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Minnesota Soybean Growers Association



Minnesota's B5 Mandate



Presented by Hoon Ge
MEG Corp

Demand For Crude

1 barrel (bbl) = 42 gallons (U.S.)

- Globally about 85,000,000 bbl/day
 - Over 17,000,000 bbl of crude oil processed every day in the US (714,000,000 gal/day)
 - 800,000,000 gal/day total product demand
 - 360,000,000 gal/day gasoline
 - 140,000,000 gal/day distillate
 - 68,000,000 gal/day jet fuel
- 150 U.S. refineries with capacities ranging from 15 mbbl/day (600,000 gallons/day) to over 500 mbbl/day (21,000,000 gallons/day) and operate at 90+% capacity

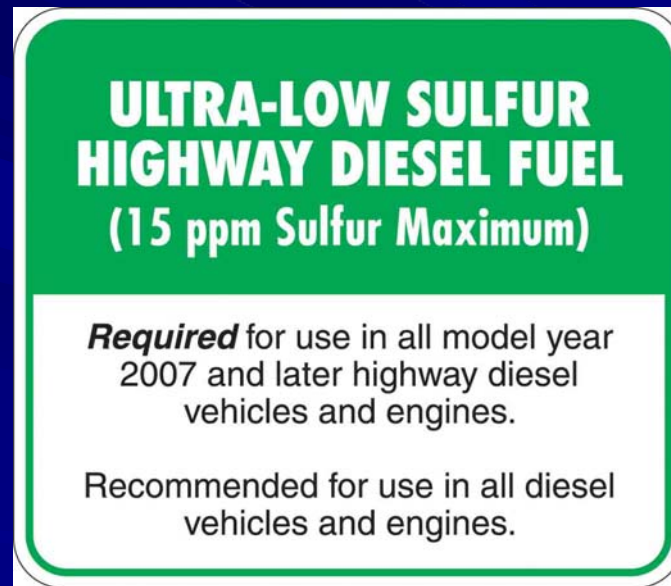
Biodiesel - 2005

On September 29, 2005 Minnesota was the first state to mandate a specific biodiesel blend (B2) 98% petroleum diesel, 2% biodiesel



Ultra Low Sulfur Diesel - 2006

June 1, 2006 the EPA mandated that at least 80% of diesel being produced be ULSD



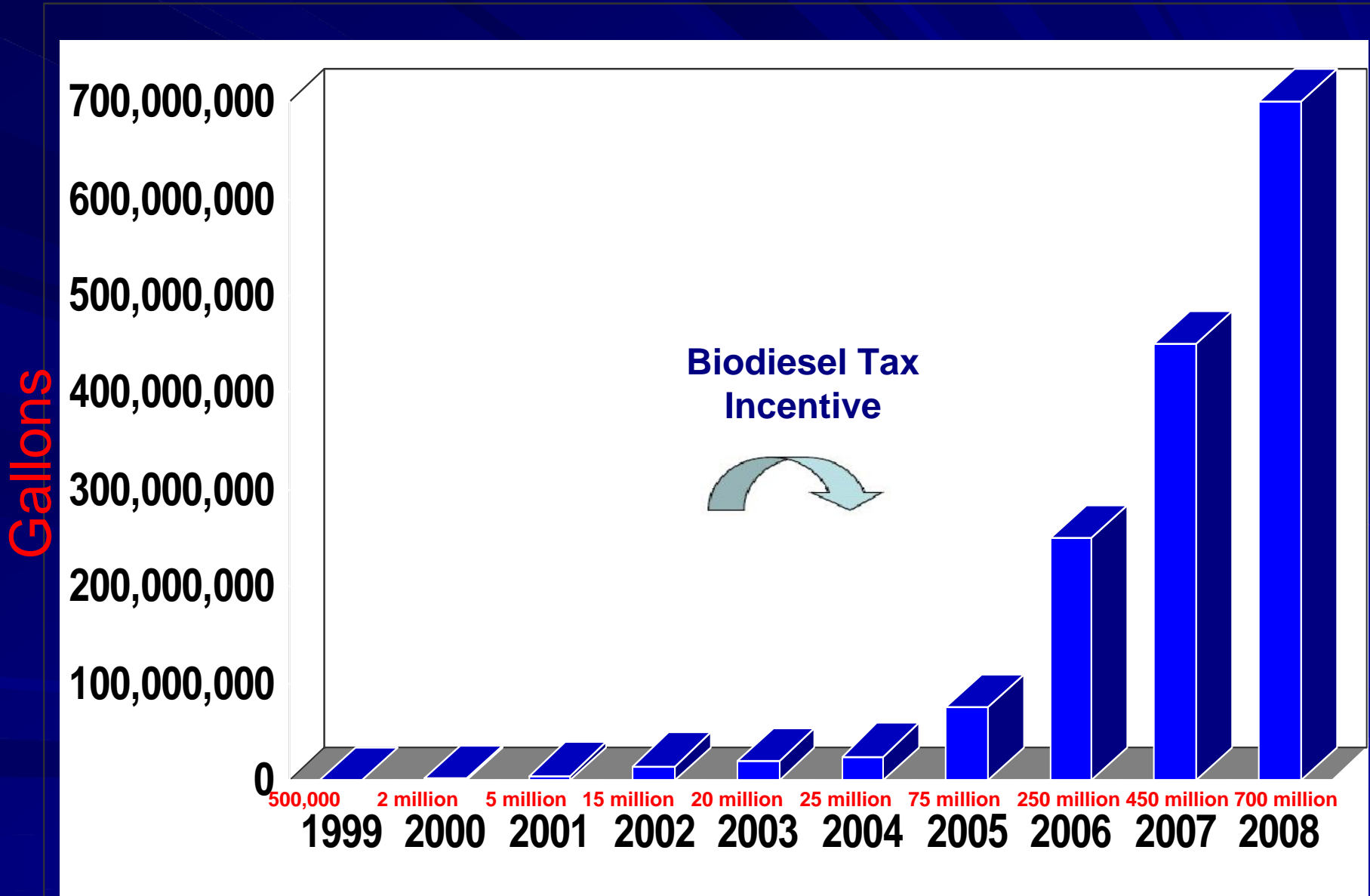
This is due to the 2007 and beyond engines being outfitted with a Diesel Particulate Filter

Problems with ULSD

- Low Lubricity
- Low Stability
- Higher incidence of microbial contamination
- Higher incidence of paraffin wax dropping out in cold weather

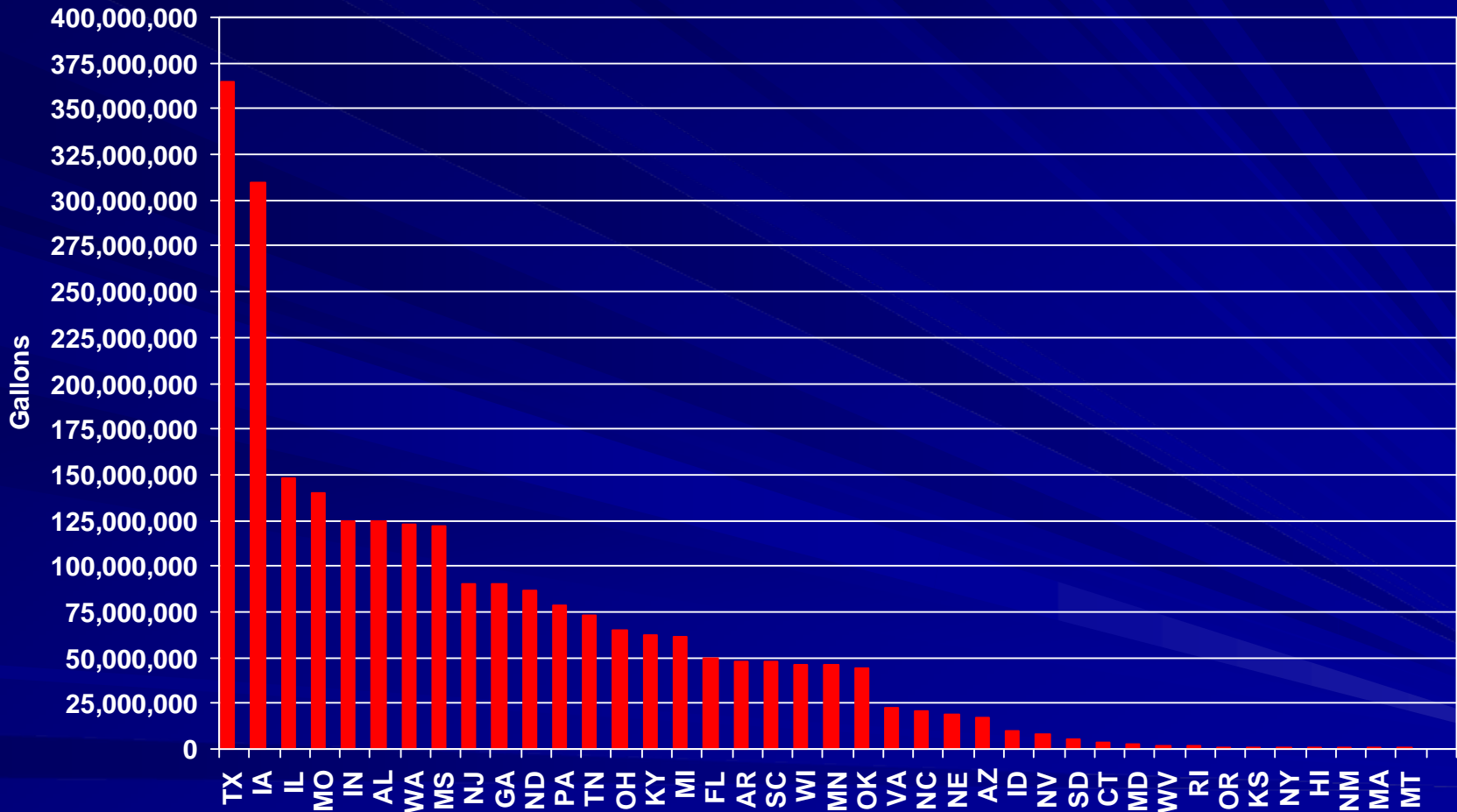
Biodiesel Demand and Production

Biodiesel Demand



Production Capacity by State

(8/11/08)



Recent Developments

Biodiesel ASTM D6751

Property	ASTM Method	Limits	Units
• Calcium & Magnesium, combined	EN 14538	5 maximum	ppm (ug/g)
• Flash Point (closed cup)	D 93	93 minimum	Degrees C
• Alcohol Control (One of the following must be met)			
• Methanol Content	EN14110	0.2 maximum	% volume
• Flash Point	D93	130 minimum	Degrees C
• Water & Sediment	D 2709	0.05 maximum	% vol.
• Kinematic Viscosity, 40 C	D 445	1.9 - 6.0	mm ² /sec.
• Sulfated Ash	D 874	0.02 maximum	% mass
• Sulfur			
• S 15 Grade	D 5453	0.0015 max. (15)	% mass (ppm)
• S 500 Grade	D 5453	0.05 max. (500)	% mass (ppm)
• Copper Strip Corrosion	D 130	No. 3 maximum	
• Cetane	D 613	47 minimum	
• Cloud Point	D 2500	Report	Degrees C
• Carbon Residue 100% sample	D 4530*	0.05 maximum	% mass
• Acid Number	D 664	0.50 maximum	mg KOH/g
• Free Glycerin	D 6584	0.020 maximum	% mass
• Total Glycerin	D 6584	0.240 maximum	% mass
• Phosphorus Content	D 4951	0.001 maximum	% mass
• Distillation, T90 AET	D 1160	360 maximum	Degrees C
• Sodium/Potassium, combined	EN 14538	5 maximum	ppm
• Oxidation Stability	EN 14112	3 minimum	hours
• Cold Soak Filtration	Annex to 6751	360 maximum	seconds
• For use in temps below -12°C	Annex to 6751	200 maximum	seconds

New ASTM Standards passed June 2008

- Inclusion of B5 into the D975 specification for #2 diesel fuel
- Inclusion of B5 into the D396 specification for heating oil
- Passage of a blended fuel spec for B6 to B20
- Addition to D6751 of a cold soak filtration test to eliminate cold filter plugging potential

Published October 2008

B6-B20 ASTM D7467 Specification

Property	ASTM Method	Limits	Units
• Acid Number	D 664	0.30 maximum	mg KOH/g
• Viscosity, 104°F	D 445	1.9 - 4.1	mm ² /sec.
• Flash Point	D 93	125 minimum	Degrees F
• Cloud Point	D 2500	Report	Degrees F
• Sulfur			
• S 15 Grade	D 5453	0.0015 maximum (15)	% mass (ppm)
• S 500 Grade	D 5453	0.05 maximum (500)	% mass (ppm)
• Physical Distillation, T90	D 86	650 maximum	Degrees F
• Ramsbottom Carbon Residue	D 524	0.35 maximum	% mass
• 10% residue			
• Cetane Number	D 613	40 minimum	
• One of the following must be met ¹			
• Cetane Index	D 976-80	40 minimum	
• Aromacity	D 1319-03	35 maximum	% volume
• Ash	D 482	0.01 maximum	% mass
• Water & Sediment	D 2709	0.05 maximum	% vol.
• Copper Strip Corrosion	D 130	No. 1 maximum	
• Phosphorus Content	D 4951	0.001 maximum	% mass
• Oxidation Stability	EN 14112	6 minimum	hours
• Biodiesel Content	D 7371	6-20%	% volume
• Lubricity, HFRR @ 60°C	D 6079	520 maximum	micron

Energy Independence & Security Act of 2007

Renewable requirement for diesel must met by biodiesel.

- *500 million gallons used in 2009*
- 1 billion gallons used in 2012



Minnesota

Governor signed bill on May 12, 2008

- *May 1, 2009 Mandate increased to B5*
- May 1, 2012 Mandate increases to B10
- May 1, 2015 Mandate increases to B20
- 5% of Feedstock must come from biological resources rather than agricultural (algae, waste oils, tallow)

*B10 and B20 mandates are effective from April to October to address cold weather issues. B5 during the rest of the year.

B5 Usage in Minnesota

- Prevents 139 tons of particulate matter
- Eliminate 330,000 tons of lifecycle greenhouse gases

**That is Equal to Taking
55,000 Cars of the Road**

Biodiesel and ULSD Benefits and Compatibility

Biodiesel Attributes

- High Cetane (avg. over 50)
- Ultra Low Sulfur (avg. ~ 2 ppm)
- High Lubricity, even in blends as low as 1-2%
- High Energy Balance (3.5 to 1)
- Low Agriculture Inputs: Soybeans
- 78% Life Cycle CO₂ Reduction
- Renewable, Sustainable
- Domestically Produced
- Reduces HC, PM, CO in existing diesel engines

Benefits: Biodiesel and ULSD

- Compatible with the compression ignition platform and with diesel fuel itself
- Greatly enhances lubricity of ULSD
- Compatible with 2007 diesel engine catalysts
- Aids with ULSD conductivity issues
- Reduces harmful emissions
- Power and performance virtually unchanged
- Seamless & transparent with existing petroleum infrastructure, (liquid not gaseous)
- Promotes national energy security
- Renewable, non-toxic, green blend stock option

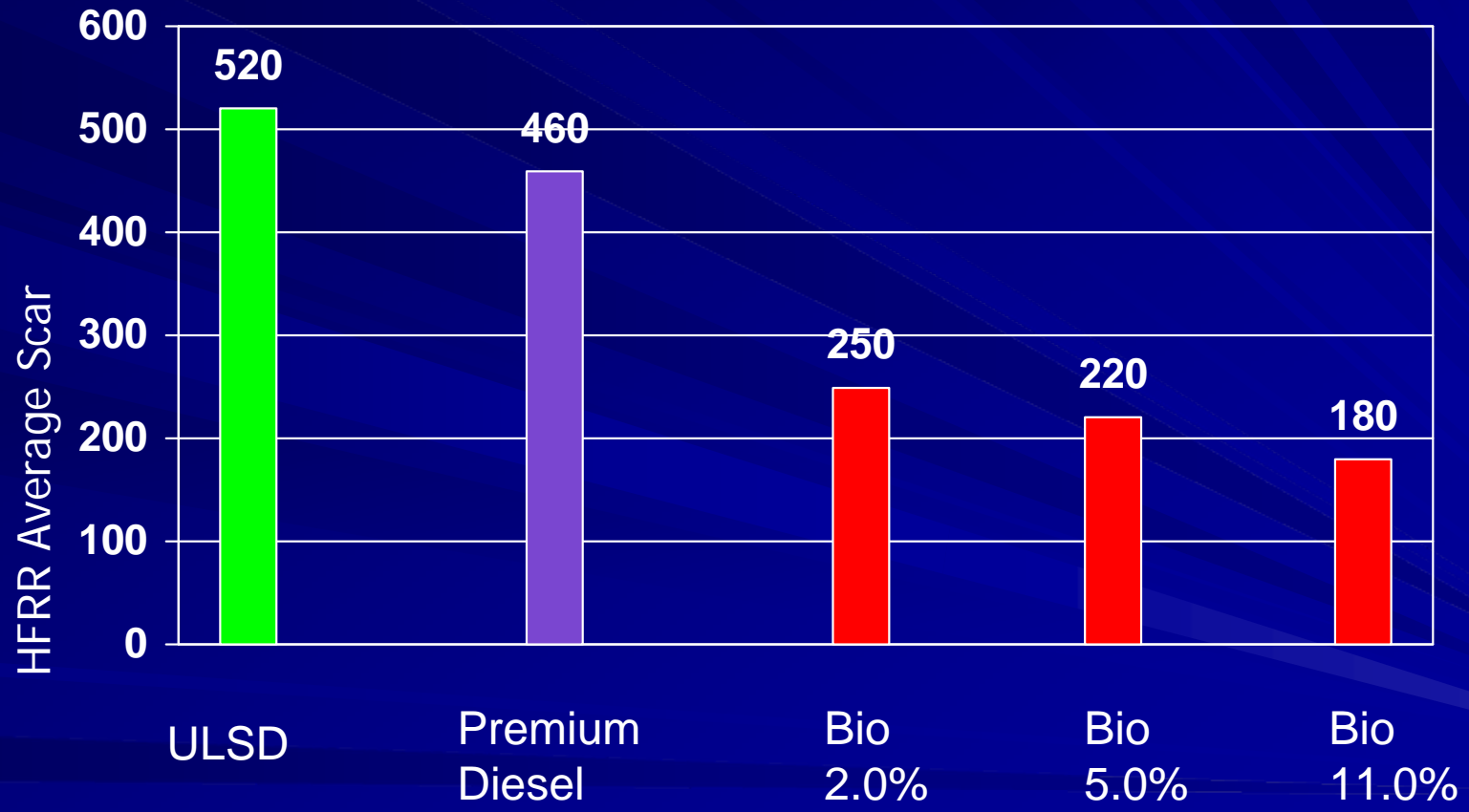
Properties of ULSD & Biodiesel Blends

	ULSD	B2	B5	B20
API Gravity	33.4	33.4	33.2	32.3
Distillation				
IBP	326°F	326°F	327°F	336°F
10%	402°F	403°F	404°F	418°F
50%	509°F	510°F	510°F	550°F
90%	605°F	604°F	608°F	638°F
EBP	611°F	610°F	614°F	645°F
Cetane Index	42.7	42.7	42.8	44.4
Cloud Point	0°F	1°F	1°F	3°F
CFPP	-26°F	-26°F	-24°F	-20°F (3-4x Additive)

ULSD & Lubricity

- Sulfur compounds are natural lubricants in diesel.
- ULSD regulations are causing major concerns with diesel engine performance.
- ASTM lubricity requirement effective Jan 1, 2005 for diesel fuels.
- ASTM D 6079
- High Frequency Reciprocating Rig (HFRR)
Wear Scar Maximum = 520 micrometers

Biodiesel Adds Significant Lubricity to ULSD



Cold Flow Properties and Additives

CFPP Testing of ULSD Bio Blends

Sample Description	Cloud Point °F Base Fuel	CFPP °F w/ Additive
ULSD	-2	-22
B2 ULSD	-2	-22
B5 ULSD	-1	-18
B11 ULSD (3x)	+1	-20
B20 ULSD(4x)	+3	-17

Filter Plugging Sources

Breakdown of Filter Plugging Sources

Filter Plugging Issues Addressed by the Minnesota Diesel Hotline

	Sept 2007 to Feb 2008	Sept 2008 to Feb 2009
Microbial Only	36%	18%
Water	21%	34%
High Water & Microbial	21%	8%
Oxidation	7%	8%
Paraffin falling out of ULSD	4%	20%
Too much Additive	4%	2%
No problem found	3%	8%
Biodiesel Contaminants	0%	2%

Tips for Using Biodiesel Blends

Tips for Using Biodiesel Blends

- Buy biodiesel that meets ASTM D 6751. Buying from a BQ-9000 Accredited Producer/Marketer will help ensure quality.
- If using a biodiesel blend, buy it pre-blended from the supplier.
- Fuel tanks should be kept as full as possible to reduce the amount of air and water entering the tank.

Tips for Using Biodiesel Blends

- When switching from diesel fuel to biodiesel blend it may be necessary to change the fuel filter an extra time or two.
- Monitor hoses, fill/vapor caps, gaskets for leaks.
- If any biodiesel is spilled, it is important to clean it up quickly. Pure biodiesel may remove paint from equipment.

Tips for Using Biodiesel Blends

- Storage in on-site tanks should be limited to less than 6 months. The storage container should be clean, dry, and dark.
- Copper, brass, lead, tin and zinc tanks should not be used to store biodiesel.
- Equipment with biodiesel blends in the fuel system should not be stored for more than 6 months.

Tips for Using Biodiesel Blends

- In the fall before colder weather sets in, check tanks for water concentration and microbial contamination. Check again in the spring.
- In the winter months, as part of a winter strategy, it's important to use appropriate additives to ensure good winter-weather operability.

Tips for Using Biodiesel Blends

- It is highly recommended that you install a filter on the outgoing product from your bulk storage tank. This will help prevent any downstream contamination from the bulk tank.
- If you have a water separator, check for indication of water daily. If there is water, drain it.

MN Diesel Hotline



Established to:

- **Provide triage for fuel problems**
 - problems not adequately addressed by distributors/producers
- **Diagnose/analyze/assist with problems from:**
 - customers
 - fleets
 - fuel distributors
- **Provide assistance through chemical analysis**
 - Through the use of third party Lab
- **Help provide assistance to users to ensure the image/integrity of biodiesel is maintained**

Contact Information

The MN Diesel Hotline is:

- For general guidance issues
- Fuel related problems

800-929-3437

763-746-3452

Email: info@megcorpnmn.com

Questions

