

Effects of Oxygenated Fuels and Reformulated Diesel Fuels on Elastomers and Polymers in Pipeline/Terminal Components

API PUBLICATION 1132
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American Petroleum Institute
1220 L Street, Northwest
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Manufacturing, Distribution and Marketing Department

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**EFFECTS OF OXYGENATED FUELS AND REFORMULATED
DIESEL FUELS ON ELASTOMERS AND POLYMERS
IN PIPELINE/TERMINAL COMPONENTS
AMERICAN PETROLEUM INSTITUTE**

INTRODUCTION

With the passage of the Clean Air Act, pipelines are required to transport reformulated oxygenated gasolines containing ethers and alcohols and reformulated diesel fuels . In some cases pipelines are shipping neat oxygenates that may have effects on pipeline components. It is for this reason that the American Petroleum Institute (API) sought information from the pipeline/terminal industry to determine the proper methods for handling these products, for proper selection of materials and product compatibilities.

The objective of this project was to develop a document that consolidates the industry's experience with oxygenated fuels and reformulated diesel fuels and their effects on elastomers and other pipeline and storage components.

Oppenheim Research conducted the scientific research that provides the specific and measurable data required by the API through a survey of the industry. The specific objectives of this research were to identify:

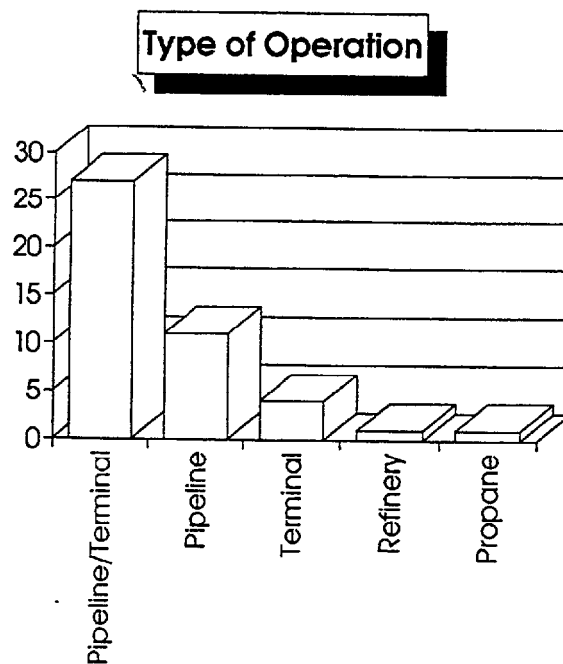
- elastomers or polymers used for different components used in pipelines now and prior to the transport or storage of oxygenated fuels
- the cause of failure of components
- the problems associated with oxygenated fuels on elastomer and polymer components
- changes that have been made in the use of elastomer and polymer components
- usefulness of published methodology for evaluating the impact of operating service variables on the service life of elastomer and/or polymer pipeline components
- problems encountered in the pipeline transportation and storage of reformulated diesel fuels.

ANALYSIS

Of the 44 companies who returned a questionnaire, 27 indicated that their company operates pipeline and terminal facilities, 11 operate pipelines only, four operate terminals only and one each operates refinery and propane only.

QUESTION 1:

Does your company operate pipeline/terminal facilities?



It should be noted that when asked what type of products their pipeline or terminal handles, respondents could mention all types of products. The following table shows the types of products that were mentioned.

TYPES OF PRODUCT HANDLED

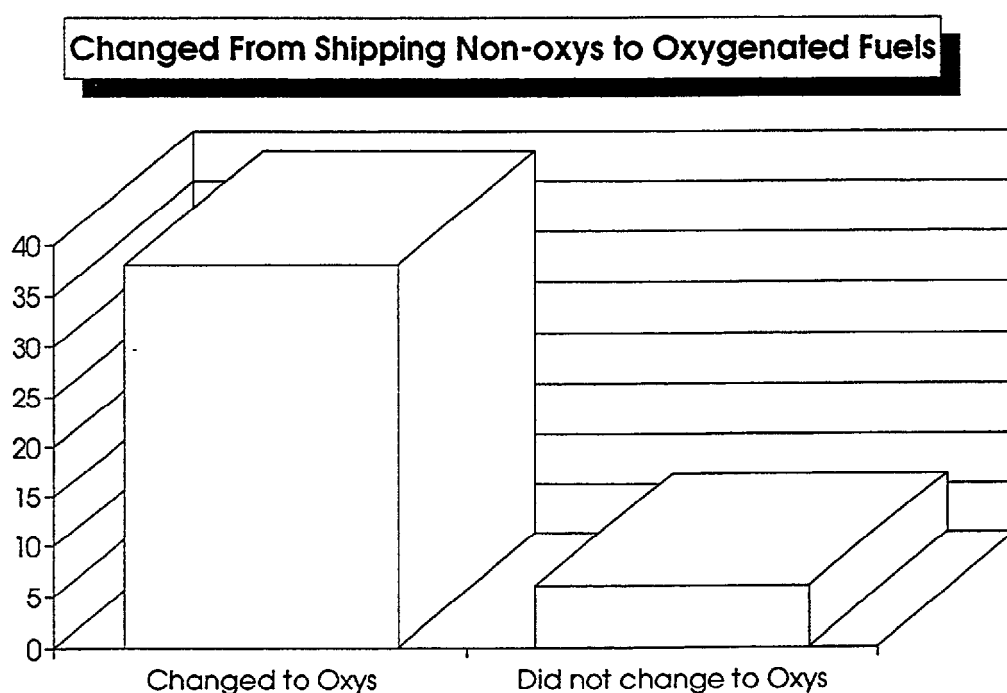
TYPE OF PRODUCT	NUMBER OF RESPONSES
Refined Liquid Petroleum Product	41
Neat Petroleum Aromatics	10
Neat Oxygenates (ether & alcohol)	27
Blended Petroleum Product Containing Oxygenates	33
Reformulated Diesels	19
Other:Propane	1
Other:Natural Gas	2
Other:Crude	2
Other:Refinery	5
Other:Various Chemicals	1

Next, respondents were asked if they changed from shipping non-oxygenated to oxygenated fuels. Almost all companies (38) have changed from shipping non-oxygenated to oxygenated fuels. Six companies said they had not changed from shipping non-oxygenated fuels to oxygenated fuels.

If they had not changed to shipping oxygenates, they were asked what elastomers or polymers they were using now and then skipped to a follow-up question pertaining to any problems they are experiencing now (question 14).

QUESTION 2B:

Have you changed from shipping non-oxygenated to oxygenated fuels?



Only one company that had not changed to oxygenated fuels mentioned general wear and tear as a current problem.

The following table indicates the types of elastomers and polymers they were using before they began transporting or storing oxygenated fuels and the types of elastomers and polymers they are using now. Thirty-eight companies were included in the "before changing" category, while all 44 companies were included in the "what elastomers/polymers are you using now" category.

Some re-coding was done on the types of elastomers and polymers used which were mentioned under "Other". The following list shows which elastomers were included in the main categories listed in all tables.

URETHANE:	Vithane, Thiothane, MESA 6000 Series, MESA Superchem 1000
NITRILE/MODIFIED NITRILE:	GVM, HH-505, Dan-Seal, Buna, Buna-N
OTHER:	Garlock 3000, Polyethylene, Graphite, Neoprene, GVS, other proprietary materials and combinations of more than one type of elastomer

ELASTOMERS AND POLYMERS USED BEFORE CHANGING FROM NON-OXYGENATED FUELS AND NOW

COMPONENTS	URETHANE	VITON [®]	NITRILE/ MODIFIED NITRILES	KALREZ [®] CHEMRAZ [®]	TEFLON [®]	OTHER
STATIC SEALING eg. static sealing o-rings (valve bonnet, closures), elastomeric gaskets, tubes & hoses, thread o- ring fittings	Before	33 Before	13 Before	3 Before	14 Before	2 Before
	Now	30 Now	14 Now	13 Now	22 Now	5 Now
DYNAMIC eg. valve stem seals, prover scraper cups, pipeline scraper, spheres, solenoid valve piston o-rings	Before	31 Before	10 Before	1 Before	12 Before	2 Before
	Now	30 Now	9 Now	12 Now	24 Now	5 Now
TANK SEALS	Before	2 Before	13 Before	0 Before	4 Before	2 Before
	Now	3 Now	11 Now	0 Now	11 Now	3 Now
HIGH SHEAR SEALS eg. block & bleed plug valve slips, other valve seals	Before	31 Before	5 Before	1 Before	11 Before	1 Before
	Now	26 Now	9 Now	5 Now	26 Now	2 Now

- 1 - Fluoroelastomers
- 2 - Perfluoroelastomer (PTFE)
- 3 - Fluorocarbon resin

Other elastomers or polymers named before changing were:**Other elastomers or polymers used now:****Other elastomers mentioned for static sealing:**

Garlock 3000 (1)
Neoprene, Buna (1)

Teflon encapsulated viton (1)

Buna vinyl (1)
Polyethylene (1)
Ionomer crosslink polymer (1)
Neoprene, Buna (1)

Other elastomers mentioned for dynamic sealing:

Graphite with carbon yarn (1)
Neoprene, Buna (1)

Scraper cups (1)
Graphite packing (1)
Graphoil (graphite based compound) (1)
Neoprene, Buna (1)
Metal on metal (1)

Other elastomers mentioned for tank seals:

Rubber coated canvas like bag (2)

Ionomer & PVC-nitrile blend (1)
Fabric type seal (1)
Neoprene (1)

Other elastomers mentioned for high shear seals:

Metal on metal (1)

H & H valve-proprietary compound (1)
GVS (1)

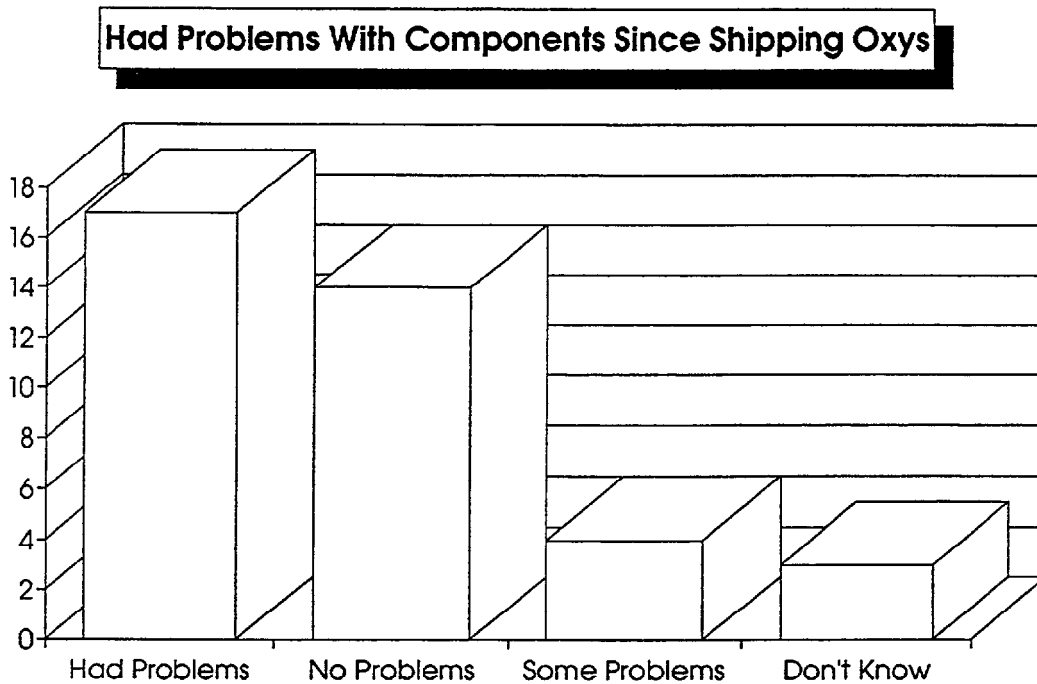
When asked if they have had any problems since they started transporting or storing batched or blended oxygenates, 17 of the 37 companies that have changed from non-oxygenated to oxygenated fuels said they have had problems. Fourteen companies said they have not had any problems since they changed from transporting or storing non-oxygenates to oxygenates; four companies indicated that they have had some problems with some pipelines/terminals but not with others; and three companies did not know if they have had problems since they changed.

If respondents said that they had problems with some pipelines/terminals, we asked follow-up questions pertaining to those who have had problems (question 7) as well as those who had no problems with elastomer or polymer components (question 5 and 6).

Those who had problems were asked what problems they had (question 7).

QUESTION 4:

**Have you had any problems since you started
transporting/storing batched/blended oxygenates?**



No Problems

Of the 21 companies indicating no problems, did not know of any problems, or had problems with some but not all pipelines or terminals, 11 companies said they have done verification on the elastomers and polymers used in oxygenated fuel services.

Nine companies have **not** done any verification on the elastomers and polymers they use for oxygenated fuel services and one company did not know if they had done any verification.

QUESTION 5:

**Have you verified that your elastomers/polymers
function properly in oxygenated fuels services?**

Performed Verification On Elastomer Components

