

Ultrafine particle emission from incinerators: The role of the fabric filter

Buonanno G.; Scungio M.; Stabile L; Tirler W.

Incinerators are claimed to be responsible of particle and gaseous emissions: to this purpose Best Available Techniques (BAT) are used in the flue-gas treatment sections leading to pollutant emission lower than established threshold limit values. As regard particle emission, only a mass-based threshold limit is required by the regulatory authorities. However, in the last years the attention of medical experts moved from coarse and fine particles towards ultrafine particles (UFPs; diameter less than $0.1 \mu\text{m}$), mainly emitted by combustion processes. According to toxicological and epidemiological studies, ultrafine particles could represent a risk for health and environment. Therefore, it is necessary to quantify particle emissions from incinerators also to perform an exposure assessment for the human populations living in their surrounding areas. A further topic to be stressed in the UFP emission from incinerators is the particle filtration efficiency as function of different flue-gas treatment sections. In fact, it could be somehow important to know which particle filtration method is able to assure high abatement efficiency also in terms of UFPs. To this purpose, in the present work experimental results in terms of ultrafine particle emissions from several incineration plants are reported. Experimental campaigns were carried out in the period 2007-2010 by measuring UFP number distributions and total concentrations at the stack of five plants through condensation particle counters and mobility particle sizer spectrometers. Average total particle number concentrations ranging from 0.4×10^3 to 6.0×10^3 particles cm^{-3} were measured at the stack of the analyzed plants. Further experimental campaigns were performed to characterize particle levels before the fabric filters in two of the analyzed plants in order to deepen their particle reduction effect; particle concentrations higher than 1×10^7 particles cm^{-3} were measured, leading to filtration efficiency greater than 99.99%. Implications: The main implication of the study is that the use of a fabric filter in the flue-gas treatment section of incinerators is able to guarantee very low concentrations at the stack in terms of UFPs. As regards the incineration plants, a further implication of the proposed study is that an a priori negative social response seems to be unjustified when referred to the ultrafine particle emissions.