Estrategia de emisiones de partículas en entornos industriales: inventario de emisiones y MTDs. Resultados de AIRUSE LIFE+ project

AIRUSE

LIFE 11 ENV/ES/000584

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UIMP, Santander, 20-21/07/2015

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B.5 Industrial sources contributions

Technical staff from ITC involved in AIRUSE:

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Results from the receptor model

Area	Contributions to 2013 annual mean (values in %)									
	TOTAL*		INDUST		REG ($OC+SO_4^{2-}$)		nTR-NO_3^-		Shipping	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
POR-TR	< 12	< 14	4	5	10	13	2	1	<1	<1
BCN-UB	< 36	< 39	11	12	26	37	8	3	4	5
FI-UB	< 23	< 26	5	6	21	29	6	4	<1	<1
MLN-UB	n.a.	< 22	n.a.	5	n.a.	19	n.a.	6	n.a.	<1

n.a.: not available

*Contributions for sources directly/indirectly and totally/partially related with industrial source

AIRUSE industrial activity inventory

Methodology. Required information

Channelled primary PM	Diffuse primary PM
Main industrial activity (IPPC or E-PRTR code)	
Annual production (kg, tonnes, m^2, …)	
Type of fuel	
Process stages: number of point sources	Activities that can generate diffuse emissions
Implemented BATs	Quantity of material handled
Emission duration (hours/year)	Distance travelled by trucks inside the company
Emission temperature	Paving in the areas travelled (paved or unpaved)
Emission volume flow rate (dry basis)	Storage park area and amount of stored material
Emitted PM concentration	Implemented mitigation measures
BATs maintenance operations	Maintenance operations of the mitigation measures

Primary PM emissions quantification

Channelled emissions

- **Methodology 1**: Direct emission data for TSP and/or PM10 available from the industrial emissions inventory. **BCN and FI**.

- **Methodology 2**: Calculation of annual TSP emissions from C_{TSP}, flow rate and total hours of annual emission. **MLN**.

- **Methodology 3**: No detailed information was available. PM10 and PM2.5 emissions were calculated from production data, applying emission factors. **POR**.

PM10/TSP and PM2.5/PM10 ratios and emission factors were obtained from the following databases: EMEP/EEA, AP 42 (US-EPA), AUSTRALIA-EPA and IIASA

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Primary PM emissions quantification

Diffuse emissions

Methodology: PM10 and PM2.5 emissions were calculated from **amount of bulk material handled or production data**, applying generic emission factors.

Only emissions associated with the handling of bulk solids have been quantified

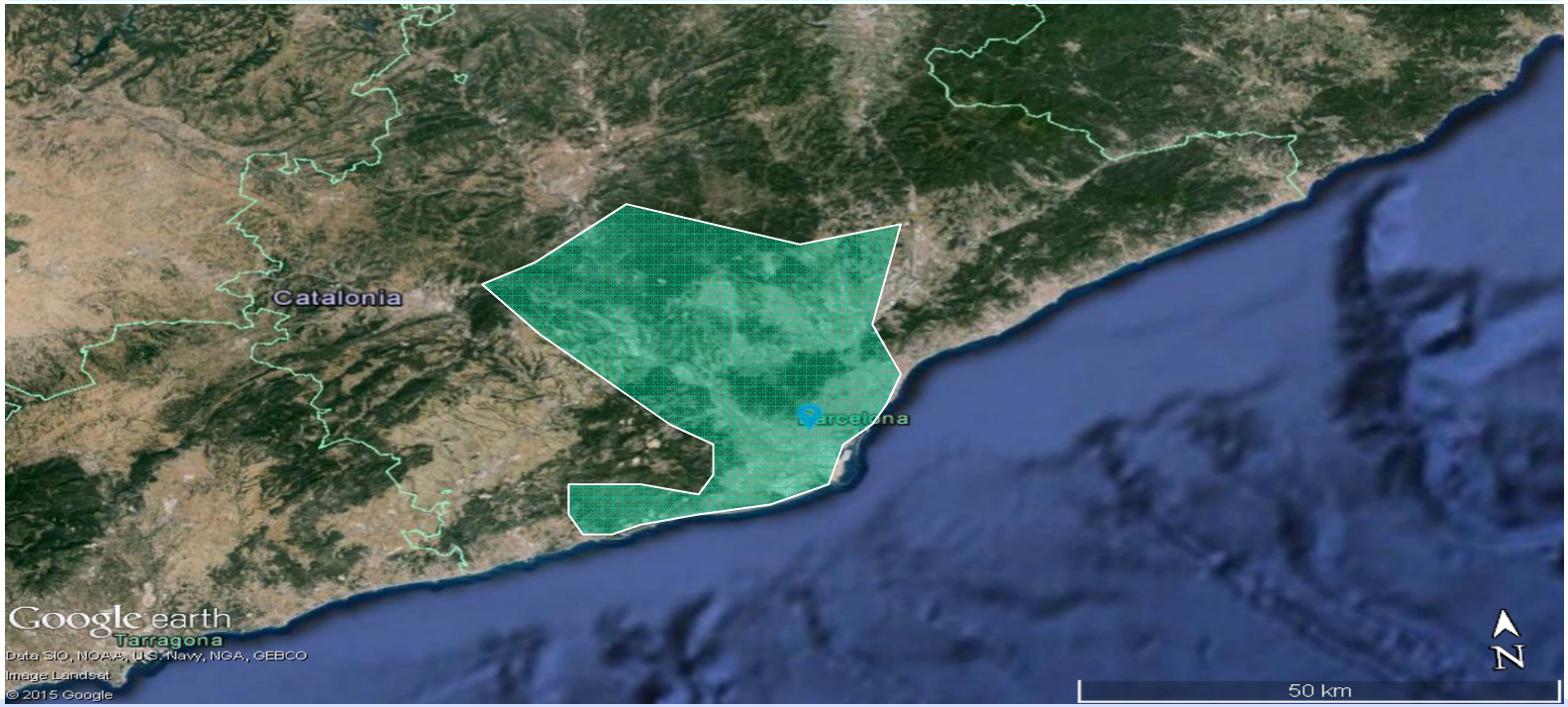
Two handling operations have been considered

Primary PM diffuse emissions have been underestimated

PM10/TSP and PM2.5/PM10 ratios and emission factors were obtained from the following databases: EMEP/EEA, AP 42 (US-EPA), AUSTRALIA-EPA and IIASA

BCN-SEPA

Study area			Industrial emission inventory		
Population (Minhab.)	Area (km^2)	Density ($inh./km^2$)	Facilities	Methodology	ELV-BAT
4.6	**725**	**6345**	**>60**	**1**	**Medium-High**



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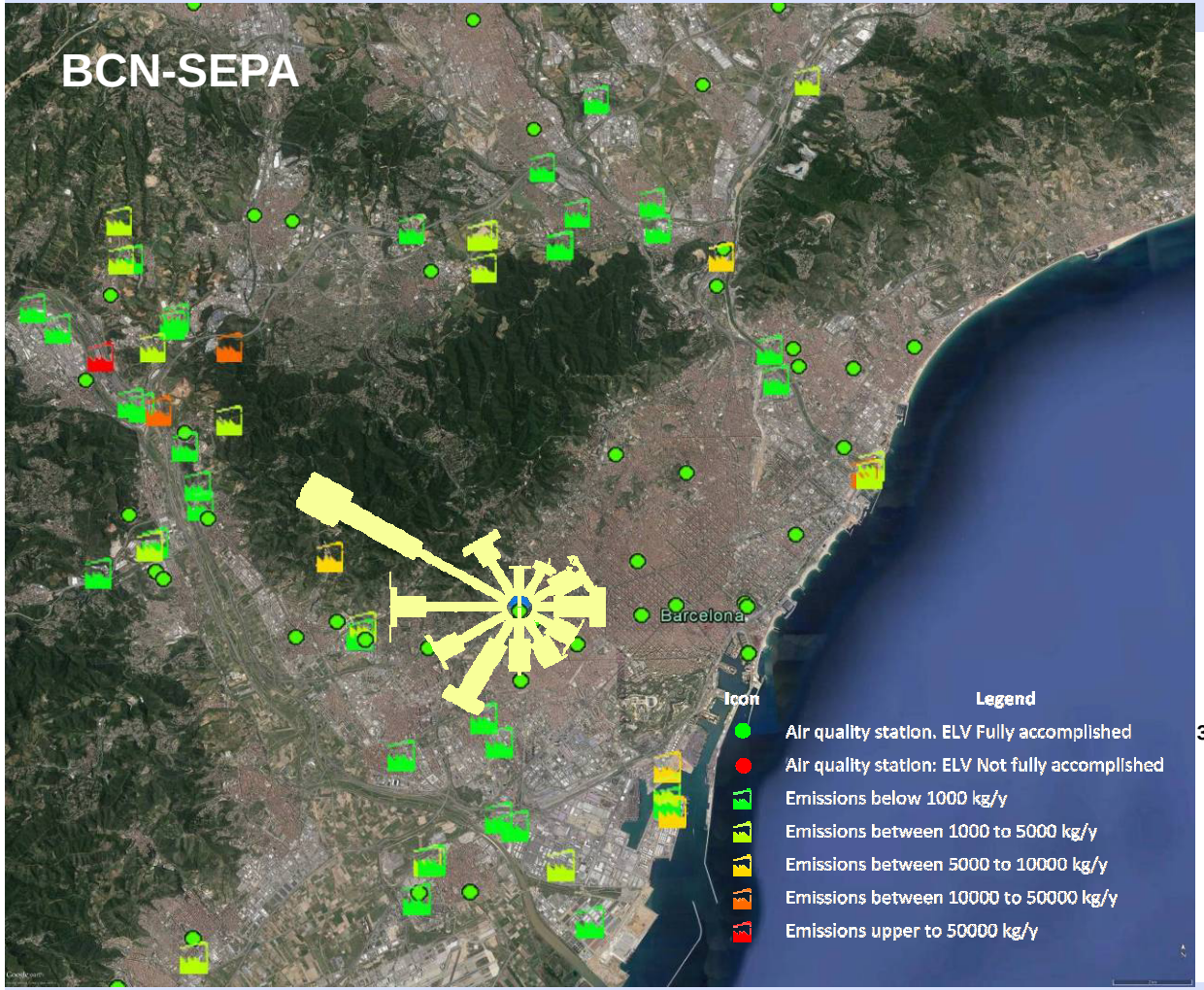
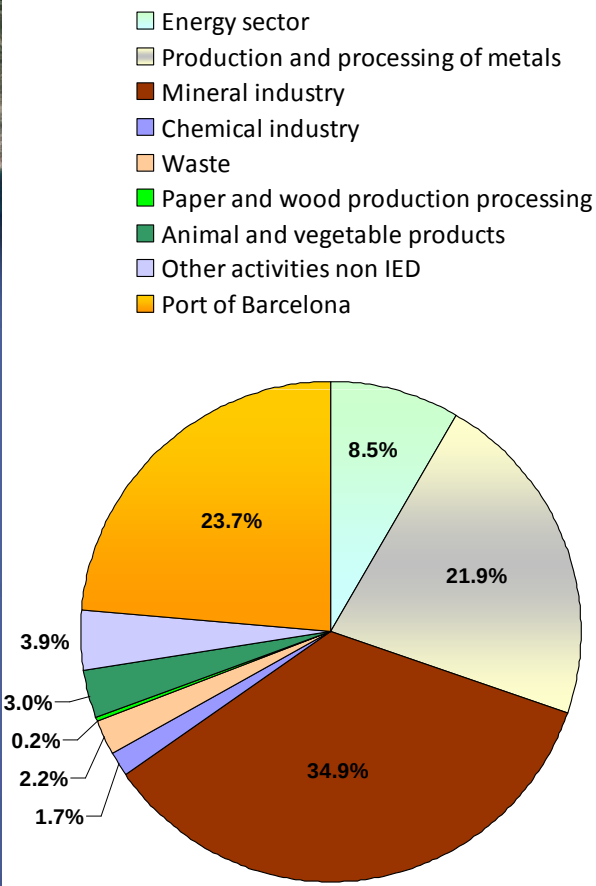
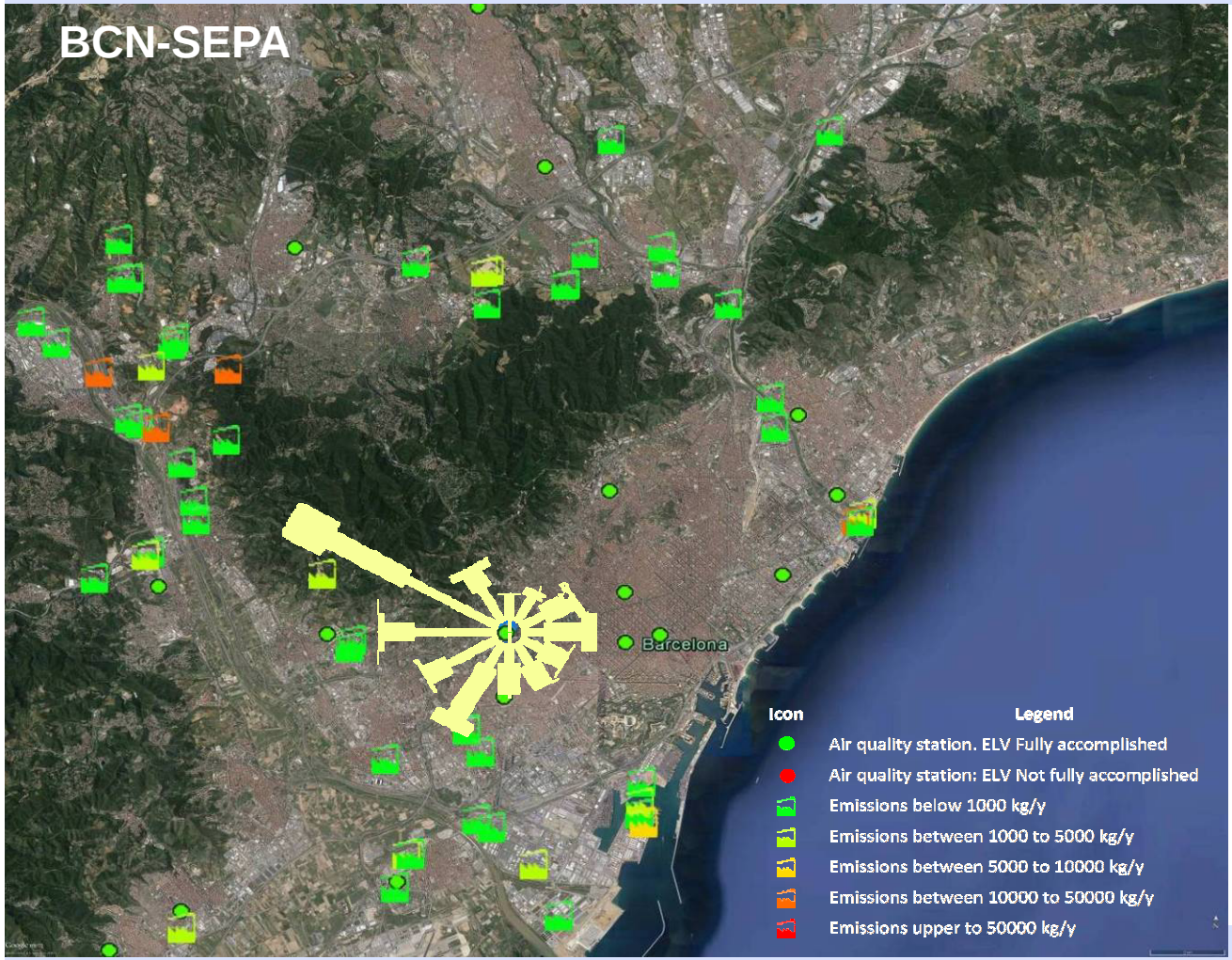
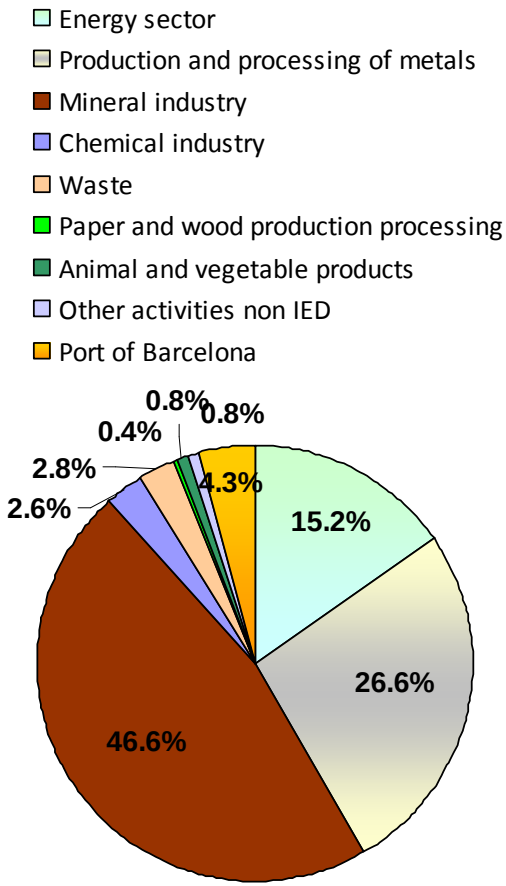
Primary Industrial PM10 emissions



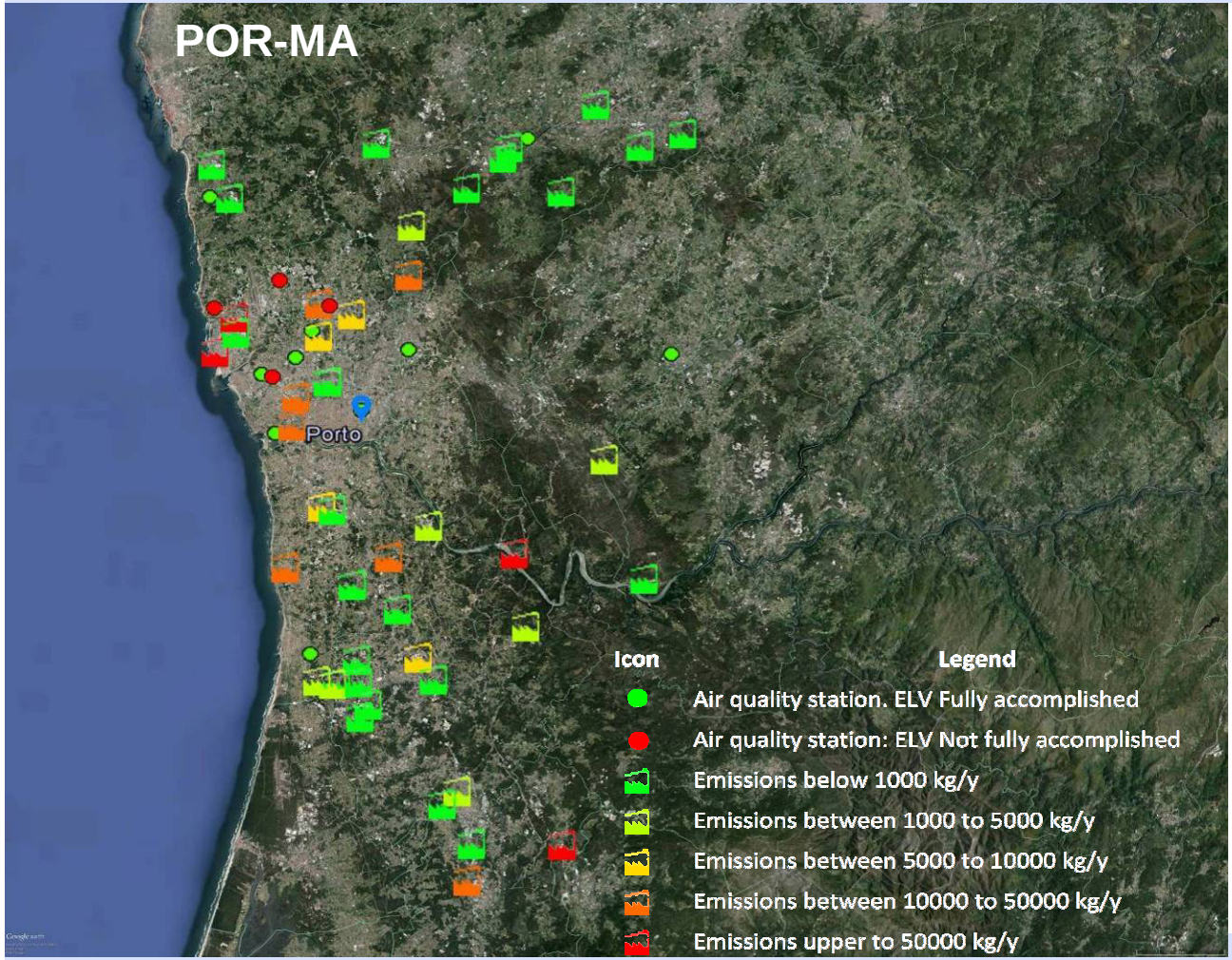


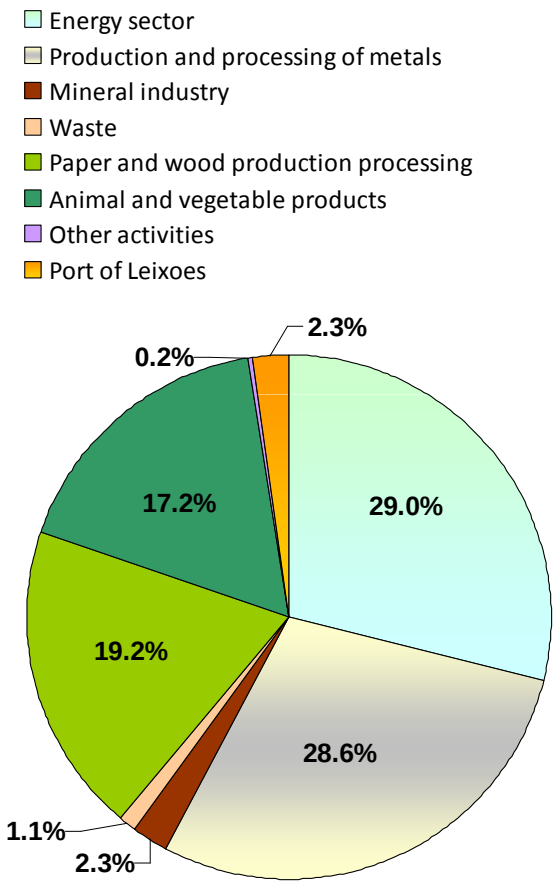
Primary Industrial PM2.5 emissions



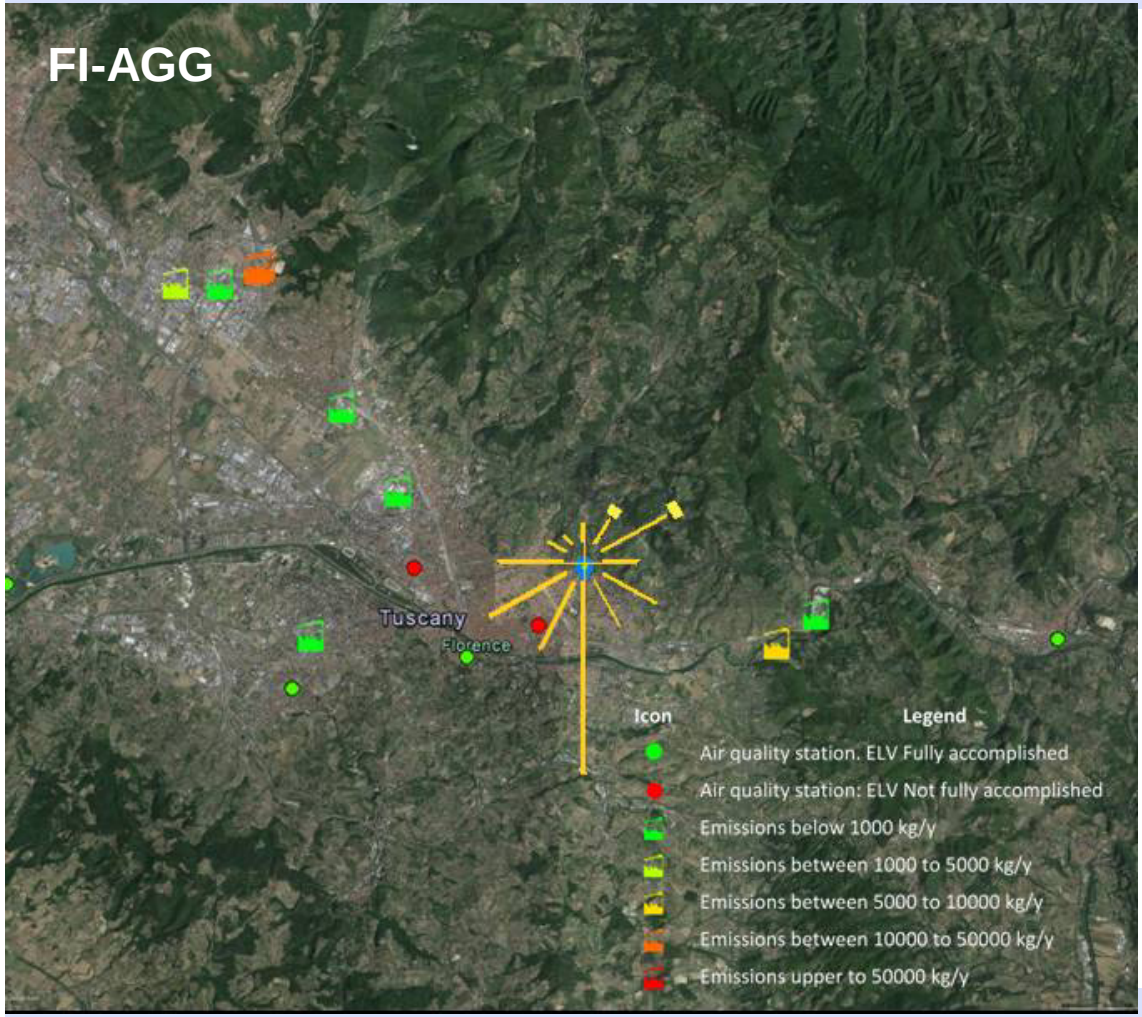


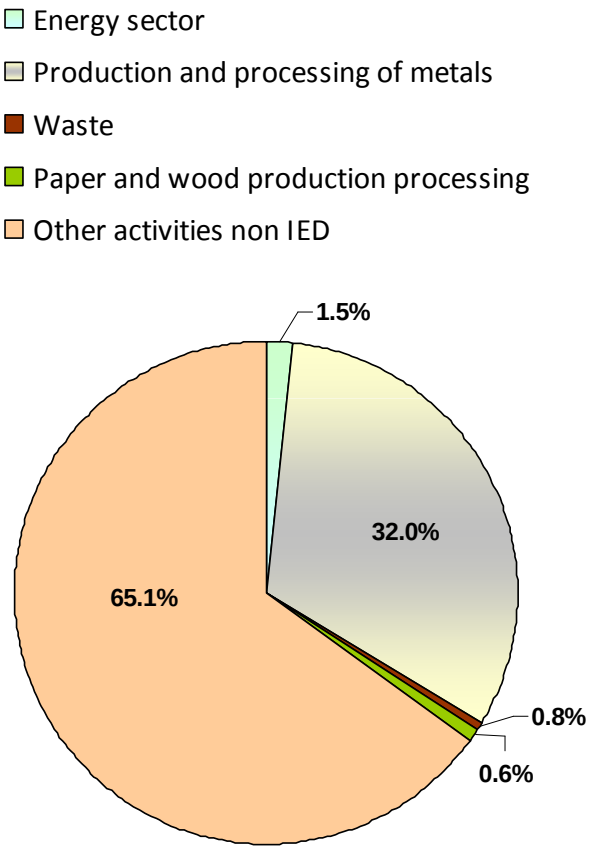
Primary Industrial PM10 emissions





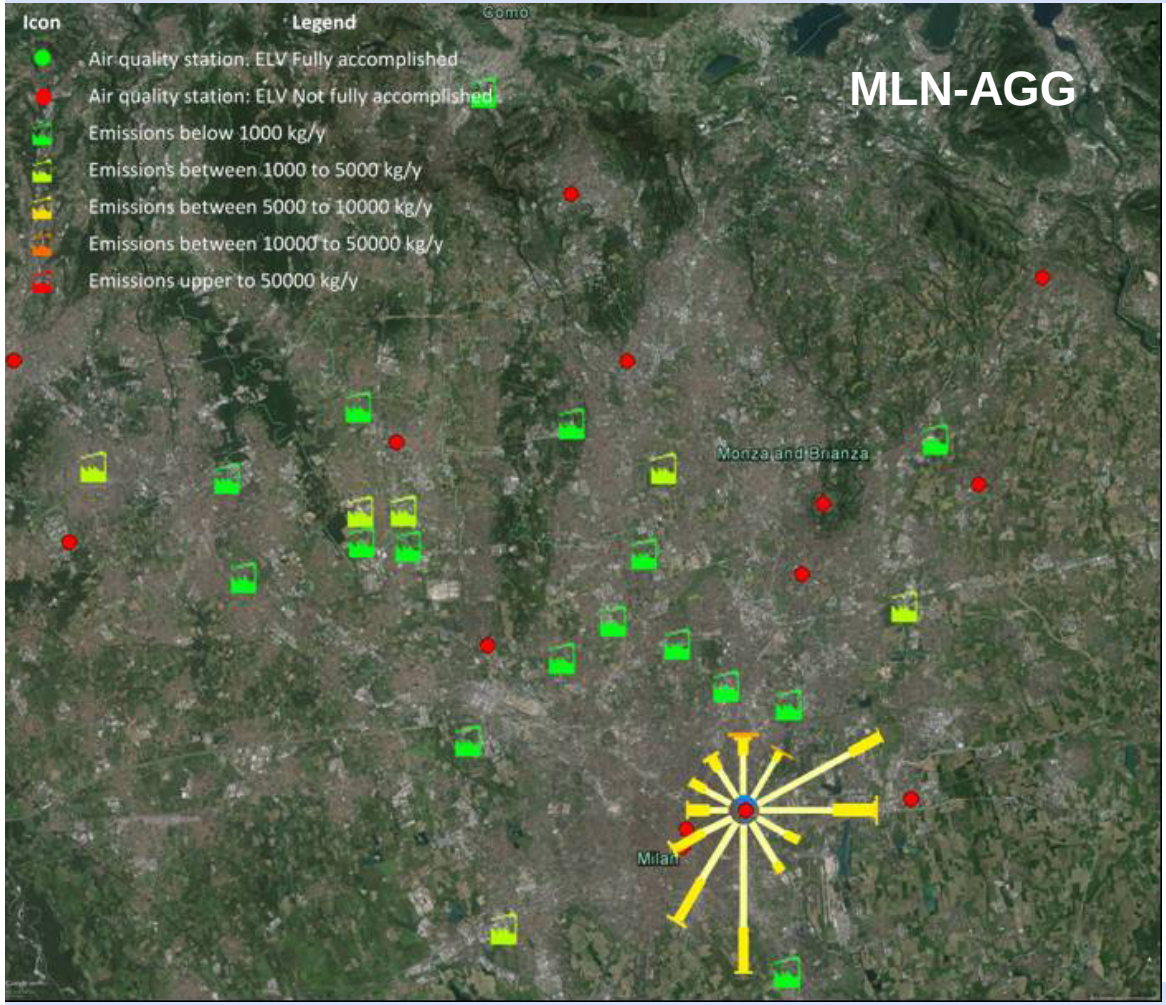
Primary Industrial PM10 emissions

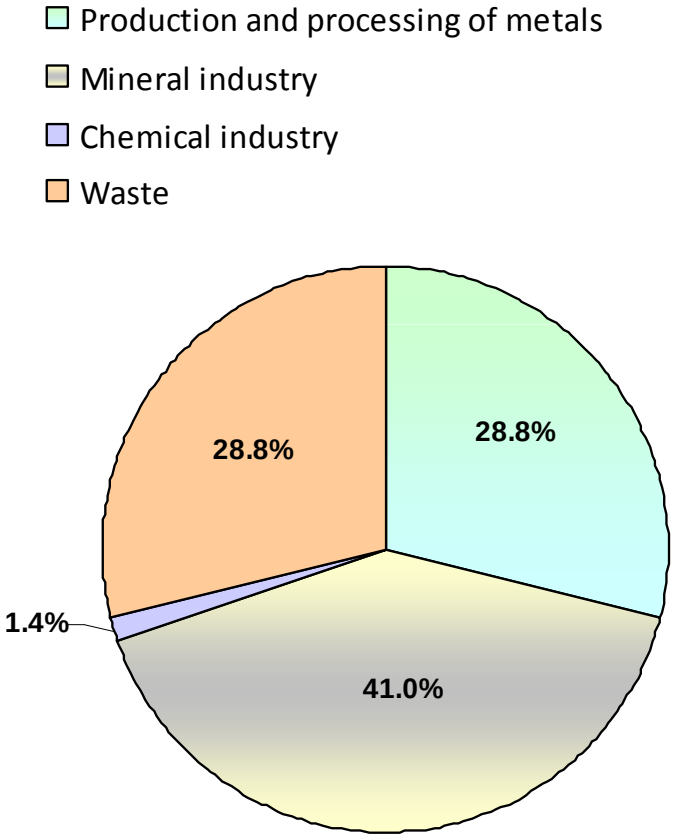




Other activities: Concrete manufacturing, silver processing and biomass co-generation plant (<50Mw)

Primary Industrial PM10 emissions





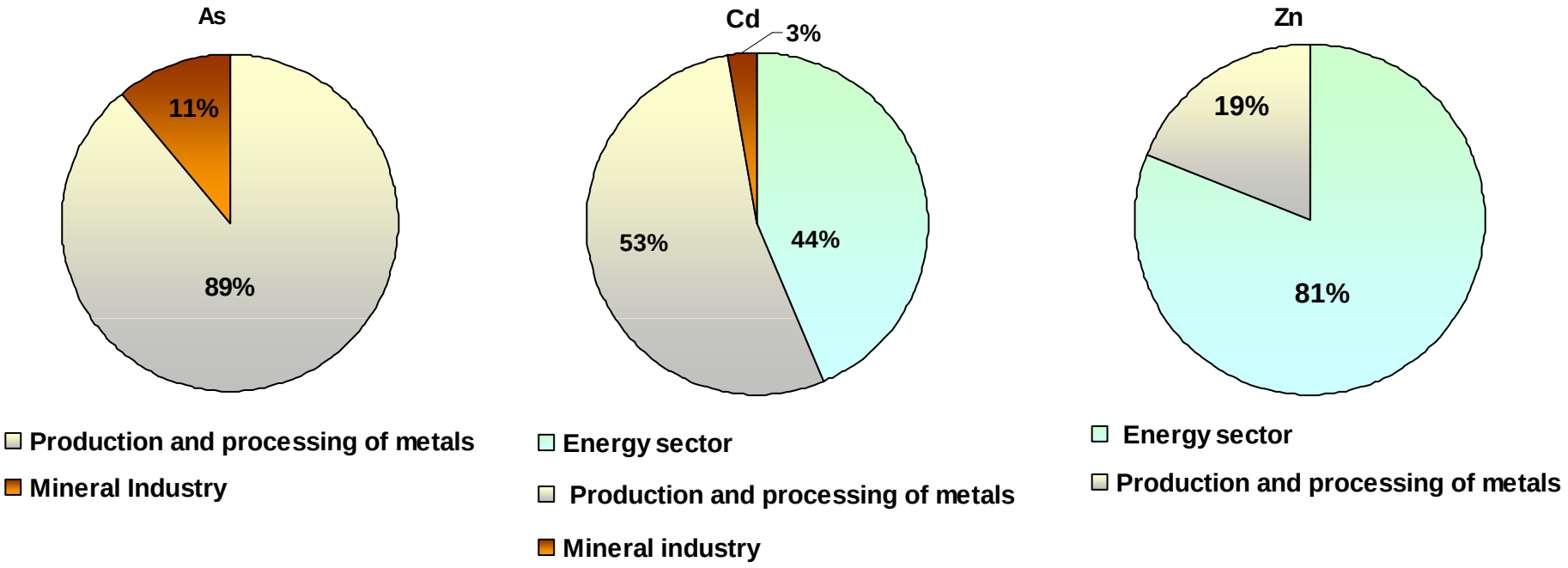
Precursors of secondary PM

Study area	Total emissions (tonnes/year)					
	PM emissions		Gaseous emissions*			
	PM10	PM2.5	NO_x	SO_2	NH_3	NMVOCs
POR-MA	669.8	571.3	3278	3189	40	1207
BCN-SEPA	246.5	137.0	5733	221	10.7	4070
FI-AGG	31.9	17.0	N/C	N/C	N/C	N/C
MLN-AGG	16.3	14.3	993	410	N/C	N/C

N/C: Unquantified

*Data from E-PRTR 2012

Heavy Metals (E-PRTR 2012)



Cu: 100% from production and processing of metals

Data from E-PRTR 2012

Recommendations

Addressed to EU regulatory and technical bodies: EMEP, IPTS, and R&D managers

- **Emission inventories:**
  - Encouraging efforts to standardise and coordinate baseline information
  - Extending information in public inventories (e.g. E-PRTR) to improve transparency
  - Harmonising key parameters: air quality (PM10, PM2.5), ELVs (PST), and E-PRTR (PM10)
- **Diffuse sources:**
  - Developing and compiling specific PM diffuse emission factors and control efficiencies
- **Channelled emissions:**
  - Developing and compiling specific PM10/TSP and PM2.5/PM10 ratios
  - Fostering control of secondary PM precursors and heavy metal emissions
  - Regulating maximum temperatures in exhaust gases and/or abatement systems

Recommendations

Addressed to National and/or Regional environmental bodies

- **Primary PM emissions:**

- Updating the ELVs adopted in the BREF documents
- Increasing emission control frequency to ensure proper BATs operation
- Including **real control and quantification** of diffuse emissions

- **Gaseous emissions** (**secondary PM precursors) and heavy metals:**

- Quantifying these emissions in greater detail
- Selecting the cleanest available fuels and/or using controlled combustion systems
- Fostering implementation of cleaning systems in hot emissions

Recommendations

Addressed to Regional environmental bodies:

- **Regional inventories of PM industrial emissions**

  - Periodically updating the list of industrial activities

  - Using a bottom-up approach, including non-IED activities and diffuse emissions

  - Controlling and quantifying shipping, harbour, and public works emissions

Addressed to stakeholders

- **Awareness-raising activities**

  - Organising specific campaigns (workshops, info-days…) for industrial associations, harbour managers, local authorities, health groups, etc

  - Involvement of stakeholders can greatly increase emission inventories accuracy

Emisiones difusas

Recommendations: Diffuse sources

EMEP-EEA air pollutant emission inventory guidebook 2013

2. Industrial processes and product use: Handling of mineral products

TIER 1: Not estimated TSP, PM10 and PM2.5

TIER 2:

Practice	BATs	E.F.			
		TSP	PM10	PM2.5	Units
Handling	Uncontrolled	12	6	0.6	g/ton

TIER 3: EFs are not available for the especific processes combined with especific mineral products

Recommendations: Diffuse sources

Emissions Factors & AP 42, *Compilation of Air Pollutant Emission Factors*

Chapter 11. Mineral Products Industry

Only coal mines have emission factor equations for uncontrolled open dust sources (blasting, truck loading, bulldozing, dragline, grading, etc.)

Chapter 13. Miscellaneous sources

Handling:

$$E = k \cdot (0{,}0016) \cdot \frac{\left(\frac{V}{2{,}2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \quad \text{kg/tonne}$$

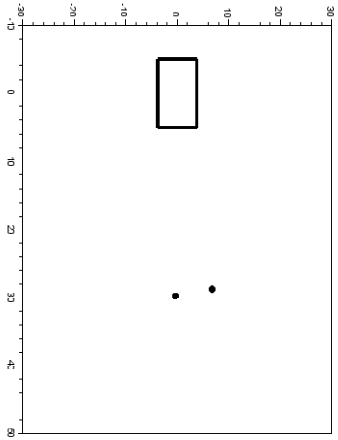
- Materials (iron ore and coal); operations (truck unloading and telestopic tubes),
- Parameters: v (wind velocity) and M (materials humidity)

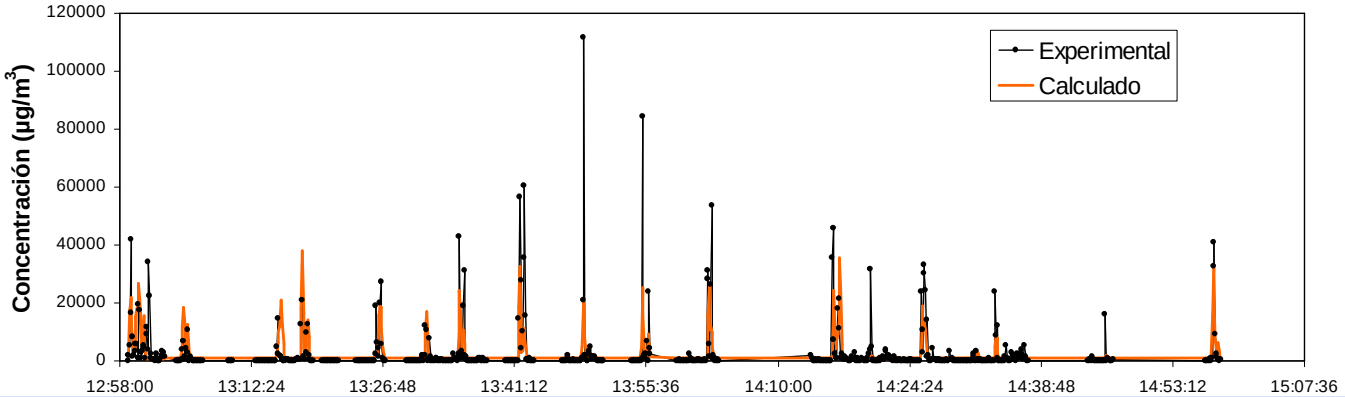
Recommendations: Diffuse sources

Emissions Factors & AP 42, *Compilation of Air Pollutant Emission Factors*

Chapter 13. Miscellaneous sources: Handling

Recommendations: Diffuse sources





Sanfelix et al., 2015 Atmospheric Environment

Recommendations: Diffuse sources

Mineral Products Industry

Methology	ITC	EMEP-EEA	AP-42
Operations	E.F. PM10 (g/ton)		
Pile load-in clay	5	6	0.11
Pile load-out clay	21	6	0.11

Sanfelix et al., 2015 Atmospheric Environment

Recommendations: Diffuse sources

Puertos: desembarque cristobalita

Operaciones específicas estudiadas

Carga de tolva con grúa móvil

Carga de camión mediante tolva

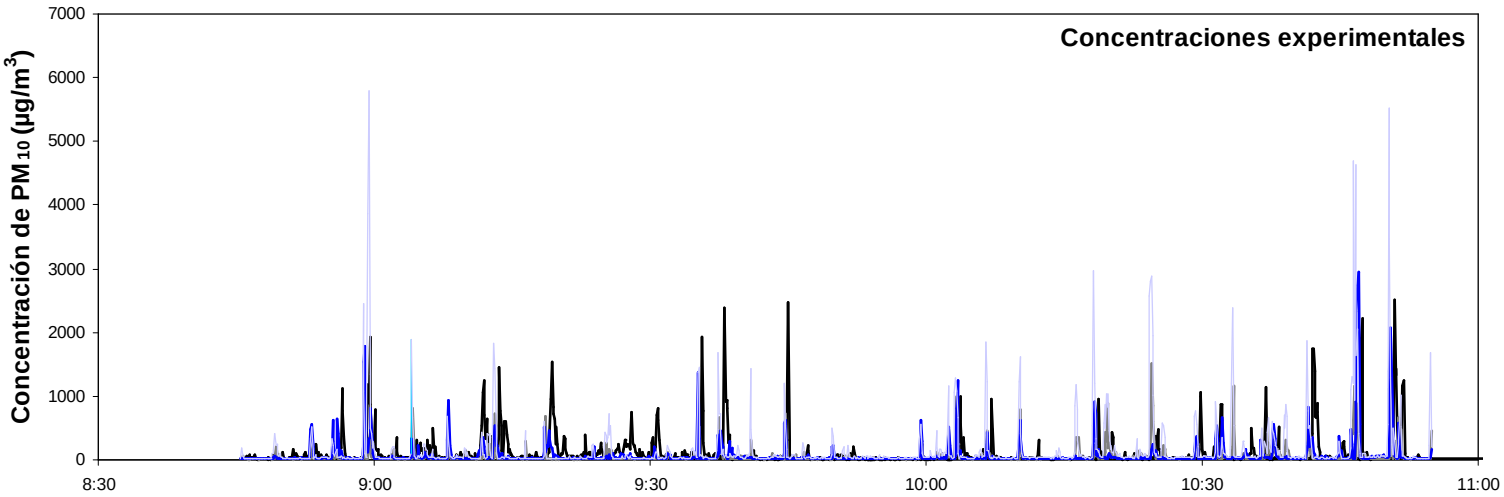
Paso de camiones por vías asfaltadas

Ubicación equipos de muestreo

Recommendations: Diffuse sources

Puertos: desembarque cristobalita

FE_{PM10} obtenidos C_{PM10} registradas



Experiencia	Material manipulado	Operaciones específicas	FE_{PM10}
Desembarque	Cristobalita	Carga de camión con tolva	9.8 g/ton
		Paso de camiones por vías asfaltadas	221 g/km

Recommendations: Diffuse sources

F.E.PM10 (g/ton): : Operaciones de manipulación con máquina-pala

Operación	Material	Rango granulométrica	MTDs	F.E. $_{PM10}$
Carga	Arcilla	<1-30mm	No	5
Descarga	Arcilla	<1-30mm	No	21
Carga y descarga	Clinker gris	No disponible	No	46.5
	Caliza	No disponible	No	3.6
	Clinker blanco	No disponible	No	25.5
	Chatarra	Estructural y recortes	No	10

Recommendations: Diffuse sources

F.E.$_{PM10}$ (g/ton): Operaciones de manipulación con camión

Operación	Material	Rango granulométrica	MTDs	F.E. $_{PM10}$
Carga de camión con tolva	Cristobalita	No disponible	No	9.8
	Nefelina	No disponible	No	1.1
Descarga camión+cinta articulada móvil	Sulfato amónico	No disponible	No	9.6
Descarga camión a tolva	Arena	<1-5 mm	No	0.29
	Arena	<1-5 mm	Tolva semicerrada	0.20
	Grava	20-40 mm		0.33
Descarga camión en celda	Chatarra	Estructural y recortes	Celdas	0.9

Recommendations: Diffuse sources

F.E.$_{PM10}$ (g/ton): Operaciones de manipulación con grúa móvil

Operación	Material	Rango granulométrica	MTDs	F.E. $_{PM10}$
Carga tolva con grúa móvil	Nefelina	No disponible	No	3.3
Carga tolva con grúa móvil+carga de camión con tolva	Roca fosfórica	No disponible	No	262.2
Carga grúa móvil desde acopio	Chatarra	Estructural y recortes	No	6.5
Descarga grúa móvil en cesta	Chatarra	Estructural y recortes	No	4.3

Recommendations: Diffuse sources

Impacto quema intencionada de restos de poda agrícola



Valorización energética



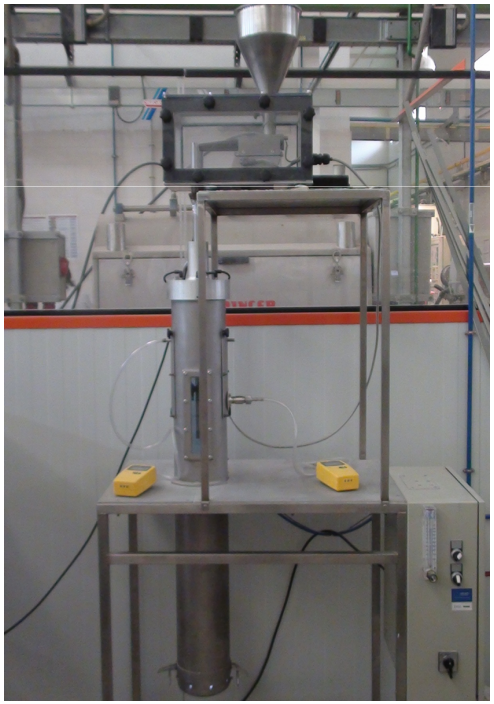


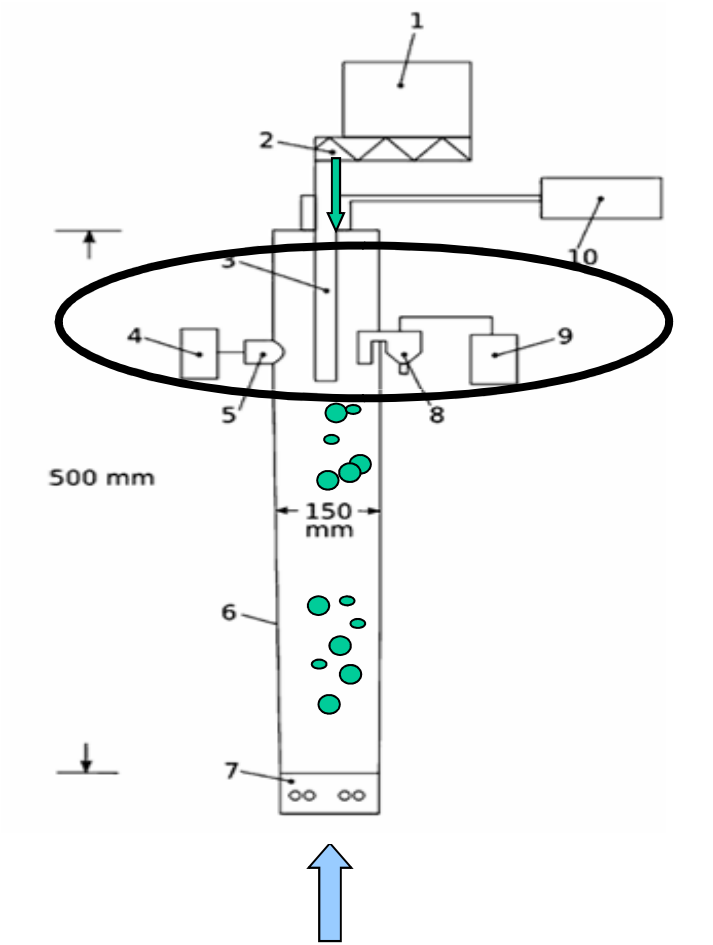
GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE
Fundación Biodiversidad
AIRUSE

Recommendations: Diffuse sources

Método de caída continua

(Norma EN 15051: 2006)



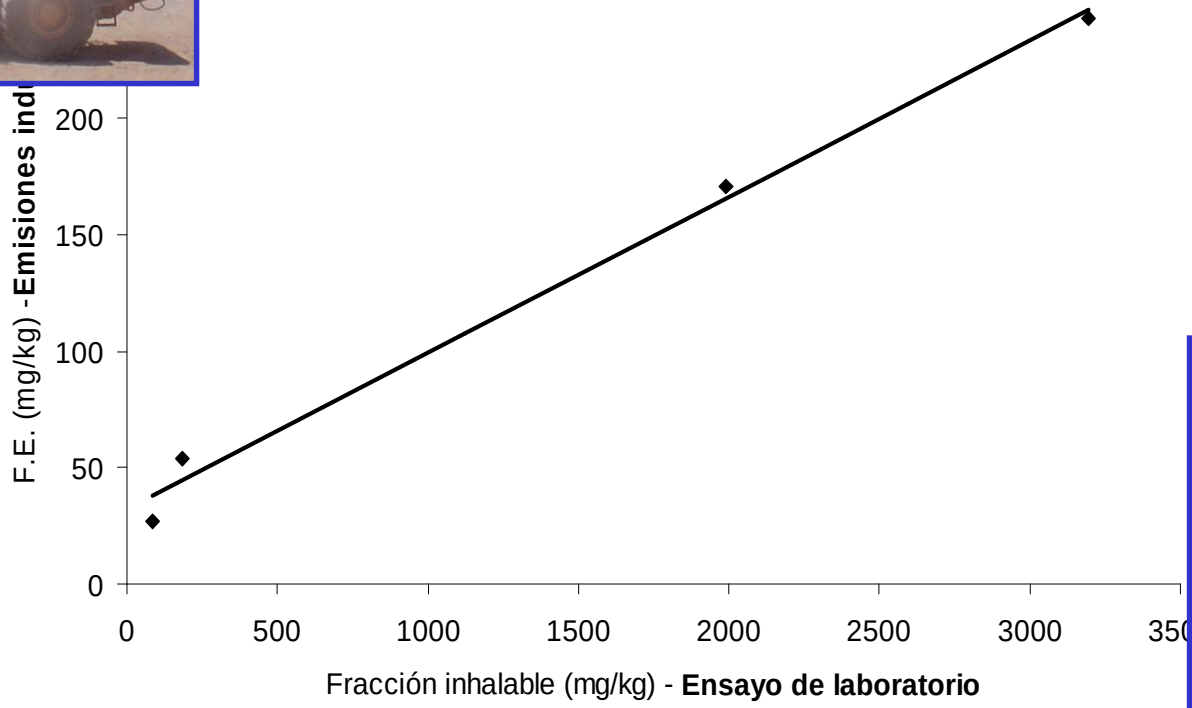


Clasificar de forma estandarizada los materiales

Clasificación	Fracción másica de polvo (mg/kg)	
	Inhalable (w_I)	Respirable (w_R)
Muy bajo	**<1000**	**<20**
Bajo	**1000 a 4000**	**20 a 70**
Moderado	**>4000 a 15000**	**>70 a 300**
Alto	**>15000**	**>300**

Norma EN 15051-3:2013

Relación directa entre la emisión industrial y el poder de emision de polvo



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Emisiones canalizadas

Proceso	Etapa	Sist. depuración		Valores medios		
				C (mg/m_N^3)	W_{10} (%)	$W_{2.5}$ (%)
T ambiente (15-40)ºC	Molienda	FM - ↑Rto		<5	74.8	53.4
	Prensado	Sin depuración		109±33	21.0	2.1
		FM	↑ Rto	<5	75.3	28.9
			→ Rto	22±7	27.2	21.3
	Esmaltado	Sin depuración		132±71	51.8	20.1
		FM - ↑ Rto		<5	74.5	41.7
T media (60-120ºC)	Secado	No aplica		<5	84.5	66.9
	Atomización	Ciclón		>1000	73.4	41.3
		FM - ↑ Rto		<5	81.7	53.5
		FVH		75 34	97.7	80.6
Alta T (120-260ºC)	Cocción	Sin depuración		11±5	99.4	93.9
		FM + Reactivo		<5	81.6	59.2
	Fusión	Sin depuración		415±318	74.9	59.1
		FM / PE	↑Rto	<5	85.5	64.3
			→ Rto	36±18	51.8	28.1

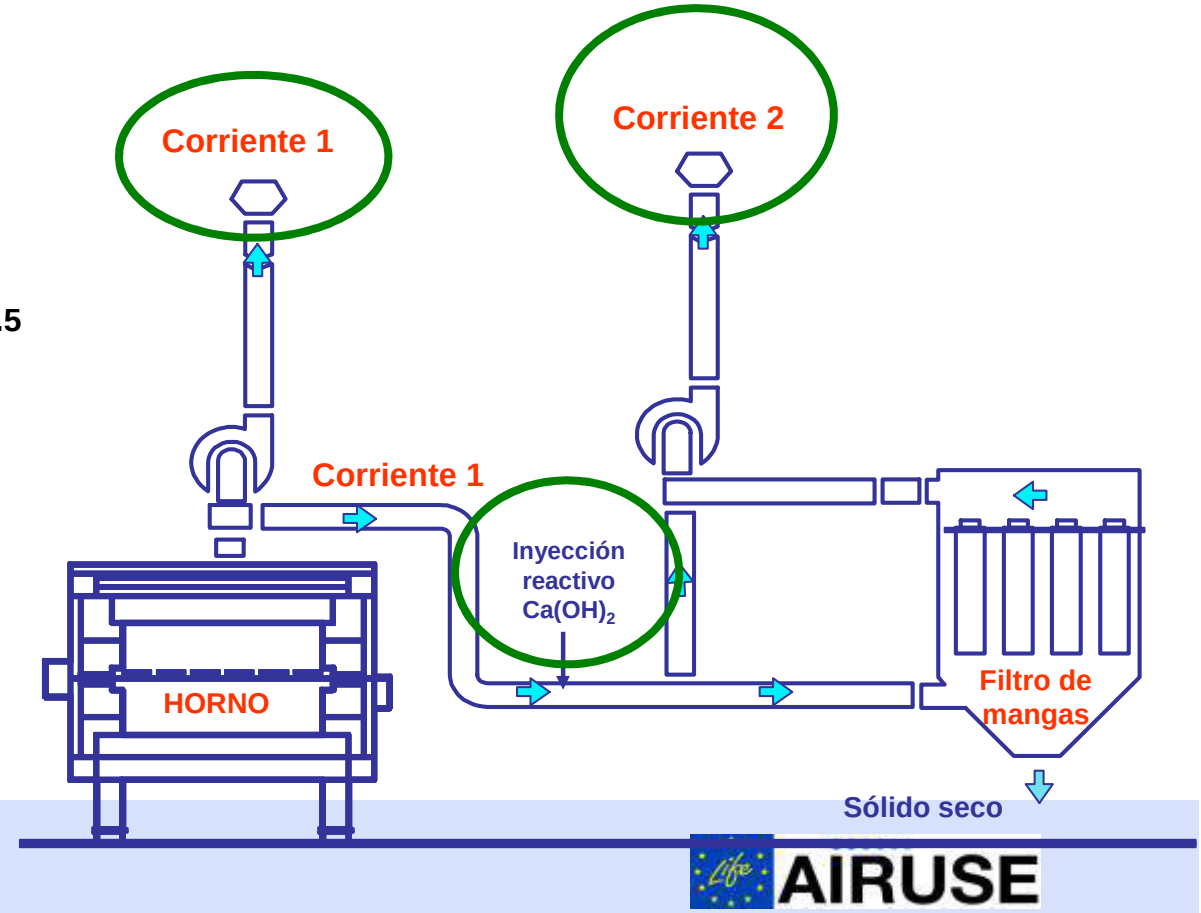
Influencia de la temperatura de emisión

Referencia de los materiales:

SIN depuración: C-PC/AR/GR

CON depuración: C-PC-$PM_{10/2.5}$

Reactivo inyectado: $Ca(OH)_2$



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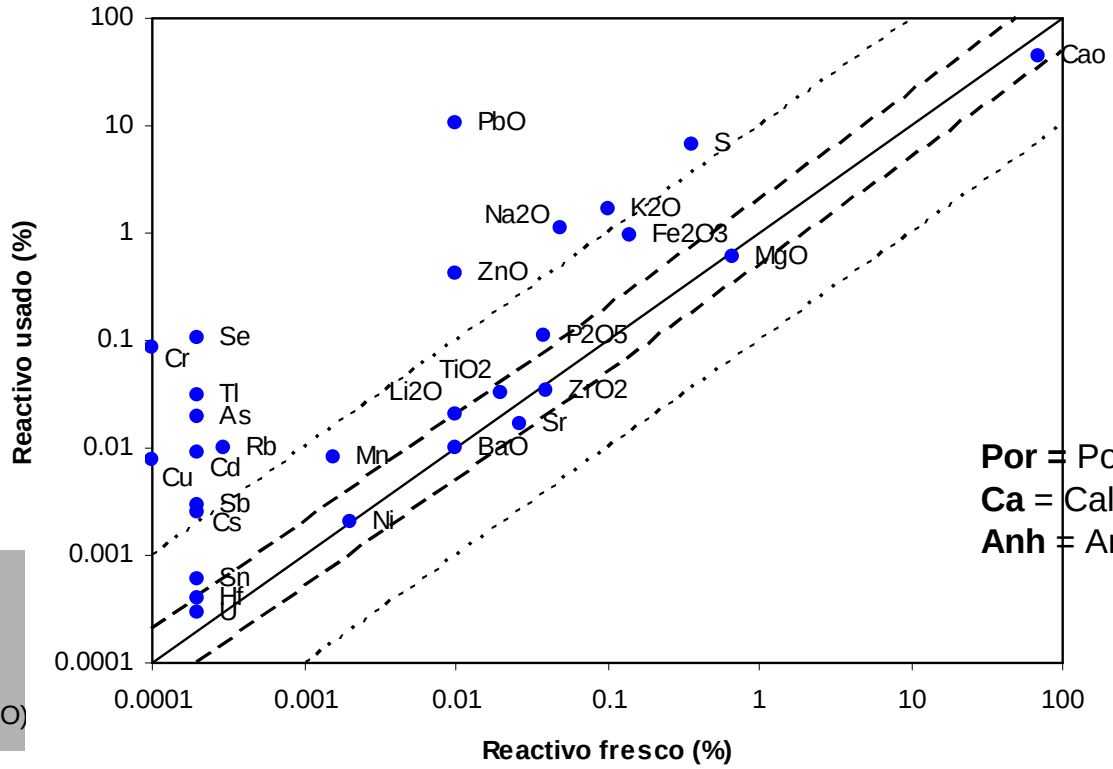
Influencia de la temperatura de emisión

DRX

CaF = Fluorita (CaF2)
Pal = Palmierita (K2Pb(SO4)2)
Ang = Anglesita (PbSO4)
Anh = Anhidrita (Ca(SO4))
Pol = Polihalita (K2Ca2Mg(SO4)4·2H2O)



DRX

Por = Portlandita (Ca(OH)2)
Ca = Calcita (CaCO3)
Anh = Anhydrita (Ca(SO4))

Influencia de la temperatura de emisión

Enriquecimiento en la fracción PST de elementos y componentes estudiados en el reactivo utilizado en la depuración de contaminantes

Las condiciones de operación del filtro de mangas con adición de reactivo, (temperatura<200ºC, baja velocidad de filtración, etc.), favorece la retención de elementos considerados como de interés ambiental (Pb, Se, Cr, Cd, As, Zn y Tl)

Gracias por su atención