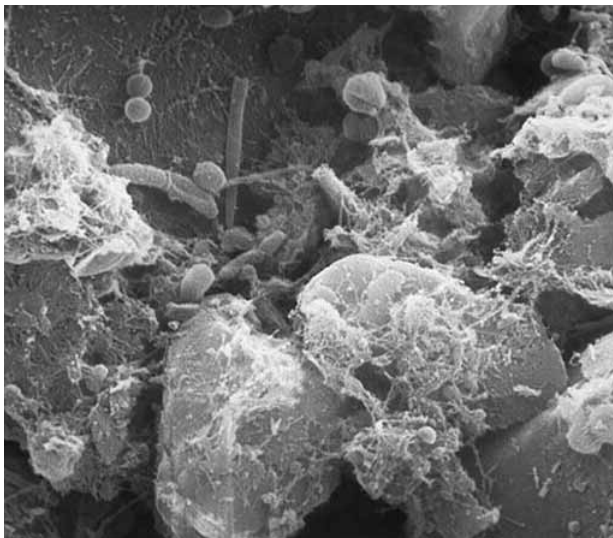


BEWARE OF BUGS!

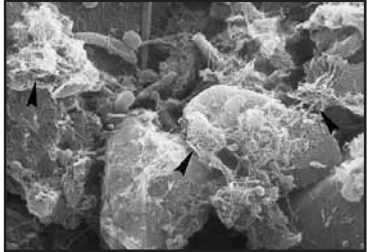
**A Short Question and Answer Guide
Dealing With
Microbial Contamination**



**Marathon
Petroleum Company LLC**

**The First Step To
Prevention Is Awareness!**

MPC wants you to know that your business is important to us. So, for your convenience, we devised this short question and answer guide to assist you in providing proper care for your quality fuels. Your fuel is vulnerable to water contamination during transportation and storage. The moment water gets into your fuel system, it becomes a friendly habitat for microorganisms (bugs) to thrive and multiply. This bug invasion is known as microbial growth and is becoming a costly problem in the fuel industry.



Microbial growth under magnification

The term microbial growth, as used in this context, refers to bacterium responsible for the biodeterioration of fuel. These overlooked bugs consume fuel, and are responsible for a host of other problems that may occur. This document will provide some insight on means by which these bugs enter the system. It discusses detection methods, preventive measures, and a list of the consequences that may result from uncontrolled microbial contamination.

Why Are These Bugs Appearing?

- The recent increase in waste disposal costs, which results in longer retention of water in storage tanks
- The removal of lead from gasoline, a bug poison
- The reduction of aromatics from both gasoline & diesel, a bug inhibitor
- The introduction of moisture and other contaminants due to the revised Clean Air Act requiring vapor recovery
- The addition of oxygenates, a bug food source at current use levels

Terminology

Bacterium - Single-celled or non-cellular spherical or spiral or rod-shaped organisms lacking chlorophyll that reproduces by fission.

Biocide - A poisonous substance that can kill living organisms

Bactericide - Kills bacteria.

Cidal agents - Agents that kill bacteria.

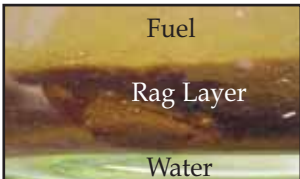
Microbe - A minute life form; a microorganism, especially a bacterium that causes disease.

What Causes Microbial Contamination?

It is caused by living microscopic cells that are in the water and that feed off the hydrocarbons in the fuel, much like mold that grows on a loaf of bread. The microbes can be air or waterborne and they contaminate fuel by entering the UST's through vents, through standing water in the spill containment boots or through the fuel delivery and transportation system. Water from the spill containment boots can enter the UST when the fill caps don't seal properly and when the drain plungers are used to drain the water into the UST. As the microbes grow, they form mats that are dark in color and appear gel-like. Their waste produces sludge, acids and other harmful by-products. Microbes will consume rubber and metal in an effort to obtain their mineral content creating an emulsion or rag layer. They can also prevent water and particulate from settling out of the fuel. Once established, they will double in population every twenty minutes. Eventually they will form a black, brown or green slime which will clog filters, corrode metal, and cause gaskets and hoses to swell and blister.

Warning Signs of Microbial Growth

- Filter replacement with less than 100,000 gallons of throughput is an early warning signal
- Corroded dispenser filters



- Slow flow rate at the dispenser nozzle caused by clogged dispenser filters
- Samples from the bottom of the UST show a rag layer (a combination of

microbes, their waste products and emulsified water in fuel) between the water and fuel layers.

- Odors (described as rotten-egg smelling)
- Swelled or blistered hoses, seals and connectors
- Slime coating on metal parts

Potential Exposure Costs

- Replacement of Dispensing System components
- Contamination control
- Slow dispensing rates
- Poor fuel performance (inefficient combustion, dark exhaust smoke)
- Poor public relations
- Lost opportunities (lower productivity during downtime)
- Customer complaints

Microbial Preventative Maintenance

Prevention is the key to controlling microbial infestation. Following the housekeeping suggestions listed below, removing water and using biocides on a regular basis, is a good start to avoiding microbial derived problems and exposure costs. Microbes obtain nutrients from the fuel, and use water as an oxygen source.



*Sample Thief
(Bacon Bomb)*

- Check the fill end of the tank for water at least monthly and after every heavy rain and remove if it exceeds one inch.
- Check the submersible pump end of the UST for water at least annually and remove water if any is detected.
- Use a Sample Thief (Bacon Bomb) to retrieve bottom samples and test for microbes using the Liqui-Cult Test Kit. (to order, see back page)
- Check fill caps monthly to ensure they properly seal the fill tube.
- Inspect spill containment boots and sumps weekly to ensure they are clean and dry.
- Do not use the spill containment drain to eliminate water from the spill containment boot. Instead remove with a hand pump or towels.



Sample of Liqui-Cult Test Kit

Good Sampling Practices are Essential to the Testing Phase

Incorrect sampling practices may have an adverse effect on examination results. The first step to correct sampling is only collecting samples in new or unused containers. Second, samples should be taken from the bottom of the tank. Bottom samples provide the best material for a thorough evaluation. Good preservation techniques are also important when handling a sample. After a sample is retrieved, it should be immediately stored in ice. Testing of the sample should follow within 1 hour and no later than 36 hours from the time that it was retrieved.

Testing Sources:

There are numerous microbial and pH testing devices available. The following is recommended based on ease of use and reliability.

Sample Thief (Bacon Bomb):

Obtains samples from storage tanks, tank cars and drums. When the thief strikes the bottom of the tank, a plunger assembly opens to admit the sample. We recommend the 4 oz 'Pencil' model K27760 (approximately \$200) for sampling through small diameter pipes and openings such as the UST fill tube.

Koehler Instrument Company, Inc.

1595 Sycamore Avenue

Bohemia, New York 11716, USA

1-800-878-9070 (USA only)

Tel: +1 631 589 3800

Fax: +1 631 589 3815

For General Information and Questions:

send e-mail to info@koehlerinstrument.com

Visit web page at www.koehlerinstrument.com

Microbial Kits:

Liqui-Cult Fuel Test Kit

Catalog Number LC-100

\$80.00 for a box of 10 tests

MCE Chemicals & Equipment Co., Inc.

34 Main St. P. O. Box 990

Lake Placid, NY 12946

518-523-2355

518-523-2821

website: www.metalchem.com

Tank Cleaning Companies:

Clean Fuels of Indiana Inc.

4620 East 900 South

Keystone, Indiana 46759

1-877-346-2900 or 260-345-2500

clean@cleanfuelsindiana.com

www.cleanfuelsindiana.com

Refuel Incorporated

4280 Groves Road

Columbus, OH 43232

(614) 863-9724

www.refuel.com

US Tank Alliance

6665 Huntley Rd.

Columbus, OH 43229

859-992-3324

sproffitt@ustankalliance.com

www.ustankalliance.com

Tank Cleaning Companies (continued):

FeeCorp

Aaron Messerly
7995 Allen Rd NW
Pickerington, OH 43147
614-837-3010

Kleentek Environmental (KTES)

Dan Lutz
11142 Greenbrier Drive
Bolivar, OH 44612
330-874-7103

Fluid Control System (FCSI)

Gary Hanks
888-344-3451

Biocide Sources:

Fuel Quality Services (FQS)

James Hansen
P.O. Box 1380
4584 Cantrell Road
Flowery Branch, GA 30542
518-887-3024
hchesneau@fqsinc.com
www.fqsinc.com

Baker Petrolite

Brian Hills
12645 W. Airport Blvd
Sugarland, TX 77478
856-582-0008
brian.hills@bakerpetrolite.com

BCA Microbial Contamination Control Service

Frederick Passman
P.O. Box 3659
Princeton, NJ 08543-3659
609-716-0200
bca-fjp@ix.netcom.com

For additional information concerning microbial contamination, refer to the American Standards and Testing Materials (ASTM) website at www.cssinfo.com/info/astm/html.

References:

ASTM D6469, ASTM D4057 Standard Guide for Microbial Contamination in Fuels and Fuel Systems

Fuels and Microbial Contamination, Lewis, R. P.

Microbes and Fuel Retailing "The Hidden Costs of Quality," Passman, Fredrick J.