98 carbon rings and

flexible graphite rings. Deer Park has also ordered new valves with this stem packing arrangement for high pressure hydrogen service, for some high pressure-high temperature process services, and high pressure steam service.

As seen on the attached price comparison chart (Attachment 7), the straight Garlock 98 stem packing rings or the combination Garlock 98 and flexible graphite stem packing sets carry significant price premiums over the standard John Crane 187-I stem packing. Because of the significant price premiums, use of the Garlock 98 or Garlock 98 and flexible graphite stem packings can only be justified in very hard-to-hold service valves or in critical service valves at this time.

Vogt Valve Company has tested a number of non-asbestos-containing stem packings and has found that a combination of flexible graphite rings and non-asbestos braided rings to be the most service effective and cost effective stem packing substitute for the standard asbestos-containing John Crane 187-I valve stem packing (Attachment 8). Price adders per valve which include the Shell discount) for Class 800 bolted bonnet gate valves with the new non-asbestos-containing stem packing and non-asbestos-containing bonnet gasket range from $4.40 for 1/2" valves to $11.20 for 2" valves. Price adders per valve (which include the Shell discount) for Class 800 welded bonnet valves with the non-asbestos-containing stem packing range from $1.60 for 1/2" valves to $4.80 for 2" valves (Attachment 9). Price adders for Smith Valves with the same type of non-asbestos-containing stem packing and bonnet gaskets are about the same as Vogt (Attachment 10).

Norco Manufacturing Complex has standardized on the combination graphite rings/non-asbestos braided rings stem packing system for all API 602 welded bonnet valves (Attachment 11). Welded bonnet valves are used mainly for steam service and Norco favors this combination stem packing system for steam service. Rather than order this packing system for steam service valves and the less expensive standard packing system for welded bonnet valves used in other services, Norco has decided to order only the combination graphite rings/non-asbestos braided rings stem packing system in all API 602 welded bonnet valves to avoid double stocking.

Within the last six months John Crane Packing Company has announced the availability of a new non-asbestos-containing valve stem packing (brand name John Crane 187-IG) which Crane claims is a totally compatible substitute across-the-board for the asbestos-containing John Crane 187-I stem packing (Attachment 12). The new non-asbestos-containing 187-IG stem packing carries a 15% cost premium over the standard 187-I stem packing. Assuming that Crane's claims for the 187-IG stem packing can be substantiated, this cost premium would not be significant when the total cost of a new valves is considered or in the cost to repack an existing valve or in the total cost to recondition a valve. Smith Valves has said that they would offer the John Crane 187-IG packing in their valves at no cost increase over the regular John Crane 187-I packing.

Crane does not know of any refiner who is extensively using the 187-IG stem packing at this time. Commonwealth Edison reports good service with the 187-IG packing in 2100 psig/1050°F steam service after five weeks service. Previously they were getting only one week's service life from Garlock's non-asbestos-containing 127-AFP stem packing in the same service. However, Commonwealth plans to test flexible graphite packing in this service in the future.

Garlock also has a non-asbestos-containing valve stem packing (trade name 127-AFP) which Garlock claims is equal to 187-I but it carries a 100% price premium over the 187-I stem packing. This product has been on the market for a couple of years. Deer Park is currently testing some of this material but no results are currently available. One valve reconditioning shop and one plant turnaround contractor have reported that some of their customers who have used the 127-AFP stem packing material have reported problems with it in high temperature service. Also, one valve manufacturer has tested the 127-AFP packing in its manufacturing facility and did not find it to be very satisfactory.

We believe that the John Crane 187-IG stem packing has the potential to be a cost effective replacement across-the-board for asbestos-containing valve stem packings if we can substantiate Crane's claims for the 187-IG stem packing. However, since we cannot presently substantiate Crane's claims for the 187-IG stem packing, we cannot recommend changing our EGS at this time to permit its use across-the-board in valves. We encourage field locations to use the 187-IG stem packing in order to demonstrate the effectiveness of the 187-IG stem packing. Meanwhile, we will continue to monitor the industry use and acceptance of 187-IG stem packing through our contacts at the API, with our competitors, and with valve manufacturers.

If the John Crane 187-IG does not prove to be effective, we will not have a cost effective, across-the-board replacement for asbestos-containing stem packing. We estimate that a switch to the combination graphite rings/non-asbestos braided rings stem packing system in API 602 valves at Deer Park alone might cost about $75,000 a year (Attachment 13).

COMPETITORS' FINDINGS AND VALVE MANUFACTURERS' OUTLOOK

Per discussions with a number of our competitors, engineering contractors, valve manufacturers, gasket manufacturers and packing manufacturers, all of the major users are experimenting with non-asbestos-containing valve stem packings and gasket materials. Some of the end users, such as Celenese, Diamond Shamrock, Arco, and Rohm and Haas, are actively phasing out the use of asbestos-containing products throughout their facilities. Others, such as Exxon, are phasing out some of the asbestos-containing products in individual units within their manufacturing complexes, i.e., the olefin unit at Exxon's Baytown Complex is phasing out asbestos-containing sheet gaskets in pump cases and heat exchangers.

With respect to valve stem packings and sheet gaskets, none of our refinery competitors (Exxon, Gulf, Amoco, Conoco, Texaco) have found satisfactory, cost effective across-the-board replacements for John Crane 187-I stem packing and asbestos sheet gaskets.

The attached memo from MCC Pacific Valves is probably typical of the valve industry's outlook on the use of asbestos-containing stem packing (Attachment 14). Unless the customer requests otherwise, Pacific will continue to supply valves with asbestos-containing stem packing as long as it is legal to do so because asbestos-containing packing is cost effective and is not considered by Pacific to be a health or safety hazard in the form used in valve stem packing.

Recognizing the concerns and uncertainties about the continued use of asbestos-containing products, the API Subcommittee on Piping has gone on record that it will approach the API Committee on Refinery Equipment for funding for a non-asbestos-containing gasket test program in the near future.

CONCLUSION

Discounting those companies that have switched to non-asbestos-containing products by edict, it appears that the cost of the non-asbestos-containing substitutes for valve stem packings and gaskets is a major factor in changing from asbestos-containing materials to non-asbestos-containing materials. Where a non-asbestos-containing product is available which does the job as well as the asbestos-containing product and does not cost a significant premium, then the change to the non-asbestos-containing product is readily acceptable, witness the wide spread acceptance of the Flexitallic's "Flexite Super" spiral wound gasket in one year's time. Where the cost of the non-asbestos-containing product is significantly more than the asbestos-containing product, the switch to the non-asbestos-containing product has generally been on a more selective basis, witness the use of Garlock's Blue Gard and other manufacturers' non-asbestos-containing sheet gaskets and Garlock's 98 style and other manufacturers' flexible graphite valve stem packings.

SUMMARY

Legally, there are no current regulations barring the use of asbestos-containing valve stem packings and flange gaskets. Technically, we have found some non-asbestos-containing products that are equal to or superior than their equivalent asbestos-containing products, i.e., spiral wound gaskets and valve stem packings. In sheet gaskets we have not yet found a technically acceptable equivalent across-the-board substitute for asbestos sheet gaskets. Commercially, the cost to change to non-asbestos-containing products to proven non-asbestos-containing valve stem packings and flange gaskets is generally high.

RECOMMENDATIONS

1. Do not arbitrarily ban the use of asbestos-containing valve stem packing and flange gaskets as long as these products meet the position set out earlier in this report.

2. Encourage locations to use John Crane's 187-IG non-asbestos-containing packing to determine that it is a cost effective alternative to the valve industry standard asbestos-containing 187-I stem packing.

3. Revise the piping EGS to permit the use of "Flexite Super" spiral wound gaskets.

4. Encourage the use of "Flexite Super" gaskets where economical to do so.

R. W. Rapp

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