LIFE09 ENV/GR/000291

REACH Protocol for Emissions and Accident Scenarios in Supply and Distribution of Fuels and Petrochemical products

SUB ACTION 3.3 Sample analysis assessment

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Executive Summary of the Deliverable "Laboratory analyses assessment and its results" in English

LIFE+ Environment Policy & Governance

Executive summary

The scope of this deliverable is to record and assess the results of the field measurements and laboratory analyses of water, soil and air samples taken at locations related to the lifecycle stages of the petroleum products in Greece.

Emissions and concentrations in water, soil and air were sampled at locations where loading/ unloading, transportation and storage of hazardous chemicals takes place at high frequency e.g. ports, loading/unloading stations, road truck routes, pipeline routes, gas stations, etc. Sampling sites have been selected according to the transportation mode (vehicle, sea carrier/ vessel, rail vehicle and pipeline) and the following lifecycle stages:

- Loading and unloading installations/ locations
- Transportation of hazardous chemicals
- Temporary storage of hazardous chemicals
- Distribution of hazardous chemicals
- Other sites where hazardous chemicals are likely to be present

For each type of sample (water, soil, air) the following Hazardous Chemical Substances were selected to be examined, while their analysis is based on international standards Methods:

- Air samples: Volatile Organic Compounds (VOCs)
- Water samples: Benzene, toluene, ethylbenzene, p-xylene, o-xylene (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), n-Alkanes and Isoprenoids
- Soil samples: Polycyclic Aromatic Hydrocarbons (PAHs), n-Alkanes and Isoprenoids

Regarding the water and soil samples, the results were recorded by presenting the values of each and of the total concentrations of n-Alkanes and PAHs, as well as dendrograms and diagrams that include the distribution of hazardous chemicals in absolute and normalized form. In addition to the results that were recorded, assessment of hydrocarbons origin was performed with identification of their man-made source through various parameters.

According to the analyses results, higher concentrations of n-Alkanes and PAHs are detected in soil samples rather than in water samples. This is due to the fact that water samples contain substances according to the sampling time, while sediments have memory over time because they withhold substances in their "body".

The results of analytical measurements obtained were examined against the relevant regulatory limits and Environmental Quality Standards for priority dangerous compounds in water, soil and air. This assessment concerned maximum acceptable concentrations of compounds such as BTEX, priority PAHs and n-Alkanes in surface waters and solid wastes.

The results were also examined for particular receptors (case study) against past relevant studies. Comparative evaluation of impact between different sampling sites of the present study took place as well as, in relation to past environmental impact studies. The evaluation results show that the most impaired locations are associated with the temporary storage, the loading/ unloading at sea carrier/ vessel, the fuel pipeline transportation, the fuels transport with tank-truck. It is also understood that coastal zones close to fuel storage facilities are not so impaired by the processes of loading/ unloading at tank vessels and fuel pipeline transportation. In conclusion, the storage of fuels in tanks contributes to an extent to soil burden due to various activities, such as the tank flushings that can take place at regular time intervals.

Regarding the air measurements, potential Volatile Organic Compounds (VOCs) emissions, during vehicles refuelling at petrol stations, fuel unloading of tank trucks at petrol stations, tank-truck fuel transportation, temporary storage at fuel tanks, fuel pipeline transportation, and at jetties during loading/unloading of tank carriers are recorded in the deliverable. Pumps, valves, connectors, sampling connections, compressors, pressure relief devices and open-ended lines constitute potential sources of VOCs emissions in industrial sites.

The evaluation of VOCs emissions is based on Leak thresholds, as defined by the NSPS and NESHAP international standards. High severity leaks (>5000 ppm) were not presented at sites where volatile organic compounds emissions were detected. Low severity leaks (> 500 ppm) were presented for some lifecycle stages of gasoline and automotive gas oil.

In the framework of a case study, assessment of air quality was performed with estimation of VOCs mass emission rate during the process where the emission is observed, as well as of annual VOCs mass emission rate using VOCs emission estimation techniques. Mass emission rate for various types of equipment (components) can be assessed using correlation equations, which show the empirically determined relation between measurement values using VOCs measuring instrument and the mass of emitted hydrocarbons.

The results for gasoline show higher annual VOCs mass emission rates for each critical equipment during loading of tank trucks at sites and motor vehicle refuelling at service stations. Regarding the refuelling losses of gasoline and automotive gas oil at motor vehicle tanks, the motor vehicle refuelling with gasoline shows higher annual emission values due to higher density and higher frequency of the procedure in comparison with the motor vehicle refuelling with automotive gas oil.