

# Road traffic vs. waste incineration: local-scale air quality impact assessment at municipality level in Northern Italy

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Industrial plants frequently face strong protests from local communities where they are situated and the location of new plants is an ongoing concern. In particular, there is considerable concern in the public opinion about possible adverse health effects associated with waste incineration due to their emissions of organic and inorganic toxic pollutants. However, these pollutants are also emitted by “common” sources, like road traffic and domestic heating, that are not commonly perceived as a threat for human health. Actually, risk perception in most of the public opinion is biased by a number of factors (Ren et al., 2015), namely because risk awareness and knowledge are still scarce.

In this work the impact on local air quality due to road traffic and to a 200 t/day state-of-the-art Waste to Energy (WTE) plant are compared for the municipality of Desio, close to Milan in Northern Italy. Focus is on both criteria pollutants (PM<sub>10</sub> and NO<sub>x</sub>), whose concentrations are particularly high in Northern Italy, and toxic pollutants, cadmium (Cd) and dioxins and furans (PCDD/F), typically emitted by waste incineration plants.

CALPUFF air quality model was used to estimate the time series of 1-hr ground-level concentrations at the grid nodes of a 10 x 10 km<sup>2</sup> computational domain over Desio municipality for calendar year 2016.

Traffic emissions were split into emissions from the main roads (i.e.: national and highly-trafficked local roads) crossing the municipality of Desio and emissions from minor roads and from the urban road network. The former emissions have been computed based on traffic flow rates along the road segments, evaluated through a dedicated study, and on emission factors from the regional emission inventory INEMAR (ARPA Lombardia, 2018), from the traffic emissions factors database for Italy, and from the EMEP/EEA emission inventory data (EMEP/EEA, 2016). The latter emissions have been derived from INEMAR emission inventory data for Desio municipality.

For the WTE plant emission data were computed based on hourly values for flue gas temperature and speed, PM<sub>10</sub> and NO<sub>2</sub> concentrations recorded by the continuous emission monitoring (CEM) system; Cd and PCDD/F concentrations data were taken from discontinuous sampling.

## Results

Emission inventory data for road traffic and waste management in Desio are compared in Figure 1:

inventory data are about 4x (NO<sub>x</sub>) and 12x (PM<sub>10</sub>) higher than the actual emissions from the WTE plant computed based on CEM monitored data. Thus, road traffic and WTE plant emission are comparable only for Cd; conversely, road traffic emissions largely exceed those from the WTE plant for all the other pollutants.

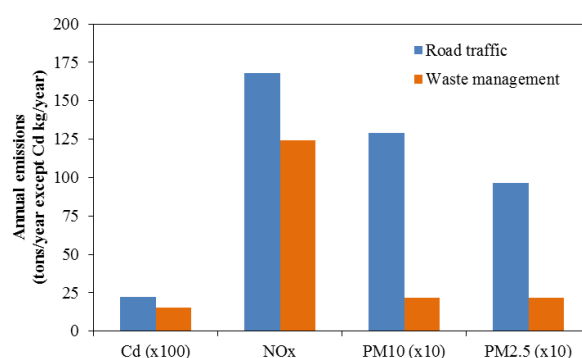


Figure 1. Annual emissions for Desio municipality.

Coherently with the higher emission rate and the close-to-ground emission location, road traffic has a stronger impact on air quality in Desio, not only for PM<sub>10</sub> and NO<sub>x</sub> but also for toxic pollutants (Table 1). Actually, the impact of traffic in the residential area of Desio is from two to four orders of magnitude higher than the WTE plant impact: namely, the estimated contribution from traffic is three orders of magnitude higher for PCDD/F and two orders of magnitude higher for Cd.

Table 1. Range of estimated contributions from road traffic and WTE plant to Cd and PCDD/F annual average concentrations in the residential area of Desio

Source	Cd (ng/m <sup>3</sup> )	PCDD/F (fg <sub>TEQ</sub> /m <sup>3</sup> )
Road traffic	0.06-0.08	1.3-2.2
WTE plant	3×10 <sup>-4</sup> - 4×10 <sup>-4</sup>	5×10 <sup>-4</sup> - 7×10 <sup>-4</sup>

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