



Warmth minus worry. Warmth minus wear.



# What You Need To Know

- How the supply chain impacts you and your customers.
- Strategies that can help reduce unscheduled service visits.
- Strategies designed to help compete in the 21<sup>st</sup> century energy marketplace.



# Sulfur Reductions Progress

## SULFUR & BIOHEAT REQUIREMENTS FOR No. 2 HEATING OIL IN THE NORTHEAST & MID-ATLANTIC STATES

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**Updated: 9-13-2017**

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### CHART 1. SUMMARY

LOW SULFUR & BIODIESEL BLENDING REQUIREMENTS IN THE NORTHEAST/MID-ATLANTIC							
All data is listed for No. 2 Fuel Oil only. Compliance dates are July 1st of that year unless otherwise specified. Cities are listed in <i>italics</i> .							
	Previous Sulfur	2012	2014	2015	2016	2017	2018+
New York State (Sulfur)	2,500-5,000ppm	15ppm					
New York State (Bioheat)							5% Bio
<i>New York City (Bioheat)</i>		2% Bio				5% Bio*	
<i>Philadelphia, PA (Sulfur)</i>	2,000ppm			15ppm			
Delaware	3,000-10,000ppm				15ppm		
New Jersey	2,000-3,000ppm		500ppm		15ppm		
Maryland	3,000ppm		2,000ppm		500ppm		
Pennsylvania	2,000-5,000ppm				500ppm		
Massachusetts	3,000ppm		500ppm				15ppm
Rhode Island (Sulfur)	5,000ppm		500ppm				15ppm
Rhode Island (Bioheat)			2% Bio	3% Bio	4% Bio	5% Bio	
Vermont	20,000ppm		500ppm				15ppm
Connecticut	3,000ppm		500ppm				15ppm
Maine	3,000-5,000ppm						15ppm
New Hampshire	4,000ppm						15ppm
<i>Washington, DC (Sulfur)</i>	10,000ppm				500ppm		15ppm
*New York City will require 5% blends on October 1, 2017 and after a study and report, 10% in 2025, 15% in 2030 and 20% in 2034.							

**Note:** The term Bioheat® is a registered trademark of the National Biodiesel Board (NBB). Its use in this document refers generally to biodiesel-blended heating oil.

**DISCLAIMER:** This document provides general information regarding the status of state and local sulfur and bio-blending standards for heating oil and other distillate fuels. It is subject to revision and is not intended to provide guidance on legal or regulatory compliance obligations. Please consult with a qualified legal professional or contact the state association or regulatory agency for more information.



# Lessons Learned, ULSD

- The industry anticipated sulfur reduction to negatively impact lubricity, BTU's, material compatibility, and microbial growth. **An increase in corrosive activity and peroxide formation was not in its thought process.** Today much has been documented about excessive corrosive activity in a majority of equipment in ULSD underground storage tanks ( UST ).
- In **2010**, a task force of industry leaders came together and formed the **Clean Diesel Fuel Alliance**, (CDFA) funding an independent study to determine the cause of accelerated corrosion in USTs containing ULSD. **Conclusions from the study point to Microbial generated Acetic Acid, possibly exacerbated by the introduction of ethanol into ULSD tanks due to switch loading.**

*Battelle Study*



# ASTM Standards

**ASTM D6751** is the approved standard for B100

**D975** – Covers petroleum based diesel and blends up to five percent biodiesel maximum for on/off road engines; B5 is now fungible with diesel fuel

**D396** – Covers heating oil and blends up to five percent biodiesel; B5 is now fungible with petro-based heating oil, recently a (stand-alone 6-20% specification now falls under D396 however not supported by a few OEM's without further testing.

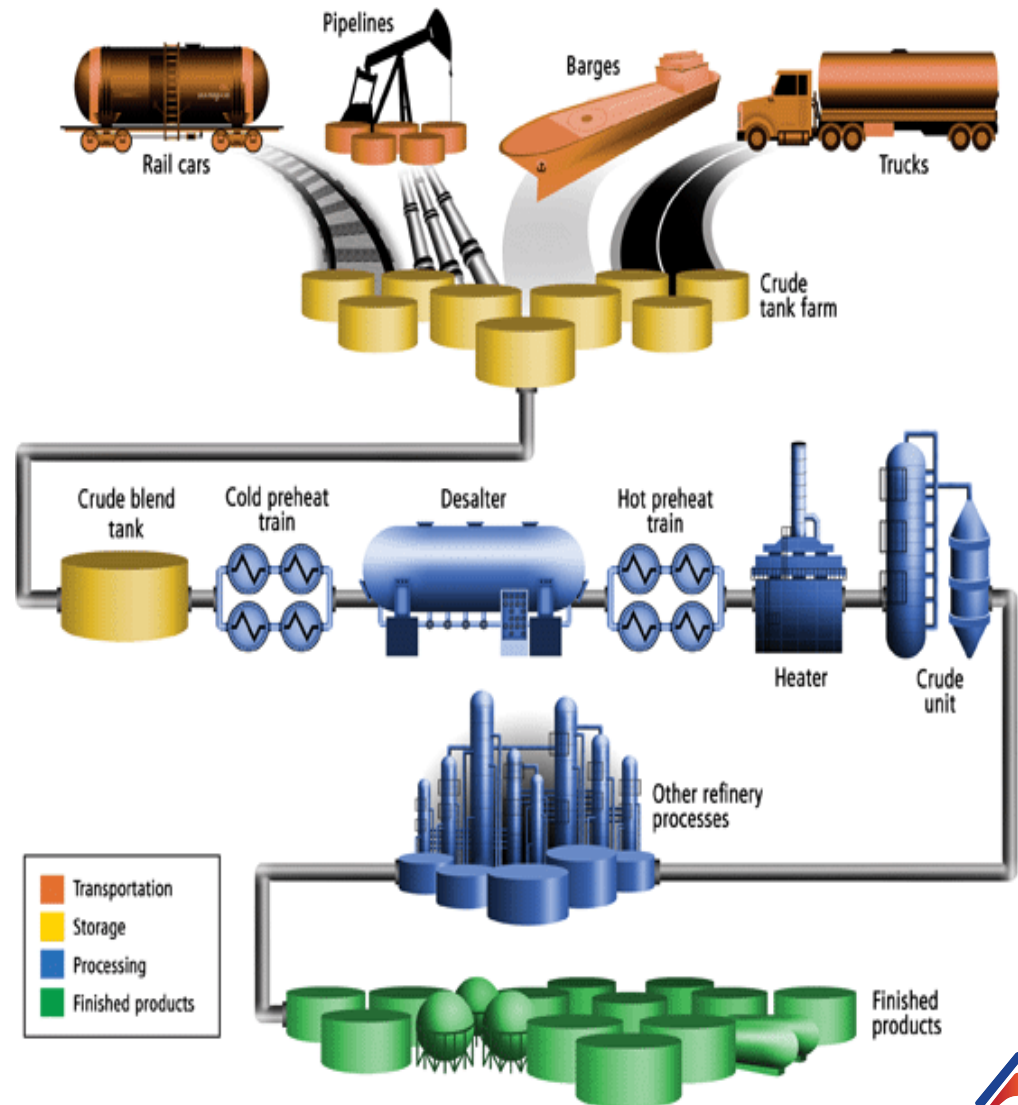
**D7467** – Covers blends containing six to twenty percent biodiesel (B6-B20) for on/off road engines

Stay Clear of Viscous Renewable Diesel, Raw Vegetable Oil



# Upstream Challenges

- Refining processes impact your fuel
- Transportation impacts field quality
- Fungible Storage requires attention
- Multiple points of contamination



# ULSHO

## Advantages --- Challenges

- Cleaner burning
- Thought to generate less sludge by traditional test methods
- Less occurrence of soot “puff back”
- Reduced preventative maintenance, specifically brush and vacuum
- Enables higher efficiency heating equipment
- Compliments biodiesel blends
- Different storage stability concerns
- Reduced natural peroxide stabilizers
- Reacts with yellow metals which degrade fuel, brass/copper
- Greater affinity for moisture entrainment and microbial contamination growth
- Corrosive to fuel systems
- More paraffinic impacting pour points
- Reduced lubricity



# Downstream Challenges

- Fuel degradation
- Legacy seals and elastomers can become compromised
- Unmanaged fuel storage
- Minimum specifications
- Discretionary blending
- Additive misuse





# Customers Attitudes about Heating Oil

Before ULSHO Bioheat®

- Smelly & dirty
- Higher maintenance cost than natural gas
- Environmentally challenged
- Inefficient & undependable
- Concerns over spills, tank leaks



Source: 1999 NORA Consumer Survey



# Your Heating Oil

- The Incumbent
- Understood
- Buy/Sell
- Low Barrier of Entry
- Carbon Intensive
- Favorable Pricing
- Policymakers Scorn



# Advantages

## 100% biodiesel & ULS Bioheat®

### Biodiesel

- Renewable
- Biodegradable
- High cetane
- High lubricity
- High flash point
- No nitrogen or aromatics
- Virtually sulfur free
- Contains 11% oxygen by weight

### ULSHO Bioheat®

- Enhances fireside performance
- Helps reduce brush & vacuum intervals
- Ready for distribution now
- Compliments ULSHO
- Enables a positive consumer impression



# Environmental Conclusion

- Biodiesel blends at 20% (B-20) with ultra-low sulfur heating oil (ULSHO) are lower in Greenhouse Gas Emissions (GHG) than natural gas when evaluated over 100 years, **while blends of 2% (B-2) or more are lower in GHG than natural gas when evaluated over twenty years.**
- Any ULSHO and biodiesel blend is equally clean in criteria pollutants and particulates. With future research and applications, increasing the biodiesel blend reduces GHG emissions even further. Bio blends for heating oil are a clean responsible alternative to natural gas heating systems and perform admirably against all other heating systems.

## Developing a Renewable Biofuel Option for the Home Heating Sector

A Report to Congress,  
State Governments  
and Administrator of the  
Environmental Protection  
Agency

MAY, 2015



**NORA** Research  
NATIONAL OILHEAT RESEARCH ALLIANCE

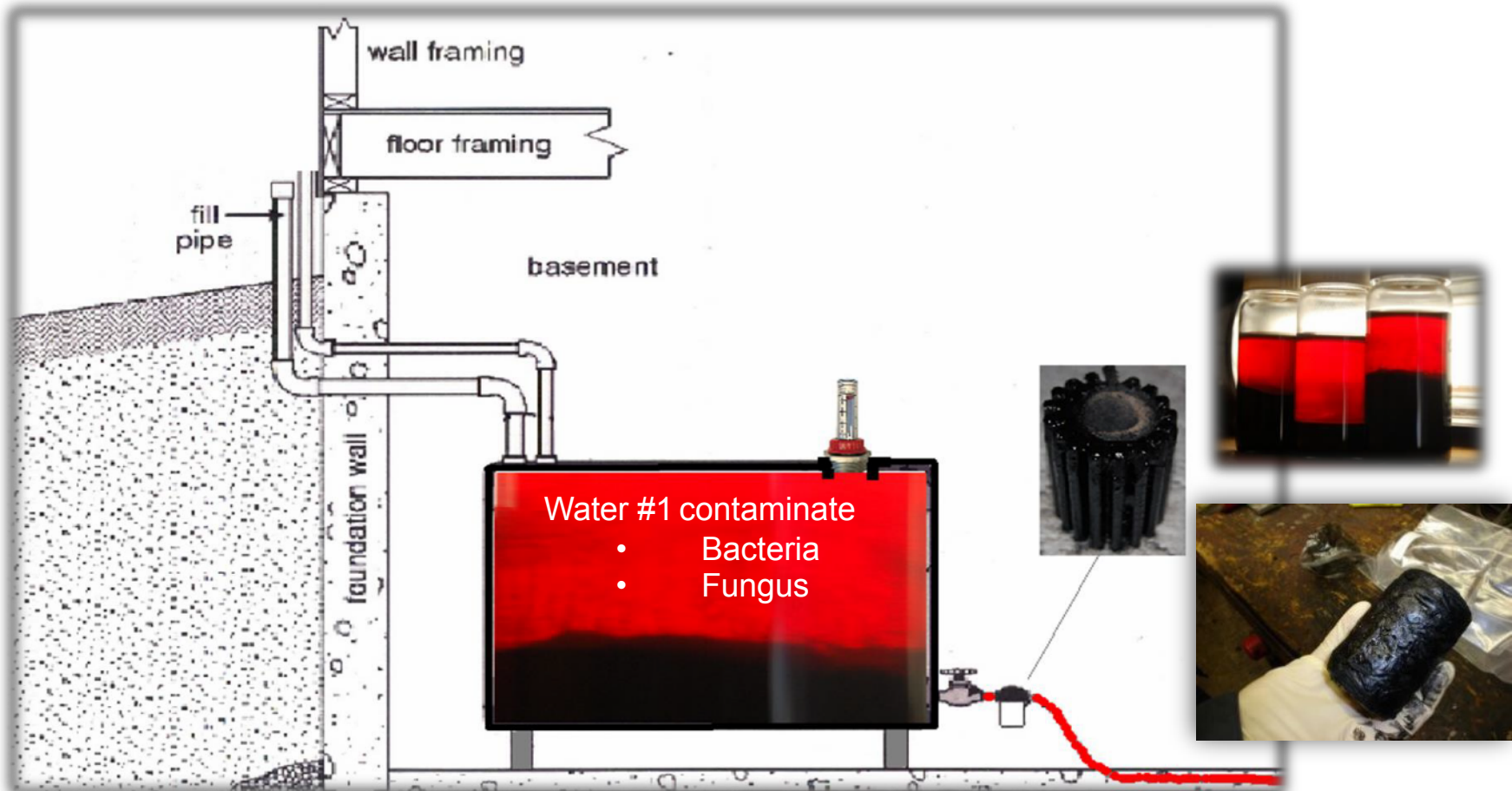


# Deconstructing A Gallon

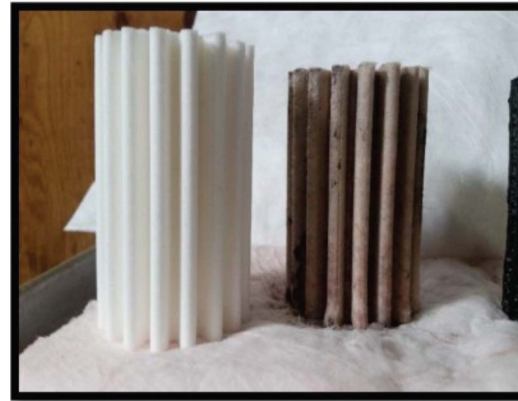
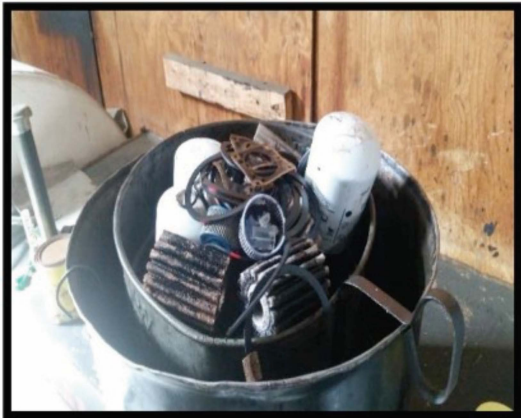
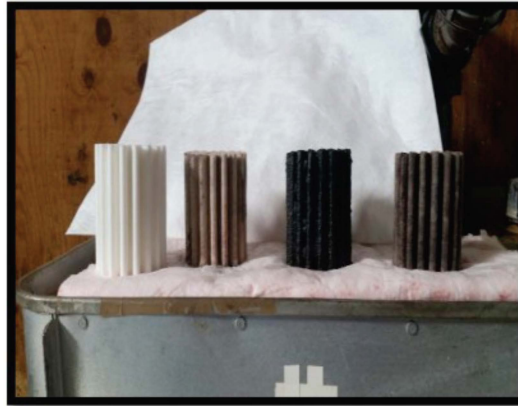




# The Impact Zone



Today there is a little less sludge but a greater tendency to form peroxides and acids. 75% of all contaminants are organic\* Varnish & Sludge also referred to as fuel degradation products (FDP).



# Managing H2O & Bugs

- #1 contaminant, H2O
- Bugs are activated by time & temperature
- Bugs discharge acetic acid which causes corrosion



Water  
Contamination



Algae/Fungi

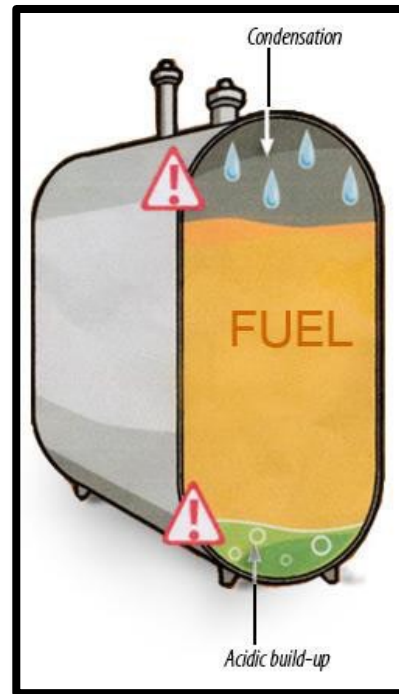


Corrosion



# Fuel System Corrosion

- Heating oil is corrosive to steel tanks
- Causes pitting of copper fuel lines
- Condensation in tanks promote microbial contamination
- Tank failures are environmental concerns

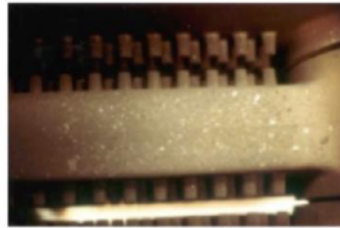


# Installation of Oil Tanks

- ASTM recommends tank tested for water
  - $\frac{1}{4}$ " or greater of water on tank bottom – recommend pumping
- Improperly installed tanks can lead to moisture and premature failure
  - $\frac{1}{4}$ ' pitch per linear foot toward drain plug or valve
- NORA released Recommended Practice for securing tanks NFPA 31



# Strategies Designed To Optimize Heating Oil Performance



No. 2 heating fuel, 0.04% Sulfur by weight



No. 2 heating fuel, 0.10% Sulfur by weight



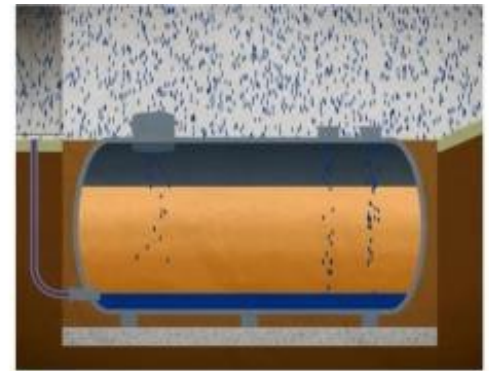
No. 2 heating fuel, 0.24% Sulfur by weight



No. 2 heating fuel, 1.00% Sulfur by weight

# Dispersant

- ✓ Gradually disperses and mobilizes tank sediment allowing for safe and reliable passage through fuel lines, filters and strainers into combustion.



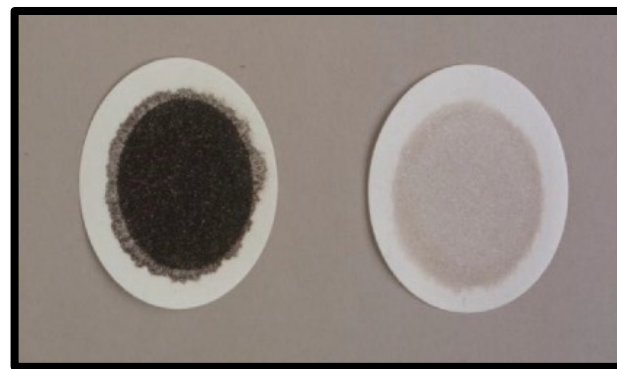
# Multi Stabilizer Package

- ✓ The changing chemical composition of ULSHO, biodiesel and Bioheat® also mean a change in how aggressive various degradation pathways work.
- ✓ **Oxidative Degradation** is the main mode of instability but with different by products. Oxidative degradation also represents the time factor.
- ✓ **Peroxide Formation** and **Peroxide Decomposition** are areas of greater concern.
- ✓ The response to the problem required new chemistries that would neutralize peroxide formation and subsequent degradation products better than traditional HO additives, Global recognized and reacted to these required changes in 2012, today others are following its path.



# Multi Stabilizer Package

- ✓ Keeps ULSHO, biodiesel and Bioheat® fuel fresh over an extended period of time.
- ✓ The historical fuel stability strategy was controlling sedimentation that plugs filters, strainers and nozzles. This remains an essential prevent defense during summer fill.
- ✓ Traditional testing used ASTM D6468 as a stability prediction tool. However the unstable degradation products of ULSHO, biodiesel and Bioheat® are not detected using this test method.



*Results of ASTM D6468 Accelerated Stability Test, Reflectance @ 180 mins.*

# Multi Stabilizer Package

## Peroxide Protection

- ✓ Global transitioned to a new multi-component system that slowed peroxide formation. Peroxide formation is typically higher when the fuel is stored.
- ✓ Peroxide formation can attack seals, gaskets, metals and some filter material.

Material	Compatibility rating
Buna N (Nitrile)	D-Severe Effect
Copper	D-Severe Effect
Bronze	D-Severe Effect
Carbon Steel	C-Fair
Nylon	C-Fair

- ✓ Peroxide degradation results in formation of volatile acids, odors, gums, polymers, and sludge.





# Corrosion Protection

- ✓ Helps protect the entire fuel handling system from corrosive activity driven by moisture, microbial contamination and peroxides for both ULSHO and blends of biodiesel.



Untreated

Treated

*Result of NACE TM-01 Corrosion Test*

*National Association Corrosion Engineers*



# Metal Deactivator

- ✓ Helps reduce fuel degradation in both ULSHO and biodiesel blended fuels which are caused by the fuels interaction with yellow metals, (copper/brass).

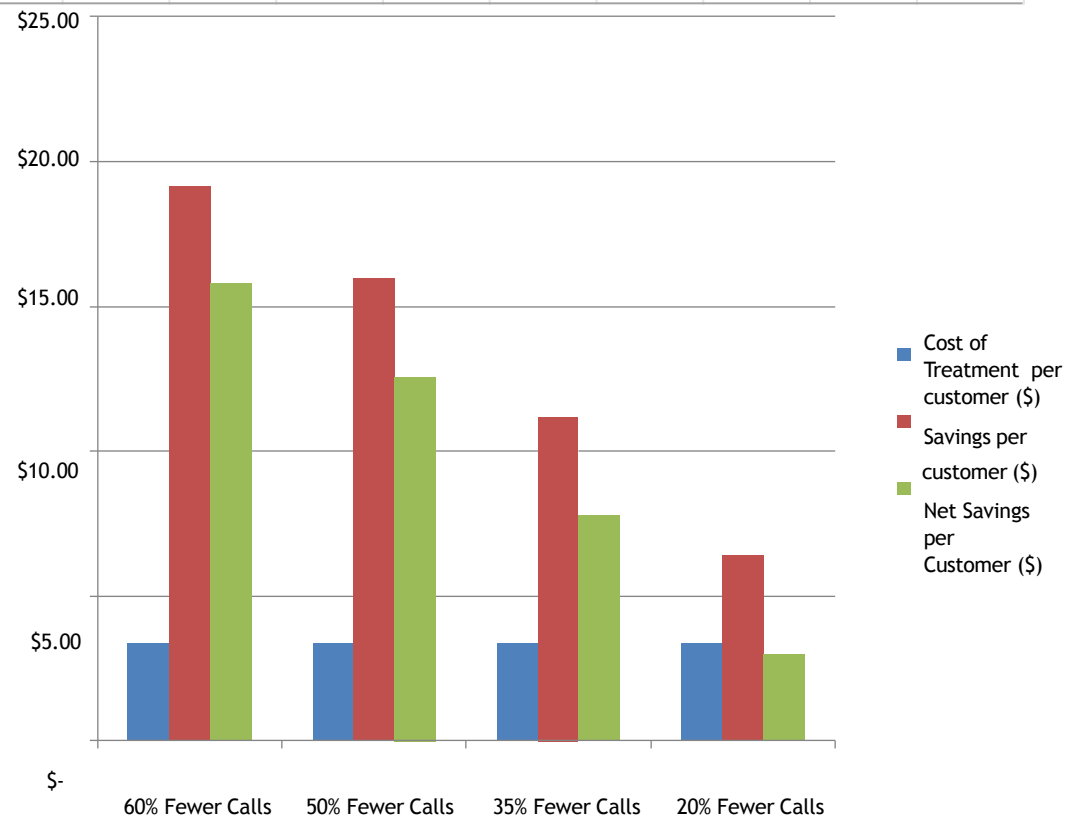


# ROI Calculator

Data Input



Items	Company Variables	
a	Avg. Annual Vol. / Cust (gallons)	750
b	Customers on Service Plan (%)	65.0 %
c	Average Time on Service calls (hrs)	1.75
d	Cost of labor / hr incl. overhead	\$ 85.00
e	Avg. fuel/combustion service Calls per customer	0.33
Data Points		
f	Fuel / Combustion call reduction (%)	80.0%
g	Fuel Treatment cost	\$ 0.0045
Treatment (cost / savings) Calculations		
Cost of Treatment per customer		\$ 3.38
Savings per customer (\$) (see below)		\$ 25.53
Net Savings / Customer		\$ 22.15
Savings Calculation = E x F x B x C x D		
Plus:		Average Savings of an oil burner nozzle, fuel line filter & strainer is @ \$5.50 per occurrence - not in above analysis



# Heating Oil Plus Helps

Enhanced Results Will Be Achieved if Complimented By A Housekeeping Program

- Cleans and protects entire fuel system
- Reduces filter, strainer and nozzle service calls
- Helps protect service department revenue driving a healthier business and stronger bottom line.
- Strengthens dealer and consumer confidence in home heating oil and keeps both aligned with the demands of today's changing fuel slate.

