



In the beginning...

The issue of black soot on the hulls of yachts and floating diesel particulate in our oceans and harbors was troubling for the two inventors of **clean-exhaust**... a marine Engineer and a Captain who is a 21 year veteran of the sea.

An efficiently operating 100kW tier 2 certified diesel generator may legally discharge 720 grams of particulate per day or more than one and one half pounds of pollution.

SOOT SOLUTIONS Dockwalk October 2011 The life expectancy for some of the compounds present in diesel particulate range from hours to days. With diesel exhaust pollution accounting for over one quarter of the total hazardous pollution in the air, serious consideration needed to be given for a particulate cure.

Exhaust particulate emanating from the generators of marine vessels can be observed in our harbors, on our docks and hulls and in the exhaust discharge of the vessels in our trust.

The, not so obvious, ramifications of marine diesel pollution is the negative influence on the lungs and respiratory systems of humans. Diesel exhaust has been found to contain many toxic air contaminants which may contribute to lung and bladder cancer. To date, no significant studies have been done on the affects of diesel particulate on marine life.

The yachting industry is built on being the most expensive and exclusive business in the world. The hull of the vessel is always clean when the Owner is on board and the generators are purring at their best...no visible particulate, no problem. But, as the yacht ages, the obvious expense of man power and soap and water to remove the exhaust residue on the vessel, pales in comparison to the wear and tear on the hull from the use of chemicals and the cost of a new paint job.

In the effort to protect their Crew, the environment, the sea, marine life and a yacht's hull from the innate discharges of the yachting industry that they love, the Engineer and the Captain came up with an idea...a cleansing eco friendly "Brew" that could be injected

via a dosing pump before the spray-ring mixing with the dirty hot gases discharging from the generator.

The "idea" for a [clean-exhaust](#) system was put on three 3306 Caterpillar generators with a high number of running hours. The Engineer and the Captain purpose built [clean-exhaust](#) for a long service life and high efficiency with moderate complexity. The entire package was then integrated into a compact design that would require miniscule power to run (less than a light bulb) and it would clean exhaust.

During the first days of use, the inventors thought their system was ill conceived because there was an increase in diesel particulate. Then, they realized that [clean-exhaust](#) was cleaning the muffler system and like magic, the exhaust particulate began to disappear.

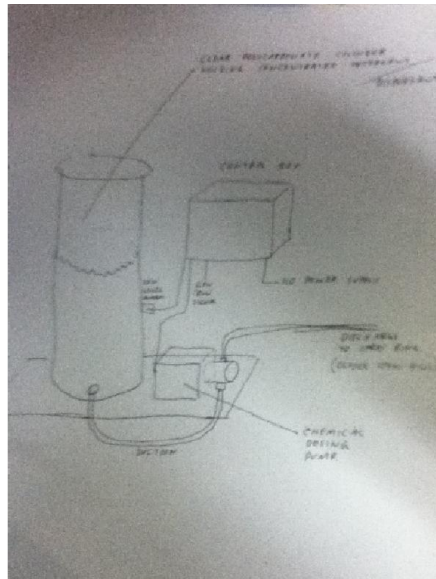
Since that "eureka" moment 2 years ago, they designed data sheets to reflect the efficiency of [clean-exhaust](#). The white sheets were set up to be submitted for 6 months on each test vessel. They have a patent pending (#61/638,669) US20130283768 , the delivery system from the dosing pump has been tweaked, they created an *ecoBrew* formula with an Environmental Seal of Approval, they have a fully developed website www.clean-exhaust.com complete with a well-informed sales force that loves the environment and our seas and [clean-exhaust](#) is cleaning exhaust.

The [clean-exhaust](#) inventors and their Crew believe that we see the future by standing on the shoulders of the past. The following report on 7 test vessels is the culmination of 2 years of trials and the resolution of problems by implementing innovative solutions. The future looks "particulate" promising...

clean-exhaust

Two Year Summary

May 2012-March 2014



Inventor's first drawing

#1...STARFIRE

54m (178') Benetti

(3) clean-exhaust systems installed May 2012

(2) 3306 Caterpillar generators

(1) 3304 Caterpillar generator

- Up and running May 28, 2012

- Port system immediately became inoperable when pipe fittings were taken to get Hamann sewage system operational

Data sheets follow

- July 2012 Stroke 60% pulse per minute 40 (average)
- August 2012 Stroke 60% pulse per minute 40 (average)
- September 2012 Stroke 60% pulse per minute 40 (average)
- October 2012 Stroke 60% pulse per minute 40 (average)
- December 2012 Stroke 50% pulse per minute 60 (average)
- March 2013 Stroke 100% pulse per minute 80 cleaned mufflers then reduced

September 2012

Salt was "crusting" on the injection nozzle. It is unknown how long [clean-exhaust](#) was operational before crusting presented.

PROBLEM

Salt crusting on the injection nozzle

SOLUTION

[clean-exhaust](#) crew consulted with the Inventor/Engineer. His thoughts included ...a stainless steel injection lance and a pump that can provide 88 psi would overcome a salt encrusted injection point. If this doesn't eliminate problem then the injection point might have to be relocated to a point in the sea water pipe that is always flooded even when it is shut down. Salt will only deposit as a crystal when there is no water present IE during the shutdown period.

Numerous solutions were explored regarding the integral parts that make up the [clean-exhaust](#) system. Manual rinsing and cleaning of salt residue recommended as general maintenance.

February 2013

Testimonial from STARFIRE's Bosen..."Prior to the [clean-exhaust](#) installation, we had black to grey scum on the hull with floating black particulate. It was necessary to wash the hull at the minimum of once a day on charter even with a clear coat finish.

The Gens use approximately 1 liter of oil per day. After the [clean-exhaust](#) installation, we have very little exhaust residue around the exhaust exits and there is no apparent black floating particulate. **We still have to clean STARFIRE's hull, however any scum and particulate is easily removed with a gentle wash. The [clean-exhaust](#) system has worked wonders around the exhaust exits.**

Stern to docking was always a concern in the Mediterranean before [clean-exhaust](#) was installed; the deck crew on STARFIRE even offered to wash the hull of other yachts berthed alongside us, the soot we coated them with was terrible. Aboard STARFIRE we no longer have marks where exhaust has been etched into the paint by rubbing fenders and cleaner exhaust has enabled us

to have more time to focus on other important maintenance details-a much happier crew, a better looking yacht!"

March 2013

Increasing stroke/PPM on feedback from deck crew up to 100% stroke 80PPM

Measured to be 600ml/hr per generator

14.4L (3.8 Gal/day) in 24 hours per generator

At sea: 2 generators 28.8L/day (6.4 Gal/day)

Reduced by half due to stocks

June 2013

Restocked with 20 gallons *ecoBrew*... Parts were all upgraded from original design. Float switches, brass check valves, and Teflon tubing were installed in the effort to prevent salt crusting.

#2...CARPE DIEM

52.20m (190'11" Trinity

2 *clean-exhaust* systems installed December 2012

(2) 280kW Northern Lights generators

(1) 99kW Emergency *clean-exhaust* was not installed on this generator

Data sheets received

- December 2012 Stroke 40% pulse per minute 60 (average)

Initial report... "*clean hull and less soot in water*"

Shortly after the system was installed, workman in the engine room disconnected the power leads from the oil sensor that turns on the *clean-exhaust* system. The system set fallow for an unknown period of time. When the disconnected lead was discovered, *clean-exhaust* was activated and it didn't work

Problem

- Plastic check valve malfunctioned due to salt crusting in the T-Reservoir

Solution

- Brass check valves and injectors installed

Result

- No residual salt water and no residual salt

March 2013

Vessel changed Engineers

April 1, 2013

- Change-over of Chief Engineer position is cited for the reason for no data reports for January 2013, February 2013, and March 2013. New Chief reports that there was no information regarding **clean-exhaust** in the handover ...starting from "scratch" April 2013

Problem

- System inoperable...both reservoir tanks ruptured...both Schedule 40 fittings leading to the raw water discharge fractured (Schedule 40 is the wall thickness of the white PVC pipe...crack possibly due to heat)

Solution

- **clean-exhaust** supplied new reservoir tanks plus refills and new hosing with improved fittings

Result

- **clean-exhaust** operational

Per the Chief Engineer "After top end overhaul on both gens...pollution levels and carbon by product are both completely unacceptable. Just the crap on top of the water makes me cringe let alone all the exhaust the Crew must breathe in". The Chief "would like to see anything that helps clean the exhaust on vessels to be mandatory in the future".

May 1, 2013

Trans Atlantic Crossing

- **clean-exhaust** system discharged entire container of *ecoBrew* in 7 hours with set point at minimum
- **clean-exhaust** off
- Chief Engineer willing to fine tune

June 2013

clean-exhaust system down due to multiple faults

- New fittings siphon *ecoBrew* quickly regardless of setting
- Dumped entire container of *ecoBrew* in one day
- No time to trouble shoot or make repairs while in France
- The same problem exists in both systems---Chief feels that problem was created by the new fittings that were used to replace the old plastic ones

July 2013

Problem

- Pumps and frequency of discharge OK but discharge is too fast

- Check valves in newly installed fittings seized up when the brass balls and springs were overtaken by salt water.

Solution

- Fittings were changed back to plastic

Result

- **clean –exhaust** running smooth at dock

clean-exhaust Design Solution was to drop all injectors from the system by tapping from the top of the water supply a fitting that is the size of ID tubing eliminating the need for any injectors. ID tubing will be too big to frequent salt crusting issues and a check valve can still be used. This **solution** will also eliminate the frequent cleanings that result in compromised fittings.

"At the moment we (CARPE DIEM) are in St. Barth and we have a boat next to us and I switched off the system for the night and the side of the boat was dirty in the morning. When I switched the system back on, they cleaned the boat and the next morning it was clean which means the **clean-exhaust** system is working." Chief Engineer CARPE DIEM

#3...HARMONY

50m (164'0") Westport

3 **clean-exhaust** systems installed January 2013

(2) 99kW Northern Lights generators

(1) 65kW Northern Lights generator

Data sheets received

- February 2013 (one half month) Stroke 50% pulse per minute 40 (average)
- March 2013 Stroke 60% pulse per minute 45 (average) increased to 100% for 1 day **SEA CALM HULL CLEAN**
- April 2013 Stroke 80% pulse per minute 35 (average) **SEA CALM HULL CLEAN**

March 2013

clean-exhaust had 552 hours of operation using 8.22 quarts of *ecoBrew* with 67.15 hours per quart

April 2013

Good success with minimizing oily residue reported in February 2013 but there was an increase of soot in the water. The Engineer attributed the soot increase to "our pipes being cleaned". March 2013 was still in the "tweaking" stage. In an attempt to clean the mufflers, *ecoBrew* was increased to 100% with the underwater discharge closed off to force the

ecoBrew out through the dry muffler and water spinner. This action was met with "Great Success". The two 99kW generators were soot free and the oily residue on the surface was minimal. Data sheet...condition of sea and hull: Calm and clean "all good on board" "system really working well on port and starboard generators—still working out kinks mid generator". *clean-exhaust* had 600 hours of operation using 27.71 quarts of *ecoBrew* with 22.46 hours per quart.

May 2013

No formal report. "*ecoBrew* sinking in cold (48F) water...oil floats...testing *Brew* in cold water
Fresh supply of *ecoBrew* ordered

Problem

ecoBrew sinking in cold (48F and below water)

Research (*ecoBrew* sinking in cold water)

Manufacturer of *ecoBrew* talked with Chemist. "The water leaving the engine is probably much warmer than the seawater at 48 degrees and is probably staying on top due to this but should disperse over time once the temperatures average." Also, "water mixed in a lot of oil would look milky". The Engineer emailed that when the *ecoBrew* dosage is turned up the system seems to work but the water is milky.

Solution

No solution realized. Tests will continue on *ecoBrew* formulation.

Analysis

The problem of *ecoBrew*'s ability to stay in solution is multi-faceted.

The salinity, temperatures, and dissolved gases such as oxygen, carbon dioxide, and nitrogen of ocean waters vary. It is affected by such factors as melting of ice, inflow of river water, evaporation, rain, snowfall, wind, wave motion, and ocean currents that cause horizontal and vertical mixing of the saltwater...is it logical to assume that *ecoBrew* will work in all waters and temperatures? Possibly, a lower salinity coupled with a low temperature in Alaska Glacier Park caused the water to turn "milky" or the opaque color was caused by the oil mixing with the water and *ecoBrew* was a non factor.

ecoBrew had not been tested in water temperatures below 50 degrees to the *clean-exhaust* Crew's knowledge. Manufacturer's Chemists consulted with no clear resolution. Consideration might be given to adding this issue to *ecoBrew* data sheets

The difference in the *ecoBrew* usage between March and April might be attributed to the efficiency deficits between the Port, Starboard and Center generators.

June 10, 2013

Location Alaska Glacier Park

April 2, 2014

Engineer reported that the plastic valve is leaking and that he has replaced the spring several times...[clean-exhaust](#) Engineers will board HARMONY in Florida and replace plastic valves with brass valves and install insulated hose from the engine boxes to the check valves.

Engineer reports that [clean-exhaust](#) works really well and HARMONY's Owners and Crew have noticed the difference with a cleaner hull and clean exhaust.

"We seem to have had great success with this and are happy to say that our two bigger generators seem to be mostly soot free now. We will do it again on the mid gen in the near future and let you know. We have also tweaked our levels and will let you know once we have reached a happy medium. Current Stroke 80 at 40 hertz." Captain of

HARMONY

4...MIA ELISE

50m (164'0") Trinity

(2) [clean-exhaust](#) systems installed April 2013

(2) 130kW Northern Lights

Data sheets received (in all of these data sheets, the line for the condition of the sea and hull were omitted for no apparent reason)

- April 2013 Stroke 20% pulse per minute 10
- May 2013 Stroke 20% pulse per minute 10
- June 2013 Stroke 30% pulse per minute 20
- July 2013 Stroke 40% pulse per minute 20
- August 2013 Stroke 55 pulse per minute 70 (average)

April 2013

Vessel was making the crossing and was unable to "fine tune" system

May 2013

"dosing pump wasn't able to go low enough to facilitate 1 liter *ecoBrew* per 30 hours of running generator which was the advice given by [clean-exhaust](#). Minimum setting was used for stroke length (20) and stroke per minute (10) Engineer wants to dilute *ecoBrew* in a 1 to 1 ratio. (unknown if this was tried) Engineer then realized that May consumption had a mistake in calculating usage. [clean-exhaust](#) was turned down too low...30 stroke length should be the MINIMUM setting

June 2013

Dose was increased. 30 hours running =1.23 Liters. This has created foam and bubbles on the water and **less soot on the tender and hull.**

August 2013

Some oil fumes coming from the valve cover...it's time to do a "top end overhaul of the generators." This will be done in January 2014. Engineer states that oil is rarely added to MIA ELISE's generators but that the oil is changed every 250 hours.

Vessel continues to have soot issues. (unknown if this was a result of the generator's need for overhaul)

September 2, 2013

ecoBrew separating or dropping out of solution in the storage containers.

Problem

ecoBrew "separating" in storage jugs with white flakes settling to the bottom of the container

Solution/Research

Report to *ecoBrew* manufacturer for consult

ecoBrew is distributed from the container through lines that are subject to engine room temperature or above when it is inside the sound shield of the generator. The engine room's ambient temperature on the **clean-exhaust** test vessels range between 85 degrees Fahrenheit and 100 degrees Fahrenheit. The separation phenomenon was reported when the container was exposed to innate engine room conditions for a minimum of 24 hours. Initially, the onset of the separation was barely visible in the container. However, after 29 days of use, the separation became more pronounced. Curiously, a separation has not been reported when the solution is stored on pallets in a warehouse.

At this juncture, changing the formulation of *ecoBrew* was considered

September 13, 2013

5 gallons of *ecoBrew* was altered by mixing the formula with 1 cup of high foaming emulsifier. The running time was 72 hours with no visible grey smoke/exhaust after 10 minutes of running and minimal barely visible particulate on the hull. The conclusion was that testing would continue to determine the best settings for the **clean-exhaust** pump and the concentration of *ecoBrew*. **Overall, the **clean-exhaust** system's performance with the altered *ecoBrew* on MIA ELISE's port Northern Lights generator was a success.** (report follows)

Friday, September 13, 2013

clean-exhaust test vessel- MIA ELISE

Test vessel size and builder- 50 m/164' Trinity

Location - San Remo, Italy

Harbor water condition- clean

Weather conditions- partly sunny, wind 8 knots out of the East, air temperature 78 degrees

Test- conducted by Captain Ted Sputh, a member of the **clean-exhaust** Crew

Equipment

clean -exhaust systems were installed on the port and starboard 130kW Northern Lights generators of MIA ELISE in April 2013.

The following test was performed on the port generator. The starboard generator was not functioning during the port generator test. The load on the port generator was approximately 40% for all testing.

5 gallons of **ecoBrew** was altered and mixed with 1 cup of high foaming emulsifier.

MIA ELISE was positioned with the port generator to the harbor starboard generator to the dock. Excessive grey smoke/exhaust was observed blowing into the harbor creating the adverse effect of particulate and residue on the hull. The **clean-exhaust** system was set at a 40% stroke, with 20 injections per minute of *ecoBrew* during the exhaust observance. The running time was approximately 72 hours.

MIA ELISE changed positions...port generator to the dock starboard generator to the harbor.

The **clean-exhaust** *ecoBrew* flow rate was increased to 40 injections per minute.

Conclusion -- **No visible grey smoke/exhaust was observed after 10 minutes of running.**

Test Photos

Friday, September 13, 2013, 14:00PM... After readjusting the port generator to 40% of stroke and 40 pulses per minute of *ecoBrew*, a meter square area above the exhaust exit was cleaned and taped.



Saturday, September 14, 2013, 10:00 AM (after 20 hours of running time)...

Result - Blue tape was removed on the port side, **particulate was minimal and barely visible** -



Conclusion: Testing will continue to determine the best settings for the *clean-exhaust* pump and concentration of *ecoBrew*. The September 13, 2013 test should be considered successful in the continued quest for cleaner waters, cleaner air and cleaner hulls.

January 2014

Generators rebuilt. *clean-exhaust* plastic check valve was replaced due to a small crack in the original...this check valve has been given a lot of thought. This vessel's Engineer was concerned about the plastic valve cracking so it was changed to a brass valve and then back to a high end (\$200) plastic valve. The Engineer continues to worry about the plastic valve. He gave the new plastic valve 50 hours of running time (without incident) and then decided to install the old brass check valve again and possibly apply insulation around the metal non return.

Problem

Engineer worried about plastic being compromised. The *clean-exhaust* check valve has to be cleaned frequently to prevent salt residue build up and can create cross threading issues and cracking.

Solution

Plastic check valve changed to brass

March 2014

The following test report was filed by the 1st Officer, David Poole, of MIA ELISE



Mia Elise

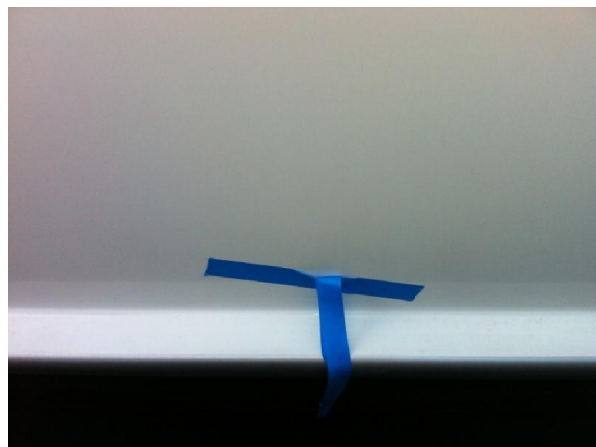
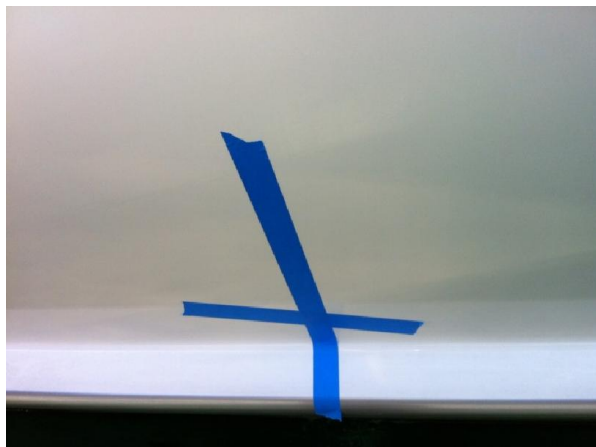
GEORGETOWN

Clean Exhaust System review: Yacht Mia Elise

Clean Exhaust System was installed on board Motor Yacht Mia Elise 1 year ago. During this time the system has worked wonders in keeping exhaust emissions down as well as keeping black soot off the hull. Captain Ted Sputh the president of Clean Exhaust System recently came aboard the Yacht to see if we were still satisfied with the system. During his time aboard we conducted the following test: Thursday the 20 March 2014 both port and starboard side hull was washed. This was completed at 1400 and once the hull was dry blue tape was placed in an area close to the exhaust. The Clean Exhaust system was turned on with a 30% Load on the Generator and 25 BPM of the echoBrew18. The weather during this time was fair with a light easterly wind. The vessel stayed at the dock until Sunday the 23 March where she then traveled for two hours. On Monday the 24 March at 10:00 the Blue tape was removed to see how much black soot had stuck to the hull as well as running our hand over the surface. After observing the results with Captain Ted as well as 3 deck crew and the engineer it was quite evident that there was no black soot on neither the tape nor our hands. The area where the tape was matched the clean surface adjacent to it. I can conclude that the echoBrew18 was a great success. We then turned off the System and monitored the soot build up on both port and starboard for two days. The result was irrefutable that, without the system turned on the soot and emissions into the atmosphere and water were quite prevalent. I would highly recommend the Clean Exhaust System to any vessel needing to cut down on exhaust emissions as well as soot build up. We are certainly satisfied and will continue to use the system indefinitely.

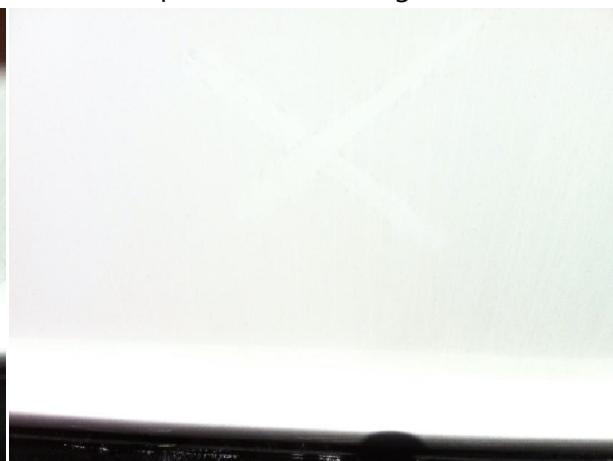
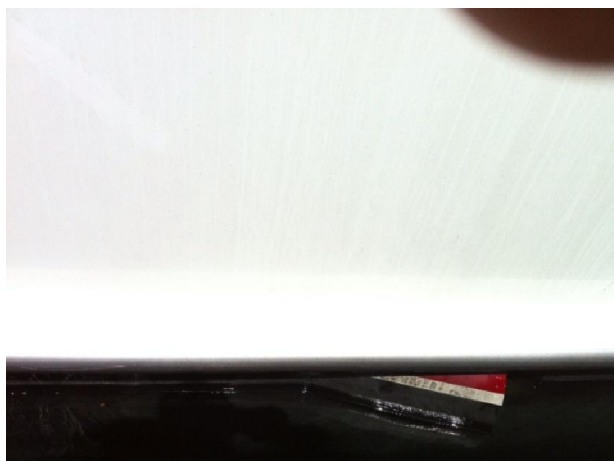
Signed
David Poole
1st Officer
Yacht Mia Elise.





Finger drag across hull produced **no particulate**

MIA ELISE, 18 hours later with **clean-exhaust** turned **off** – wiped an X with a rag



Observed: Streaks on hull, very dirty, oil and particulate floating on water next to exhaust with **clean-exhaust** **off**

Conclusion: **clean-exhaust** close to 100% effective in eliminating particulate on the hull and in the water

5...PARAFFIN

60.1 (197'2") Feadship

2 **clean-exhaust** systems installed May 2013

(2) 200kW generators

Data sheets received

None (PARAFFIN has 2 engineers that job share)

October 31, 2013

clean-exhaust system running on starboard generator 749 hours

clean-exhaust system running on port generator 1205 hours

Total volume of *ecoBrew* supplied 132.475 Liter or 14.7 hours per Liter

Engineer reported that the center generator seawater pipe work arrangement is to be replaced November 2013 to improve efficiency of exhaust cooling due to steam carryover

November 2, 2013

Engineer having trouble convincing Captain to order *ecoBrew* ...wanted estimate for buying 4 five gallon drums so that it can be presented to the Captain to authorize purchase for the Caribbean season...Engineer's suggestion for approval..."if he will not authorize the purchase then we cannot help you and then you may as well email me asking permission to remove your two systems which might stimulate a more positive response"

November 14, 2013

"Large amount of charcoal build-up found in the muffler using *ecoBrew*" The initial, **but proven to be inaccurate**, conclusion was that it was the fault of **clean-exhaust**. Engineer's reaction was to remove the system from the vessel.

Problem

Chunk of gunk in the muffler

**Solution**

Metallurgical analysis...Semi-quantitative EDS analysis was run on the sample submitted to determine the elemental composition. The sample was found to be made of primarily salt. A follow up was made with Brew manufacturer ... *ecoBrew* does not contain any of the elements listed on the metallurgic analysis findings. There were also only traces of carbon found in the "gunk". Could this be because [clean-exhaust](#) was working? (report follows)

QC Metallurgical, Inc.

Testing & Consulting Services

2870 Stirling Road • Hollywood, FL 33020-1199 • (954) 889-0089 • Fax (954) 241-5890

INSPECTION REPORT

12/10/13 Revised Report

DATE December 6, 2013

QCM JOB# 13LM-1037 CUSTOMER Captain Ted Sputh

DESCRIPTION 1 sample

CUSTOMER ORDER# Verbal

MATERIAL _____

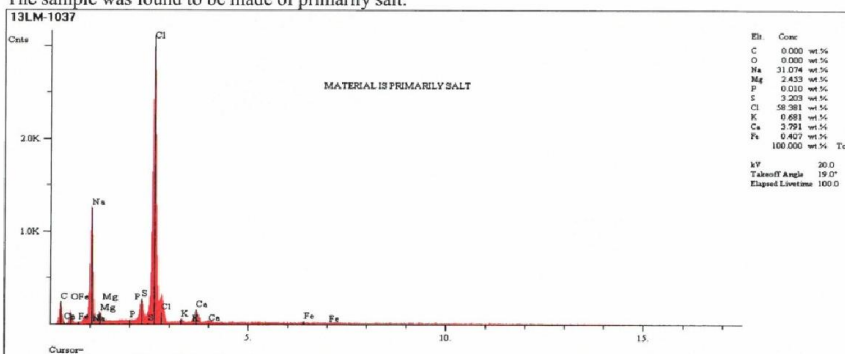
INSPECTION SPECIFIED EDS Analysis

APPLICABLE SPECIFICATIONS _____

RESULTS OF INSPECTION

EDS ANALYSIS RESULTS

Semi-quantitative EDS analysis was run on the sample submitted to determine the elemental composition. The sample was found to be made of primarily salt.



Note: Semi-quantitative EDS analysis is an approximation and not a full quantitative chemistry.


Frank Grate

Q C Metallurgical, Inc. assumes no responsibility for losses of any kind due to interpretations.

FORM #27

ecoBrew manufacturer's comment on the EDS Analysis:

the ingredients in EcoBrew are:

Water, H₂O

Ethoxylated Alcohol, Carbon chain * O(CH₂CH₂O)₆H

Tetrasodium Iminodisuccinate, C₈H₇NO₈Na₄

Sodium Metasilicate Penthydrate, Na₂SiO₃

2-Hydroxypropanoic Acid, C₃H₆O₃

As you can see there is no Magnesium, Iron, Sulfur, Potassium or Calcium used

Andrew Richards
Director of Quality and Regulatory Compliance

It is abundantly clear, that the hardened residue in the residue of PARAFFIN's muffler is mostly sea salt and very little carbon.

Solution

Problem did not originate from [clean-exhaust](#)

February 17, 2014

It was decided by all of PARAFFIN's departments that [clean-exhaust](#) should be decommissioned. The vessel is undergoing major welding works in the region where [clean-exhaust](#) was fitted...thus, it was removed. The seawater injection valve was clogged with a "solid soap plug". The Engineer's opinion is that the system did not work on this vessel for reasons that he feels are apparent...

- Vessel seawater flow into the spray ring needed to be improved
- Vessel was advised by Sounddown Exhaust Systems that the Cat C9 seawater pump (Sherwood) is at the limit of its volume capability when used on the dry exhaust system and susceptible to considerable loss of flow with high back pressure.
- "If vessel had a wet exhaust system, [clean-exhaust](#) would have worked. But, with the water gas separator, we need a good even spray pattern to cool and wash the gases of un-burnt fuel oil carry over before the system is effective on the dry gas."
- Feels that [clean-exhaust](#) works in principle but that test vessels should be carefully selected to determine whether the existing system is already efficient. PARAFFIN's spray-ring was inefficient and failed to meet [clean-exhaust](#)'s criteria.

Problem

- Vessel had seawater flow problem prior to installation of [clean-exhaust](#)
- Vessel needed major welding work which was discovered after [clean-exhaust](#) was fitted
- Seawater injection valve (check valve) was clogged with a solid soap plug

Solution

- Soap plug in check valve was probably due to lack of use, low spray ring flow, and lack of maintenance

PARAFFIN failed to meet test vessel criteria, [clean-exhaust](#) equipment was returned

#6...KIPANY

35.36m (116') Intermarine

2 [clean-exhaust](#) systems installed May 2013

Port main engine 1997 MTU 16V2000 M90

Port generator 50kW

First installation on a main engine

Data sheets received

- None
- All information was sent in photo form

Both **clean-exhaust** systems were installed on the port side for testing. This vessel has a small water drop muffler.

Problem

No results in 2 weeks of use

Failure attributed to size of muffler....not enough space, force or time to mix *ecoBrew*

Solution

- All aspects of engine and muffler system studied...concluded that **clean-exhaust** is not compatible with small water drop mufflers
- **clean-exhaust** removed
- Investment returned to Owner
- Vessel Owner was grateful for the chance to test and thinks the **clean-exhaust** system is a "great idea". He wants to be considered as a resource as **clean-exhaust** moves forward.

#7...SEAQUEST

49.71m (163.1") Westport

(3) **clean-exhaust** systems installed August 2013

Data sheets received

- None

January 30, 2014 Summary of communication with SEAQUEST Engineer and Captain Ted

SEAQUEST has a water drop muffler system and the mufflers should be "clean as a whistle" due to work in the vessel's last yard period.

- The Engineer ran tests at a 30% load on the **clean-exhaust** system with 40 beats per minute.
- **clean-exhaust** made a difference with 24 hours of run time. The generator was loaded to 80%. Pictures were attached to the email to prove the point.
- Engineer wants to try adding another emulsifier to *ecoBrew* to stretch the *ecoBrew* as he drained almost ½ jug in five days with about 150 hours of generator run time.
- Engineer is concerned that it will take too much juice to run the system and he doesn't have storage room

- Engineer seems very keen to continue testing but there will be at least a 2 week lag time because vessel just picked up a charter. As soon as he can, he will test at a higher pulse rate.

A special thank you at the end of this 2 year period goes to Craig, Hannah, and Jonathan, the **Maz Ocean Team** for the installations on all of the test vessels. Their professionalism, advice and kindness were invaluable on this journey. www.mazocean.com 954-767-4799.

In conclusion...

To date **clean-exhaust** has collected data on seven (7) test vessels with an accumulation of approximately **9500 hours of run/testing time** on Northern Lights, Caterpillar, and MTU port, starboard, and center generators. Every system that has been installed, thus far, has been an individual vessel process. The **clean-exhaust** Crew has been driven to develop the perfect standardized system. This system was realized by dropping all injectors from the system. A fitting the size of the inner diameter of the tubing was tapped from the top of the water supply eliminating the need for any injectors. The tubing is too big to cause frequent salt crusting issues and a check valve can still be used. This solution also eliminates the needs for frequent injector cleanings that results in compromised fittings. The new improved **clean-exhaust** has been installed on all test vessels.

ecoBrew adjustments by trial and error have proven that the *ecoBrew* flow is best set at a 30% stroke with 40 beats per minute on the average. This would represent a run time of about 250-300 hours for every 5 gallons of *ecoBrew* depending on the efficiency of the burn of the generators. An initial 100% stroke with an 80 pulse per minute setting effectively cleans the mufflers.

ecoBrew will continue to be tested and improved to provide the best product for the efficient running of **clean-exhaust**. The formula will always maintain the integrity of Approved for the Environment.

Five of the seven test vessels had positive results for a 71% success rate. Two of the test vessels did not meet the criteria that is now in place for a successful **clean-exhaust** installation. This criteria takes into account that **clean-exhaust's** greatest successes, to date, are on vessels with large water drop mufflers and efficiently functioning spray-rings.

Communication and implementation has proven to be the key in refining the system and the *ecoBrew*. It is integral to the success of **clean-exhaust** that vessel's are contacted frequently and encouraged to share problems and positive results. This "hand's on approach" will encourage vessels to respect, maintain, and feed the system. It's not the big problems that wind people up, it's the little things.

The yachting industry changes with the tide and companies in the yachting industry rise and fall on the talent, endurance and ethics of their employees and the quality of the products that they promote. The **clean-exhaust** Crew has a passion for a healthy lifestyle and for the sea. It is their mission to be part of the marine pollution solution.

A special thank you at the end of this 2 year test period goes to Craig, Hannah, and Jonathan, the **Maz Ocean Team** for the installations on all of the test vessels. Their professionalism, advice and kindness were invaluable on this journey. www.mazocean.com 954-767-4799.

clean-exhaust

the **green** solution to marine diesel pollution

Introducing . . .



Equipment

- Installation of an injection point into the vessel's raw water cooling line somewhere between exiting the engine and the spray-ring
- Installation of a **dosing pump** near the generator
- Installation of a 5 gallon **bucket** to draw a calculated amount of "certified **green**" *ecoBrew* to dose the exhaust before the spray-ring

Process

- Start the generator. **clean-exhaust's** purpose built pump automatically and strategically doses the *ecoBrew*
- The spray-ring mixes the cooling sea water with the *ecoBrew* as it exits the engine
- The specifically formulated *ecoBrew* neutralizes contaminants, particulates, and product from incomplete burn
- Both underwater exhaust and gas exhaust exit clean

Result

- Cleaner oceans
- Cleaner harbors
- Clean hulls
- Clean boot tops with no floating black sludge

Below is a typical three system dosing pump installation for three generators on the back of the generator box. A dipstick in the 5 gallon container reads out the *ecoBrew* level and sends a warning signal if the *ecoBrew* is low.



cleanexhaust *ecoBrew*
 formula for use with the Patent
 Pending **cleanexhaust** System
 was awarded the EPA's "Design
 for the Environment" seal.



ecoBrew :

- ✓ performs well
- ✓ cost-effective
- ✓ non-toxic

- ✓ non-flammable
- ✓ biodegradable
- ✓ safer for the environment

ecoBrew Product Specifications:

- Container – 5 gallons
- Color – Purple
- Fragrance – None
- ph – 11.0 – 11.9
- Viscosity – Water thin (<50cps)
- Foaming – Moderate
- Biodegradable – Complete
- Solubility in Water – 100%
- Weight per Gal – 8.40lb
- Two Year Shelf Life

Contact:

Email info@clean-exhaust.com
www.clean-exhaust.com



the **green** solution to marine diesel exhaust pollution

The Crew at **clean-exhaust** wish you
Fair Winds, Calm Seas, and Clean Exhaust!

Diesel engines produce very little carbon monoxide as they burn the fuel in excess air even at full load, at which point the quantity of fuel injected per cycle is still about 50 percent lean of stoichiometric.

This is a list of chemical components that have been found in diesel exhaust.

Contaminant	Note
acetaldehyde	IARC Group 2B carcinogens
acrolein	IARC Group 3 carcinogens
aniline	IARC Group 3 carcinogens
antimony compounds	Toxicity similar to arsenic poisoning
arsenic	IARC Group 1 Carcinogens, endocrine disruptor
benzene	IARC Group 1 Carcinogens
beryllium compounds	IARC Group 1 Carcinogens
biphenyl	It has mild toxicity.
bis(2-ethylhexyl)phthalate	endocrine disruptor
1,3-butadiene	IARC Group 2A carcinogens
cadmium	IARC Group 1 Carcinogens, endocrine disruptor
chlorine	
chlorobenzene	It has "low to moderate" toxicity.
chromium compounds	IARC Group 3 carcinogens
cobalt compounds	
cresol isomers	
cyanide compounds	
dibutyl phthalate	endocrine disruptor
1,8-dinitropyrene	Carcinogen
dioxins and dibenzofurans	
ethyl benzene	
formaldehyde	IARC Group 1 Carcinogens
inorganic lead	endocrine disruptor
manganese compounds	
mercury compounds	IARC Group 3 carcinogens
methanol	It may cause blindness.
methyl ethyl ketone	It may cause birth defect.
naphthalene	IARC Group 2B carcinogens
nickel	IARC Group 2B carcinogens
3-Nitrobenzanthrone	One of the strongest carcinogens known
4-nitrobiphenyl	
phenol	endocrine disruptor
phosphorus	
polycyclic organic matter, including polycyclic aromatic hydrocarbons (PAHs)	
propionaldehyde	
selenium compounds	IARC Group 3 carcinogens
styrene	IARC Group 2B carcinogens
toluene	IARC Group 3 carcinogens
xylene isomers and mixtures: o-xylenes, m-xylenes, p-xylenes	IARC Group 3 carcinogens

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