Brief Research Report

INFLUENCE OF SERVICE STATIONS ON AIR QUALITY*

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Air pollution problems have been caused throughout the ages by the use of fuel. Benzene, toluene, xylenes and methyl-tert-butyl ether (MTBE) are volatile substances found in gasoline, which through evaporation can contaminate our environment leading to adverse effects on human health and other ecosystems. Service stations are a point source of such organic substances emissions. In Malta there are 48 petrol stations and 26 kerbside stations, while in Gozo there are 7 petrol stations and 3 kerbside stations (at time of study). Most of these are situated on main roads surrounded by domestic dwellings.

In this study, air quality in the vicinity of service stations was investigated in order to determine whether these fuel marketing outlets are producing a significantly higher risk to people in their area. Benzene, toluene, xylene and MTBE concentrations in air at points proximate and distal from service stations were used as indicators of air quality. This study also included an investigation of variation in wind direction and speed between street sites and the Luqa Meteorological Station.

Analysis was performed following methodologies validated by the National Institute for Occupational Safety and Health in the US (NIOSH) and OSHA Analytical Laboratory [1-4]. Volatile organic compounds (VOCs) in air were adsorbed onto activated charcoal and subsequently desorbed into carbon disulfide. Analysis of the resultant solution was carried out by GC-FID. Due to co-elution of MTBE and 2,3-dimethylbutane (also found in gasoline), concentrations of MTBE in air had to be quoted as MTBE equivalents (eq.). Both active and passive samplers were used in this study.

Concentrations of VOCs in air detected in active samplers showed that wind direction and height of vents of the underground storage tanks at the service station are important determinants of pollutant concentrations in the vicinity of service stations. Passive samplers showed a clear trend of significantly higher concentrations in the vicinity of the service stations compared with the situation 300 - 400 m away. In one case passive samplers exposed during the same period detected 491 μg m^{-3} of MTBE eq., 34 μg m^{-3} of benzene, 97 μg m^{-3} toluene, 55 μg m^{-3} p- + m-xylene and 17 μg m^{-3} of o-xylene in the vicinity of a service station compare to 18 μg m^{-3} benzene, 38 μg m^{-3} toluene and 29 μg m^{-3} p- + m-xylene, but no MTBE eq. and o-xylene at a point 400 m away from the service station.

Measurements of wind direction and speed showed that topography and structures in a given area have a strong bearing on the micrometeorology at a specific site and therefore field studies should be performed when carrying out air pollution measurements.

This study shows that concentrations of VOCs in Malta air may reach worrying levels both in our streets and particularly so in the vicinity of service stations. It is also evident that service stations are probably causing a significantly higher risk to people living in the area of the service station.

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An intensive monitoring campaign, investigating air quality for VOCs should be carried out on a national scale, while authorities responsible for fuel marketing should seriously consider the adoption of technologies which mitigate the impact of service stations on air quality.

References:

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[2] NIOSH (1994) Method No. 1501 - Aromatic Hydrocarbons; National Institute for Occupational Safety and Health.

[3] NIOSH (1994) Method No. 1615 - MTBE; National Institute for Occupational Safety and Health.

[4] Lodge, J.P. (1988) Methods of Air Sampling and Analysis; Lewis: Florida, p. 678-685.