

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



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

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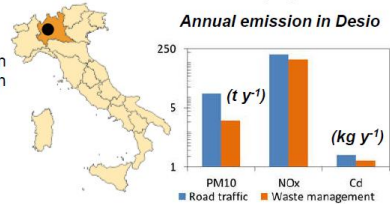


Background & scope

- Waste-to-Energy (WtE) plants frequently face strong protests from local communities because of the concern on possible adverse health effects due to the emission of organic and inorganic toxic pollutants
- Risk perception in most of the public opinion is biased by a number of factors because proper environmental education (i.e.: levels of risk awareness and knowledge) is still scarce
- A correct perception of the risk can profitably derive by the comparison of the real impact of WtE plants on local air quality with the impact of other common sources (e.g.: road traffic, domestic heating through biomass burning), not perceived by the public opinion as a threat for human health
- This work is intended to:
 - assess the actual impact of a WtE plant on local air quality based on its real emission data;
 - compare the impact on local air quality of the WtE plant emissions with the impact of road traffic

Study area

Desio municipality: a 40000-dweller town, about 15 km North of Milan in Lombardy region



Methods

Road traffic emissions

- Split between main road traffic and urban traffic
- Dedicated study for traffic flows on the main roads in and around Desio, based on both transport supply system data (road network structure) and mobility demand data (O-D trip matrix)
- Hourly emissions from traffic flow data and emission factors data
- Urban traffic emissions = inventory data for traffic - main road emissions

Fleet-averaged emission factors

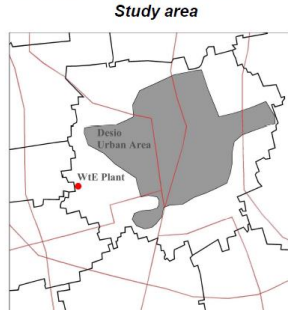
	Cars	LDV	HDV
PM10 (*) (mg km ⁻¹)	39.9	77.4	217.9
NO ₂ (**) (mg km ⁻¹)	152.8	347.9	598.3
Cd (***) (µg km ⁻¹)	0.7	0.9	2.4
PCDD/F (****) (pg _{TEQ} km ⁻¹)	21.3	39.6	49.4

(*) Lombardy region emission inventory (ARPA Lombardia, 2018)
 (**) Road traffic emissions factors database in Italy (ISPRA, 2017)
 (***) EMEP/EEA emission inventory guidebook 2016 (EMEP, 2016)

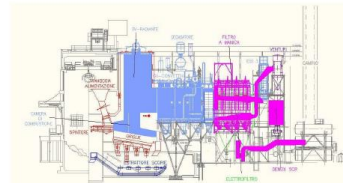
Road traffic emissions in Desio

	Inventory	Main roads	Urban traffic
PM10 (t y ⁻¹)	12.9	9.2	3.7
NOx (t y ⁻¹)	168.1	116.2	51.9
Cd (g y ⁻¹)	222	144	78
PCDD/F (mg _{TEQ} y ⁻¹)	-	4.5	1.8 (*)

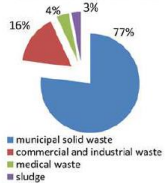
(*) No inventory data for PCDD/F. Estimated based on PM10 data



WtE plant emissions



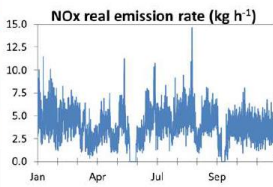
Waste composition



- WtE plant (200 t day⁻¹) with two combustion lines operating with Combined Heat and Power energy recovery scheme
- Flue gas dry treatment line: electrostatic precipitator + baghouse filtration unit; double alkali injection system for acidic gases control; activated carbon injection for dioxins (PCDD/F) control; two-stage SNCR/SCR system for NOx control
- Real emission data from the 2017 emission monitoring system records: flue gas temperature and speed, PM10, NOx, Cd, PCDD/F hourly concentrations

WtE plant real emission rates

	Annual mean	Range	Max Auth.
PM10 (g h ⁻¹)	20.9	1.4 - 72.7	1,100
NOx (kg h ⁻¹)	4.0	0.2 - 14.5	22
Cd (mg h ⁻¹)	22.2	4.5 - 29.4	5,500
PCDD/F (ng _{TEQ} h ⁻¹)	39.9	1.8 - 110.2	11,000



Results and conclusions

- CALPUFF air quality model simulations for year 2016
- Sources' contributions to annual average concentration levels
- WtE plant's emissions do affect the air quality in the urban area of Desio

Range of contributions from WtE plant and road traffic: annual average concentrations in Desio residential area

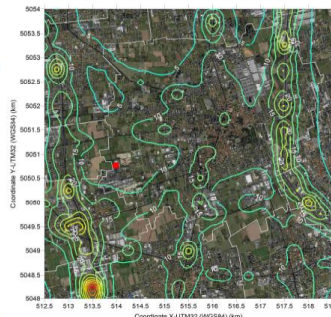
	PM10 (µg m ⁻³)	NO ₂ (µg m ⁻³)	Cd (ng m ⁻³)	PCDD/F (fg _{TEQ} m ⁻³)
WtE plant	2 - 3.5 (x10 ⁻⁴)	5 - 7 (x10 ⁻²)	3 - 4 (x10 ⁻⁴)	5 - 7 (x10 ⁻⁴)
Road traffic	4 - 6	10 - 15	0.06 - 0.08	1.3 - 2.2
AQ limit (annual avg.)	40 (*)	40 (*)	1 (*)	150 (**)

(*) Directive 2008/50/EC (**) German Länderausschuss für Immissionsschutz

- The real emissions from WtE plant are well below the authorized values: on average, 5.5 times less for NOx, 52 times less for PM10, 250 times less for Cd, and 275 times for PCDD/F
- In the residential area of Desio:
 - road traffic impact on air quality for any of the investigated pollutants is at least two orders of magnitude higher than the impact of the WtE plant
 - on annual average basis, road traffic is responsible for about 20% of NO₂, for 10% of PM10 and Cd, and from a few percentage points up to 20% of PCDD/F

NO₂ annual average concentration (Desio 2016: 46.4 µg m⁻³)

Road traffic contribution



WtE plant contribution

