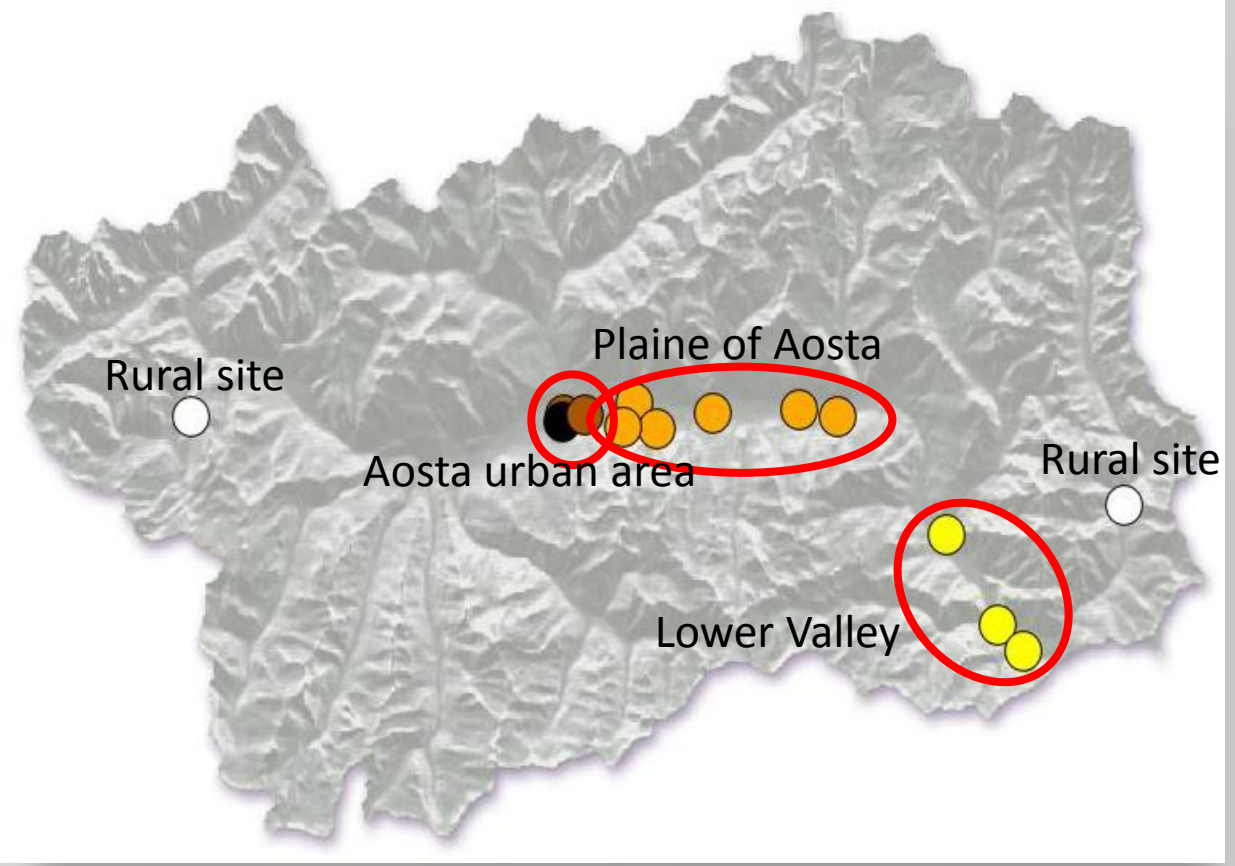
ENVIRONMENTAL ASSESSMENT OF A STEEL MILL BY CHEMICAL CHARACTERIZATION OF PM10 AND DEPOSITIONS IN THE URBAN AREA OF AOSTA (ITALY)

DEVIS PANONT - CLAUDIA TARRICONE

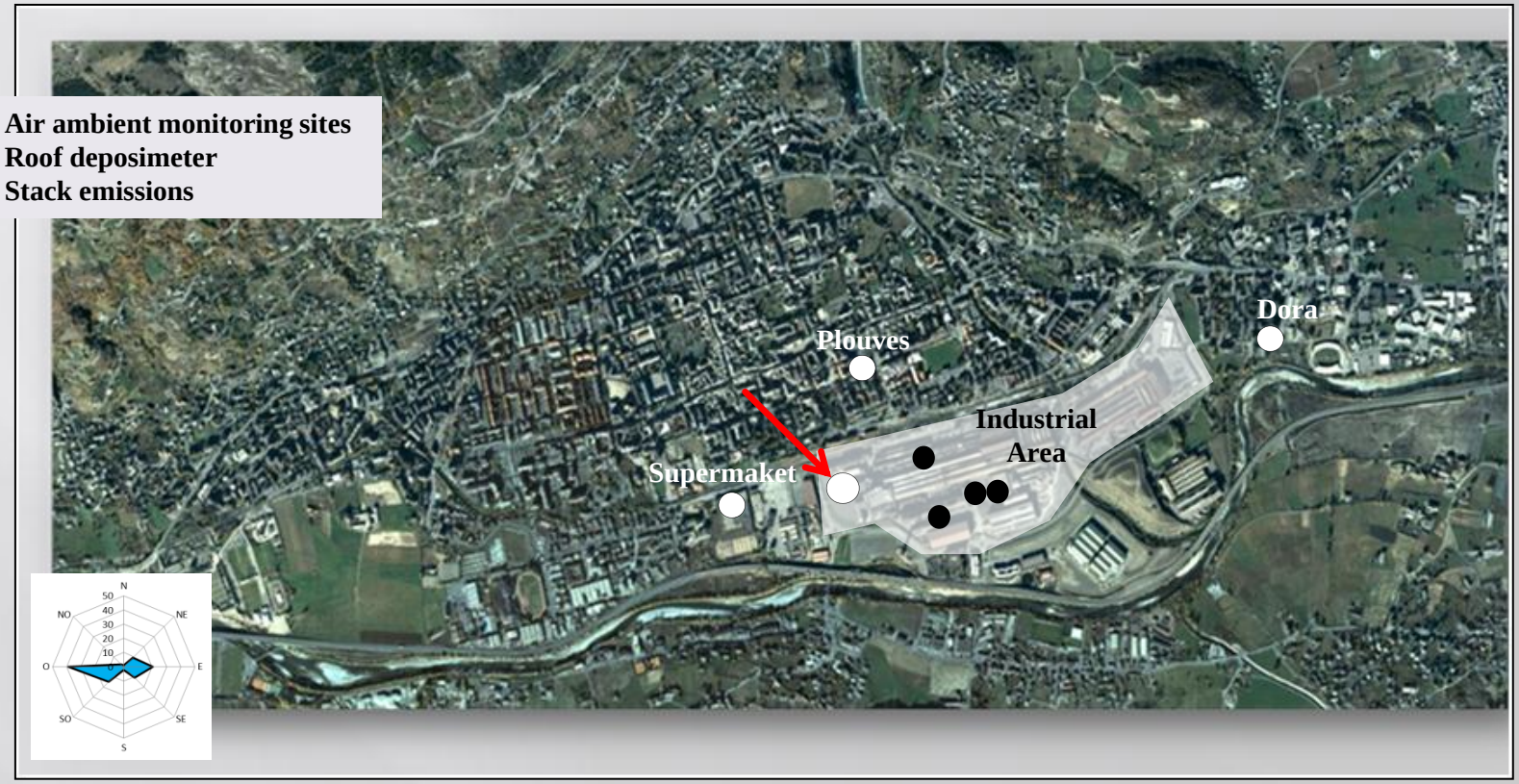
AIR QUALITY MANAGEMENT at URBAN REGIONAL and GLOBAL SCALES 4° International and IUAPPA Regional Conference,10-13 September 2012 Istanbul-Turkey

WHERE…

Monitoring sites



MONITORING SITES IN AOSTA



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STACK EMISSIONS

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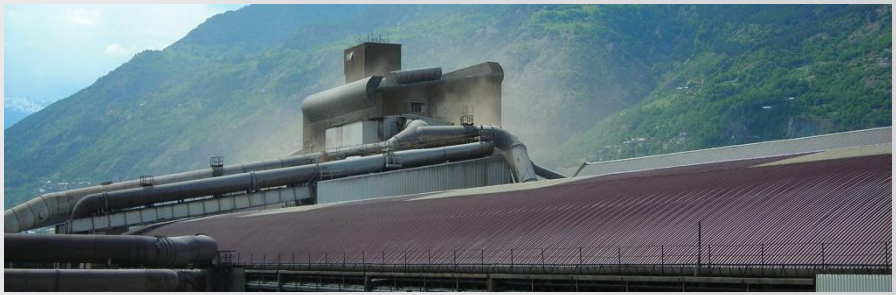
DIFFUSE EMISSIONS



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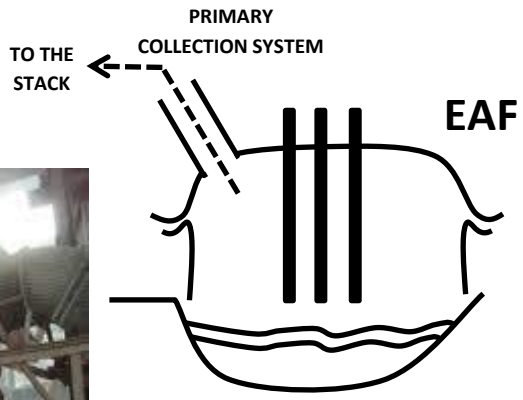
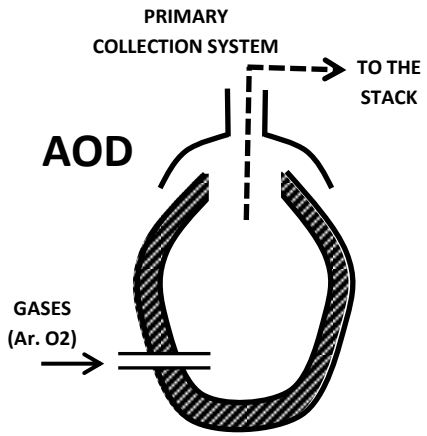
PRIMARY EMISSIONS





EAF = Electric Arc Furnace

AOD = Argon Oxygen Decarburization

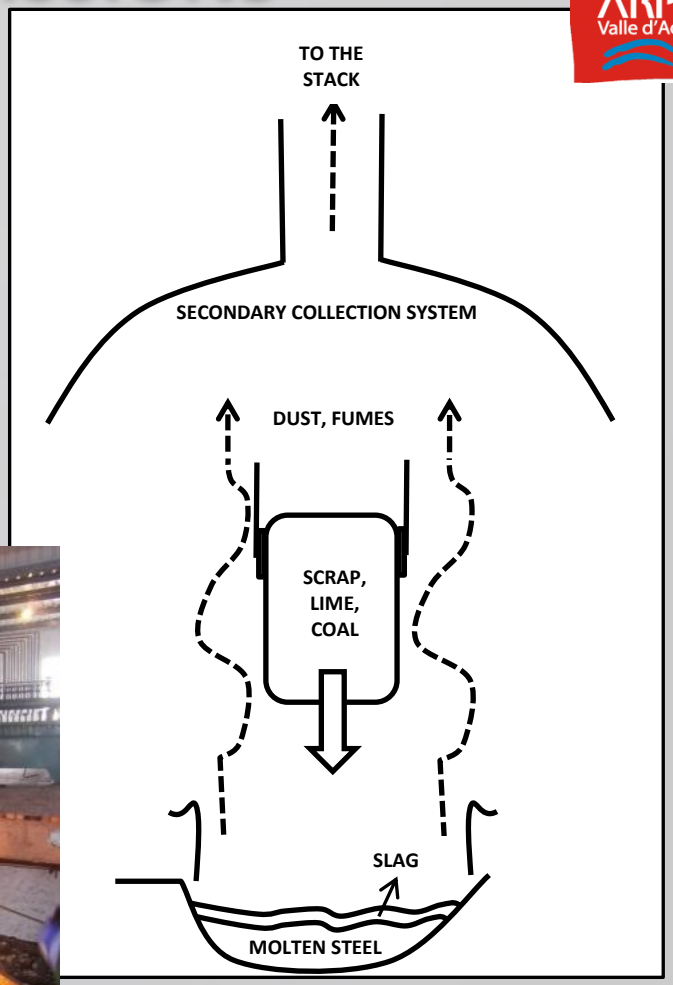
Electric steelmaking emissions can be distinguished in primary and secondary emissions

Primary emissions are derived from operations carried out at high temperatures as melting of scrap (in EAF) and refining of molten steel (in AOD)

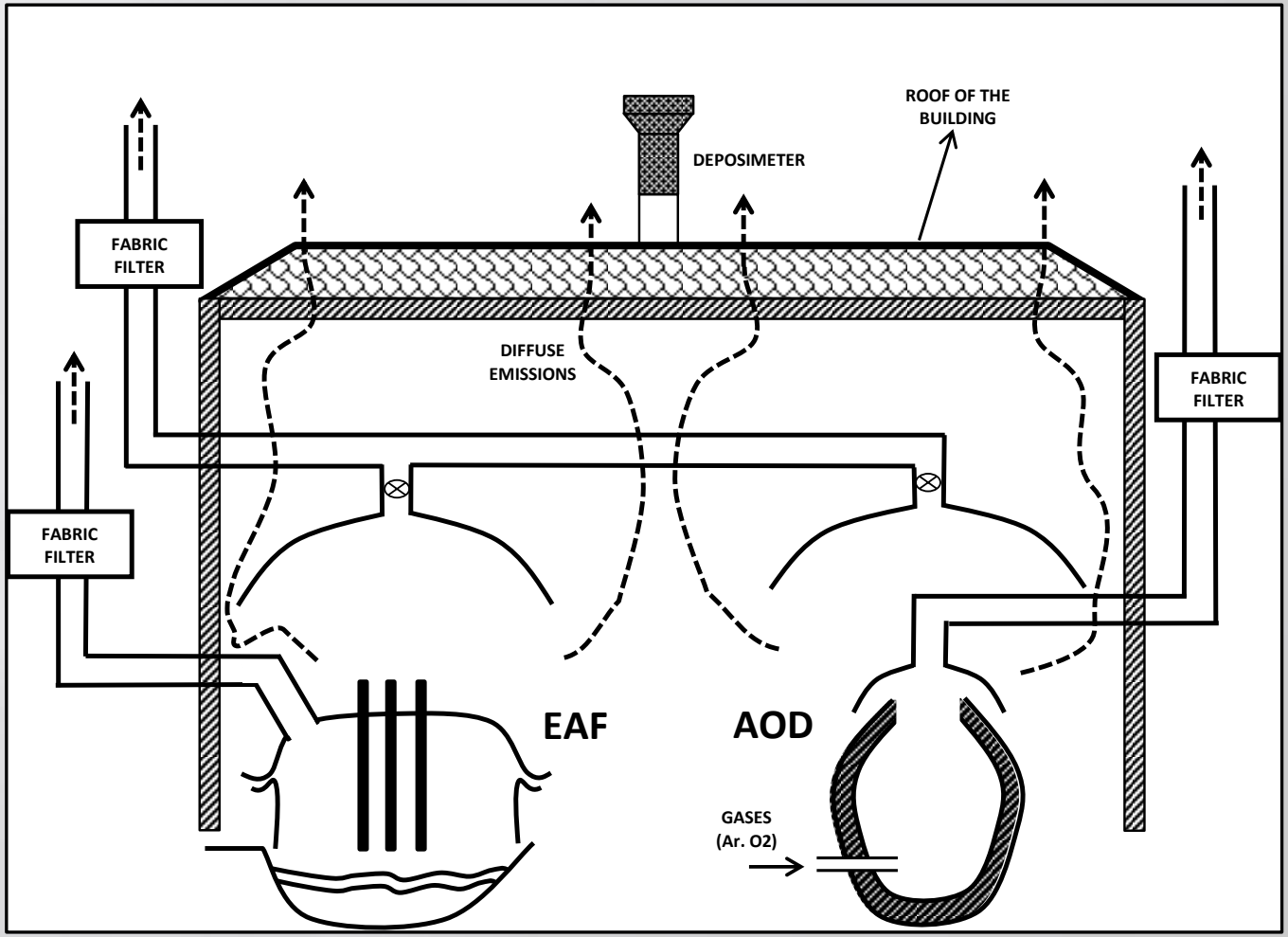
SECONDARY EMISSIONS

Secondary emissions are derived from production steps such as:

- furnace charging
- de-slagging
- liquid steel transfers
- handling of additives



STACK AND DIFFUSE EMISSIONS



Off-gases extraction system of Aosta steel mill

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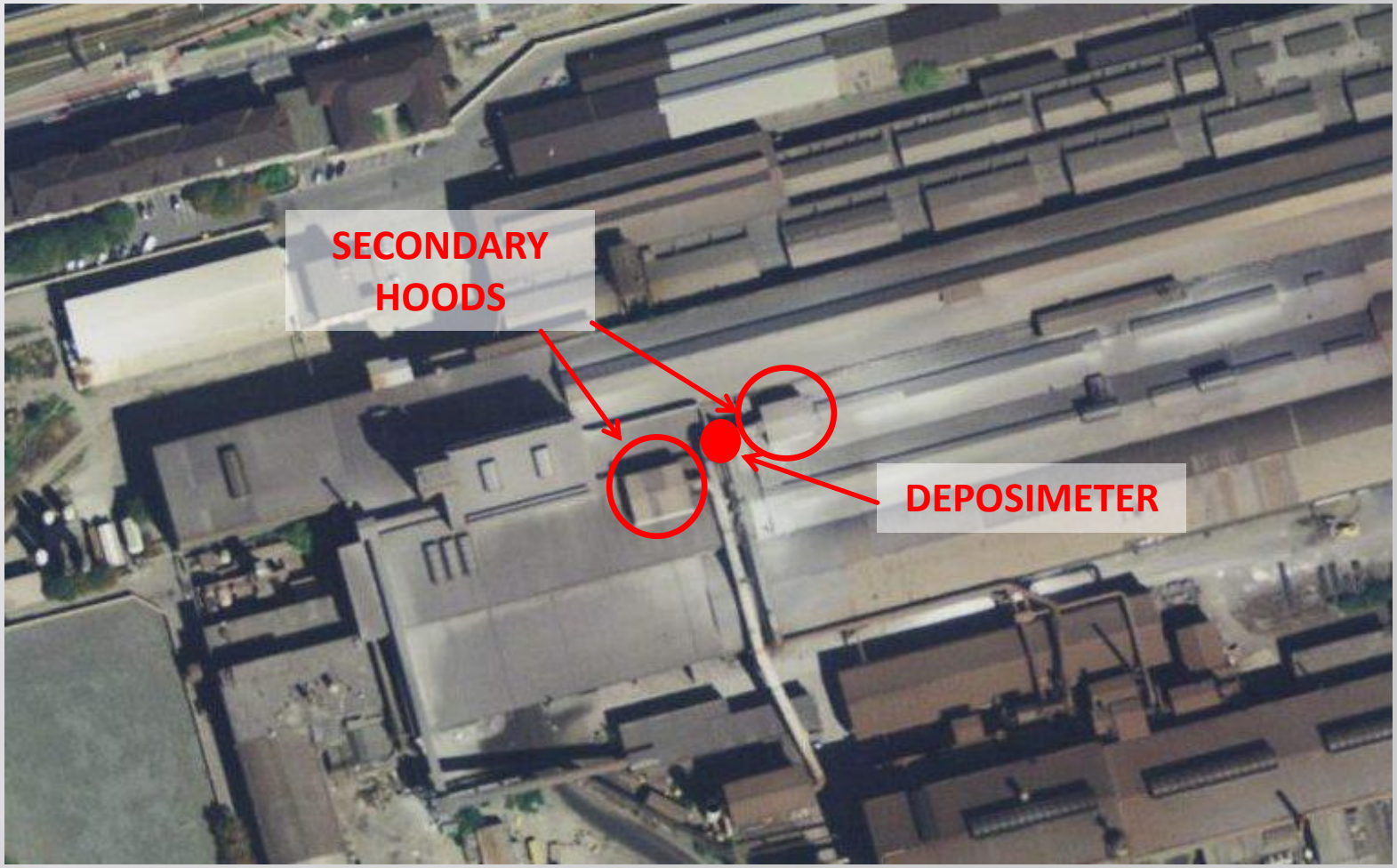
DIFFUSE EMISSIONS MONITORING BY DEPOSITION SAMPLING



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DEPOSITIONS

ROOF OF THE STEEL MILL BUILDING

SUPERMARKET SITE

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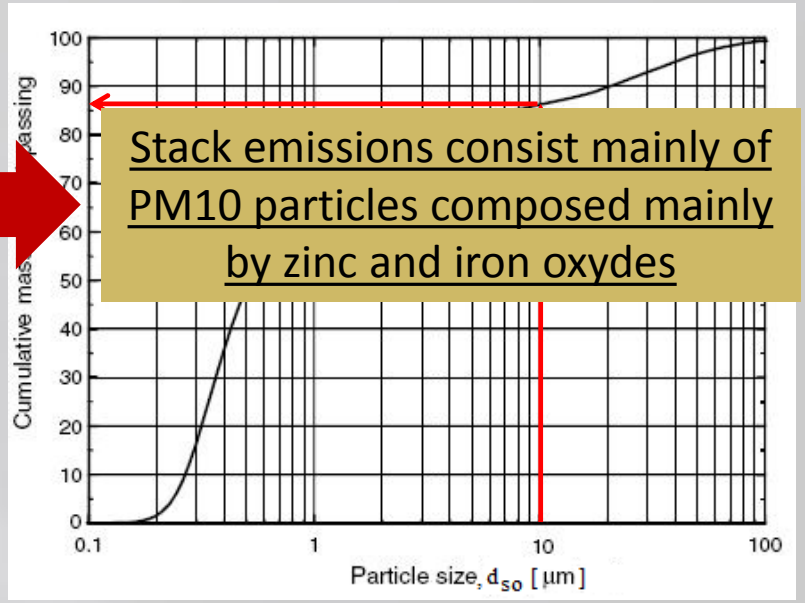
STACK AND DIFFUSE EMISSIONS

STACK EMISSIONS

- 90% of the dust comes from melting and refining processes (container is closed)
- at high temperature (>1600°C) Zn and Fe are volatilized and oxidized
- Particles size distribution: 85% is < 10 µm
- ~100% of dust emissions is collected and treated by fabric filters



Stack emissions consist mainly of PM10 particles composed mainly by zinc and iron oxydes

DIFFUSE EMISSIONS

- Furnace charging, tapping of molten steel, deslagging (container is opened)
- Layer of slag in the surface of melt
- Emission of coarse particles with slag composition
- Diffuse emissions are not collected and treated

Diffuse emissions consist mainly of coarse particles with the same composition of the slag

DATA

- The environmental monitorings were conducted by ARPA Valle d'Aosta (Regional Agency of Environmental Protection) and are referred to the years from 2008 until 2011. . The temporal coverage of the series extended to 100% of the considered years.

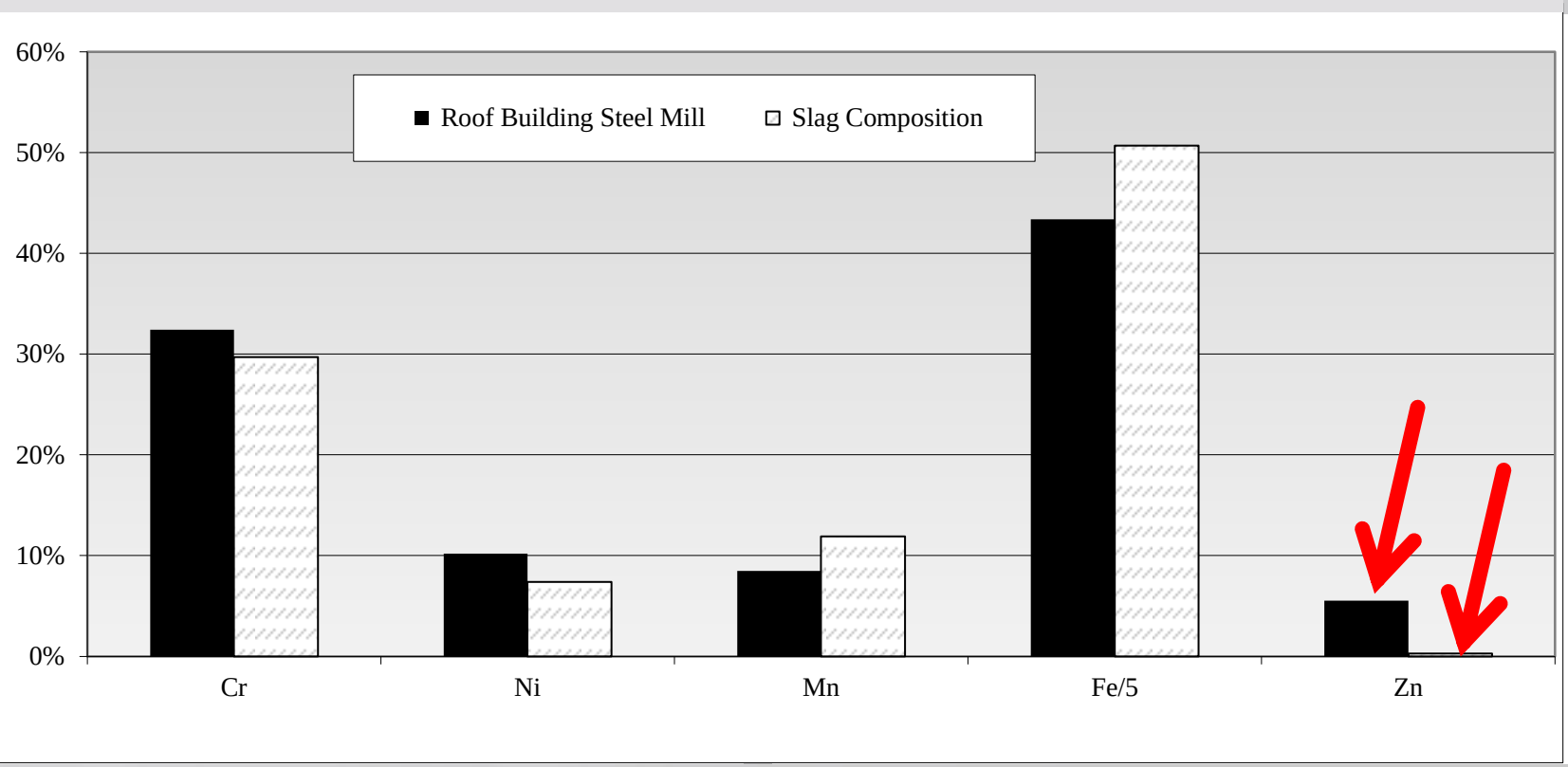
- Stack and diffuse emissions data were carried out within the integrated pollution prevention and control (IPPC) permit in the same years.

METHODS

- PM10 and metals determinations in ambient air quality monitoring have been performed according to the EU Directive 2004/107/EC and UNI EN 14902-2005.
- Measurements of metals in stack emissions have been carried out according to the UNI EN 13284-1 method.
- Monitoring of total depositions has been conducted following the Italian laws and regulations (National Institute of Health, 2006) according to EU Directive 2004/107/EC. Total depositions are determined as sum of dry and wet fractions collected by passive exposure of a HDPE bottle/cylindrical funnel system with standardised dimensions, for one month exposure time. The deposited samples are filtrated, then both the particulate matter collected on filter and the filtrate are processed and carried out according to UNI EN 14902-2005 method.

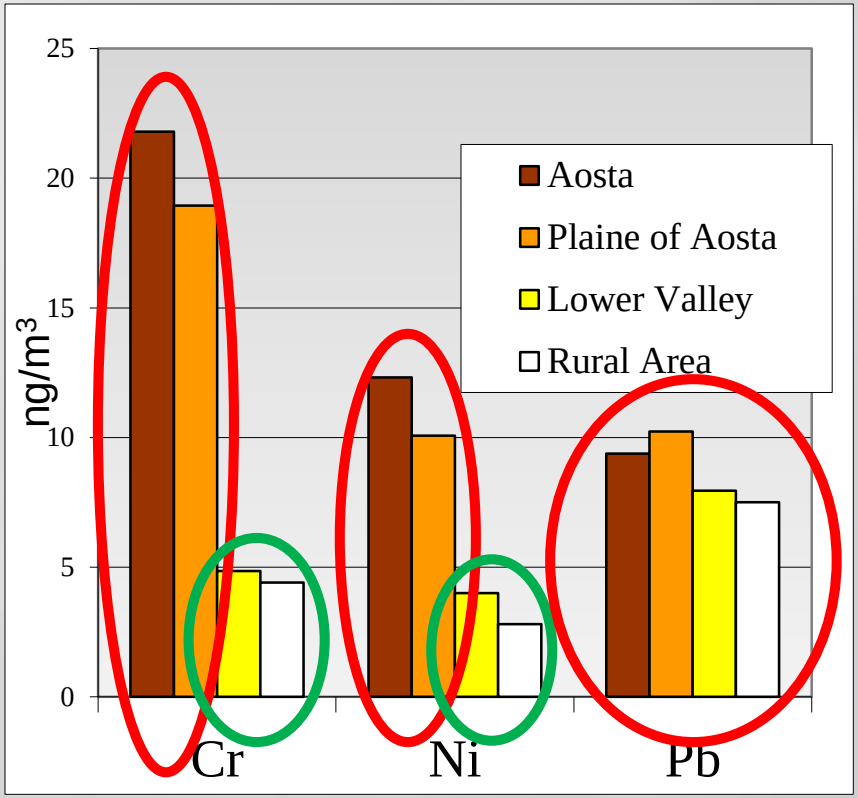
FINGER PRINT

Comparison between metal slag composition and the fingerprint of depositions of the roof of the steel mill building

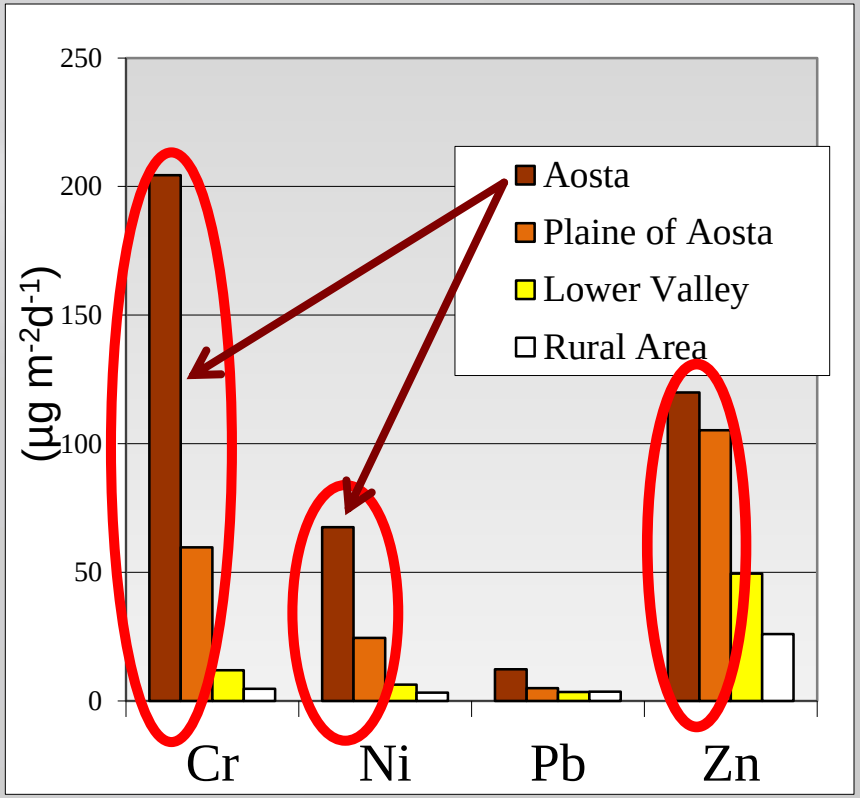


METALS LEVELS

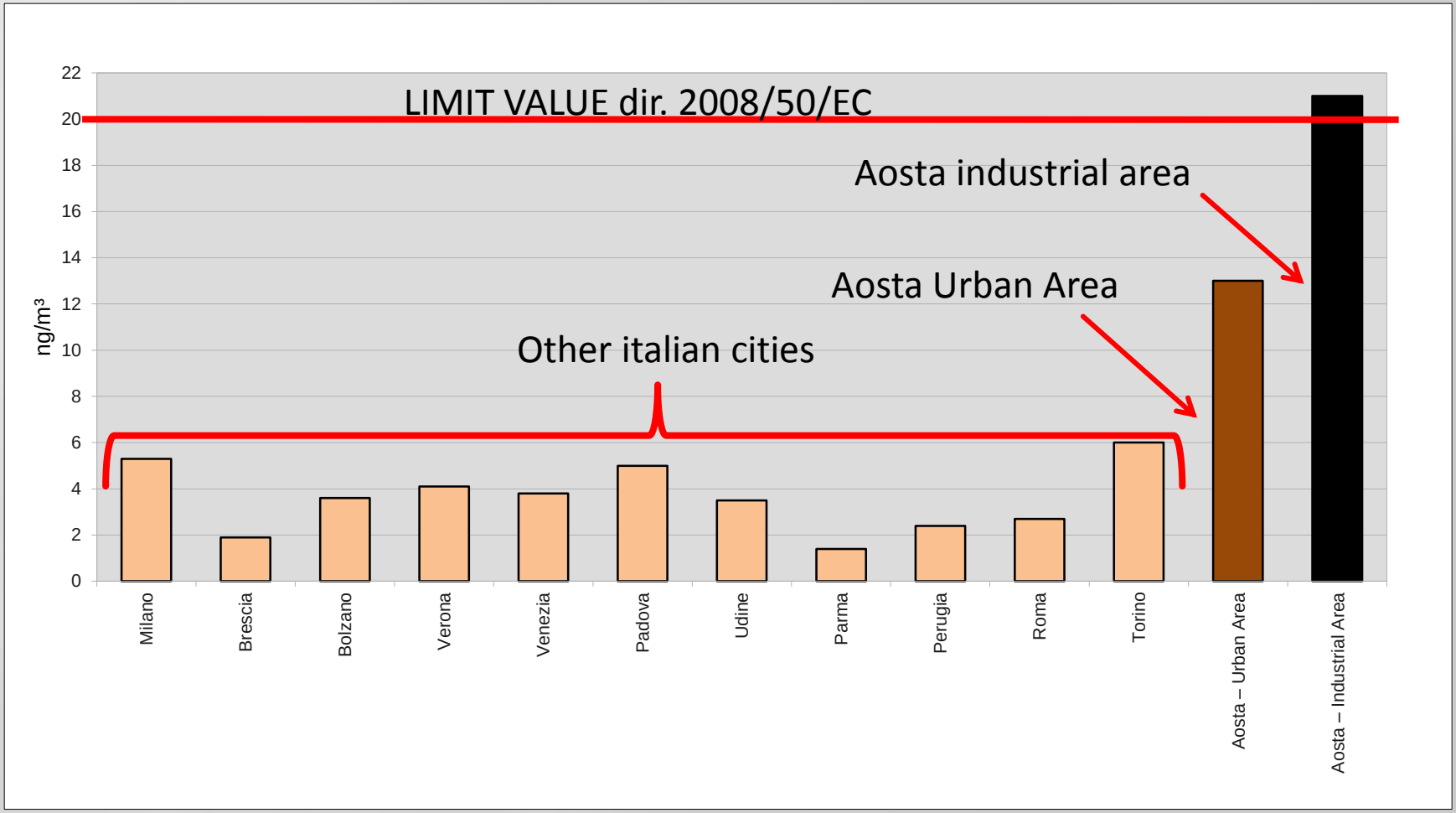
PM10



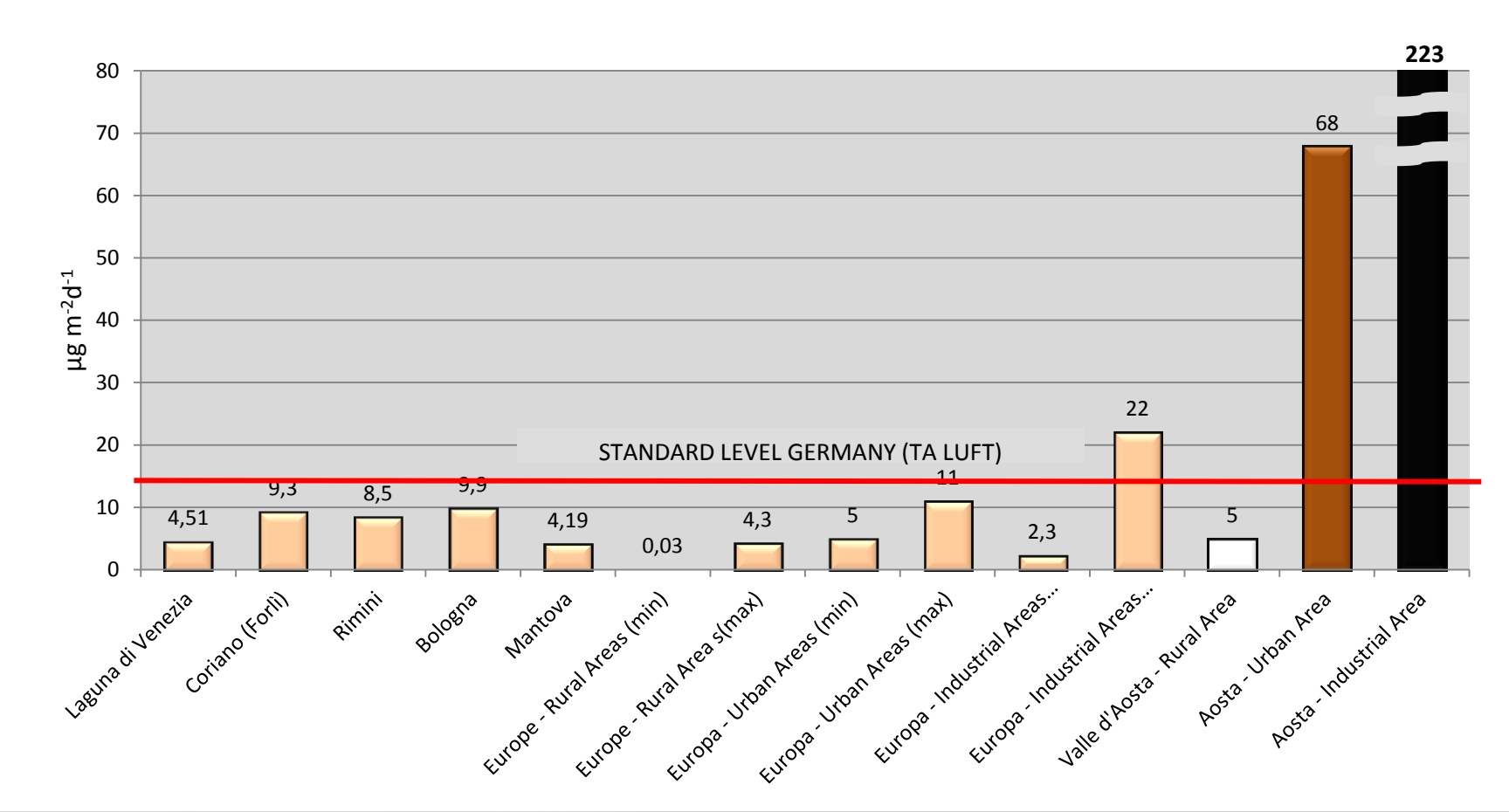
Depositions



NICKEL LEVEL IN PM10 RESPECT TO OTHER ITALIAN CITIES



NICKEL DEPOSITIONS LEVEL IN AOSTA RESPE
TO ITALIAN AND EUROPEAN SITES



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CONCLUSIONS

Chemical characterization of metal content of stack and diffuse emissions of the steel mill allowed to determine **two different fingerprints referable to primary and secondary emissions** of steelmaking processes respectively

- Fine particles (PM10) disperse uniformly along the urban area and the Plaine of Aosta
- Cr and Ni content in PM10 in these areas are determined by steel mill primary emissions, and result significantly higher respect to other Italian cities.
- Conversely, in the Lower Valley, metals levels in PM10 are comparable with rural areas.
- Coarse particles from diffuse emissions determine critical levels of deposition of Cr and Ni in urban area, comparable with levels measured near metal processing plants and higher with respect to TALuft – Germany standard values.

Taking into account these results, appropriate management and technical measures should be applied to prevent diffuse emissions and to reduce stack emissions from steelmaking process.