The project - installation for saving of heavy fuel on boilers, utilization of condensate water and heavy residuals of fuel in tank farm. The standard project for tank farm and boiler rooms.

Why did I read this document? Here is how as we provided for our client some effects with fuel economy and recycling its waste sludge. In detail. Photos and films. Step by step. Interesting? A short list of effects

1. The direct savings of own heavy fuel oil.

According to our calculations - 3% without adding watered sludge and 5% for sludge disposal, condensate water and residues. In accordance with the data of the Customer - 4% and 8% for the same positions.

The **fuel consumption** for all the boilers: average - 3600 liters per hour, the maximum - 4860 liters per hour.

- 2. The customer is completely **abandoned the use any additives** for best burning boiler fuel. Since the start of homogenizers TRGA was not spent even 1 liter of this additive.
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- 5. Customers save considerable money and time resources for boilers cleaning works.
- Customer has fully complied its obligations under the complete elimination of smoke and minimization of harmful emissions in the center of the spa town. Odessa, Ukraine
- 7. Installed equipment has reduced the cost of heating oil before nozzles, through the use of some physical effects when using a homogenizer TRGA, more <u>www.afuelsystems.com/ru/trga/s165.html</u>
- 8. Opens the way for a successful burning heavyweight fuel oil with a combination homogenizer + additive for best combustion.

If interested - will continue - below quotes from the questionnaire received from our customers :

03.01.2013 we received the questionnaire from the **PJSC ''Eximnefteproduct'',** Odessa city, for installed equipment for optimization of heavy fuel burning and watered sludge in steam boilers of Russian and American production. Questionnaire (quotes)

Contact information								
Business name	PJSC "Eximnefteproduct"							
Full postal address of the company	Ukraine, Odessa city, ul. Nalivnaya 15							
Date of completion	01/03/ 2013							
Technical information								
Boiler type	RILEY UNION Holman Boiler Works Inc. 1994 №1							
Consumption for each nozzle								
- the average kg/h	954							
- maximum kg/h	<u>1374</u>							
Excess air coefficient	1,57÷1,2							
Flue gas temperature	243÷352							
Boiler type	RILEY UNION Holman Boiler Works Inc. 1994 №2							
Consumption for each nozzle								
- the average kg/h	912							
- maximum kg/h	<u>1315</u>							
Excess air coefficient	1,54÷1,21							
Flue gas temperature	183÷294							
Boiler efficiency	85,06							
Boiler type	DE-25-14-225 #3							
Consumption for each nozzle								
- the average kg/h	912							
- maximum kg/h	<u>1315</u>							
Excess air coefficient	1,49÷1,25							
Flue gas temperature	121÷177							
Boiler efficiency	90,69							
Scheme supplying fuel oil on boiler								
Boiler type	DE-25-14-225 #4							
Consumption for each nozzle								
- the average kg/h	857							
- maximum kg/h	<u>925</u>							
Excess air coefficient	1,49÷1,23							
Flue gas temperature	110÷146							
Boiler efficiency	92,32							
The total consumption of fuel oil								
- the average kg/h	<u>3610</u>							
- maximum kg/h	4875							
Fuel supply	line and return							
	Pump NMS 8-25-6, 3 gear 3 pieces							
	Capacity-0.5 m5/n							
	RILEV LINION ## 1.2							
	Pressure-15.5 kg/cm ² (actual)							
Working performance of injection pumps								
(m3/h) for boilers #. 1 and 2	Pump A-13V – 4/25 8-25-6.3 screw 2 pieces							
	Performance-4.0 m3/h							
	Purpose is to supply fuel oil to boilers							
	DE-25-1,4-225 ## 3,4.							
	Discharge pressure 15.5 kg/cm2 (actual)							
The temperature of fuel oil before the heater	90÷98							
The temperature of the fuel oil after heater	105÷120							
Fuel oil (other fuels)							
The type of fuel used	Mazut m-100, watered oil sludge with water content 5-30%.							
	Copy of the passport of quality (certificate) is attached.							
Tank	and lines							
The Amount of storage tank	300 cubic meters. (4 pieces of the RGS 75 m3)							
Temperature of the fuel oil in the feed (day) tank	75÷90 °C							
A pump for recycling in storage tank	No,							

Brief information about the customer -_PJSC "Eximnefteproduct" is one of the largest transhipment tank farms in Ukraine, which is capable of handling 20 million tons of oil products in the year. Read More - <u>www.eximneft.com.ua</u>. Below is a photo of the object from the satellite.



17 January 2013 two leading specialist of our Customer Been object <u>Makarov-1</u>, which was continuously operated for 5 years with homogenizer TRGA 3G-10 for combustion of low quality and watered mazut M-100.

The photo acting Chief Engineer of JSC "Eximnefteproduct", Pavel Yunoshev (left) and Chief boiler <u>Makarov -1</u>, Aleksandr Cozyarsciy



At this point, there was the burning of fuel oil with remnants of heavy fuel flooded from 0.3 meters of the level of the storage tank.

Burning was great. The smoke from the pipe completely absent.



1. Thereafter Customer provided us a fuel circuit of his object.



Customer provided us: boilers regime charts, report of thermal testing and laboratory data on the quality of the fuel.

Within 40 days, together with the specialists of the customer we agreed to the technical requirements for the operation, analyzed multiple configuration options and the installation of equipment. In order to obtain maximum efficiency and versatility of the equipment, the customer agreed to purchase additional recirculation pumps and partial modernization of the consumable capacities.

The main current problems of the customer :

1. Low efficiency boilers caused by clogged heat transfer surfaces, and fuel quality.

2. Big difficulties when burning sludge from sediment and from fuel storage tanks.

3. High cost when disposing of the condensate water from the storage tanks of

traditional technologies. Attempt to add a small amount of water in fuel significantly reduced the temperature of outgoing gases, resulting in low-temperature corrosion of heat exchangers and pipes. This could cause a serious accident and required constant repairs.

4 . During the winter period of exploitation in some reservoirs have accumulated precipitation of fuel, mineral oil and oil sludge. Attempts to add sludge in fuel leads to a sharp increase in deposits on heat exchangers, the need for constant cleaning, efficiency decreases a boiler, a significant amount of smoke.

5. The need to significantly reduce harmful emissions from the combustion of fuel oil and waste residues in Odessa acquired greater importance after the public of the city and city officials began to express serious dissatisfaction, until the requirements of the plant closure. Read more here.

http://odessa-life.od.ua/news/6147-nadezhdy-odessitov-na-chistyi-vozduh-tayut-vrednyepredpriyatiya-prodolzhat-svoyu-rabotu http://timer.od.ua/news/v_odesse_opyat_vonyaet_376.html http://www.reporter.com.ua/news/i2j/ http://youtu.be/jiEr07DgzN8

Previously, PJSC ''Eximnefteproduct'' conducted a modernization of its boiler house in traditional ways, but it was not enough.

http://odessa-life.od.ua/news/7302-odessity-mogut-rasschityvat-na-chistyi-vozduh

According to the website of the Odessa City Council, according to the decision of the company JSC "Eximnefteproduct" intensively conducted maintenance work. A revision of all process units, made to prevent harmful emissions at all stages of the transport and storage of petroleum products. Upgraded boiler room, which also helped to reduce emissions and improve the efficiency of its work. On today signed an agreement with the test laboratory "Monitoring" of the Odessa Institute of Physical Chemistry of Environmental Protection and the person on the assessment of the actual impact of industrial activity "Eximnefteproduct" on the air in the buffer zone of the enterprise. "We opened the admission for all supervising organizations that can give an objective professional assessment on the implementation of environmental protection measures of" Eximnefteproduct ". This is primarily interested enterprise itself, "- said Acting Chief Engineer Refining Company Paul Yunoshev. Copied from the website <u>http://odessa-life.od.ua</u>

The schedule of the work performed and the resulting effects.

1. In the summer of 2013, the work included:

1.1. Analysis customer questionnaire.

1.2. Development of technical proposals to the customer indicating the composition of the main and auxiliary equipment. Harmonization of the technical proposal.

1.3 Signed a contract to supply equipment and beginning of manufacturing.

1.4. Carried out a Visual inspection of the customer's company, clarified the location of major equipment, tanks, expendable modernization plan transferred to the detailed installation instructions.

At the same time, made repairs to the boiler-repair and cleaning ad partial replacement of heat exchangers, cleaning chimneys.



www.afuelsystems.com/ru/trga/s152.html

State of heat exchangers



Then were installed the TRGA Homogenizer in the supply fuel line to the boilers

1 Homogenizer TRGA-3G-08 on two boilers DE-25 (Russian)

1 Homogenizer TRGA 3G-05 two boiler HOLMAN Boiler (US)

http://www.afuelsystems.com/ru/trga/s155.html



http://www.afuelsystems.com/ru/trga/s155.html

12.19.2013 has been included in the work of the first of three homogenizers TRGA series - **TRGA-3G-08**, which is installed in the fuel supply line for two boilers, fuel consumption is 1 ton per hour. <u>www.afuelsystems.com/ru/trga/s163.html</u>



Homogenizer can not do incombustible particles combustible ... It can reduce their size, for that would burn all the combustible components in the boiler furnace, prior to their contact with the rear wall of the heat exchanger ... Unburned particles do not adhere to the heat exchanger does not burn out in the pipe - i.e. boiler efficiency is not reduced and but reduces the smoke amount.

Picture of burning fuel oil after the Homogenizer TRGA -3G-08.



1. scheme for installation the TRGA activator for best boiler fuel burning in boiler feed line



Since the switching the homogenizer last **2 days**, burning fuel oil greatly improved - completely disappeared particles that do not burn because of their grinding in a homogenizer

nomog	
Burning oil after switching TRGA homogenizer - fuel passes through the homogenizer once.	Burning fuel oil in 2 days after switching TRGA homogenizer - fuel passes through the homogenizer multiple times, although it is replenished from a storage tank
Flow channel through the homogenizer is 6 cbm., Burns 2 .2 cbm., 3.8 m. cbm - back to the feed tank with volume = 70 cubic meters.	Flow channel through the homogenizer is 6 cbm., Burns 2 .2 cbm., 3.8 m. cbm - back to the feed tank with volume = 70 cubic meters.
Link to the movie - http://youtu.be/l-zKXRVt7zk	Link to the movie - http://youtu.be/TH1cw8FAneo
www.afuelsystems.com/ru/trga/s163.html	www.afuelsystems.com/ru/trga/s166.html

www.afuelsystems.com/ru/trga/s166.html

In this way, 2-3-fold treatment of fuel wich contains noncombustible particles not only leads to their breakage, but complete separation of combustible components from the incombustible.

The result - a complete lack of unburned fuel residues adhering to the heat exchangers. Commercial results - maximum efficiency between its boiler cleaning, reducing the cost of cleaning the furnace and the heat transfer surfaces.

02.02.2014 was launched a second line homogenizer before 2 boilers HOLMAN BOILER (Made in USA, Dallas, Texas). Smoke absent. Pressure drop on the photo.

Read more here www.afuelsystems.com/ru/trga/s171.html



Fuel oil burned completely - the smoke is completely absent -<u>http://youtu.be/IjlbXYxFKzM</u> i.e. For one chimney works simultaneously 4 oil-fired boiler, and instead of smoke there is the steam only



www.afuelsystems.com/ru/trga/s171.html

During 88 days of boilers works, any unburned fuel residues, residues of resins or asphaltenes on the surfaces of heat exchange is not detected. Chemical additives that have been used previously to reduce the amount of carbon on the heat exchangers are not used within 88 days.

03/07/2014 Finished roughing assembly homogenizer TRGA-3G-20, which is set to handle the two feed tank at a time. In this storage tanks underwent partial modernization for increasing the efficiency of the homogenization process.





www.afuelsystems.com/ru/trga/s172.html

09.04.2014 Put into operation the system utilization of accumulated sludge oil and condensate water. Link - <u>www.afuelsystems.com/ru/trga/s175.html</u> The scheme below.



it is not wiring diagrams, but some options concepts in each individual case it may be changed

legend

- 1. fuel oil tank
- 2. prefilter
- 3. fuel oil supply pump to the boiler
- 4. fuel oil heater
- 5. secondary filter
- 6. slotted screen
- 7. boilers
- 8. pump for recycling
- 9. back to the line supply of fuel oil
- 10. device TRGA
- 11. pre-mixing
- 12. flowmeter of fuel oil
- 13. flowmeter of the second component (additive in oil, Bottom water... if necessary)
- 15. manometers



Analysis of the source of oil sludge **-water content of 2%.** Then was added up to 10% of condensate water, which was formed in the tanks during the winter and get a water fuel emulsions **...** Analysis of water fuel emulsions showed the presence of 8% water ... i.e. 2% of the water analysis is not defined.



Well, and now movies.

Movie 1 - burning fuel oil water emulsion with a water content of 10% in the boilerDE25 (Russian production)http://youtu.be/NtHq-9vKfO8Movie 2 - burning fuel oil water emulsion with a water content of 10% in the boilerHOLMAN BOILER (US production)http://youtu.be/nAjkC8Wp30kMovie 3 - smoke, or more precisely the complete absence of smoke from tube whenincineration watered CHO, only steam ...http://youtu.be/aN8s_BAdI0Awww.afuelsystems.com/ru/trga/s175.html

Refinement. The amount of fuel burned per hour about 5 cubic meters. According to the APCS boiler steam output, the transition to a 10% aqueous emulsion of black oil decreased by 0.1%



www.afuelsystems.com/ru/trga/s175.html

After 120 days of boilers works, the unburned fuel residues - residues of resins or asphaltenes - on heat transfer surfaces in the boiler is not detected. Chemical additives that have been used previously to reduce the amount of carbon on the heat exchangers are not used, all within 120 days.



Photo watered fuel oil with slurry residues

www.afuelsystems.com/ru/trga/s176.html

The homogenizer reduces the amount of mechanical impurities, which ensures complete reduction of unburnt residues on the heat exchange surfaces, and as a result, reducing the amount of smoke, maintaining maximum efficiency and the maximum period between cleaning nozzles. As well as the possibility boiler works at full load for a long time.

At the bottom photo - tube of oil-fired boilers. You think boilers are switched off ? No – all homogenizers works installation and experts of the boiler station - completely eliminate smoke, even the burning of residues accumulated sludge. A good practical example of safe combustion of water-fuel emulsions on an industrial scale.



Page - <u>www.afuelsystems.com/ru/trga/s176.html</u> Film, a smoke-free - <u>http://youtu.be/Lpga_fS1X5Q</u> Film, combustion, disposal of sludge flooded - <u>http://youtu.be/_0SBkgs_MTg</u>

The first winter of operation of Homogenizers TRGA-3 g in Odessa is complete. <u>www.afuelsystems.com/ru/trga/s182.html</u> Summary results:

1. **The boiler steam productivity** increased by 25%. Not our merit - a team of engineers to disassemble and assemble, after cleaning the insides of the boiler, but there is also our part.

2. Efficiency All boilers, has not changed during 10 months of continuous operation – i.e. almost clean heat exchangers. Fuel economy. But come back to this later.

3. In the spring, they burned all accumulated condensed water and tank's residual oil sludge. Good savings on disposal and all fuel converted to heat and steam. Water cut fuel reached 8%. The boiler steam productivity is not diminished. (8% fuel savings ?)

No deviations in the boiler, no damage in the boiler or pipe. This is our effect. Controlling the flow of fuel, steam and all modes of boiler operation, made by APCS. All data is recorded with high precision.

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EJIN24	Contra Pr	Расход пара от котла	TA.	56.63	15.17	15.26	0.00	13.08	0.00	13.73	
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4. An additive for improving combustion is not used. Savings.

5. **The smoke** from the pipe is eliminated completely. Ecology for which no one complains.



6. Heat Exchangers. (boiler DE-25) Soot particulate residues have on the edges of the furnace in the center - no. Soot and ash covered only the peripheral parts of the pipe near the walls of the boiler. Soot and ash are fragile and can be easily removed from the surfaces of the tubes.

This means - full fuel burnt, remained practically only ash.

(Reasons - complete fuel combustion and increase the temperature in the furnace). Remains of the ash is removed by light hammer blows on heat exchangers.

No need to use a blaster, steel brush and then wash the pot. Great savings on the works of cleaning of boilers.

Movie - removal of soot and ash from heat exchange surfaces http://youtu.be/f8wLuXEuxS8

Full details here -

www.afuelsystems.com/ru/trga/s182.html Photo below - the heat exchanger on this boiler before to install a homogenizer.

Please vote difference - after and before



October 2014.

Enterprise "Eximnefteproduct" received for **burned** (**burn waste**) **oil sludge and bilge water from the Odessa Commercial Port** (300 tons).

At the time of this writing (11/02/2014), the burning of this waste ends up on the boiler Holman Boiler. **Read More - <u>www.afuelsystems.com/ru/trga/s189.html</u>**



all the movies and read more here - www.afuelsystems.com/ru/trga/s189.html

<mark>Nov, 2014.</mark>

Get movies and photos from boilers DE-25, heat exchangers condition.

Read more here www.afuelsystems.com/ru/trga/s188.html



Economizer filled black dust. This ash, incombustible particles in the fuel oil. We can not turn them into fuel. Equipment TRGA separates the fuel from ash, whereby the ash can't accumulate and adhere to surfaces of heat exchangers. It supports a maximum efficiency between boiler cleaning dates.

What is important is that the ash is easily removed from the economizer. Without a shot-blasting, no metal brushes and washing, just a broom ... This proves the most complete combustion of fuel oil after processing and reduces the cost of cleaning.

Before and after pictures below. No trace of the scrapers and brushes on the pipes.

Even lower - photos of the economizer top. Same ash, which is easily and quickly removed without big effort and expense. Photo before and after.





Photos of the economizer top. Same ash, which is easily removed quickly without the effort and expense. Photo before and after. <u>www.afuelsystems.com/ru/trga/s188.html</u>



Boiler furnace DE-25.

Condition of the side surfaces of heat transfer –**all soot is easily removed** by tapping and broom without effort.

The bottom of the combustion chamber clean. Since the installation of the homogenizer TRGA not need a crowbar and a scraper unstick unburned fuel residues from the bottom of the furnace. **Only hand, hammer and broom.**



www.afuelsystems.com/ru/trga/s188.html



www.afuelsystems.com/ru/trga/s188.html



Condition of heat exchangers after burning fuel oil and sludge throughout one year using a homogenizer TRGA 3G-05.

Film https://www.youtube.com/watch?v=WZMfPBDx9eA **Summary.** Equipment set homogenizers TRGA, including the schematic for install and use, provide customers with such effects:

1. The direct savings of own heavy fuel oil.

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- 6. Customer has fully complied its obligations under the **complete elimination of smoke and minimization of harmful emissions** in the center of the spa town. Odessa, Ukraine
- Installed equipment has reduced the cost of heating oil before nozzles, through the use of some physical effects when using a homogenizer TRGA, more -<u>www.afuelsystems.com/ru/trga/s165.html</u>
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