

DOW CHEMICAL U.S.A.
Materials Technology

PLAINTIFF'S EXHIBIT

DOW-2463

CONSULTATION REPORT NO. 4-0071-88

To: Alvin Bravenec, B-108 Group: Insulation/Fireproofing
Department: Materials Technology Report Date: November 2, 1988
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TITLE: NON-ASBESTOS GASKETS/PACKING FOR FIRESAFE VALVES AND FLANGES

Non-asbestos Garlock Gylon® gaskets were chosen for most CEP processes in recent Plant Engineering Specification revisions. However, Gylon® will not withstand fire, since it is 75% PTFE (Teflon). Concern of non-asbestos gaskets in flammable services led to meeting of Loss Prevention, CEP/TOX Tech Center, Engineering Specifications, and Materials Technology personnel. Meeting attendance, discussion items, and post-meeting developments follow.

Future developments will be communicated to the above distribution list.

MEETING ATTENDANCE:

Bob Oubre, CEP/TOX Technology Center
Walt Hoffman, Loss Prevention Engineering
Benny Howard, Engineering Specifications
Janna Ellis, Materials Technology

DISCUSSION ITEMS:

1. Required fire tests for gaskets/packing.
2. Currently documented fire tests.
3. Potential alternatives to PTFE-based materials, considering fire safety and process compatibility, specifically for CEP.
4. Means to improve communication of this potential safety hazard.

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DISCUSSION ITEMS, DETAIL:

FIRESAFE REQUIREMENTS:

1. Dow Chemical standards are listed in Loss Prevention Principles 6.6 USE OF GASKETS and 6.12 FIRESAFE VALVES.
 - a. Firesafe valves
 - are designed for flammable liquid service.
 - can withstand direct fire exposure for at least 15 minutes without excessive internal/external damage.
 - are required for flammable storage tanks bottoms, process vessels with significant inventories, and valves critical to emergency shutdown in fire.
 - b. Primary standards for firesafe valves are FM (Factory Mutual) Class 6033 and API 607 with diesel or kerosene test liquid.
 - c. Acceptable leakage rate for remanufactured valves is 0 ml/hr.

DOCUMENTED FIRE TESTS:

1. FLEXIBLE GRAPHITE is currently the ONLY non-asbestos material to pass in standard API 607 and FM Class 6033 firesafe valve tests. Kerosene or diesel was not used as test liquid in these tests. (Reference: Flexible Graphite Manufacturer Union Carbide.)
 - Flexible graphite is available as sheet gaskets, filler for spiral wound gaskets, and packing.
 - API 607 and FM Class 6033 will be investigated to verify exact form of flexible graphite used in tests. (See POST-MEETING DEVELOPMENTS.)
 - Material Safety Data Sheet states flexible graphite is non-combustible.
 - Flexible graphite 0.015 inch sheet is specified gasket for Dowtherm® service. (Reference Dow Engineering Specifications 46-320 and 46-321.)
2. PTFE-BASED materials, including Garlock Gylon®, are not suitable for flammable service.
3. MICA/GRAPHITE filled spiral wound gaskets have been tested in both API 607 or FM Class 6033 firesafe valve tests.
 - Manufacturer Flexitallic conducted a firetest. Leakage occurred with both graphite and mica/graphite filled spiral wound gaskets, when 40% or more of B-7 bolt preload was lost during fire.

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DOCUMENTED FIRE TESTS, CONTINUED:

- Manufacturer Garlock predicted negative outcome of API 607 and has no future firetests scheduled.
 - Material Safety Data Sheets state that direct flame will ignite mica/graphite filler.
4. CARBON FIBER gaskets with SBR (Styrene Butadiene Rubber) binders underwent a variation of API 607 firetest, but leaked.
- This is not acceptable for remanufactured valves.
 - Material Safety Data Sheet states that direct flame will ignite carbon fiber with SBR binder gaskets.
5. ARAMID FIBER with elastomeric binder gaskets are not suitable for flammable services.
- Material Safety Data Sheet states that direct flame will ignite aramid fiber/elastomeric binder gaskets.

POTENTIAL ALTERNATIVES FOR CEP:

1. Bob Oubre CEP/TOX Technology Center will contact CEP personnel to discuss possibility of using flexible graphite gaskets and packing in flammable services.
- Flexible graphite is ONLY non-asbestos gasket and packing to be in successful API 607 and FM Class 6033 firesafe valve tests.
 - Manufacturer Union Carbide's chemical compatibility chart includes recommendations of flexible graphite with the following services:
 - Ethylene Dichloride
 - Dry Chlorine
 - Sodium Hydroxide

IMPROVED COMMUNICATION:

1. Walt Hoffman Loss Prevention Engineering will include information on flexible graphite gaskets and packing in flammable services in Quarterly Loss Prevention Report and 1988 fall edition Quarterly Technology Exchange.
2. Loss Prevention Principles 6.6 USE OF GASKETS and 6.12 FIRESAFE VALVES will be revised to recommend either asbestos or flexible graphite for flammable services, where chemically compatible with service. Specific date for revisions has not been scheduled. (I recommend waiting for further testing of firesafe gaskets. See POST-MEETING DEVELOPMENTS.)

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POST-MEETING DEVELOPMENTS:

1. Janna Ellis Materials Technology will contact Southwest Research Institute to discuss:

- Tests to determine gasket firesafety, for both:
 - flat sheet and
 - spiral wound gaskets.
- Estimated cost.
- Scheduling.

Discussion results with Southwest Research Institute will be relayed to Loss Prevention, Engineering Specifications, CEP/TOX Tech Center, CEP and Texas Operations Safety Directors, and Materials Technology personnel. Proposal for Southwest Research Institute testing of gasket firesafety can then be discussed.

2. Investigation of API 607 and FM Class 6033 tests involving flexible graphite revealed:

- Valves tested were Whitey firesafe ball valves. Tests were conducted and certified by the following:
 - API 607: Whitey Valve Co., Highland Heights, Ohio
 - FM Class 6033: Factory Mutual Research, Norwood, Mass.
- Materials used for both API 607 and FM Class 6033 included:
 - Packing: Flexible graphite die-formed rings.
 - Weir Ring: Flexible graphite with 0.007 in. 316 SST No. 24 woven wire.
 - Flange seal: Flexible graphite no wire.
 - Bolts: ASTM A-193 Grade B 8M Class 2: internally threaded, Whitey representative said bolts were approved for Dow use by Dow Metals Technology and Engineering Specifications.
- Leakage considered:
 - FM Class 6033: Leakage through valve port, if closed, and external leakage, including leakage from flanged connections.
 - API 607: External leakage including stem, bonnet joint, and body joint, but not including leakage at piping-to-valve end connections.

3. Dow Material Recovery currently uses B-7 studs with firesafe valves unless otherwise specified. This practice of using B-7 studs will be investigated.

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