

**REPORT ON THE NATURE, DISTRIBUTION AND LIKELY SOURCE OF BLACK PARTICLES  
IN DUST FALL IN MALTA**

**NON-TECHNICAL SUMMARY**

**Alfred J Vella**

**March 2011**

This report reviews experimental information about how and where dust collects in Malta and in view of this information it suggests what might be the likely source or sources of black dust that people complain about from time to time.

The complaints are generally occasioned by the discovery of substantial black dust which deposits in exposed or open spaces in homes, including roofs and balconies which deposits are recognised as having formed over a very short period of time, e.g. overnight. These observations always originate from certain parts of Malta notably Fgura and a few other towns that are proximate to Fgura and generally present in the Grand Harbour southern area such as Paola, Hal Tarxien etc.

This report is based on two separate but related studies.

The more recent work involved a study carried out between August 2009 and November 2010 by a team working at the University of Malta under the supervision of the author. In this work, the quantity and the quality of dust which collects passively by gravity settling in containers placed around Malta and Gozo was determined with a view to establish the presence in such dust of a particular set of contaminants. Among these contaminants, black or very dark coloured dust particles having a coarse size, i.e. larger than approximately 50 micrometer in diameter, were measured by a method based on optical microscopy. Dust is a mixture of particles and the particles that were counted were those of a large size. Very fine black particles and light-coloured particles of any size which were present in the dust were not counted because the interest was in the larger black (or dark) particles.

The earlier work was carried out in 1995 and was published in the international scientific literature: in that work the quantity was measured of coarse black dust found embedded in the surface layer of

limestone bricks forming part of exposed outside walls of church bell towers. The degree of sulfation of the limestone, a measure of its contamination with the air pollutant sulfur dioxide, was also determined.

The results of these two studies point to the following similar conclusions:

- (a) there is a *single* source of coarse black dust particles geographically located in the Marsa area which is currently active and which causes dust of this type to deposit on the ground following its emission to air; the black dust appears to travel with the prevailing wind direction, which is from the northwest to produce high values of coarse black dust fall especially at Fgura and smaller but elevated values at Hal Tarxien, Isla, Hamrun etc and the quantity of such coarse black dust generally diminishes as the distance from the Marsa area increases
- (b) the source of coarse black dust appears to have been active in the Marsa area for a long period since its effects have left two measureable imprints, namely, significant presence of coarse black particles in the fabric of the limestone surface of church walls found in and around the affected area and an elevated degree of contamination by sulfur compounds of the same church walls; both the black particle counts on the church walls and the degree of contamination are generally more abundant close to Marsa and in a south-easterly trend from Marsa and appear to be influenced by prevailing wind direction;
- (c) it is known that both sulfur dioxide, which causes sulfur contamination of limestone, and black particles having a coarse size are formed as products of combustion from fuel-oil burners.

In light of the above, the conclusion appears to be that the power station at Marsa is the main source of these coarse black particles present in the environment to the southeast of Marsa, which source must have been consistently active in the same geographical location for an appreciable period in order to explain the mentioned experimental observations. A key consideration is the *size* of the dark-coloured particles: their relatively large size suggests that their source is located at a short distance from their area of deposition. Large particles do not travel far due to their weight. Another key consideration is their *shape* under the microscope, especially high powered microscopy: the particles are often round or sub-round in shape and appear hollow inside and this is typical of

ash particles formed from the combustion of fuel oil. A small number of the dark-coloured coarse round particles collected from Fgura during October 2009 were analysed and found to contain nickel and vanadium and this corroborates the view that this sample of coarse black particles were indeed derived from the combustion of fuel oil since the metals nickel and vanadium are chemical markers for this type of fuel.

The foregoing results relative to the 2009-10 work describe black particles in dust fall collected over three separate periods of measurement each of one month duration. During this time, there were no reports of observed dust falls from residents in any locality. It is clear that coarse black dust is falling continuously from the air even when it is not being observed and complained about.

*Writer is of the opinion that the occasional substantial deposits of coarse black particles occurring in the same localities as identified in this work and which cause public outcries are likely to be generated by the same source as the one responsible for the less observable but constant 'background' deposits.*

The cause/s for the episodic surges in black dust fall remain unknown to the author although one suspects these episodes may be related to anomalous emissions perhaps during 'soot blowing' or other unintended emissions as may result when problems occur with soot mitigation equipment at the power station.

One cannot entirely exclude the presence of other emitters of coarse dark coloured particulate matter in this area of Malta but if these exist they must act occasionally and be of very local importance. In this context one can mention grit blasting in ship repair and steel construction operations and the recycling of metal wastes which activities are indeed present in the general area. However dust from these operations is readily distinguishable from combustion ash in view of the strong presence of iron and other features of such material.

Motor traffic exhaust is not a source of the coarse black particles as observed and measured in the studies carried out in our laboratory. Emissions from motor traffic produce *very fine* black dust that is found suspended in air and eventually settles out but this material is much smaller in size than the black particles measured in our work. The fine particles in automotive dust do not grow in size, once deposited, to produce larger grit-sized particles. Moreover, traffic dust deposition is *not sporadic and episodic* since traffic flows are reasonably regular and their emissions do not suddenly increase (or decrease).

It is anticipated that once the Marsa power station is decommissioned, deposition of coarse black particles (technically called “cenospheres”) will very likely decrease considerably. However, this will not be true of the fine black dusts which motor traffic produces constantly and continuously so that residents in areas where traffic flows are high will remain exposed to these insidious fine particles, which, because of their size, can also be inhaled thus making them more problematic from a health impact point of view. This environmental contamination will continue for as long as its main source is not properly controlled.

The conclusions in this report are not based on size or chemical analysis of any dust fall samples collected by complainants following a public outcry. It is essential that in any future dust fall episode as may be experienced by residents, the occurrence is reported for investigation to the competent authority and *the dust matter be collected from the site directly by the scientific examiners.*

Further, more detailed, experimental work of a similar nature to the one reported here can be carried out in order to confirm or modify the general conclusions reached in this report.