Heating Oil Case Study

Ric Hosley (Hale Hill Biofuels) - Bxx Distributor

Loren Nauss (Biodiesel One) – B100 Producer

Christopher Perkins (CESE) – Certified Biofuels Testing Lab

Rich Sulinski (AgriFuels) - Biodiesel Quality Control Solutions
Resolution Process

Suspect Non Conformance: product, equipment, process

- Problem Identification – source, type
- Disposition:
  - Accept As-Is - no non-conformance
  - Action Required – confirmed non-conformance

ANALYSIS

- List Potential Cause & Effect
- Determine How-to-Measure
- Rank Relevant
- One or more C & P Actions - high ranked

C & P ACTIONs: Corrective & Preventive

- Problem Identification – status, who’s-affected
- Corrective Action Plan – assign team, root-cause
- Implement - approved plan
- Audit Results - Root Cause Eliminated
  - YES – close / root cause eliminated
  - NO – open / not eliminated, more analysis

Customer
Internal
Supplier
Problem Identification

Title: Heating Oil Causes Burner Fuel Pump to Seize

Description:
Selected new customers receiving biodiesel blended oils experienced failures associated with burner pump

Source: Customer (choices: customer, internal, supplier)
Type: Equipment (choices: product, process, equipment)

Material Review Board: others:
• Ric Hosley (Hale Hill)
• Loren Nauss (Biodiesel One)
• Christopher Perkins (CESE)
• Service Technician
• OEM – pump supplier
• Rich Sulinski (AgriFuels)

Disposition

Problem Definition:
a) 28 New Customer sites received B20 Heating Oil from same supply
b) 10 sites experienced fuel pump failures, some multiple w/ replacement pumps
c) 10 sites represents < 1% of all existing customers, none with same failure
d) Same 28 accounts have common previous fuel supplier, non-biodiesel petroleum oil

Investigation Results:
a) Adhesive build-up on internal housing & pump plates causes seizing
b) Root cause of problem requires more analysis

Disposition:
Confirmed Non-conformance / Corrective Actions Required
Non-Conformance Initial Review

From: Paul  
To: halehillfarm@yahoo.com  
Subject: RE: Furnace pumps burning up in Connecticut

What you need to do is change the line-up. If you follow xxxx's remarks he is suggesting that you begin treating your fuel with an anti-oxidant. Of course we can put that product into your hands but it will add additional cost and frankly no one really knows the outcome. I asked you the other day if the pumps in question are new or rebuilt. Certainly if they are new, "back" to the factory they go under warranty. If they are rebuilt which I am inclined they are then you are suffering from the same brownout visual which I sent you pictures of earlier. Rick, bottom line you need to determine what is the uncommon denominator in this ongoing issue. What other customers are experiencing the problem. Are they all the same type of pumps, are they all about the same as it pertains to hours of operations. Is your biodiesel prior to blending meeting the Rancimat test value as defined in 6751? Sadly, if the pump manufacturer wishes not to dig in, I take an exception to that.

-----Original Message-----
From: halehillfarm@yahoo.com  
To: Paul  
Subject: Furnace pumps burning up in Connecticut

Two more pumps burned up over the weekend. Spoke again with xxxx ...no earth shattering conclusions. Spoke with xxxx, he supports and speaks highly of you! He believes the that we have a polymer's of the fuel as a result of a chemical or biological change! He recommends oxidation stability additives as well as/or antimicrobial additives. I am not sure what to think without a lot of testing.
Pump Tear-Down
Cause & Effort Review

Non Conformance

Burner Fuel Pump Failure

Petroleum Blendstock

Spec Fuel?
B1-B5 @ D396

Does COA match fuel

Lab Re-inspect
Tier-II Std
Tier-II Plus
Tier-I Full

Seller Certification
Buyer Screening

Process

B99/B100 Blendstock

Spec Fuel?
B100 @ D6751

Does COA match fuel

Lab Re-inspect
Tier-II Std
Tier-II Plus
Tier-I Full

Additive Type
Additive Brand
Additive Interaction

Additives

Biodiesel Blend Bxx

Spec Fuel?
B1-B5 @ D396
B6-B20 @ D7467

Inspect @Sources
As-Delivered
Customer Tank Fuel in Pump

Lab Re-inspect
Tier-II Std
Tier-II Plus
Tier-I Full

Pump Type
Pump Temp
Filters /Screens
Tank Environment

Equipment

If It Can’t Be Measured
It Can’t Be Corrected

Does COA match fuel
Inspect @Sources
As-Delivered
Customer Tank Fuel in Pump

Lab Re-inspect
Tier-II Std
Tier-II Plus
Tier-I Full

Spec Fuel?
B1-B5 @ D396
B100 @ D6751

Spec Fuel?
B1-B5 @ D396
B6-B20 @ D7467

Spec Fuel?
B1-B5 @ D396
B100 @ D6751

Spec Fuel?
B1-B5 @ D396
B6-B20 @ D7467

rev 3-31-10
# Resulting Corrective & Preventive Actions

<table>
<thead>
<tr>
<th>Title</th>
<th>Reason</th>
<th>Type</th>
<th>Status</th>
<th>Root Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-spec Biodiesel Blend vs Pump Failure</td>
<td>preventive</td>
<td>product</td>
<td>implement</td>
<td>NO</td>
</tr>
<tr>
<td>Non-spec B100 Blendstock vs Pump Failure</td>
<td>preventive</td>
<td>product</td>
<td>implement</td>
<td>NO</td>
</tr>
<tr>
<td>Non-spec Petroleum Blendstock vs Pump Failure</td>
<td>preventive</td>
<td>product</td>
<td>identified</td>
<td>NO</td>
</tr>
<tr>
<td>Replace Pump Brand (patch / not-preventive)</td>
<td>corrective</td>
<td>equipment</td>
<td>audit</td>
<td>YES</td>
</tr>
<tr>
<td>Fuel Additive Interaction vs Pump Failure</td>
<td>preventive</td>
<td>product</td>
<td>identified</td>
<td></td>
</tr>
<tr>
<td>COA Do Not Match Received Product</td>
<td>preventive</td>
<td>process</td>
<td>identified</td>
<td></td>
</tr>
<tr>
<td>Receiving Process Acceptance Screening</td>
<td>preventive</td>
<td>process</td>
<td>identified</td>
<td></td>
</tr>
<tr>
<td>Filters &amp; Screens causes Pump Failure</td>
<td>corrective</td>
<td>equipment</td>
<td>reject</td>
<td>NO</td>
</tr>
<tr>
<td>Inspect Tanks for Biodiesel Solvent Candidates</td>
<td>corrective</td>
<td>equipment</td>
<td>reject</td>
<td>NO</td>
</tr>
<tr>
<td>Pump Temperature vs Adhesive Failure</td>
<td>corrective</td>
<td>equipment</td>
<td>reject</td>
<td>NO</td>
</tr>
</tbody>
</table>

### Status
- **Identify** – new problem identified
- **Plan** – develop corrective action plan
- **Implement** – implement as planned
- **Audit** – post-implement “root-cause” review
- **Reject** – do not implement for reasons stated
- **Closed** - completed C&P action

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C & P Action Guidelines

Correction of a Problem
IS NOT the Crucifixion of a Person

Adjust the Process
Fix the Equipment
Prevent Human Error Opportunity
**Conclusions**

- **Move Quickly to Identify & Rank Potential Causes**
  - consider product, equipment, process, environment ...
  - “human-error” is not a cause

- **Solutions ... may be multiple & incremental**
  - Quick Response ............. stabilize
  - Correct Problem ............. reactive / retain knowledge for reuse
  - Prevent Reoccurrence ... proactive / problem prevention
  - Root Cause Eliminated .. may be external to your organization

- **Sometimes Root Cause Analysis requires additional resources**
  - Reach across the supply chain (suppliers, fuel associations, OEMs ...)
  - Leverage associations to share knowledge & solutions
  - Web-managed C&P Actions to support Solution-Teams

- **If It Can’t Be Measured, It Can’t Be Corrected**

- **Use Qualified Lab Results to**
  - Validate product spec & compliance
  - Fine Tune your process
  - Address more sensitive supply issues