USED LUBE OIL RE-REFINING

A SUCCESSFUL INVESTMENT

PRESENTATION

STP - Studi Tecnologie Progetti Srl

Engineering & Contractor

Rome, Italy
Oil recycling proves its worth
Re-refining of used lube oil is an economically attractive recycling method in terms of resources conservation and environment protection. It allows processing of hazardous material in a safe and effective way to recover an high quality base oil product.

This result in a strong economic incentive for re-refining considering lube oil price.

Re-refining can produce base oils or VGO distillate that is a suitable feedstock to FCC or HDC Refinery Units.

Used lube oil is generally a mixture of different types and grades of used lube oils, coming from motor crankcases and industry users.

Used lube oil is made up of a multitude of small individual batches collected at garages, maintenance shops, transportation companies and industries and depends on local situation, seasonal consumption, handling practice at the collection source and collecting system organization.

2 liters of Used Lube Oil

give

1.5 liters of Rerefined Oil
LUBE OIL LIFE CYCLE

Lube oil Production

Lube oil marketing

Lube oil user

Used lube oil Collection

Used Oil Re-Refining

Used LUBE OIL RE-REFINING
When refilling lubricant on motor crank-case, used lube oil is collected and re-refined to give Re-refined Base Oil for lubricant production.
Energy consumption lower than for virgin base oil production

Environment Protection

Energy consumption lower than for virgin base oil production

High quality products and less dependence on imported oil

Re-refining is a strong economic incentive for environment protection and energy saving
SUCCESS OF RE-REFINING depends on the COLLECTION SYSTEM

USED LUBE OIL COLLECTION

Collection of used lube oil is the starting point for a successful Re-refining. Re-refining depends on collection effectiveness and used lube oil availability. Efficient collection facilities are a necessity for Re-refining in relation to:

- Availability of used lube oil (quantity)
- Composition of used lube oil (quality)
USED LUBE OIL COLLECTION STRATEGY

- Investigation on used lube oil providers
- Division of the territory in Areas and Sectors
- Storage capacity of collection centres
- Transport network and drivers formation
- Pre-selection laboratory
- Segregation of contaminants
Re-refining removes all the contaminants from used lube oil to recover base lube oil product.

During the last years many factors have obliged re-refiners to look for alternative Re-refining process, such as:

- increased use of additive packages in the formulation of finished lube oil and by consequence higher level of contaminants in the used oil
- increased amount of thermal degradation products due to longer mileage of the lubricants
- pollution problems related to the disposal of acid sludges and spent clay from the traditional acid/clay re-refining

Among the available today processes, STP Re-refining offers a low energy high yield operation, high quality products and absence of noxious wastes or by products.
STP is pioneer on Used Lube Oil Re-refining since more than 20 years.

STP has implemented several Re-refining Plants worldwide and is providing the last generation of Re-refining Process based on unicum open art know-how.
Advantages of STP Re-refining Process

- High flexibility towards feedstock quality and composition
- High process yield. The lube oil recovery is more than 95%
- High separation selectivity, removal of contaminants and production of high quality base oils
- Low energy and low utility consumption
- High onstream efficiency without corrosion, fouling, coking
- Environment safeguarding operation
- Management of all odorous compounds to eliminate malodorous and toxic emissions
- Capital investment and operating cost highly competitive
STP Re-refining Process

STP Re-refining process removes all the contaminants from the used lube oil and recovers a distillate product as VGO or high quality base oil either API Group I by chemical finishing or API Group II by hydrofinishing.

STP Re-refining process does not release harmful or pollutant wastes to be disposed and is therefore environment friend.

Effluents are oily drains / low BOD/COD oily process water sent to treatment before disposal and process off gas sent to thermal oxidizer for combustion and destruction according to environmental law and regulations.
API Definitions for Base Oils

For the purpose of guidelines on Base Oil Quality Assurance and Base Oil Interchange, base stocks are divided into six base stock groups according to defined physical and chemical characteristics as follows:

**Group I** Base stocks containing less than 90 mass percent saturates and/or greater than 0.03 mass percent sulphur and having a viscosity index greater than or equal to 80 and less than 120.

**Group II** Base stocks containing greater than or equal to 90 mass percent saturates and less than or equal to 0.03 mass percent sulphur and having a viscosity index greater than or equal to 80 and less than 120.
API Definitions for Base Oils (cont’d)

**Group III**  Base stocks containing greater than or equal to 90 mass percent saturates and less than or equal to 0.03 mass percent sulphur and having a viscosity index of greater than or equal to 120.

**Group IV**  Base stocks are polyalphaolefins (PAO)

**Group V**  All base stocks not included in Groups I, II, III, IV or VI.

**Group VI**  Base stocks are polyinternalolefins (PIO)

The analytical methods to be used in the definition of the above base stock groups are:

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturate content</td>
<td>ASTM D 2007</td>
</tr>
<tr>
<td>Viscosity index</td>
<td>ASTM D 2270</td>
</tr>
<tr>
<td>Sulphur content</td>
<td>ASTM D 2622</td>
</tr>
<tr>
<td></td>
<td>ASTM D 4294</td>
</tr>
<tr>
<td></td>
<td>ASTM D 4927</td>
</tr>
<tr>
<td></td>
<td>ASTM D 3120</td>
</tr>
</tbody>
</table>
STP Re-refining Process

Unit Operations

- Dehydration
- Gas oil removal
- Vacuum distillation
- Finishing and final fractionation
PROCESS DESCRIPTION

- **Dehydration:** used oil is partly vaporized at atmospheric pressure and 160°C to remove water, gasoline, light contaminants (solvents, glycols, lighter organic). Water and lights are condensed and recovered.

- **Gasoil removal:** dehydrated oil is stripped under vacuum for light gasoil removal and flash point adjustment of lube oil.

- **Vacuum distillation:** oil from gasoil stripper is sent to vacuum distillation to recover VGO oil fraction from “heavier than” contaminants. Vacuum distillation is carried out under high vacuum conditions, high temperature and by thin film evaporator.

Thin film evaporator achieves high selectivity and oil purification from metals, heavy polymers, carbon, dust.
Thin film evaporator is a vertical cylindrical shell enclosed in an heating jacket with an internal rotor distributing a thin layer of oil on the heated wall, by means of rotating blades.

By the action of rotor (electrically driven) high turbulence and back mixing occur in the thin layer of the oil film and product degradation at high temperature is avoided.

Main features of thin film evaporator are:

- short residence time (in order of magnitude of 10 seconds) by mechanical agitation of oil on the heat transfer surface;
- high heat transfer rate through the film;
- efficient and regenerative cleaning of the contact surface

Cracking and fouling problems are avoided by keeping low residence time, low wall temperature and high flow turbulence.

Lube oil is recovered as distillate while heavy components, additives, metals and degradation products are concentrated in the bottom residue.
**THIN FILM EVAPORATOR**

- **OPERATING PRINCIPLE**
  A Thin Film Evaporator consists of a cylindrical shell with internal rotor and external heating jacket

- **FEED**
  The feed is distributed by the rotor blades and spread on the heated wall to form an highly turbulent thin layer.

- **PRODUCTS**
  Light fractions are evaporated and flow out up towards the top
  Heavy components flow in a spiral path down to the bottom
FEATURES

- Short residence time and high turbulence in the film give high heat transfer coefficient and avoid overheating, cracking and fouling

- High evaporation rate is obtained by a simple pass

- High oil yield is achieved without degradation or polymerization of heat sensitive material

- High onstream factor and easy maintenance
**Finishing and final fractionation**: vacuum distillate is further finished to improve product quality.

Finishing is done by Chemical Reactor or Hydrofinishing (Base oil API Group II production).

Hydrofinishing provides deep removal of further contaminants such as chlorinated, sulfurous, and oxygenated organic compounds and polyaromatic hydrocarbons.

Finished oil is then fractionated to produce light oil (SN-150) and heavy oil (SN-500).
STP Re-refining Process

- Advanced vacuum system for high vacuum level stability, based on the combined use of steam ejectors and individual tubular condensers.

- High efficiency/low pressure drops special packing in lieu of normal packing (pall rings + grids), to reduce pressure drops and increase oil yield and product separation.

- Special type of pumps and instrumentation for critical services.

- Use of antifouling to reduce fouling and maintenance/cleaning operation.

- Proprietary design Chemical Reactor

- Two Stage hydrofinishing (demetallization + hydrogenation) and high activity catalyst, to upgrade the product quality in accordance with Api Group II specification.
**USED LUBE OIL RE-REFINING**

**USED LUBE OIL CHARACTERISTICS**

**(TYPICAL)**

- **Specific gravity**
  
  - 0.915

- **Viscosity, cst**
  
  - at 40°C: 130
  - at 100°C: 15

- **Composition, wt%**

<table>
<thead>
<tr>
<th>Component</th>
<th>Min.</th>
<th>Norm.</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>2</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Light ends</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Gasoil</td>
<td>2</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Lube oil fraction</td>
<td>65</td>
<td>75</td>
<td>80</td>
</tr>
<tr>
<td>Asphaltic residue</td>
<td>10</td>
<td>13</td>
<td>15</td>
</tr>
</tbody>
</table>

- **ASTM D-1160 Vacuum distillation of dry oil (corrected at atm pressure)**

<table>
<thead>
<tr>
<th>Vol. %</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBP</td>
<td>150</td>
</tr>
<tr>
<td>5</td>
<td>270</td>
</tr>
<tr>
<td>10</td>
<td>325</td>
</tr>
<tr>
<td>20</td>
<td>395</td>
</tr>
<tr>
<td>30</td>
<td>420</td>
</tr>
<tr>
<td>40</td>
<td>430</td>
</tr>
<tr>
<td>50</td>
<td>440</td>
</tr>
<tr>
<td>60</td>
<td>450</td>
</tr>
<tr>
<td>70</td>
<td>470</td>
</tr>
<tr>
<td>80</td>
<td>505</td>
</tr>
<tr>
<td>90</td>
<td>570</td>
</tr>
<tr>
<td>FBP</td>
<td>590</td>
</tr>
</tbody>
</table>
USED LUBE OIL RE-REFINING

USED LUBE OIL PRESELECTION TEST

- PCB / PCT, wt ppm 25 max
- Cl, wt % 0.5 max
- S, wt % 1.5 max
- Saponification N°, mgKOH/g 20 max
- Heavy fuel oil (drop test) pass
- Fatty acids (lux test) pass
## LIGHT GASOIL

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific gravity at 15 °C</td>
<td>0.850</td>
</tr>
<tr>
<td>End point, °C</td>
<td>360</td>
</tr>
<tr>
<td>Viscosity, cst at 40 °C</td>
<td>3-5</td>
</tr>
<tr>
<td>Sulfur, wt%</td>
<td>0.1</td>
</tr>
<tr>
<td>Cetane Index</td>
<td>50-55</td>
</tr>
<tr>
<td>Colour</td>
<td>L 1.0</td>
</tr>
<tr>
<td>Flash point, °C</td>
<td>55</td>
</tr>
</tbody>
</table>

Gasoil can be used as substitution fuel in the Plant or as light fuel oil in industrial fired heaters and/or boilers.
PRODUCTS CHARACTERISTICS

VGO

- Distillation range, °C: 370 - 550
- Specific gravity at 15°C: 0.875
- Viscosity, cst @ 40°C: 27 - 35
- cst @ 100°C: 4 - 5
- Flash point, °C: 210 min
- Sulfur, wt%: 0.25
- CCR, wt%: 0.1 max
- TAN, mgKOH/g: 0.1 max
- Ashes, wt%: 0.2
- Metals content, wt ppm: 10 max

VGO is used as feedstock to FCC or HDC Refinery Units.
## USED LUBE OIL RE-REFINING

### PRODUCTS CHARACTERISTICS

#### RE-REFINED BASE OILS

**API GROUP II**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Base Oil SN-150</th>
<th>Base Oil SN-450</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific gravity at 15 °C</td>
<td>0.870</td>
<td>0.885</td>
</tr>
<tr>
<td>Viscosity, cst at 40 °C</td>
<td>25-32</td>
<td>85-95</td>
</tr>
<tr>
<td>Sulfur, wt%</td>
<td>&lt;0.03</td>
<td>&lt;0.03</td>
</tr>
<tr>
<td>Saturates, wt%</td>
<td>≥90</td>
<td>≥90</td>
</tr>
<tr>
<td>CCR, wt%</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Colour</td>
<td>L 1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>TAN, mg KOH/g</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Flash point, °C</td>
<td>220</td>
<td>260</td>
</tr>
<tr>
<td>Pour point, °C</td>
<td>-3</td>
<td>-6</td>
</tr>
<tr>
<td>Metals, ppm</td>
<td>absent</td>
<td>absent</td>
</tr>
</tbody>
</table>
# PRODUCTS CHARACTERISTICS

## REREFINED BASE OILS

### API GROUP II

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Base Oil</th>
<th>Base Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SN-150</td>
<td>SN-450</td>
</tr>
<tr>
<td>VI</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>PCB, wt ppm</td>
<td>&lt;1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>PCT, wt ppm</td>
<td>&lt;5</td>
<td>&lt;5</td>
</tr>
<tr>
<td>PNA, wt ppm</td>
<td>&lt;1000</td>
<td>&lt;1000</td>
</tr>
<tr>
<td>Cl, wt ppm</td>
<td>&lt;1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Cu corrosion</td>
<td>1a</td>
<td>1a</td>
</tr>
<tr>
<td>Noack evaporation loss</td>
<td>15.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Saponification N°</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Demulsification N°</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Oxydation stability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCR increase, %</td>
<td>0.10</td>
<td>0.15</td>
</tr>
<tr>
<td>Viscosity ratio @ 40°C</td>
<td>1.09</td>
<td>1.1</td>
</tr>
<tr>
<td>Color stability</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>
# PRODUCTS CHARACTERISTICS

## RE-REFINED BASE OILS

### API GROUP I

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Base Oil</th>
<th>Base Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SN-150</td>
<td>SN-500</td>
</tr>
<tr>
<td>Specific gravity at 15 °C</td>
<td>0.870</td>
<td>0.885</td>
</tr>
<tr>
<td>Viscosity, cst at 40 °C</td>
<td>25-32</td>
<td>90-100</td>
</tr>
<tr>
<td>Sulfur, wt%</td>
<td>0.20</td>
<td>0.25</td>
</tr>
<tr>
<td>CCR, wt%</td>
<td>0.05</td>
<td>0.07</td>
</tr>
<tr>
<td>Colour</td>
<td>2.0</td>
<td>2.5</td>
</tr>
<tr>
<td>TAN, mg KOH/g</td>
<td>0.03</td>
<td>0.05</td>
</tr>
<tr>
<td>Flash point, °C</td>
<td>220</td>
<td>260</td>
</tr>
<tr>
<td>Pour point, °C</td>
<td>-3</td>
<td>-6</td>
</tr>
<tr>
<td>Metals, ppm</td>
<td>L 10</td>
<td>L 10</td>
</tr>
</tbody>
</table>
PRODUCTS CHARACTERISTICS

ASPHALTIC RESIDUE

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific gravity at 15 °C</td>
<td>0.950 - 1.050</td>
</tr>
<tr>
<td>Viscosity, cst at 40 °C</td>
<td>10,000</td>
</tr>
<tr>
<td>Viscosity, cst at 100 °C</td>
<td>80</td>
</tr>
<tr>
<td>Sulfated ash, wt%</td>
<td>3-4</td>
</tr>
<tr>
<td>Sulfur, wt%</td>
<td>1-2</td>
</tr>
<tr>
<td>Penetration, mm/10 at 25 °C</td>
<td>200-400</td>
</tr>
<tr>
<td>Softening point, °C</td>
<td>15-20</td>
</tr>
</tbody>
</table>

Residue contains high quantity of polymers and metals and can be used for asphalt blending, production of paving asphalt, bitumen protective covering or as fuel in the cement factories.
## OVERALL MATERIAL BALANCE

<table>
<thead>
<tr>
<th>Product</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used Lube Oil</td>
<td>100</td>
</tr>
<tr>
<td><strong>PRODUCTS</strong></td>
<td></td>
</tr>
<tr>
<td>Water and Light Ends</td>
<td>7</td>
</tr>
<tr>
<td>Light Gasoil</td>
<td>5</td>
</tr>
<tr>
<td>Lube Oil</td>
<td>75</td>
</tr>
<tr>
<td>Asphaltic Residue</td>
<td>13</td>
</tr>
</tbody>
</table>
### OPERATING REQUIREMENT

Utilities Consumption (per MT of Used Lube Oil)

<table>
<thead>
<tr>
<th></th>
<th>VGO or Base oil API Group I production</th>
<th>Base oil API Group II production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric power, Kwhr</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Cooling water, m³</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Steam, Kg/hr (Note 1)</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Fuel, 10³Kcal</td>
<td>350</td>
<td>570</td>
</tr>
<tr>
<td>Chemical, Kg</td>
<td>7.5</td>
<td>-</td>
</tr>
<tr>
<td>Hydrogen, Nm³</td>
<td>-</td>
<td>35</td>
</tr>
</tbody>
</table>

Note:
1 - Steam consumption for vacuum systems does not depend on used lube oil capacity.
OPERATION STAFF

Operating labour requirements will depend on factors such as Plant operating philosophy, geographical location, whether or not the Plant is part of an existing complex.

Based on STP experience with similar Plant, the estimated typical labor and technical staff requirement is as follows:

<table>
<thead>
<tr>
<th>Role</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Manager</td>
<td>1</td>
</tr>
<tr>
<td>Plant Operation:</td>
<td></td>
</tr>
<tr>
<td>Supervisor/Board person</td>
<td>4</td>
</tr>
<tr>
<td>Operators</td>
<td>8</td>
</tr>
<tr>
<td>Maintenance/Workshop:</td>
<td></td>
</tr>
<tr>
<td>Supervisors</td>
<td>1</td>
</tr>
<tr>
<td>Workers</td>
<td>4</td>
</tr>
<tr>
<td>Laboratory</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20</td>
</tr>
</tbody>
</table>

The staffing estimate is provided as a guideline and is intended for preliminary assessment.
Utilities Systems & Offsite facilities at the service of the Re-refining Unit

- Electric power system
- Steam system
- Cooling water system
- Compressed air system
- Fire fighting system
- Sewage and WWT
- Flare system (in case of Hydrofinishing)
- Used oil and Products storage and loading system

ISBL Re-refining Unit includes DCS system, Thermal oil system, Thermal oxidizer, Process water stripper and post treatment (chemox)
The Used Oil Re-refining Unit is a very compact facility. The plot size required for the Unit will depend upon the particular circumstances of the proposed location. The estimated land area required for a 50,000 MTPY Re-refining Unit on a battery limits basis is as follows:

Production of Base Oil API Group I or VGO (without Hydrofinishing) 1,400 sq.mt
Production of Base Oil API Group II (with Hydrofinishing) 2,400 sq.mt
Used Lube Oil Re-refining

FLOW SCHEMES
USED LUBE OIL RE-REFINING

Used Lube Oil Re-refining

Block Scheme
USED LUBE OIL RE-REFINING

Used Lube Oil Re-refining
VGO production
Used Lube Oil Re-refining

Base oil API Group I production

Flow Scheme
USED LUBE OIL RE-REFINING
Used Lube Oil Re-refining
Base oil API Group II production
Flow Scheme
Distillation
USED LUBE OIL RE-REFINING

Used Lube Oil Re-refining

PLANT VIEW AND ELEVATION
USED LUBE OIL RE-REFINING

Used Lube Oil Re-refining

PLANT VIEW AND ELEVATION
USED LUBE OIL RE-REFINING

Used Lube Oil Re-refining

VACUUM DISTILLATION MODELLING
Client: VEOLIA ES CANADA
Location: St. Hyacinthe, Quebec
Capacity: 60,000 Ton/year
Type of Facility: Used Lube Oil Rerefining for production of VGO
Year: in progress. Completion 2012
Client: ECOIL
Location: Ferrandina, Italy
Capacity: 65,000 Ton/year
Type of Facility: Used Lube Oil Rerefining for Base Oils production and Blending
Year: in progress. Completion 2012
Client: TOTAL / VEOLIA - OSILUB
Location: Gonfreville l’Orcher, France
Capacity: 120,000 Ton/year
Type of Facility: Used Lube Oil Rerefining for production of VGO
Year: in progress. Completion 2011
Client: SIRAL S.p.A.
Location: Nola, Italy
Capacity: 30,000 Ton/year
Type of Facility: Used Lube Oil Rerefining for Base Oils production and Blending
Year: 2005-2007
Client: KLOC- KUWAIT LUBE OIL COMPANY
Location: Ahmadi, Kuwait
Capacity: 27,000 Ton/year
Type of Facility: Used Lube Oil Rerefining for Base Oils Production
Year: 1998-2000
Client: SOTULUB – Société Tunisienne de Lubrifiants
Location: Bizerte, Tunisia
Capacity: 20,000 Ton/year (Revamping)
Type of Facility: Used Lube Oil Rerefining for Base Oils production
Year: 1997-1999
Client: **GROUPO LWART**

Location: Lencois Paulista, Brazil

Capacity: 60,000 Ton/year

Type of Facility: Used Lube Oil Rerefining for Base Oils production

Year: 1996-1998
Client: RAMOIL
Location: Naples, Italy
Capacity: 30,000 Ton/year
Type of Facility: Used Lube Oil Rerefining for Base Oils production and Blending
Year: 1994-1996
Client: KONKAT
Location: Armavir, Russia
Capacity: 50.000 Ton/year
Type of Facility: Used Lube Oil Rerefining for Base Oils production and Blending
Year: 1991-1993
Client: SOTULUB- Société Tunisienne de Lubrifiants
Location: Bizerte, Tunisia
Capacity: 16,000 Ton/year
Type of Facility: Used Lube Oil Rerefining for Base Oils production
Year: 1987-1989
Client: EKVE/LPC
Location: Aspropyrgos, Greece
Capacity: 25,000 Ton/year
Type of Facility: Used LUBE Oil Rerefining for Base Oils production and Blending
Year: 1983-1985
The re-refined lube oils produced by STP process have been approved by USA Department of Army, USA Lubricants Research Institute, Grandi Motori Trieste (Italy), FIAT (Italy), ANSALDO Motori (Italy) and Mercedes Daimler Benz (Germany).

The Approval Certificates and Test Report are available on request.

Certificates and Test Report clearly show that the base oils product are top quality and suitable for motor and industrial application.

Re-refined base oils characteristics and performance are fully equivalent to the virgin lube oils.
Carlo G. Lombardi is the Chief Executive Officer and Managing Director of STP, Studi Tecnologie Progetti S.r.l..

He has more than 20 years experience in design and implementation of Used Lube Oil Re-refining Plants and is a recognized worldwide leading expert of Used Lube Oil Re-refining and one of the pioneer of the Re-refining technology based on thin film evaporator and hydrofinishing process.

Mr. Lombardi is author of presentations on Used Lube oil Re-refining and former lecturer at the Industrial Chemistry Institute of Chemical Engineering College at Rome University.
His experience in Lube Oil Technology and Marketing includes:

**Technology:**

- Process technology development
- Pilot testing for the application of thin film evaporator to Used Lube Oil Re-refining in the year 1980 at HABERLAND Co., Dollbergen, Germany
- Design of the first industrial Re-refining plant in Greece for the former EKVE Industries, at Aspropyrgos, Greece

**Marketing and Sales Strategy:**

- Cooperation with the Italian “Obligatory Consortium of Used Lube Oil” to set up the procedures and regulation for the collection of the Used Lube Oil in Italy
- Participation with SOTULUB and other Tunisian Lube Oil distribution Companies to the assessment of regulation and quality specification of re-refined lube oil in Tunisia, years 1983-84
- Cooperation with REDOIL Italy, partner of Chall-Oils USA, for finished lubricant formulation, Motor Oil, Transmission Fluids, White Oils, Industrial Oils
- Cooperation with AGIP PETROLI, Italy, on lubricant production, marketing and selling.
Publications and Conferences:


STP attendance to NORA Conference at Palm Springs (USA)
STP attendance to NORA Conference at Palm Springs (USA)

1999 LIQUID RECYCLING CONFERENCE AND TRADE SHOW
PALM SPRINGS – November 10 – 13, 1999

MODIFICATION OF EXISTING REFINING UNITS
AND REALIZATION OF NEW MODULAR UNITS

Mr. Carlo G. Lombardi
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