Monitoring of air pollution levels related to Charilaos Trikoupis bridge

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The Charilaos Trikoupis bridge, known as bridge of Rio-Antirio, is the biggest cable-stayed bridge of multiple openings in the world, with a total length of 2,252 meters. It connects Western Greece with the rest of the country. In this study an overview of the air pollution monitoring in the area in 2013-2014 is presented. This is part of the annual environmental impact assessment of the bridge operation that our laboratory is responsible for on behalf of the Ministry of Development.

Four campaigns were realized in the course of the last two years. The exact periods of the two annual campaigns were selected taking into account the high traffic seasons according to a careful examination of the bridge traffic patterns. In each of the campaigns dynamic measurements of CO, NOx, SO_2, PM1, PM2.5 and PM10 were performed continuously during 10-day periods near the edges of the bridge located in the urban areas or Rio and Antirrio. Sampling of PM2.5, PM10 and TSP were sampled every 24 hours using low-volume automatic sequential samplers. TSP were collected on quartz filters (203 mm × 254 mm). The total volume of air sampled was approximately 2000 m^3. ¼ portion of the exposed filter was cut and carefully placed into teflon bottles. After that, it was digested to 95 °C for 3 hours using an extraction fluid containing 20 mL HNO_3 (6N), until the liquid evaporated up to about 10 mL, and then diluted to a final volume of 50 mL. After extraction, the solutions were filtered through 0.2 μm membrane filters. Lead concentrations were measured using an inductively coupled plasma mass spectrometer (ICP-MS). Moreover, meteorological data (wind speed and direction, temperature, cloud cover and humidity) were measured and recorded. The pollution data were analyzed statistically and the quality of the air was characterized according to the US Environmental Protection Agency indicators and the European Common Air Quality Index framework.

The results indicated that air pollution levels are in generally below the regulatory thresholds. Moreover, the traffic emissions from the bridge are not the main source of air pollution in the area. PM2.5 and PM10 levels were below 25 and 50 μg/m^3 on both sides of the bridge almost every day. These limits were exceeded only one day (5/12/2013) on the side of Antirrio (26.4 και 52.2 μg/m^3 for PM2.5 and PM10 respectivelly). The low contribution from traffic emissions in the area is also justified by the low PM2.5/PM10, which is on average 0.49 (s.d. 012), indicating that long range transport is more significant that loal sources. However, during thewinter period, PM2.5 and PM10 levels are higher due to the use of light oil and biomass burning for space heating. Pb levels were very low; the daily value recorded (4.5 ng/m^3) is two orders of magnitude lower than the regulatory limit of 0.5 mg/m^3. Hourly agerage concentrations of CO, SO_2, NO and NO_2 for the side of Antirio where 3.99 mg/m^3, 1.82 μg/m^3, 6.6 μg/m^3 and 38.6 μg/m^3, while for Rio

the respective levels were 5 mg/m^3, 4.39 $\mu g/m^3$, 3.74 $\mu g/m^3$ και 22.81 $\mu g/m^3$ respectivelly. SO_2 have been reduced for year 2013 compared to 2005, while they have been slightly increased for NO_2.

Overall the contribution of the Charilaos Trikoupis bridge to the surrounding air pollution levels is very low. This is the result of the relatively low daily volume of vehicles (~ 9000 vehicles per day), the respective traffic fleet composition (~80% of the traffic fleet are passenger vehicles) and the speed limit (80 km/h) wich does not favor traffic emissions. In addition, the strong and frequent winds further contribute to the rapid dispersion of the emitted pollutants. The higher levels of PM observed during the winter period are attributed to local sources of space heating, as well as to the lower mixing height.