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Project start date: 1/01/2011
Project end date: 31/12/2015

LIFE + EUROPEAN PROGRAMME
ENVIRONMENT POLICY &
GOVERNANCE 09/ENV/GR/291



LAYMAN'S REPORT



PROTEAS

REACH PROTOCOL FOR EMISSIONS AND ACCIDENT SCENARIOS
IN SUPPLY AND DISTRIBUTION OF FUELS AND PETROCHEMICAL PRODUCTS

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1. BACK GROUND

Fuels, petrochemicals and other dangerous products across their multimodal supply chain may have an environmental impact when their normal emissions or accidental spills are not fully prevented, controlled or mitigated in all the involved operations during transportation, distribution, storage or handling stages. Fuels and other dangerous substances as fluids can escape from their containment into the air, water or soil, and can contaminate the human environment, fauna and flora causing harm to health after acute or long term exposure when inhaled, ingested or by entering into the food chain through plants, fish or other animals.

Normal emissions of minor amount of chemicals into the air, water or soil, occur frequently during several operations e.g.:

- across transportation and distribution routes (on land via road/rail trucks and pipelines or in water via tank vessels and carriers),
- loading and unloading operations in ports, rail or road truck stations through pipelines, hoses, etc.,
- refilling and handling operations in intermediate storage installations and stations where depot tanks, trucks and other cars are involved,
- sampling, testing, cleaning and maintenance operations in any type of fluid containment and flow circuits including vessels, tanks, pipelines, pumps, compressors, seals, valves etc., and
- in any other closed or open operational systems according to the implemented technology such as vapour recycling and recovery, safety relief, normal or emergency venting, spill confinement, collection, dumping, separation or neutralization arrangements, etc.

Accidental releases of larger amount of harmful or toxic substances into the environment can be the result of infrequent disasters or incidents. The probability and the risk of a large leak or accidental spill of dangerous substances to water, soil or air, should always be kept as low as reasonably practicable (ALARP) at any stage, mode or operation during transportation, supply, handling and storage. This applies to a wide variety of containment, tanks, equipment and instrumentation used in water, rail, road and pipelines supply systems the integrity of which should always be safeguarded and controlled by the appropriate technical, managerial and organizational measures.

The environmental impact, whether due to emissions or accidental releases of dangerous substances, becomes more important when supply and transportation routes become closer to conflicting land uses or land uses either densely populated by receptors potentially exposed to environmental effects or frequented by more vulnerable receptors. In many EU countries there are multiple, diverse and in cases conflicting land uses close to supply and transportation routes and stations. In the extended coastline of Greece for instance, of approx. 15,000 km, there are certain coastal zones that serve in common as, commercial and touristic ports, industrial terminals for energy and fuel supply with pipelines, coastline resorts, urban centers, etc. All such versatile land uses and activities can co-exist under the condition that specific sustainable development rules and a sound safety management system promoting risk prevention in environmentally vulnerable areas are implemented including Strictly Controlled Conditions (SCC) for the transportation and supply stages of chemicals.

Interdependent stakeholders involved in the supply and distribution chain of hazardous chemicals encounter problems to get harmonized among them on Health Safety and Environmental (HSE) requirements. Effective and harmonized implementation of relevant Regulations including REACH, in several EU Member States, is thus affected. As a consequence, there is an ongoing need in performing HSE controls and providing technical support to all stakeholders involved. In Greece and Cyprus particularly, a solid technical background is needed for the support, development and implementation of relevant policies and of appropriate methodological tools related to the HSE and Hazardous Chemicals Regulations.

2. THE PROTEAS PROJECT

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The main goal of the project is to develop a Protocol of good practices with the essential HSE provisions, procedures, obligations and recommendations useful to all stakeholders involved in the management of chemical risks related to the supply and distribution of fuels, petrochemical products and other dangerous substances in Greece. The protocol supports the implementation of HSE Regulations and best industrial practices and procedures aiming at the reduction of human and environmental consequences arising from the emissions or accidental releases of hazardous chemicals in different transportation modes (road, rail, sea and pipelines) and supply stages such as loading/ unloading, in transit, temporary storage and distribution. Prime concern in the development of the Protocol is the definition of “Strictly Controlled Conditions” for the safe handling of fuels and other dangerous substances. Project's primary goal is to raise the awareness of stakeholders, employees and the public on HSE risks and accident prevention.

3. THE RESULTS OF THE PROJECT

The project objectives have been completely achieved through the development and dissemination of the PROTEAS Protocol (e-tool) of good practices for the safe handling of dangerous substances. The main results include among others:

- An overview has been performed on HSE Regulations, Best Available Techniques (BATs), industrial practices and safety procedures for “Strictly Controlled Conditions” (SCC) in the supply and transportation stages of fuels and other hazardous chemicals, as implemented in Greece.
- A dedicated analysis performed in numerous international accidents involving dangerous substances of all Classes (flammables, toxics, corrosives) showed that road transportation of fuels and loading/ unloading in particular, pose higher risks than other modes of transport or supply stages. Human casualties are mostly related to lighter fuels (Gasoline) while environmental impact to heavier fuels (Diesel).
- Extended measurements and laboratory analyses have been carried out on possible emissions and spills in numerous loading/unloading sites and location where fuels are likely to be present. Water, soil and air samples from 400 sites around Greece, were analyzed for PAHs, n-alkanes, VOCs and BTEX, and evaluated with fingerprinting methods. More than 700 measurements in ports, truck & petrol stations, etc. showed that concentrations of pollutants are well within regulatory limits with soil and sediments keeping a better pollution memory than surface waters.
- A Life Cycle Analysis (LCA) performed for all transportation stages of primary fuels (Gasoline, Diesel and LPG) in Greece showed that the environmental impact expected from transportation releases and potential accidents is low compared to the emissions from combustion engines and electricity usage relevant to transportation.

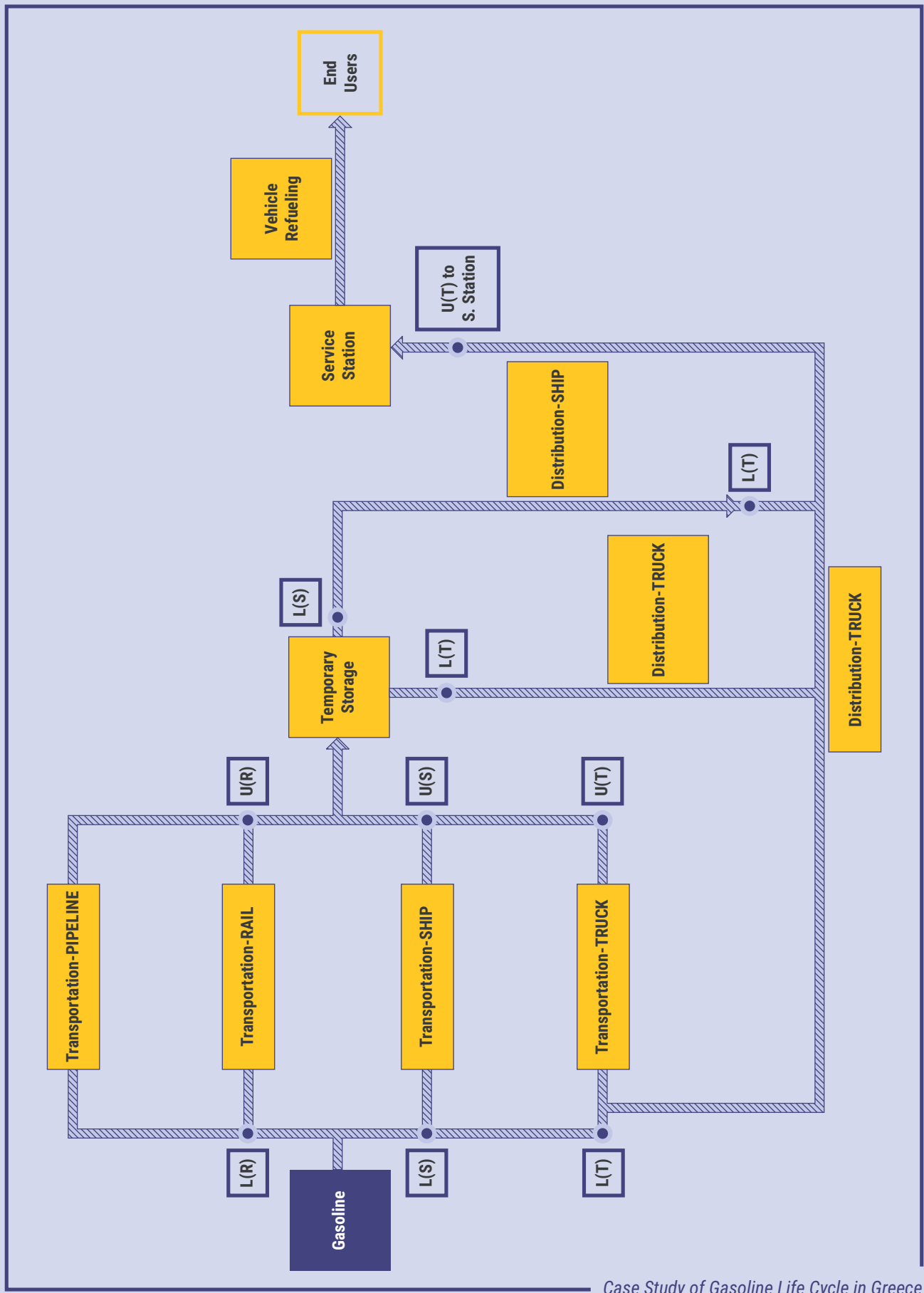
- A Protocol of good practices has been developed as an e-tool (PROTEAS Protocol), including practical HSE guidelines and information based on BATs for the control of accidental releases and the safe handling of fuels and other hazardous chemicals.
- An ADR CONTROL Inspection e-tool has been developed (PROTEAS ADR CONTROL) for ADR roadside checks of vehicles carrying dangerous goods.
- Generalized Safety Data Sheets (SDSs) have been developed for substance Hazard Classes such as Flammable gases, Non-flammable, Non-toxic gases, Toxic gases, Flammable liquids, Oxidising substances, Toxics, Corrosives and Miscellaneous dangerous substances and articles.
- Web-based intelligent tools have been developed to support the implementation of HSE legislation, namely the “PROTEAS Legislation Search Engine” for information retrieval of national, EU and International Legislation related to chemicals handling and transportation (REACH, CLP, SEVESO, ADR, IMDG, etc.) and the “PROTEAS Discussion e-Forum” for information exchange on issues related to handling of hazardous chemicals.
- An Information Centre on Hazardous Chemicals has been designed including Specifications of five functional tools for systematic support of users (SMEs, industry, transporters, etc.) on handling and transportation of petrochemicals and environmentally dangerous chemicals.
- Dissemination and training activities have been carried out including informational and awareness events, workshops, seminars, etc. with the participation of Competent Authorities and Industry.

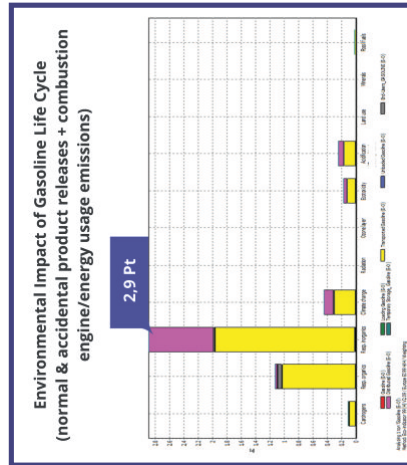
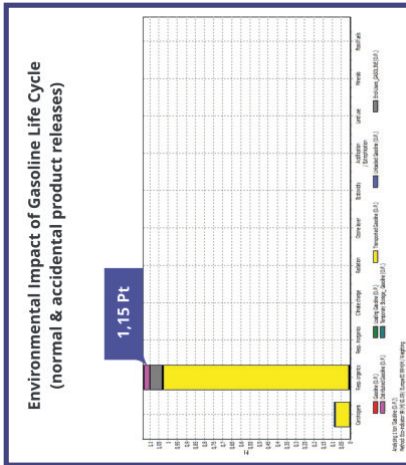
	Class 1	Class 2.1 (LPG)	Class 2.2	Class 2.3 (Chlorine)	Class 3 (Gasoline + Gasoil)	Class 4.1	Class 4.2	Class 4.3	Class 5.1 Oxidizing substances	Class 5.2	Class 6.1	Class 6.2	Class 7	Class 8 (Sulphuric acid)	Class 9
Loading/Unloading		×		×	×				×					×	
Transportation	Road	×		×	×				×					×	
		×		×	×				×					×	
		×		×	×				×					×	
		×		×	×				×					×	
Pipe-lines					×										
Rail		×		×	×				×					×	
Temporary Storage		×		×	×				×					×	
Supply stations		×			×										
Distribution		×			×										
Use		×		×	×									×	



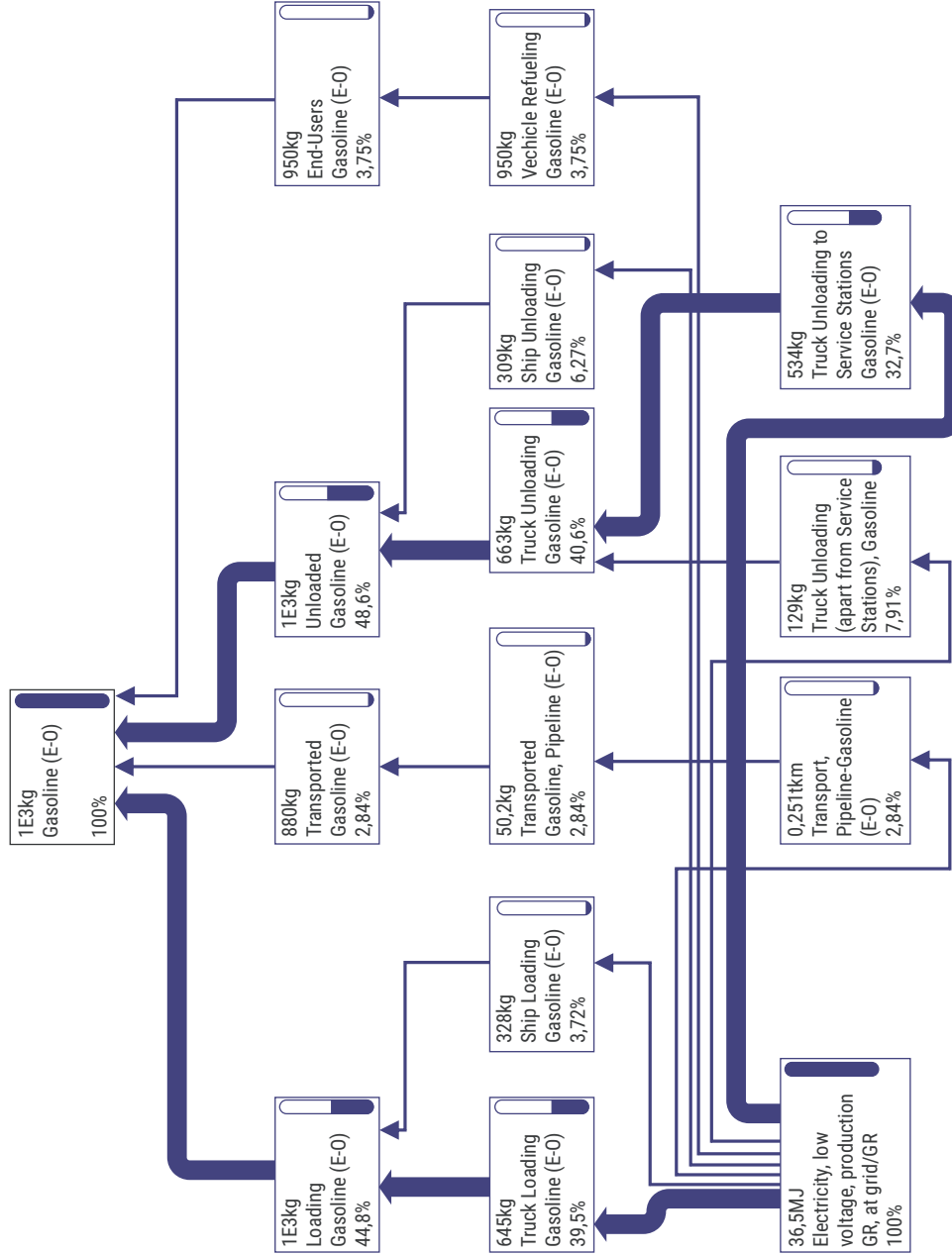
*Sampling, measurements
and laboratory analyses
of emissions and spills
to water, soil and the
atmosphere*







Indicative results of
PROTEAS Life Cycle
Impact Assessment
(LCIA)



**GASOLINE - ENERGY -
OPERATION CASE STUDY -**
Contribution of LC stages
to air emissions of
Hydrocarbons, aliphatic,
alkanes, cyclic in %
(processes contributing
more than 2%)

4. THE PROTEAS PROTOCOL E-TOOL

www.kartes.proteas-reach.gr

The PROTEAS Protocol is an innovative web-based tool that systemizes BATs and industrial practices for the safe transport and distribution of hazardous chemicals in four transportation modes: Road, Rail, Sea, Pipelines.

The Protocol e-tool includes practical HSE guidelines on the control of accidental releases and the safe handling of selected chemicals. It consists of two connected sub-platforms:

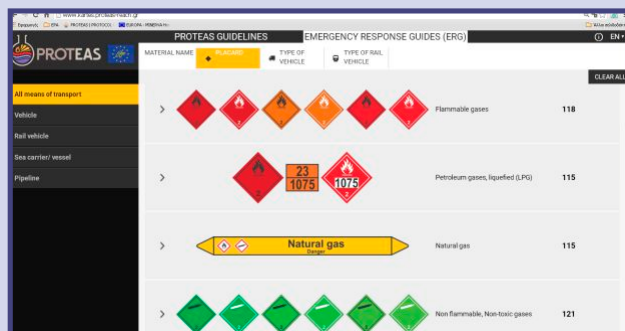
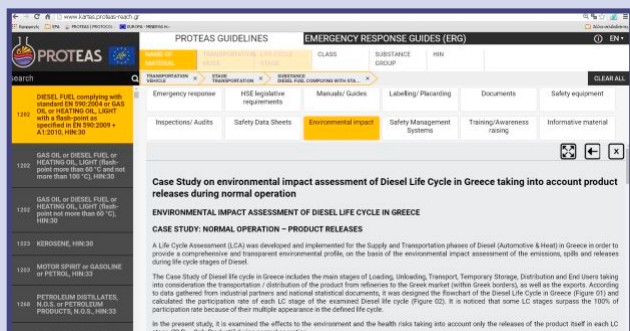
A. The PROTEAS Guide e-Tool including practical HSE guidelines related to safe loading/ unloading and handling of fuels and other hazardous chemicals and emergency response plans in transportation cycle for selected hazard classes and selected chemicals (more than 2000 hazardous chemicals). The HSE information is presented per transportation mode, life cycle stage, hazard class, group of substances, hazardous chemical and Hazard Identification Number (HIN). The HSE data has been further analyzed and presented in twelve categories such as:

- Emergency response; HSE legislative requirements; Manuals/ Guides; Labeling/ Placarding of HazChems; Documents (transport/ operation documents); Safety equipment; Inspections/ Audits; Safety Data Sheets; Environmental impact; Safety Management Systems; Training/ Awareness raising; Informative material

B. The Emergency Guide e-tool according to the Emergency Response Guidebook 2012 of US Department of Transportation: this platform includes emergency plans per type of Road trailer, Rail vehicle and placard that shall be affixed to the transport unit carrying dangerous goods (this application is very useful and can be used if materials cannot be specifically identified by using the transport documents or numbered placards). The e-tool includes more than 100 placards used on transport vehicles, transport rail vehicles, pipelines and sea carriers carrying dangerous goods for all hazard classes and specific chemicals according to European and International Regulations (ADR, RID, CLP, IMDG).

In total the Protocol includes HSE information for 4 transportation modes, 7 life cycle stages, 8 hazard classes, 46 groups of substances, more than 2000 hazardous chemicals and 96 HIN. The information is presented in "Protocol Cards" and in Technical Manuals, Guides and information cards. The users according to their choice among thousands of search combinations can have access to all "Protocol Cards" with solid information on safety and environmental protection matters.

The Protocol e-tool has been uploaded on the PROTEAS website (<http://www.kartes.proteas-reach.gr/>). The Protocol is available in Greek language while an English version of the tool has been prepared including HSE information such as "Emergency response", "SDSs", "Environmental impact" for selected hazardous chemicals.



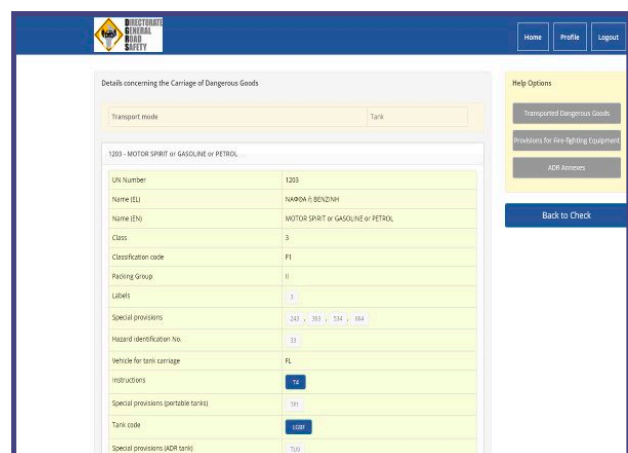
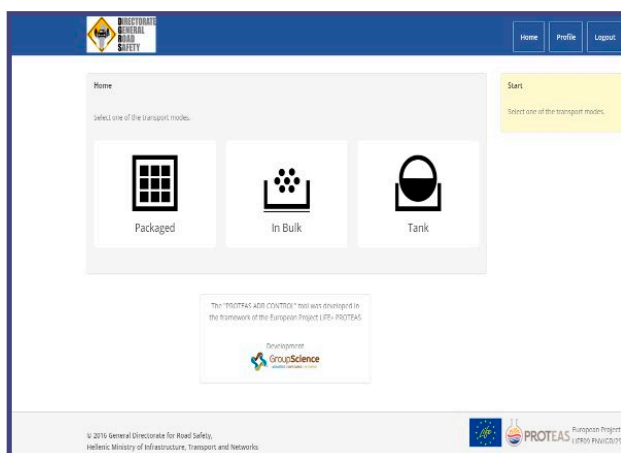
5. THE PROTEAS ADR CONTROL INSPECTION E-TOOL

The PROTEAS ADR CONTROL is an innovative inspection e-tool developed in cooperation with the Hellenic Ministry of Infrastructure, Transport and Networks (MITN) to support National Inspectors conducting roadside ADR checks of vehicles carrying dangerous substances. The tool with user friendly interface on tablet provides handy utilities and specifications to ADR Inspectors conducting road checks of vehicles carrying dangerous goods. The inspection e-tool has been integrated as a good-practice to the Protocol.

The ADR e-tool consists of two connected sub-platforms:

- An ADR e-tool: web-based ADR database including all dangerous substances/ articles covered under ADR Agreement, the special requirements (e.g. carriage restrictions, special provisions, packing instructions, labels, etc.) and guidelines for the control of ADR checks. The users by filling in specific parameters of the transported substances can have access to relevant reference information.
- An ADR controls - infringements e-tool: web-based platform for the control of ADR infringements. According to the specifications of the transported dangerous goods and the mode of transport (tank, in bulk, package/ container), the user can choose and fill in specific parameters through specific “ADR controls checklists” in order to check for any infringements and impose fines based on the relative legislation. For this purpose, six ADR infringements checklists have been developed and incorporated into the tool based on the mode of transport and exceptions in ADR implementation.

ADR controls during a roadside check and infringements per risk category are exported to an official report produced automatically after input of required data and filling in relevant checklists. The tool has been uploaded on the PROTEAS website (“e-Tools & Guidance” tab in the Main Menu, “PROTEAS ADR Tool” submenu) and is available in Greek and English language.



6. THE IMPACT & BENEFITS

The project developments and outputs obtained have a positive impact on the environment. The PROTEAS Protocol based on BATs and industrial practices, supports and promotes the implementation of national and EU Regulations and their performance. The overall PROTEAS project results and the Protocol comprise an integrated guidance with training package and e-tools, which are validated and widely disseminated through the operation and consultation of three Working Groups of experts on “ADR-Road transport of dangerous goods”, on “SEVESO-REACH/CLP” and on “Hazardous pipelines”, in close collaboration with Competent Authorities.

The implementation of the REACH oriented Protocol will ensure to provide a structured framework for the reduction of human and environmental consequences arising from the emissions or accidental releases of hazardous chemicals in different life cycle stages by applying SCC in critical operations and embodying the proposed intergraded BATs into enterprises’ on-going Safety Management Systems. The actual implementation of the suggested framework will result in reducing the environmental impacts and problems subjected to the project e.g. contamination of soil and water resources, deterioration of local air quality, ecotoxicity, degradation of landscape, loss of recreational values as far as the implementation of good-practices and BATs of Protocol are concerned.

The project is highly relevant to the national and European environmental policy and HSE legislation and promotes several aspects regarding human protection and environmental objectives of EU policy for Chemicals:

- **Support on the implementation of REACH/ CLP Regulations and SEVESO III Directive:** REACH constitutes the centrepiece of chemical regulation in EU that puts in place a system of identification, registration & control of chemical substances in order to ensure high level of protection to man and the environment, while SEVESO III Directive is the new (updated) European legislation on the control of major-accident hazards involving dangerous substances. The support on the implementation of regulations and on controlling procedures for Chemicals through collaboration with the enforcing Authorities provides added value to REACH/CLP and SEVESO III Enforcement Policies and contributes to EU policy. PROTEAS project closely collaborated with the General Chemical State Laboratory (GCSL) of Greece (common dissemination and training activities, participation in project Working Groups) and the Hellenic Ministry of Environment (acceptance of the PROTEAS proposals on SEVESO III and incorporation into the Greek legislation and guidelines).
- **Improvement of national system and regulatory guidelines on roadside checks for vehicles carrying dangerous goods:** The need to improve the national system of road safety and to develop an inspection ADR tool was highlighted by the MITN through the operation of the project WG “ADR-Road Transport of dangerous goods”. The PROTEAS ADR CONTROL was developed through the project, validated and approved by the MITN as an innovative tool for the systematic support of National Inspectors across Greece conducting checks on the transport of dangerous goods by road. The tool comprises a training and self-assessment tool for all stakeholders involved in the transport of dangerous goods and provides support to national inspection authorities and Safety Advisers. The support on the implementation and the control procedures for the road transport of dangerous goods provides added value to the national and EU enforcement policy. The e-tool and its guidelines can be translated in many languages and can be used as an inspection ADR tool by enforcing authorities of other MSs and finally can potentially act as the background for the revision of ADR inspection guidelines. The inspection tool can also be applied, after appropriate modifications, for the support and enforcement of other EU and International Regulations on transport of dangerous goods by rail and sea (support of RID and IMDG Regulations).

The main medium-term and long-term economic benefits of the project and of the promotion and implementation of the PROTEAS Protocol and its good-practices are:

- Provision of a Protocol as best common practice, auditing and training tool to all stakeholders handling dangerous substances;
- Increase of the awareness of stakeholders and the public on HSE risks and accident prevention;
- Support of REACH implementation and the use of SDS;
- Provision of training to stakeholders and transfer of knowledge and expertise to SMEs from larger companies on national and European harmonised policies and best HSE practices including Emergency Planning;
- Support on the safe handling of chemicals by employees and the public in line with the principles of REACH and CLP Regulations and other European Regulations on Health and Environment Protection.

Finally, the project results in significant social benefits and it is characterised by high potential of replicability, demonstration, transferability and innovation at national and European level.

7. TRANSFERABILITY OF THE PROJECT RESULTS

PROTEAS project team organised and took part in several dissemination actions in order to promote successfully project activities and share the results and experience obtained. Some of the main dissemination activities included:

Consultation meetings - workshops with Competent Authorities

Three different thematic WGs “ADR-Road transport of dangerous goods”, “SEVESO-REACH/CLP” and “Hazardous pipelines” developed through the project with the participation of experts from industry & representatives of Competent Authorities for the development and pilot implementation of the Good Practice Protocol, as well as for collaboration during the dissemination activities resulting to very positive developments for the project.

Informational events

Four informational events took place from 2013 to 2015 disseminating the HSE critical information to the project target groups (industrial producers, carriers/ transporters, distributors, controlling Authorities).

Awareness raising events

Eight informational events took place from 2013 to 2015 with the participation of industry and Competent Authorities for the dissemination of the project’s scope of work and the good-practice Protocol e-tool, as well as for the provision of information regarding risks related to the transport, supply and distribution stages of hazardous chemicals.





Two national workshops took place in Athens in 2014 and 2015 in collaboration with the General Chemical State Laboratory of Greece (GCSL, Directorate of Energy, Industrial and Chemical Products). The workshops were tailor made to the needs of industrial stakeholders and SMEs (chemicals) subjected to REACH/ CLP Regulations and SEVESO III Directive (with more than 340 participants in total in the 2 workshops).

Participation in Conferences

Participation in international and national conferences with project presentations and paper submission (International Conference Technological Novelty & Civil Protection, SafeChania, Chania, June 2015 and Refineries Conference, Attica, December 2014 and December 2015).

In addition a national Conference titled “The new SEVESO III Directive: Good Industrial Practices for its Implementation” was co-organised with the GTPIS in Athens in December 2015.

Training seminars

Eight training seminars took place from 2013 to 2015 (2 in Crete and 6 in Athens) informing stakeholders about techniques and procedures derived from the Protocol for the safe carriage and handling cycle of hazardous chemicals and the control of possible emergencies involving hazardous chemicals. The training material of seminars is available on the project's website and on the Protocol e-tool (<http://www.kartes.proteas-reach.gr/> Thematic area: Training/ Awareness raising).



PROTEAS publications

A series of technical editions and specific articles have been published about the project results and the Protocol e-tool:

- The safe road transport of oil products and other dangerous chemicals (1st technical publication, 2015)
- The safe handling of oil products in service stations (2nd technical publication, 2015)
- Raising Awareness of Response Bodies on Health, Safety & Environmental Risks and Accident Prevention in Supply / Distribution of Fuels and other Dangerous Substances: The PROTEAS Protocol (SafeChania, 2015)
- Development and implementation of LCA for the supply and transportation of widely used liquid fuels in different geographical boundaries (International journal of Industrial Pollution Control, 2016)
- The PROTEAS Protocol for the safe transport of dangerous goods and emergency response planning (66th magazine issue (2016) "Occupational Health and Safety" of the Hellenic Institute for Occupational Health and Safety, see <http://bit.ly/29UepIO>).

Project website and newsletters

A project website www.proteas-reach.gr was developed to keep the public informed of the project's progress and results. This site contains deliverable documents, the project web-based tools, publications and other dissemination material. The website is available in multiple languages through the use of a translation tool.

PROTEAS has sent during the project digital newsletters to selected target-groups and its stakeholders (more than 500 representatives of Competent Authorities, industry, SMEs, etc.) to keep them up to date on the progress of the project and on the website's informative material. These newsletters provided information about the development and pilot implementation of the Protocol e-tool, the Inspection ADR e-tool and the other project e-tools, the material of the dissemination and training activities and newly developed publications.



PROTEAS also used a variety of other channels for publishing information about the project's results, including:

- Leaflets about the project results and the PROTEAS Protocol e-tool in Greek and English
- ADR brochure about the PROTEAS Inspection ADR e-tool in Greek
- Posters: Research posters were produced and displayed at various dissemination events of the project.

Project target groups

Industrial producers (Chemical and Petrochemical Industry) in Greece and Cyprus

Carriers / transporters via sea, road, rail and pipelines

Distributors (i.e. fuel distribution, filling stations)

Controlling Authorities (i.e. Environmental and Safety Authorities, SEVESO Competent Authority, REACH/CLP Competent Authorities, Labour Inspection, National ADR Inspectors and Enforcing Authorities, Hellenic Fire Service)

Federations of Industries and Enterprises

Professional associations and institutions (e.g. associations of engineers)

Potential users of HSE and REACH related Regulations (i.e. SMEs, petrol stations, public and other third parties).

Project partners

The project partners in the LIFE+ project are the Technical University of Crete (TUC, Coordinating beneficiary), Motor Oil (Hellas) Corinth Refineries S.A. and AVIN OIL S.A. The coordinating beneficiary TUC (CEIS Lab, School of Production Engineering & Management) performs research on industrial & occupational risk management and has undertaken successfully numerous research projects. The industrial partners MOH and AVINOIL are main fuel and petrochemical producers and distributors in Greece offering the industrial knowhow on HSE management and safe handling of hazardous chemicals.

Abbreviations and definitions

ADR: Accord Dangerous Routier, European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)

BATs: Best Available Techniques

BTEX: Benzene, toluene, ethylbenzene, and xylene (Volatile Aromatic Compounds)

CEIS Lab: Cognitive Ergonomics and Industrial Safety Laboratory

CLP: Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP Regulation)

GCSL: General Chemical State Laboratory of Greece

GTPIS: Greek Technology Platform on Industrial Safety

HIN: Hazard Identification Number

HSE: Health Safety and Environmental

IMDG: International Maritime Dangerous Goods Code

LCA: Life Cycle Assessment

MITN: Hellenic Ministry of Infrastructure, Transport and Networks

PAHs: Polycyclic Aromatic Hydrocarbons

REACH: Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

RID: Regulations concerning the International Carriage of Dangerous Goods by Rail

SCC: Strictly Controlled Conditions

SDS: Safety Data Sheet

SEVESO III: Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances

SMEs: Small and Medium Enterprises

TUC: Technical University of Crete

VOCs: Volatile Organic Compounds

WG: Working Group



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