



**Integrated Green Life-Cycle Management
of Waste Oils and Residues**

LIFE10 ENV/GR/000606



Layman's Report

CYCLON HELLAS S.A.

**Athens
February 2015**



Contents

Basic Project data	3
1 Introduction.....	4
1.1 The ELINA project & the environmental problem targeted	4
1.2 ELINA results & direct environmental benefits	5
1.3 ELINA sustainability & long term results	6
2 Review & Analysis of WO&PR Legislation Framework.....	7
3 Distribution of questionnaires, sampling & analysis.....	8
4 WO&PR inland pilot collection and separation at source onboard ANEK's ships.....	9
5 Green Practice Guide for WO&PR management.....	11
6 Stakeholder Forums & Dissemination activities.....	12
7 The Team	13

Figures

Figure 1: Pilot WO&PR collection per activity (%w/w).....	9
Figure 2: Pilot WO&PR collection per waste group (%w/w)	9

Pictures

Picture 1: Green Practice Guide	5
Picture 2: Vacuum Distillation apparatus.....	8
Picture 3: Oil – water Separator and Piping Network (OLYMPIC CHAMPION, ANEK).....	10
Picture 4: Approval of the WO&PR ship collection system from the Classification Society "RINA"	10
Picture 5: Green Practice Guide for WO&PR management on ships.....	11
Picture 6: 1 st Stakeholder Forum (Athens, 05.07.2012)	12
Picture 7: ELINA Dissemination event (Chania 03.07.2014).....	12
Picture 8: ELINA poster.....	12

Tables

Table 1: Number of Distributed Questionnaires & Samples per Stakeholder Main Activity	8
Table 2: WO&PR category, origin & management route	8



Basic Project data

LIFE+ Project Number
LIFE+10 ENV/GR/606

LIFE+ PROJECT NAME & ACRONYM
**Integrated Green Life-Cycle Management of
Waste Oils and Petroleum Residues
"ELINA"**

Project Data

Project location:	Greece
Project start date:	01/09/2011
Project end date:	28/02/2015
Total Project duration (in months):	42
Total budget:	2.040.875 €
Total eligible budget:	2.000.000 €
EU contribution:	1.000.000 €
(%) of total costs:	49
(%) of eligible costs:	50

Beneficiary Data

Name Beneficiary:	LPC S.A. Corporation of Processing and Trading of Lubricants and Petroleum products
Contact person:	Mr Miltiadis BANTIS
Postal address:	Megaridos Ave 124, GR-19300, Aspopyrgos, Greece
Visit address:	Megaridos Ave 124, GR-19300, Aspopyrgos, Greece
Telephone:	+302108093371
Fax:	+302108093180
E-mail:	memmanouilidou@konkat.gr
Project Website:	www.elina.org.gr



1 Introduction

ELINA is a LIFE+ 2010 Environment Policy and Governance project aimed at addressing and implementing EU and Greek legislation relating to the integrated management of waste oils & petroleum residues (WO&PR), which are the largest waste stream directly derived from petroleum.

ELINA was initiated in September 2011, lasted 42 months and ended in February 2015. The project's workload was carried out by CYCLON HELLAS S.A. (industrial company active in petroleum lubricant re-refining and trading), the ECOLOGICAL RECYCLING SOCIETY (NGO active in sustainable waste management) and ANEK LINES S.A. (shipping company).

1.1 The ELINA project & the environmental problem targeted

WO&PR are defined as any semi-solid or liquid state waste consisting totally or partially of mineral oil or synthesized hydrocarbons, oily residues from tanks, oil-water mixtures and emulsions that contain primarily hydrocarbons mixed with water. WO&PR originate from different sources -mainly ships; fuel bunkering facilities and large industrial plants, where hydrocarbons are used as fuels, lubricants, hydraulic / heat transfer / electrical insulating (dielectric) liquids etc.

WO&PR represent a significant portion of the volume of organic liquid wastes generated in Europe and worldwide.

Today, in Greece, there are approximately 166.000 tonnes of WO&PR generated per year and the three legal management methods to handle this waste are:

1. Collection, possible pre-processing (e.g. in ports or off shore, separated waters are discarded as is in the sea) and disposal at the crude oil refinery for re-refining.
2. Mixing with wood-chips for the production of stable secondary fuels with a relatively low heat capacity for disposal in cement kilns.
3. Disposal via trans-boundary transportation abroad.

The above mentioned methods have significant problems as WO&PR are sometimes mixed with waste lube oils (WLO), two waste streams with different recycling and regenerations requirements. Such practices affect the quality of fuels and lube oils that may be produced from re-refining of WO&PR and WLO respectively.

1.2 ELINA results & direct environmental benefits

The results and environmental benefits that arose from ELINA are:

- ✓ A detailed list of the EU and national legislative framework that regulates the management of WO&PR and WLO. Furthermore, the legislative review was extended in order to include International and national naval laws and conventions that deal with the WO&PR management.
- ✓ A detailed catalogue of quantities and sources of WO&PR produced in Greece from the shipping sector and industrial sectors.
- ✓ A very significant level of sampling and the identification of the chemical composition of WO&PR produced from 604 sources in Greece. Among other things, it was concluded that WO&PR sometimes are mixed with WLO on ships.
- ✓ The collection and regeneration of 7.236 tonnes of WO&PR from 487 locations in Greece.
- ✓ The pilot implementation and demonstration of a source separation scheme for WO&PR and WLO generated on two of ANEK's high speed ferries (HELLENIC SPIRIT and OLYMPIC CHAMPION).
- ✓ The pilot dehydration / concentration of WO&PR on-board and thus, the delivery of less wastes to Port Authorities.
- ✓ The realisation of 6 stakeholder forum meetings for the strengthening of national producer responsibility legislation in this field. Representatives from at least 100 stakeholders participated in 6 meetings.
- ✓ The cataloguing of existing infrastructures for the environmentally sound and certified processing of WO&PR including proposals for expanding/ improving those infrastructure.
- ✓ The publication of 4.000 copies of a Green Practices Guide and additional 300 copies of the three (3) short versions (Green Practice Guide for WLO, for WO&PR from Ships and for WO&PR from Industries).
- ✓ The creation of a data base of 1.128 stakeholders.
- ✓ One web-site with all project's findings that will be active until 2020.
- ✓ 12 e-newsletters produced and distributed to stakeholders.
- ✓ 11.000 leaflets and 2.000 posters produced and distributed to stakeholders.
- ✓ 1 dissemination event in ANEK's headquarters, Crete with more than 70 participants.
- ✓ 1 final dissemination event in Athens, Greece with 66 participants.



Picture 1: Green Practice Guide



1.3 ELINA sustainability & long term results

As a result of the project's activities and besides its direct environmental benefits, the project findings have led to some important conclusions that could lead to further long term environmental benefits, as detailed below:

- ✓ The detailed mapping (sources, quantities, chemical composition, storing infrastructures) of the WO&PR production around Greece and probable use of that knowledge for the partial mapping of WO&PRs generated in the EU.
- ✓ The effective demonstration of a pilot collection scheme of WO&PR around Greece that could be expanded to a new alternative WO&PR sustainable management as part of a National Waste Management Strategy that will promote the separation and distinct collection of WO&PR in line with the Waste Framework Directive 2008/98/EC and the circular economy package.
- ✓ The consultation regarding the necessity of establishing an integrated management system for WO&PR in Greece as another specific waste stream (like packaging waste, waste lube oils etc.) that needs to be handled in an environmental friendly and sustainable way, according to the "Producer responsibility" principle.
- ✓ The production of guidelines regarding the low cost technical modifications in a ship's engine rooms for separate collection and temporary storage of WO&PR and WLO on board.
- ✓ The use of proven technical solutions for the 'in situ' management of WO&PR in ships by separating aqueous and oily phase and thus, by minimizing the quantities of WO&PR delivered to waste managers prior to their processing at regeneration units.
- ✓ Consultation on the separate collection of WO&PR according to their origin and quality and apart from WLO on ships, with the involvement of International Maritime Organization (IMO). Greece, as a member of the IMO and through the collaboration with all local port authorities can assist the IMO in the formation of a regulatory framework regarding the separate collection of WO&PR aboard each ship.
- ✓ The revision of MARPOL 73/78 and its Annex I (Prevention of Pollution by Oil) so as to incorporate separate collection of WO&PR according to their origin and quality and apart from WLO. MARPOL 73/78 Convention includes regulations aimed at preventing and minimising pollution from ships, both accidental pollution and that from routine operations.
- ✓ Adapting measures, technical specifications and integrated codes of "green practices" by ship owners, industrial infrastructures and in general, all mandated entities to implement the environmentally friendly management of WO&PR.



2 Review & Analysis of WO&PR Legislation Framework

In the framework of identifying the issues that should be addressed in order to expand the separation at source of WO&PR, all legal documents that were related with the management of the respective waste stream were reviewed. The work consisted in mapping, analysing and evaluating the current European, National and Maritime legislation on WO&PR management.

In particular, European Directives were reviewed in correlation with National provisions from EU member states in the field of hazardous waste and specifically WO&PR. A comprehensive list of relevant Greek legislation was produced (laws, presidential decrees and ministerial decisions). The respective analysis aimed to define the most crucial legislative acts regarding the WO&PR management "chain" from collection to regeneration, recovery or final disposal.

As part of the legislative framework analysis, the rate of harmonization among National and European laws was investigated. Moreover, the sections that specified means, infrastructure and equipment necessary for sustainable and environmental friendly collection, transportation, temporary storage, processing and final disposal of WO&PR were underlined.

The analysis of the legislative framework was expanded in order to include maritime laws and especially MARPOL 73/78 and its incorporation into national maritime law. The relevant legislation sets the terms, conditions and prerequisites regulating the on-board management of WO&PR as well as the technical specifications that must be followed for installing equipment that will support the separate collection of certain waste streams and among them WO&PR and WLO.

Legislative provisions for WO&PR management were prioritized according to their importance, starting from the most current ones. In particular, the respective list was presented in the following order:

- ✓ European legislative framework
- ✓ National laws of the most developed EU member states.
- ✓ Greek legislative framework (laws, Presidential Decrees, Common Ministerial Decisions, Ministerial Decisions and Circular Provisions).

In the framework of the ELINA project, the mapping, analysis and evaluation of WO&PR legislative framework was accomplished in order to support the assessment of legal instruments, so as to formulate specific proposals with both managerial and legal content. These statements were formed in order to facilitate and enhance issues regarding separate collection of waste oil and petroleum residues in line with the waste minimization principle set out by the Waste Framework Directive 2008/98.

3 Distribution of questionnaires, sampling & analysis

The ELINA partners designed and distributed 3 types of questionnaires (for industries, for ships and for ports) in order to collect useful information on the WO&PR production and management practices in Greece.

Along with the data collection process, CYCLON also collected samples that helped at categorizing different petroleum derived wastes streams so as to propose afterwards their optimal management scheme. The following table presents the distributed questionnaires as well as the WO&PR samples analyzed in the framework of the project.

Table 1: Number of Distributed Questionnaires & Samples per Stakeholder Main Activity

Activity	Questionnaires sent	Samples analysed
Port	13	41
Harbors	14	25
Shipping companies	26	15
Shipyards	18	0
Hellenic Navy	5	113
Hellenic Army	-	3
Hellenic Public Power Corporation (HPPC)	27	42
WO&PR Manager	4	121
Metal industries	23	55
Other industries	48	52
Petrol Stations Companies	17	135
Other	35	2
TOTAL	230	604



Picture 2: Vacuum Distillation apparatus

The physicochemical laboratory analysis of the collected samples was based on the characterization of oily and aqueous phase and various parameters were tested (humidity, density, viscosity, boiling range, metal content, elementary analysis, sediments, pour point, flash point, saponification number, water by distillation, microbial load, energy content etc). Those laboratory tests along with CYCLON's regeneration expertise led to determine the optimal end-of-life management method of each waste category.

Table 2: WO&PR category, origin & management route

Group	Origin	Management route
Emulsions (soft)	Metal industries	Wastewater treatment unit
Emulsions (hard)	Metal industries	Re-refining
Oily wastewaters	Activities without wastewater treatment	Wastewater treatment unit
Other wastewaters	Mostly waste antifreeze	Disposal
Fuel oil and residues	Mostly from ships and HPPC facilities	Re-refining
Dirty gas oil	Navy	Crude oil refinery



4 WO&PR inland pilot collection and separation at source onboard ANEK's ships

CYCLON set up a pilot collection network of WO&PR from various industrial plants around Greece, electric energy generation facilities, petrol stations and ports. This strategy has given very promising signs as 7.236 tonnes of WO&PR were collected.

The origin and WO&PR category of the collected quantities are presented in the figures below.

Figure 1: Pilot WO&PR collection per activity (%w/w)

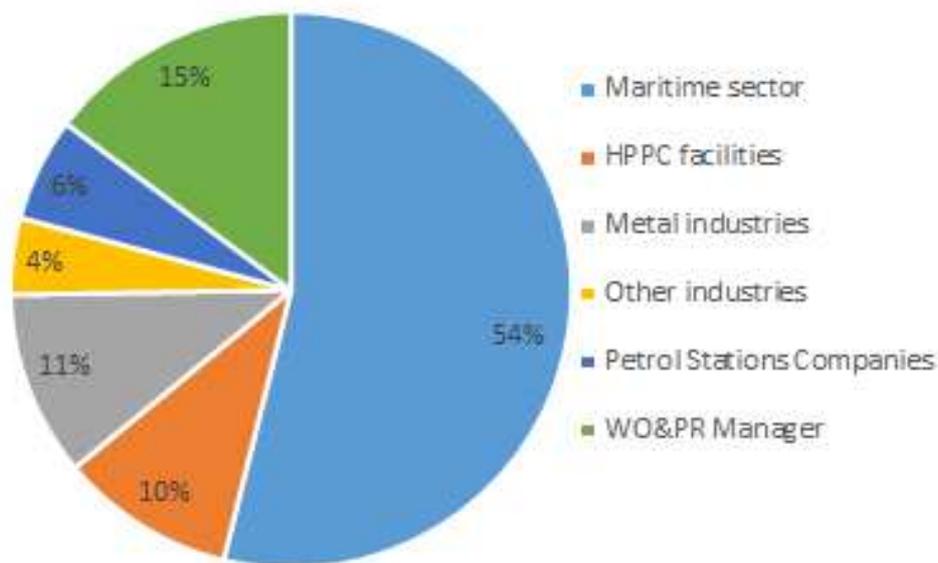
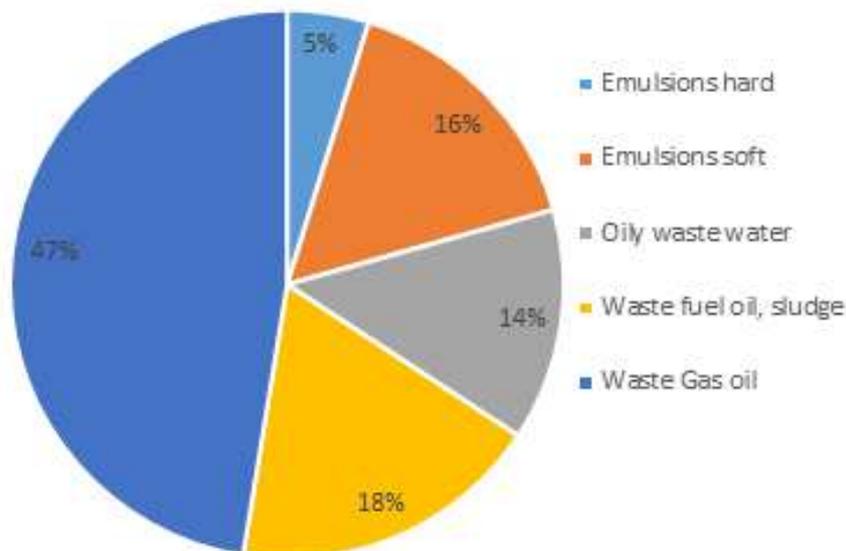


Figure 2: Pilot WO&PR collection per waste group (%w/w)



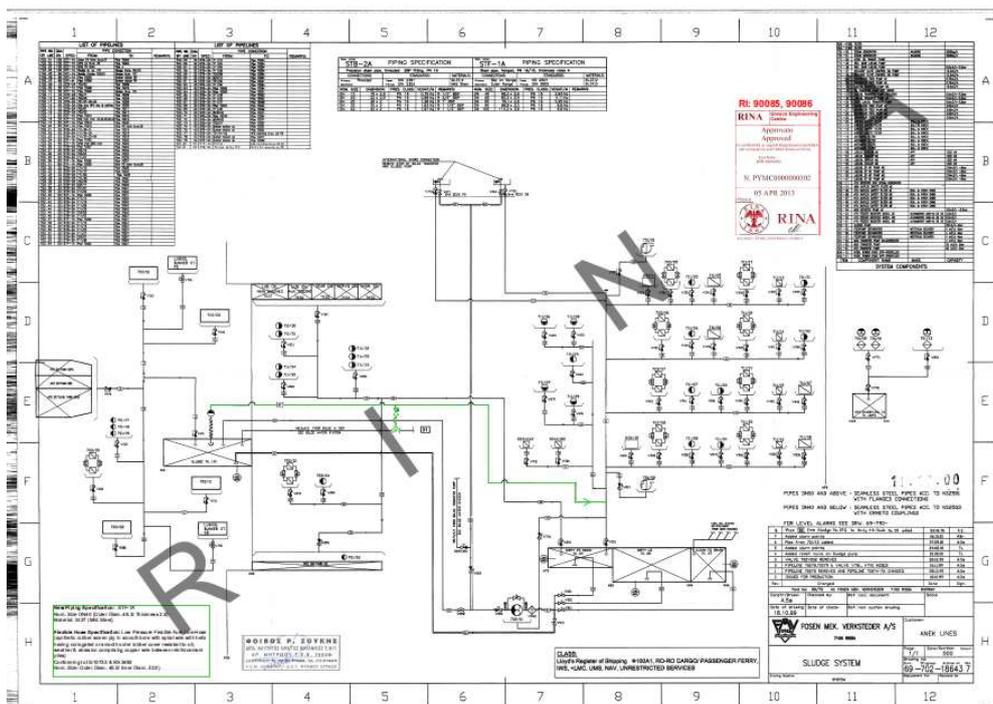


Additionally, ANEK designed, acquired all the necessary regulatory approvals from the RINA ship Register and constructed a separate collection system of WO&PR, distinct from all other waste streams, in the engine rooms of the OLYMPIC CHAMPION and HELLENIC SPIRIT high speed ferries. Following those modifications, ANEK separately collected 44,50 m³ of WO&PR from the HELLENIC SPIRIT and 47,00 m³ WO&PR from the OLYMPIC CHAMPION. Those quantities were delivered to the Port Authorities at the calling ports of the 2 ships. ANEK also separately collected and delivered more than 20 m³ of waste lube oil.

Picture 3: Oil – water Separator and Piping Network (OLYMPIC CHAMPION, ANEK)



Picture 4: Approval of the WO&PR ship collection system from the Classification Society "RINA"



5 Green Practice Guide for WO&PR management

The review of the legislative framework, the sampling of various WO&PR, the identification of existing WO&PR management methods, the pilot collection of this waste stream maround Greece and the pilot separation at source in 2 passenger ships helped ERS to formulate a detailed “Green Practice Guide”.

The “Green Practice Guide” includes a detailed list of procedures that will ensure the environmental friendly and sustainable management of WO&PR regardless of their originating sources. Furthermore, three (3) short versions of the “Green Practice Guide” were formed in order to customize WO&PR management in accordance with their three major originating sources, namely WO&PR from Ships, WO&PR from Industries, WLO from both ships and industries.

In particular, the “Green Practice Guide” includes the following:

- The characterization of WO&PR based on their primary production sources.
- The best available techniques (BATs) regarding WO&PR in Greece, including the separation at source scheme for the shipping industry already developed and applied by ANEK in the framework of ELINA onboard the HELLENIC SPIRIT and the OLYMPIC CHAMPION ships.
- A list of procedures, activities, means, infrastructure, equipment and human resources needed for the environmental friendly and sustainable management of WO&PR.
- Suggestions for optimizing WO&PR management by increasing the collected quantities and upgrading the recycling potential of this waste stream.
- Presentation of the most effective and efficient technological solutions regarding the transformation of WO&PR into useful primary and/or secondary end products.
- Regulating framework regarding the procedures in the port reception facilities.
- Mapping of the most crucial terms and conditions that regulates WO&PR management as described in International Conventions, European Directives, European Regulations and National Law.



Picture 5: Green Practice Guide for WO&PR management on ships

6 Stakeholder Forums & Dissemination activities

ERS coordinated 6 Stakeholders' Forums that aimed to develop strategies for addressing and implementing the sustainable management of WO&PR. The Forums targeted a specialised audience comprising representatives from ministries, local authorities, port authorities, waste producers and waste managers. These Forums acted as a melting point of different perspectives, regulatory requirements, business interests and helped all involved parties realise that a sustainable added value



Picture 6: 1st Stakeholder Forum (Athens, 05.07.2012)

can only be derived in terms of social, environmental and financial benefits by collaboration and mutual assistance.



Picture 7: ELINA Dissemination event (Chania 03.07.2014)

The ELINA partners also developed broad dissemination activities that included the creation of the project's website (www.elina.org.gr), electronic newsletters, press releases and press conferences, leaflets, posters, various dissemination material, notice boards, major dissemination events (in Chania and in Athens) and extensive networking with projects that were relevant to ELINA's aims, objectives, applied techniques and geographical deployment.

ELINA ultimately proposed that WO&PR are an important waste stream that must be considered in the Greek National Waste Management legal framework as a standalone stream that requires a nation-wide end-of-life management scheme.

Overall, ELINA can proudly be considered by the projects beneficiaries, stakeholders and regulators as an effective, well deployed project that demonstrated that sustainable management of WO&PR may be at the same time beneficial for the society, the environment and the financial interest of the involved parties.



Picture 8: ELINA poster



7 The Team

The ELINA Project was completed through the effective and successful collaboration of CYCLON HELLAS S.A. (coordinating beneficiary), ECOLOGICAL RECYCLING SOCIETY (associated beneficiary) and ANEK LINES S.A. (associated beneficiary).

CYCLON HELLAS S.A. (CYCLON) is an industrial and commercial Greek company, a pioneer in the field of petrochemicals, being the only enterprise in Greece that is active at the same time in the industrial production of lubricants (base oils included), the production and trade of packaged lubrication products and the sale of liquid fuels.



(URL: <http://www.cyclon.gr/>, mail: info@cyclon.gr).

The **Ecological Recycling Society** (ERS) is a Greek environmental non-governmental organization. Since 1990, it has been active in with the promotion and implementation of environmentally sustainable waste management and awareness raising at the local, national, European and international levels. The organization is also active in the fields of sustainable use of natural resources and energy, sustainable production and consumption of goods, as well as in supporting environmentally-sound solutions to other environmental issues.



(URL: <http://www.ecorec.gr/>, mail: info@ecorec.gr).

The **ANEK LINES S.A.** is a Greek company, founded in 1967 aiming to improve maritime transport between Crete and mainland Greece.



Today, after almost five decades, the company is a pioneer in the passenger shipping industry of Greece and the Adriatic Sea by operating 10 modern passenger vessels, all registered under the Greek flag, certified by the International Security and Quality Systems of ISM, ISPS, ISO and HACCP. By applying the International STCW Convention of 1995 relating to the quality of the crews, ANEK has managed to maintain a leading position in the field of international and domestic shipping.

(URL: http://web.anek.gr/portal/page/portal/ANEK_prod, mail: customerservice@anek.gr).