

Gas hazard assessment in the touristic area of Levante Beach (Vulcano island, Italy)

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Since the last eruption occurred at “La Fossa” in 1888-1890, Vulcano remained in a quiescence state characterized by an intense fumarolic activity. The main degassing manifestations are concentrated in La Fossa crater area (high temperature fumaroles) and in the area of Vulcano Porto, between Levante Beach and Faraglioni (medium-low temperature fumaroles). In addition the entire volcanic edifice of La Fossa, its base and the area of Vulcano Porto are characterized by an extensive soil CO₂ diffuse degassing. In the last century episodic “crises” have occurred with increase of temperature, gas output and compositional changes of the crater fumaroles indicating an increase of the magmatic component in the discharged fluids. These episodic crises occurred in 1916-1924, in 1988-1993, in 1996 and in 2004-2006. During the period 1988-1990, the accumulation of CO₂ in morphological depressions or excavation provoked the death for asphyxiation of two children in the area of Vulcano Porto and of some small animals at the base of the crater area. In April 2015, a child lost his senses while playing at Levante Beach; he was rescued by an air ambulance to the hospital of Lipari. According to the national chronicle (La Repubblica, 22 June 2015), doctors attributed the malaise to a high CO₂ air concentration. Soon after this event the Major of Lipari installed at Levante Beach some panels informing tourists on gas hazard.

In summer 2015 we performed a geochemical survey of the Levante Beach sector (onshore and offshore) and of the mud pool, estimating the diffuse and viscous gas flux and the air gas concentration in order to evaluate the degassing level. The total gas flux in the Levante Beach area, from 0.3 km², has been estimated in 1 t/day of CO₂ and 16,1 kg/day of H₂S; values comparable with those of the 2009 and 2011 campaigns. In addition, a soil CO₂ flux survey of the target area at La Fossa crater was performed, ascertaining that the degassing rate was within the range of the inter-crisis period (CO₂ = 200 t/day). In the mud pool area, continuous measurements of CO₂ and H₂S air concentration were also carried out for a period of a week. The CO₂ concentration was almost always higher than in the normal unpolluted air. Concentration of H₂S displayed high values (maximum of 43 ppm), with the TWA (10 ppm) and STEL (15 ppm) H₂S thresholds frequently exceeded. Offshore, gas concentration in atmosphere over the submarine vents of the Levante Beach, displayed extremely high concentrations of H₂S (values up to 1000 ppm) and CO₂ (8.6 vol.%). these values may cause serious adverse health consequences on the exposed people even in periods when the volcanic activity is not considered high or anomalous.