LP2M itenas
Lembaga Penelitian dan Pengabdian Masyarakat

Emission Inventory of atmospheric pollutants in Jakarta and surrounding provinces

SUBMITTED TO CREA

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I. Introduction

Indonesia, the most populated country in Southeast Asia (SEA) with 250 million people, has been recognized as a large emitter of air pollutants in Asia (Streets et al., 2003; Zhang et al., 2009). High rates of emissions are expected from intensive energy production activities, oil and gas extraction and refinery facilities in the country. Biomass open burning (OB) of forest fires, recorded every year, and crop residue field OB activities contribute significant emissions, which are also linked to meteorological factors and local agricultural practices. Information on emission sources and their temporal distribution is an important input for air quality management, especially for evaluating emission mitigation strategies. Recently, there are online emission databases provided by various sources which included Indonesia such as those compiled by the Center for Global and Regional Environmental Research (CGRER), Regional Emission inventory in ASia (REAS), and the Emission Database for Global Atmospheric Research (EDGAR) using international sources of activity data. However, a comprehensive emission database is not yet available for Indonesia except by Permadi et al. (2013) by combining top-down and bottom-up approach.

The capital city of Indonesia is Jakarta. The city of Jakarta is located in a lowland with an average elevation of +7 meters above sea level (ASL). The area of Jakarta Province covers an area of 662 km2 with a water environment (sea) of 6,977 km2. It centers on $6^{o}12$ ' (latitude) and $106^{o}48$' (longitude) and it is bordered by Banten Province at the west side and West Java Province at the South and East sides. In the dry season the Southeasterly (SE) monsoon dominates while in the wet season the northwesterly (NW) wind dominates (Sofyan et al., 2007). The measured air pollutants (CO, NO, SO_2, PM_{10} and O_3) frequently exceed the National Ambient Air Quality Standard (NAAQS) at various air quality monitoring sites (Shanty et al., 2002; Permadi and Kim Oanh, 2008). This was largely due to high emission from large vehicle fleets, especially with high traffic congestion. Jakarta EPA (2004) reported that ozone (O_3) is one of the two pollutants (PM_{10} is the other) that cause the air pollution standard index (PSI) to be above the unhealthy level of 100. The air pollution problem in the city needs detail study on the source apportionment that can be done either through emission inventory, receptor model and air quality dispersion model.

Even though some studies reported emission inventory (EI) data for the DKI Jakarta Province (Permadi, 2007; Breathe Easy Jakarta, 2016; Lestari et al., 2000) with various level of details, but there has been no official data which are updated and used by the government. This hinders further analysis of source apportionment and complex air quality modelling study using a Chemistry Transport Model (CTM). This study reports EI compilation for 5 provinces to comply the CTM application for modelling of source apportionment conducted by Center for Research on Energy and Clean Air (CREA). The 5 provinces are DKI Jakarta, West Java, Banten, Central Java, and Lampung. Emission sources covered in this study are: 1) fuel combustion in power generation, manufacturing industry, transportation (i.e. on-road, airport and harbour), residential and commercial, 2) fugitive emission (i.e. fuel station and depot), 3) biomass open burning (i.e. crop residue, forest fire, solid waste) and 4) others (i.e. livestock and methane from landfill). The species covered included major gaseous pollutants of SO_2, NOx, NH_3, CO, non-methane volatile organic compounds (NMVOC), CH_4, and particulate matter (PM) comprising PM_{10} and $PM_{2.5}$ (particles with the size not larger than 10 and 2.5 µm, respectively), black carbon (BC) and organic carbon (OC). Spatial distribution of emission was done to the city level and results are presented by GIS.

II. Methodology

II.1 Domain of emission inventory

Emission inventory was conducted for the base year of 2019 and it covered 5 provinces, i.e. DKI Jakarta Province, West Java, Banten, Central Java and Lampung, as presented in Figure 1.

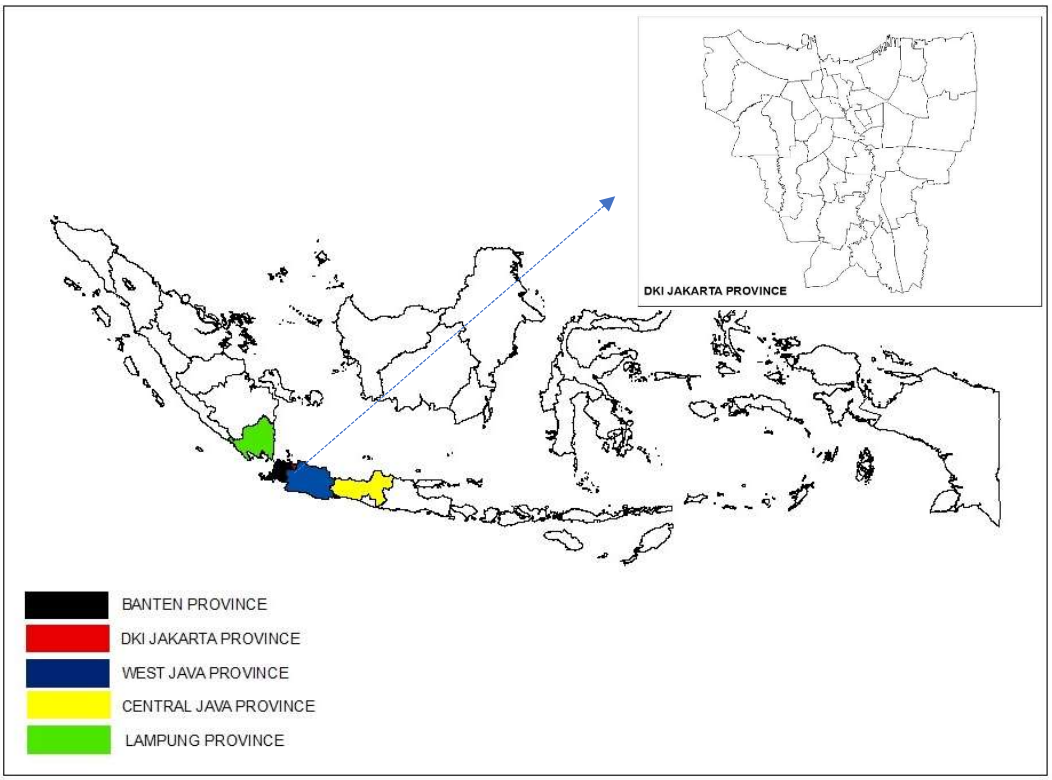


Figure 1 Provinces covered in this inventory

II.2 Emission sources and pollutants covered in the inventory

Table 1 presents emission sources and associated pollutants covered in this inventory. Emission sources was divided into 4 categories: energy combustion, fugitive emission, open burning and non-combustion emission sources. The species covered included major gaseous pollutants of SO_2, NOx, NH_3, CO, non-methane volatile organic compounds (NMVOC), CH_4, and particulate matter (PM) comprising PM_{10} and $PM_{2.5}$, black carbon (BC) and organic carbon (OC).

II.3 Emission calculation

The annual emission of a particular pollutant from a source or a source category was estimated using a general EI equation which was taken from the Atmospheric Brown Cloud Emission Inventory Manual (ABC EIM) (Shrestha et al., 2012).

$$Em_{i,j} = EF_{i,j} \times AR_i \times \frac{(100 - CE_{i,j})}{100} \quad (1)$$

Where,

i = Sub-sector or source
j = Pollutant type
$Em_{i,j}$ = Emission load (t year^{-1})
$EF_{i,j}$ = Emission factor (t per unit of activity)
AR_i = Activity rate
$CE_{i,j}$ = Emission control efficiency (%).

Table 1 Emission sources and pollutants covered in this inventory

No	Emission Sources	SO_2	NOx	CO	NMVOC	NH_3	PM	CH_4	BC	OC
	I. Energy Combustion									
1.	Power Generation	✓	✓	✓	✓	✓	✓	✓	✓	✓
2.	Manufacturing industry	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.	Residential and commercial	✓	✓	✓	✓		✓	✓	✓	✓
4.	On-road-transportation	✓	✓	✓	✓	✓	✓	✓	✓	✓
5.	Air-transportation (LTO)	✓	✓	✓	✓		✓	✓	✓	✓
6.	Other transportations (harbour)	✓	✓	✓	✓		✓	✓	✓	✓
	II. Fugitive emissions									
1.	Fugitive emissions from fuels				✓					
	III. Open burning									
1.	Agro-residual-OB	✓	✓	✓	✓	✓	✓	✓	✓	✓
2.	Forest fire	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.	Solid Waste OB	✓	✓	✓	✓	✓	✓	✓	✓	✓
	IV. Non-combustion emission sources									
1.	Livestock related emissions					✓				
2.	Methane-landfill							✓		

Emission factor of SO_2 for fuel combustion in energy sector is estimated from following relation:

$$EF_{SO2} = 2 \times CS_{fuel} \times (1 - \alpha_s) \times \frac{1}{H_u} \times 10^6 \times (1 - \eta_{cd}) \quad (2)$$

Where EF_{SO2} is specified emission factor for SO_2 (in g/GJ), CS_{fuel} represents sulfur content in fuel (in kg/kg), α_s is sulfur retention in ash, H_u is lower heating value of fuel (in MJ/kg), η_{cd} is reduction efficiency of control device. The parameters required for calculation for different type of fuels are presented in Table 2.

II.4 Source-wise methodology and activity data

Some specific sources require more detail approach for the emission calculation and typical activity data which are described as follows.

II.4.1 Power generation

Emission was calculated using equation (1) presented above while for SO_2, emission factor (EF) was calculated using equation (2). Parameters for SO_2 EF calculation are presented in Table 2. Activity data of type fuel used, fuel consumption, and air pollution control device installed in the power plant were collected. The summary of activity data is presented in Table 3.

Table 2 Parameters for calculation of SO_2 emission factor

Fuel type	Hu (Tj/ton)	Sulfur retention in ash α_s (%)	Sulfur content CS_{fuel} (%)	Ash content in fuel A (%)
Sub-bituminous coal	0.0251	5	1.27	11.46
Natural gas	0.05	0	0.00064	0
Diesel oil	0.043	0	0.54	0.03
Heavy fuel oil	0.040	0	2.46	0.03
Wood	0.015	0	0.04	23
Crude oil	0.0419	0	2.46	0.01
Gasolinea	0.045	0	0.05	0.001
Kerosene	0.04475	0	0.09	0.005
Diesel oilb	0.04333	0	0,455, 0.05	0.03
Heavy fuel oil	0.04019	0	2.46	0.03

Note: a - https://www.transportpolicy.net/standard/indonesia-fuels-diesel-and-gasoline/, for diesel for CN number < 48 sulfur content is 0,455% and CN number >51 sulfur content is 0,05%.

The emission calculation was done using EI general equation (equation 1) while for SO_2 emission factor was initially calculated using equation 2. The activity data for coal consumption, HSD and natural gas were converted from mass unit (ton/year) to energy consumption unit using the NCV data. The removal efficiency of ESP and FGD is presented in Table 4. Further process, based on power plant location, the emission was aggregated into cities. Emission factors are presented in a separate section and all calculation was done using the ABC EIM Excel sheet (Shrestha et al., 2012).

Table 3 Summary of activity data for power generation, 2019

Province	Power Plant	Type of fuel used	Fuel Consumption (ton/year)	APCD
DKI Jakarta	Muara Karang[a]		6,012	ESP, FGD
		HSD	526	ESP, FGD
		Gas	6,783,777	na
	Priok POMU[b]	HSD	6,959	ESP, FGD
		Gas	6,453,078	na
West Java	PLTU Palabuan Ratu	Coal (sub-bituminous)	4,015,000	ESP, FGD
	PLTU Indramayu	Coal (sub-bituminous)	4,200,000	ESP, FGD
	PLTU Cirebon	Coal (sub-bituminous)	2,300,000	ESP, FGD
	PLTU Muara Tawar[a]	HSD	11,962	ESP, FGD
		Natural gas	736,838	na
Banten	PLTU Suralaya	Coal (sub-bituminous)	12,235,690	ESP, FGD
		HSD	3,163	ESP, FGD
	PLTGU Cilegon	Gas	7,665	na
	PLTU Lontar	Coal (sub-bituminous)	417	ESP
Central Java	PLTU Tanjung Jati B[b]	HSD	2,236	ESP, FGD
		Coal	8,627,545	ESP, FGD
	PGU Semarang	HSD	8,153	ESP, FGD
		Natural Gas	515,924	na
	UIK Central Java[a]	Coal	7,492,477	ESP, FGD
		Natural Gas	1,926,579	na
Lampung	Industry data from CREA	Natural gas	116	na
		Coal (sub bituminous bukit Asam)	15,870,812	ESP, FGD

Note:

[a] – PT Pembangkitan Jawa Bali Statistics (2019), [b]- PT Indonesia Power Statistics (2019)

Sulfur content for coal power plant (sub-bituminuos) from Bukit Asam 1 – 1.2 %. Density for HSD = 870 kg/m^3 while for Marine Fuel Oil (MFO) and natural gas are 991 kg/m^3 and 0.7 kg/m^3. NCV for sub-bituminous coal and MFO are 0.0251 Tj/ton and 0.0402 Tj/ton, while for HSD and natural gas are 0.043 and 0.0508 Tj/ton (ABC EIM, 2012), respectively.

Table 4 Emission removal efficiency for various APCD

Air pollution control device (APCD)	Average % emission controla
Flue Gas Desulphurization (Wet scrubber), SO_2	90
Flue Gas Desulphurization (Spray dry), SO_2	80
Electrostatic precipitator, PM	95-99
Scrubber, PM	82
Thermal De NOx, NOx	50-70

[a] Average from AP-42 (EPA, 1995).

II.4.2 Manufacturing industry

Emission calculation covered fuel combustion in the manufacturing industry. Similar to power generation sector we compiled reported fuel consumption in the provincial level. The activity data for fuel consumption in the manufacturing industry are presented in Table 5. These fuels were mainly used in the industrial boilers and other relevant utilities.

Table 5 Fuel consumption data for manufacturing industry by province, 2019

Province	Type of fuel used	Fuel Consumption (Tj/year)
DKI Jakarta[a]	Coal	2,909
	Natural gas	15,889
	LPG	1,185
West Java [b]	Coal	32,576
	Natural gas	7,486,123
	LPG	1,470
	Diesel oil	10,590
	Gasoline	3,508
Banten [c]	Coal	12,558
	Natural gas	1,760,464
	LPG	557
	Diesel oil	6,145
	Gasoline	2,170
Central Java [d]	Coal	13,711
	Natural gas	5,448,216
	LPG	1,140
	Diesel oil	2,089
	Gasoline	427
Lampung [e]	Coal	5,006
	Natural gas	680,268
	LPG	153
	Diesel oil	507
	Gasoline	40

Note: [a] – BPS Industry of DKI Jakarta Province, [b] – BPS Industry of West Java Province, [c] - BPS Industry of Banten Province, [d] - BPS Industry of Central Java Province, and [e] - BPS Industry of Lampung Province.
Sulfur content for coal ranges from 1 – 1.2 %. Density for diesel oil = 870 kg/m^3 while for natural gas is 0.7 kg/m^3. Density for diesel oil and gasoline are 860 and 770 kg/m^3, respectively. NCV for sub-bituminous coal, diesel oil, and natural gas are 0.0251, 0.043 and 0.0508 Tj/ton, respectively. Associated values for LPG and gasoline are 0.047 and 0.045 Tj/ton, respectively.

The fuel consumption data were converted into energy consumption using the NCV data and the emission calculation was done in the ABC EIM excel sheet. Note that no control device data were applied in the calculation as there are also the medium and small-scale industries which normally do not install the APCD. Emission calculation used the general EI equation 1 while for SO_2 used the equation 2 but for the value of control efficiency we assigned 0. Emission factors are presented in another section of this report.

II.4.3 Residential and commercial

This source covered domestic cooking in residential and commercial facilities. Genset for commercial facilities was also considered for emission estimation. Fuel consumption data are summarized in the Table 6. Emission calculation used the general EI equation (1) while the emission factors (in g/kg) are

presented in the separate section. Coal was not used as fuel for domestic cooking in DKI Jakarta and Banten while small portion was used in other 3 provinces (West Java, Lampung, and Central Java). For providing fuel of back-up generators in commercial sector heavy fuel oil and diesel oil are mainly used. Note that no control device was applied for these sources.

Table 6 Summary of fuel consumption in residential and commercial sector

Type of fuel	Fuel Consumption Data (Ton/year)				
	DKI Jakarta	West Java	Lampung	Banten	Central Java
Coal[a]	-	167	24	-	22,732
Kerosene[a]	899	32	1.8	10.4	3
LPG[a]	6,058,369	3,693,752	493,548	1,017,054	2,444,854
Heavy Fuel Oil[b]	-	253,959	40,087	76,376	158,139
Diesel oil[b]	309	495	1,314	896	5,589

Note: [a] - for residential cooking fuel consumption was estimated from the household average fuel consumption taken from the Susenas (2019) and the number of household data for every province were taken from the BPS publication "Propinsi dalam Angka 2020". [b] – Diesel and heavy duel oil fuel consumption for Genset in the commercial sector.

II.4.4 On-road transportation

This sector consists of on-road and off-road transports. The mobile source category on-road transportation includes all types of light-duty vehicles such as automobiles and light trucks, and heavy-duty vehicles such as buses, and on-road motorcycles. Total emissions are calculated by combining activity data for each vehicle category with appropriate emission factors. Those emission factors vary according to input data (driving situations, climatic conditions etc.). Different emission factors, number of vehicles and mileage per vehicle need to be introduced for each vehicle class and category. The relation is expressed as given in the following equation,

$$Em_{i,j,k} = N_j \times M_{j,k} \times e_{i,j,k} \quad (3)$$

where,

i,j,k = Pollutants type *i* of vehicle class j and road type *k* (urban, rural)

$Em_{i,j,k}$ = Emissions of the pollutant type *i* in (g), produced in the reference year by vehicles of class *j* driven on roads of type *k* with thermally stabilized engine and exhaust after treatment system

N_j = Number of vehicles (veh.) of class *j* in circulation at the reference year

$M_{j,k}$ = Mileage per vehicle (km/veh.) driven on roads of type k by vehicles of class *j*

$e_{i,j,k}$ = Average fleet representative baseline emission factor in (g/km) for the pollutant *i,* relevant for the vehicle class *j*, operated on roads of type *k*, with thermally stabilized engine and exhaust after treatment system.

Table 7 Summary of the activity data of on-road mobile source

Type of activity data	Activity Data [a]									
	DKI Jakarta		West Java		Lampung		Banten		Central Java	
	Unit	Total VKT (km/year)[b]	Unit	Total VKT [b] (km/year)	Unit	Total VKT (km/year)[b]	Unit	Total VKT (km/year)[b]	Unit	Total VKT (km/year)[b]
Passenger cars (Uncontrolled)	331,043	4,833,219,157	2,036	29,730,038	25,966	379,107,980	83,071	1,212,829,300	123,103	1,797,297,960
Passenger cars (Good control)	2,979,383	43,499,001,611	18,327	267,569,820	233,697	3,411,971,820	747,635	10,915,463,700	1,107,923	16,175,681,640
Motorcycles (4-stroke) (Uncontrolled)	15,868,191	144,797,242,875	14,425,556	131,633,198,500	3,275,612	29,889,959,500	4,495,518	41,021,601,750	15,627,624	142,602,069,000
Angkot (non euro)	2,766	91,857,444	5,390	155,396,046	2,687	89,234,423	4,162	138,243,819	4,394	145,936,746
Angkot (euro)\	2,452	81,458,426	3,926	132,215,223	2,382	79,132,413	3,691	122,593,576	3,896	129,415,605
Taxi (non euro)	9,095	232,389,003	6,430	164,296,720	258	6,593,433	7,598	194,126,856	3,257	83,218,905
Taxi (euro)	4,686	119,715,547	3,313	84,636,930	133	3,396,617	3,914	100,004,744	1,677	42,870,345
Light-duty vehicles (Uncontrolled)	468,807	5,989,006,870	400,329	5,114,197,865	121,599	1,553,428,503	130,942	1,672,784,050	394,524	5,040,037,713
Light-duty vehicles (Good control-EURO I & II)	200,917	2,566,717,230	171,569	2,191,799,085	52,114	665,755,073	56,118	716,907,450	169,082	2,160,016,163
Heavy-duty vehicles (Uncontrolled)	24,434	1,480,425,765	20,990	1,271,753,805	3,373	204,345,834	2,173	131,649,952	26,067	1,579,375,294
Heavy-duty vehicles (Good control- EURO I & II)	10,472	634,468,185	8,996	545,037,345	1,445	87,576,786	931	56,421,408	11,171	676,875,126

Note: a – Data on vehicle registration number were taken from Provincial Statistics (2020) and the fraction of technology followed the odometer surveys conducted in Bandung and Semarang (Kimoanh et al., 2018; AIT-IGES-UNDIP, 2018). b – Total VKT was calculated from VKT per vehicle per day (taken from above surveys) and other studies for different type of vehicles and the vehicle population (Kimoanh et al., 2018; AIT-IGES-UNDIP, 2018; Sukarno et al., 2016).

II.4.5 Air transportation (Landing and take-off)

This source covered the landing and take-off (LTO) from the international and domestic flight at the airports. The LTO data of the airports located in the 5 provinces are presented in the following table. LTO emission was calculated using the following relation (equation 4).

$$Em_{i,j} = EF_{i,j} \times LTO_i \qquad (4)$$

Where,
i = Type of domestic or international flight
j = Pollutant type
$Em_{i,j}$ = Emission load (t year^{-1})
$EF_{i,j}$ = Emission factor (t per LTO)
AR_i = LTO number of each type of flight.

The summary of the LTO number in each airport in all provinces is presented in Table 7. LTO emission factors are presented in the separate section of this report.

Table 7 Summary of the LTO number of the year of 2019 at the airports

Type of activity data	Number of LTO per year [a]				
	DKI Jakarta[b]	West Java[c]	Lampung[d]	Banten[e]	Central Java[f]
Domestic flight					
Average fleet (B737-400)	29,402	-	7,899	-	-
Old fleet (B737-100)	29,402	23,786	7,899	294,064	103,560
International flight					
Average fleet (short distance, B737-400)	3,263	-	-	57,950	5,449
Average fleet (long distance, B747-400)	-	-	-	9,658	-
Old fleet (short distance, B737-100)	-	4,521	-	28,975	-

Note: [a] – data obtained from Transportation Statistics book 2 (2020), [b] – applicable for Halim Perdanakusumah International Airport, [c] – the sum of LTO data from Husein Sastranegara Airport and Kertajati International Airport, [d] – Raden Inten Airport, [e] – Soekarno Hatta International Airport, [f] – Ahmad Yani International Airport, Semarang.

II.4.6 Harbour

Indonesia is a maritime country therefore both air and waterways transportations are expected to be intensive. The activity at the harbours is also included in this inventory. It emphasizes on the ships in approaching and departuring from the harbour. It both covered the activity of propulsion and auxiliary engines. Estimation requires information of operation model including number of vessels maneuvering time, loading and unloading Time in a harbour. The total time required is known as

headway time (in hour). Average power of each vessels is also required (in Kw). The activity data were gathered from the literature. Emission factors (in g/KwH) are presented in the separate section for both propulsion and auxiliary engines. The methodology for emission estimation is presented in the following equation.

$$Em \quad = EF \quad x\ Power\ of\ vessels\ x\ N\ x\ Headway \qquad (5)$$

Where,

Em	= Emission load (g day^{-1})
EF	= Emission factor (g/kWH) for propulsion and auxiliary engines
Power of vessels	= Average power of vessels (Kilo Watt)
N	= Number of ship call
Headway	= Operational time in harbour (hour) in a day.

The summary of the activity data for each harbour is presented in Table 8.

Table 8 Summary of activity data used in the emission calculation

Harbour	Type of vessels	Number of vessels per year	Headway time (minute / day)	Average power (kW)
Tanjung priok, Jakarta[a]	Tanker	1	66	2387
	Bulk carrier	10	90	4955
	Container ship	222	27	5038
	Passenger ferry	103	60	3573
Bakauheuni, Lampung[b]	Passenger Ferry and cargo	1,460	45-59.5	3573
Merak, Cilegon, Banten[c]	Passenger Ferry and cargo	1,460	54.2 – 67.1	3573

Note: [a] – Data from PUSTRAL – UGM (2015), [b] – Pramita et al. (2020), [c] – Pradana et al. (2019).

II.4.7 Fugitive emissions from fuel storage and distribution (VOC)

This source covered the storage of fuel and also the distribution of fuel at the fuel station. The activity data compiled mainly the throughput fuel data at the fuel storage facility (depot) and fuel sale data to represent the amount of fuel distributed in the fuel station. Emission estimation methodology for fuel storage facility (depot) is presented in equation (5). Emission factors for fuel storage are presented in another section of this report.

$$Em_i = EF_i \times AR_i \qquad (6)$$

Where,

i	= Type of fuel
Em_i	= VOC emission load (t year^{-1})
$EF_{i,j}$	= Emission factor (kg per kilo ton of fuel)
AR_i	= Throughput of fuel in the storage tank.

For fuel station emission was divided in to two: evaporation during filling the ground tank from the truck (stage 1) and during fill in the fuel into the car (stage 2). Emission estimation is similar to the equation 5 but the activity data are the amount of gasoline fuel sale (kilo ton per year) and the emission factors vary by the way of fill in such as splash, submerged and balance vapor filling. For stage 2 information required is the type of fill in whether uncontrolled or using the stage 2 control (vapor recovery system). In DKI Jakarta, PT Pertamina has been implementing stage 1 and stage 2 control only at 59% of their fuel station operation. But in other provinces, uncontrol operation of fuel station is common to see at the fuel stations.

The summary of activity data for this source is presented in Table 9.

Table 9 Summary of activity data required for emission estimation

Type of activity data	Activity Data				
	DKI Jakarta	West Java	Lampung	Banten	Central Java
1. Transport and depots (kt gasoline consumed)[a]					
Plumpang Station, North Jakarta	3,641	-	-	-	-
2. Fuel station[b]					
2.1 Stage 1 (tonne of gasoline sold)					
Splash filling	-	451,941	240,977	152,741	187,015
Submerged filling	11,848,616	-	-	-	-
Balanced vapor filling	11,848,616	-	-	-	-
2.2 Stage 1 (tonne of gasoline sold)					
Uncontrolled	11,848,616	451,941	240,977	152,741	187,015
Balanced vapor filling	11,848,616	-	-	-	-

Note: [a] – Data from PT Pertamina (2018), [b] – data from PT Pertamina (2019). Kuota Dan Realisasi Premium Pertamina per Kota Kabupaten Tahun 2020 - Update Desember 2020 | Pertamina.

II.4.8 Agro residue open burning

In this source it covers open burning of various type of economical crops such as rice, maize, soya, ground nut, sugarcane, etc. Emission estimation requires the dry amount of crop residues subjected to open burning (OB). The methodology to estimate the dry amount of crop residues subjected to open burning is presented in the following equation.

$$M_l = P_l \times N_l \times D_l \times B_l \times F \quad (7)$$

Where,
M = Total mass of crop residue burned in the field
l = Type of crops
P = Crop production
N = Crop specific residue-to-production ratio
D = Dry-matter-to-crop residue ratio
B = Percentage of dry matter residues that are burned in the field
F = Crop specific burn efficiency ratio (fraction oxidized during combustion).

The summary of activity data is presented in Table 10 below. Other parameters are presented in detail in the Permadi and Kim Oanh (2013) and Kim Oanh et al. (2018). Emission factors are presented in another section in this report.

Table 10. Summary of the crop production data of various

Crop type	Rice	Soya	Maize	Groundnut	Sugarcane
Annual crop production (kilo ton per year)[a]					
1. DKI Jakarta	3,359	-	-	-	-
2. West Java	5,296	98,938	959,933	-	-
3. Banten	1,470	1,202	119,206	3,942	12,788
4. Central Java	8,194	60,666	3,194	73.81	136,798
5. Lampung	1,489	1,502	9,815	-	-
Residue to crop ratio (N)[b]	1.76	0.21	0.33	2	0.3
Dry matter to crop residue ratio (D)[b]	0.85	0.21	0.4	0.8	0.3
Fraction burned in field (B)[b]	0.8	0.8	0.8	0.8	0.8
Burn efficiency fraction (F)[b]	0.89	0.68	0.9	0.9	0.68

Note: [a] – BPS (2020). Propinsi Dalam Angka Tahun 2020, [b] – Permadi and Kim Oanh (2013); Kim Oanh et al. (2018).

II.4.9 Forest fire

First, the quantity of biomass that actually burned each year from forest fires is calculated by multiplying the area of forest burned by aboveground biomass densities and actual burn fraction. It is expressed in the following equation:

$$M_l = A_l \times f_l \times \rho_l \times \eta_l \quad (8)$$

Where,

M_l = Mass of dry matter burned (ton/year)
l = Type of land cover
A_l = Area of land cover type *l* (ha)
f_l = Fraction of total area burned annually for land cover type *l*
ρ_l = Dry matter density (ton/ha)
η_l = Burning efficiency (oxidized in the combustion).

Burned area can be obtained from the satellite monitoring such as MODIS or VIIRS. In this study we took the ground burned area observation for tropical forest from the website of the Ministry of Environment and Forestry (MoEF) for all provinces in 2019 (http://sipongi.menlhk.go.id/hotspot/luas_kebakaran). Other important parameters of burning efficiency, dry matter density were taken from Permadi and Kim Oanh (2013).

Table 11 Summary of activity data used in the calculation

Parameters	Primary tropical forest
Area burned annually (fl), in ha[a]	
1. DKI Jakarta	-
2. West Java	9,552
3. Central Java	4,782
4. Lampung	35,546
5. Banten	9
Dry matter density ρl (ton/ha)[b]	84 – 160, 93.6
Burning efficiency (ηl)[b]	0.48 - 0.68, 0.5

Note: a – Burned area extracted from http://sipongi.menlhk.go.id/hotspot/luas_kebakaran, b – Permadi and Kim Oanh (2013).

II.4.10 Solid waste open burning

Municipal Solid Waste (MSW) open burning practices are commonly done especially in developing countries which have inadequate solid waste management (SWM). Waste incineration process which is part of treatment in solid waste management is excluded as it is considered as a non-open burning process. The most important activity data is the amount of waste open-burned M. However, in most countries these statistics may not be available. The most common method for estimation is presented below (Shrestha et al., 2012).

$$M_s = P \times P_{frac} \times Fcw \; x \; MSW_{GR} \times \eta \qquad (9)$$

Where,

M_s = The amount of MSW open-burned (kg/day)
P = Number of population (capita)
P_{frac} = Fraction of population burning waste (fraction)
MSW_{GR} = Per capita MSW generation factor (kg waste/capita/day)
η = Burning/oxidation efficiency (fraction)
Fcw = Fraction of combustible waste.

The summary of activity data is presented in Table 12. Emission factors are presented in a separate section in this report.

Table 12. Summary of the activity data

Province	P_{frac} [a]	$MSW_{GR\ (l/cap/day)}$ [b]	F_{cw} [c]
DKI Jakarta	0.22 – 4.4 (2.4)	0.01 – 0.044 (0.024)	0.55
West Java	2- 63 (42.7)	0.2 – 5 (2.54)	0.45
Central Java	18-85 (53)	1 – 5.5 (3.14)	0.515
Lampung	11-85 (75)	0.1 – 0.63 (0.53)	0.59
Banten	7,6 – 62 (37.6)	0.21 – 0.72 (0.36)	0.455

Note: a – Provincial basic health research (2018), b – Ministry of Public Work, Portal for Solid Waste Management Data (Portal Persampahan (pu.go.id)), c – MoEF, 2018. SIPSN - Sistem Informasi Pengelolaan Sampah Nasional (menlhk.go.id).

II.4.11 Non-combustion emission sources

This group covered the ammonia emission from livestock and methane emission emitted from the landfill. In general, agricultural emissions are calculated by multiplying activity rate by emission factor. Detail guideline, adapted from IPCC (2019) suggests simplified methodology to calculate ammonia emissions from domestic livestock in particular from the manure management. Emission calculation can be expressed as follows.

$$Em_{j,m} = \sum_{m} NA_m \times EF_{j,m} \qquad (10)$$

Where,

j, m = Species *j* (NH_3) and livestock type *m*
$Em_{j,m}$ = Emissions from species *j* and livestock *m*
NA_m = Number of animals (head/year).

The number of animal count in all provinces was obtained from the BPS (2020). For methane emission from landfill, IPCC (2006) suggested a method to calculate methane emission from solid waste disposal facilities (SWDs) as follows:

$$Em = (MSW_t \times MSW_f \times MCF \times DOC \times DOC_f \times F \times \frac{16}{12} - R) \times (1 - OX) \qquad (11)$$

Where,

Em = Emission of methane
MSW_t = Total MSW generated (Gg/year)
MSW_f = Fraction of MSW disposed to solid waste disposal sites
DOC = Fraction of degradable organic carbon
DOC_f = Fraction of DOC simulated
F = Fraction of CH_4 in landfill gas (suggested value is 0.5)
R = Recovered CH_4 (Gg/year)
OX = Oxidation.

We obtained city specific solid waste management data such as fraction of solid waste generation factor, MSW transferred to the landfill while other data were obtained from the research data.

II.5 Emission factors

Emission factors (EFs) of all sources used the values compiled in the ABC EIM (Shrestha et al., 2012). All relevant EFs are compiled in Table 13.

Table 13. Emission factors used in this study

Fuel type	Emission factors chosen									
	SO_2	NO_x	CO	NMVOC	NH_3	PM_{10}	$PM_{2.5}$	BC	OC	CH_4
Fuel combustion in energy sector										
Power generation (kg/TJ)										
Sub-Bituminous Coal[a]	NA	300[b]-524 (474[c])	12-20[b](20)	2-5[b](5)	0.01[j]	283	42.11[d]	0.14[f]-3.66[d](0.3[e])	0.04[e]-15.7[d](2.8[g])	3-30(10)[b]
Lignite[a]	NA	300-564[c](433)	8.3-20[b](20)	2.6-5(5)[b]	0.02[j]	252	124[d]	1[e]	1.8-12.6[h](2.8[g])	3-30(10)[b]
Diesel Oil[a]	NA	632[c]	15[b]	5[b]	-	7.7-15.4[d](15.4)	5.6	0.25[d]-0.61[e](0.25)	0.18[e]	1-10(3)[b]
Heavy Fuel Oil[a]	NA	249[c]	15[b]	5[b]	2.5[j]	7.8[h]-22.4(22.4)	3.9[h]-16.4(8.9[d])	0.7[i]-8.9[f](0.98[e])	0.33[i]-6.7[k](0.37[e])	1-10(3)[b]
Natural Gas[a]	NA	98[b]-105[c](105)	20[b]-29.5(20)	1.9-5(5)	1.31[j]	25	2.5-39[d](2.5)	0.002[e]	0.019[e]	0.78-1(1)[b]
Manufacturing industry (kg/TJ)										
Sub-Bituminous Coal[b]	NA	300	150	20	0.0003[j]	51.8-478(168.5)[e]	7.8-358.5[e](71.7[a])	3.7[l]-179.3[e](11[e])	1.2[l]-2.2[e](2.2)	3-30(10)
Motor gasoline[b]	NA	373[c]	10	5	0.005[m]	22.9[d]	22.9[d]	0.44[d]	5.35[d]	1-10(3)
Kerosene[b]	NA	167[c]	15	5	-	3.3[a]-20[f](10.8[e])	0.82[a]-10[f](1.9[e])	0.06[e]-5.5[f](0.06)	1.7[e]	1-10(3)
Diesel oil[b]	NA	222[c]	15	5	0.007[m]	3.3[a]	0.83[a]-4.37[d](0.83)	3.9[d]	0[d]	1-10(3)
Heavy fuel oil[b]	NA	145[c]	15	5	0.101[j]	27.12[a]-32.3[f](32.3)	12.3[e]-17.6[a](16.17[f])	0.9[e]-8.9[f](8.9)	0.37[e]	1-10(3)
Residential (g/kg)										
Wood[n]	0.008	0.05-1.2(0.2)	19-136(77.5[o])	3.8-9(7.5[o])	1.29[p]	2[q]-8.3[r](5[q])	-	0.3-1.4(0.85)[e]	1.7-7.8(4.75)[e]	6-10(8)[o]

Fuel type	Emission factors chosen									
	SO_2	NO_x	CO	NMVOC	NH_3	PM_{10}	$PM_{2.5}$	BC	OC	CH_4
Coal[n]	2.67	0.914	71.3-300[s](71.3)	0.664	-	1.3-12.2[d](7[q])	-	0.76-5.4(3.1)[e]	0.4-7.8(2.3)[e]	2.9-66(36.6[b])
Kerosene[n]	0.025	1.1	7.39	0.39	-	0.13-1.9[d](1.9)	-	0.16[d]-0.9(0.16)	0.09-0.16[d](0.16)	0.025-1(0.56[b])
Gas (LPG)[n]	0.33	1.76	3.72	1.6-89.7(89.7)	-	0.26-0.33[d](0.33)	-	0.01[d]-0.2[e](0.01)	0.03[d]-0.05[e](0.03)	0.04-1.1(0.56)[d]
Charcoal[o]	0.3-0.69(0.49)	0.03-6(0.22)	35-280[s](116.5)	6-10(8)	0.97[p]	3.9-7.5[q](7.5)	-	1[e]	1.3[e]	6.2[t]-11.8[b](7.25[d])
Road transportation (g/km), g/kg for CH_4										
Passenger cars (gasoline)[u]	NA	1.8-2.2[m](1.8)	9.8-46[m](9.8)	1,7-5.3[m](1.7)	0.002[m]	-	0.06-0.59[v](0.06)	0.005[x]-0.025[w](0.02)	0.021-0.4[w](0.021)	1.5[m]-1.7[b](1.5)
Motorcycle (gasoline)[u]	NA	0.02[y]-0.05[m](0.03)	2.7[y]-10[m](6.5)	3.8[y]-6.5[m](3.9)	0.001[m]	-	0.05[m]-0.23(0.23)	0.01	0.18	1.24[b]-1.5[m](1.5)
Passenger cars (diesel)[u]	NA	2.77	7.3	0.37	0.001[m]	-	0.84	0.23[w]-0.44(0.44)	0.13	0.08[m]
LDV (diesel)[u]	NA	3.15	8.7	0.34	0.001[m]	-	0.15[y]-0.8(0.73[z])	0.4[w]-0.51(0.13[aa])	0.067[aa]-0.24(0.067)	0.08-0.17[b](0.17)
HDV (diesel)[u]	NA	6.54[ab]	5.5-4.96[ab](5.5)	1.78-1.88[ab](1.78)	0.003[m]	-	1.3[ac]-3.3[aa](3.3)	0.54[ac]-2.6[aa](2.6)	0.3[aa]-1(0.3)	0.17[b]-0.25[m](0.17)
Other transportations										
Air traffic (kg/LTO), g/kg for BC, and OC[m]	0.8-1.6(0.9)	8-8.3(8.3)	14.8-11.48(11.48)	-	-	-	0.2[e]	0.1[e]	0.03[e]	0.1
Shipping/harbour (g/kWH)[ap]										
- Propulsion engine	10.29	18.1	1.4	-	-	1.42	1.31	0.37	0.52	-
- Auxilliary engine	11.8	14.7	1.1	-	-	1.44	1.32	0.37	0.53	-

Fuel type	Emission factors chosen									
	SO_2	NO_x	CO	NMVOC	NH_3	PM_{10}	$PM_{2.5}$	BC	OC	CH_4
Biomass open burning										
Crop residue open burning (g/kg)										
Rice	0.18[t]-0.62[ad](0.18)	0.62[ae]-3.43[ah](0.62)	64.2[af]-180[ae](180)	7[t]	4.1[ae]	3.5[ad]-9.1[ag](9.1)	3.2[ad]-8.3[ag](8.3)	0.49[ah]-0.86ai(0.51[ag])	0.7[d]-3.3[t](2.8[ag])	9.6[ae]
Maize	0.015[af]-0.44[aj](0.44)	0.75[ad]-4.3[aj](4.3)	38.7[ad]-114.7[af](114.7)	4.4[ak]-10[aj](10)	0.68[aj]-0.7[ak](0.68)	6.21[ad]-4.3[ak](4.3)	4.1[ak]-11.7[aj](4.1)	0.35[aj]-0.95[ah](0.95)	2.21[al]-3.9[ah](2.25[aj])	4.4[aj]
Sugarcane	0.216[n]	2.6[ak]	34.7[ak]	2.2[ak]	1[ak]	4[ak]	3.8[ak]	0.78[ai]	3.3[t]	0.4[ak]
Combined crops	0.216[n]-0.4[t](0.216)	0.7[n]	86.3[n]-92[t](92)	7[t]	1.3[t]	8.05[n]	3.9[t]	0.47[am]	0.7[n]	4.56[n]
Forest fire (g/kg)[t]										
Primary tropical forest	0.57	2.45	104	8.1	1.3	10.5	9.1	0.66	5.2	6.8
Secondary tropical forest	0.57	2.45	104	8.1	1.3	10.5	9.1	0.66	5.2	6.8
Savanna/grassland	0.35	5.98	65	3.4	1	8.3	5.4	0.48	3.4	2.3
Shrubland	0.35	5.98	65	3.4	1	8.3	5.4	0.48	3.4	2.3
Mangrove forest	0.57	2.45	104	8.1	1.3	10.5	9.1	0.66	5.2	6.8
Peatland swamp forest	0.57	2.45	104	8.1	1.3	10.5	9.1	0.66	5.2	6.8
Non-combustion emission sources										
Livestock related emissions (kg/head/year)[an]										
Dairy cow	NA	NA	NA	NA	28[ao]-38.3 (38.3)	NA	NA	NA	NA	NA
Beef cow	NA	NA	NA	NA	10.2[ao]-11 (11)	NA	NA	NA	NA	NA
Poultry	NA	NA	NA	NA	0.27-0.37 [ao](0.27)	NA	NA	NA	NA	NA
Swine	NA	NA	NA	NA	6.5-11.4[ao] (6.5)	NA	NA	NA	NA	NA
Horses	NA	NA	NA	NA	8[ao]-12.3 (12.3)	NA	NA	NA	NA	NA

Fuel type	Emission factors chosen									
	SO_2	NO_x	CO	NMVOC	NH_3	PM_{10}	$PM_{2.5}$	BC	OC	CH_4
Sheep	NA	NA	NA	NA	1.34[ao]-3.4 (3.4)	NA	NA	NA	NA	NA
Goats	NA	NA	NA	NA	6.4	NA	NA	NA	NA	NA

Note: Values presented in the parentheses are best estimate emission factors compiled from various sources in the ABC EIM (Shrestha et al., 2012)

-: Not available, NA: not applicable (determined using sulfur content)

[a] AP-42, 1995; [b] IPCC, 1996; [c] Kato and Akimoto, 1992; [d] Reddy and Venkataraman, 2002a;[e] Bond et al., 2004; [f] Streets et al., 2001; [g] Hangebrauck et al., 1964; [h] APEG, 1999. [i]Kupianen and Klimont, 2007; [j]Battye et al., 1995;[k]Streets et al., 2003.[l] Ge et al., 2001; [m] EMEP/Corinair, 2006; [n] Zhang et al., 2000;[o] Battacharya et al., 2002;[p] Bertschi et al., 2003; [q] Oanh et al., 1999; [r]Roden et al., 2009;[r] Venkataraman and Rao, 2001: [s] Zhang et al., 1999; [t] Andreae and Merlet, 2001; [u] CPCB, 2000;[v] Schaeur et al., 2002;[w] Williams et al., 1989b;[x]Hildelman et al., 1991; [y] Paw-amart, 2004; [z] Caddle et al., 1999:[aa] Kim Oanh et al., 2009;[ab] Chen et al., 2007; [ac] Watson et al., 1998;[ad] Jenkins et al., 1996; [ae] Christian et al., 2003;[af] Zhang et al., 2008;[ag] Kim Oanh et al., 2010;[ah] Cao et al., 2008; [ai] Penner et al., 1996; [aj]Li et al., 2007;[ak] Dennis et al., 2002; [al] Cao et al., 2006; [am] Redy and Venkataraman, 2002b, [an]USEPA, 2002; [ao] Battye et al., 2003; [ap] USEPA – ICF, 2009,

III. Results

III.1 Total emission

III.1.1 DKI Jakarta Province

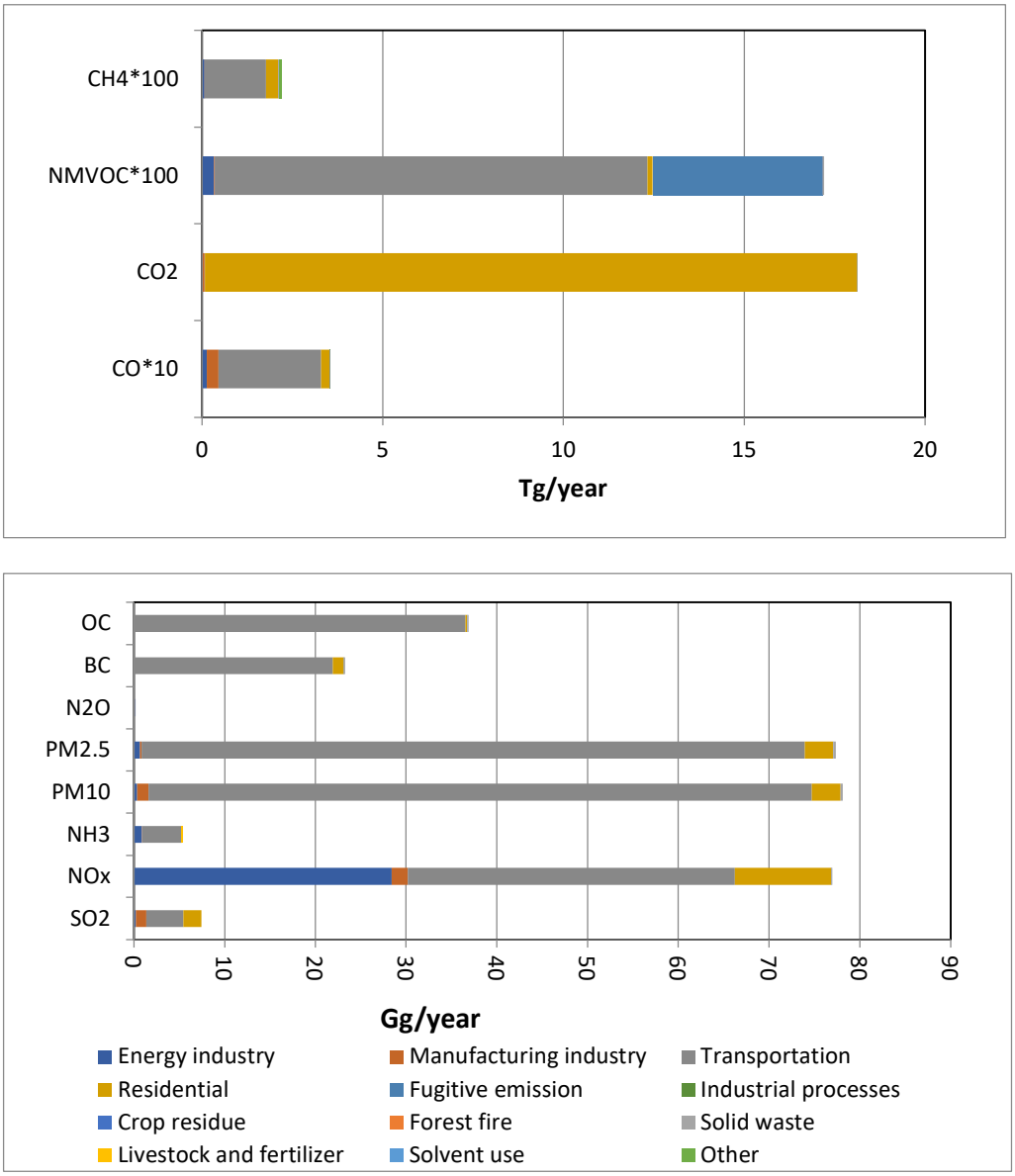


Figure 2 Total emission and share in DKI Jakarta Province, 2019

Figure 2 presents the total emission by pollutants and sectors in DKI Jakarta for the base year of 2019. On-road mobile sector dominated the total emission of most pollutants (i.e. CO, SO_2, NOx, PM_{10}, $PM_{2.5}$, NMVOC and CH_4). Power plant is the second significant contributor for NOx while residential sector contributed after on-road mobile source for NOx, PM, SO_2, and CH_4). Fugitive source (i.e. fuel depot and fuel station) is the 2nd highest contributor for NMVOC emission.

III.1.2 West Java province

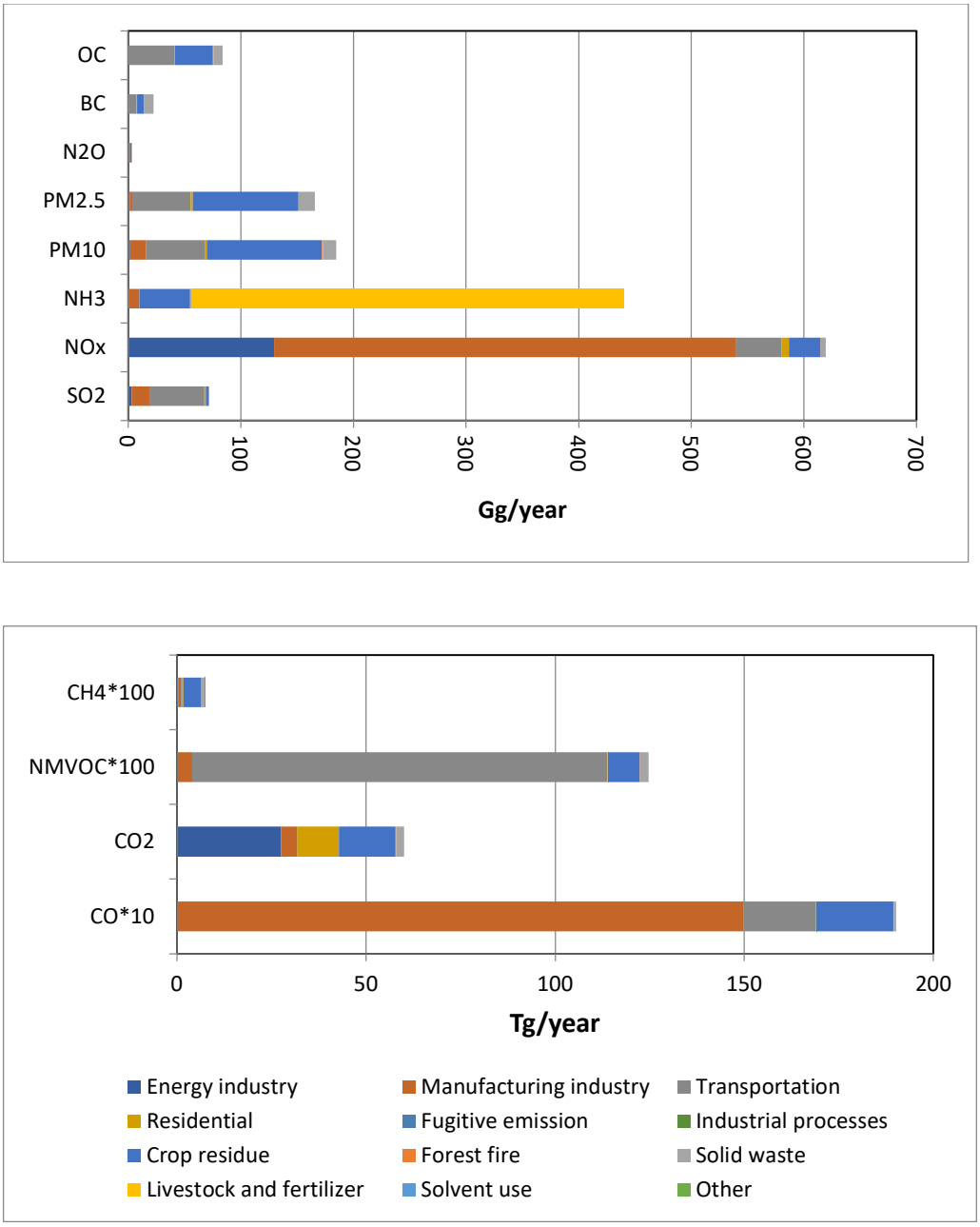


Figure 3 Total emission and share in DKI Jakarta Province, 2019

Total emission and share of the source wise emission is presented in Figure 3. Manufacturing industry contributed the most to the total emission of CO and NOx while transportation contributed the most to the total emission of NMVOC, SO_2, BC and OC. Crop residue open burning contributed dominantly to the total emissions of PM and CH_4. Total NH_3 emission was dominated by livestock activity.

III.1.3 Banten

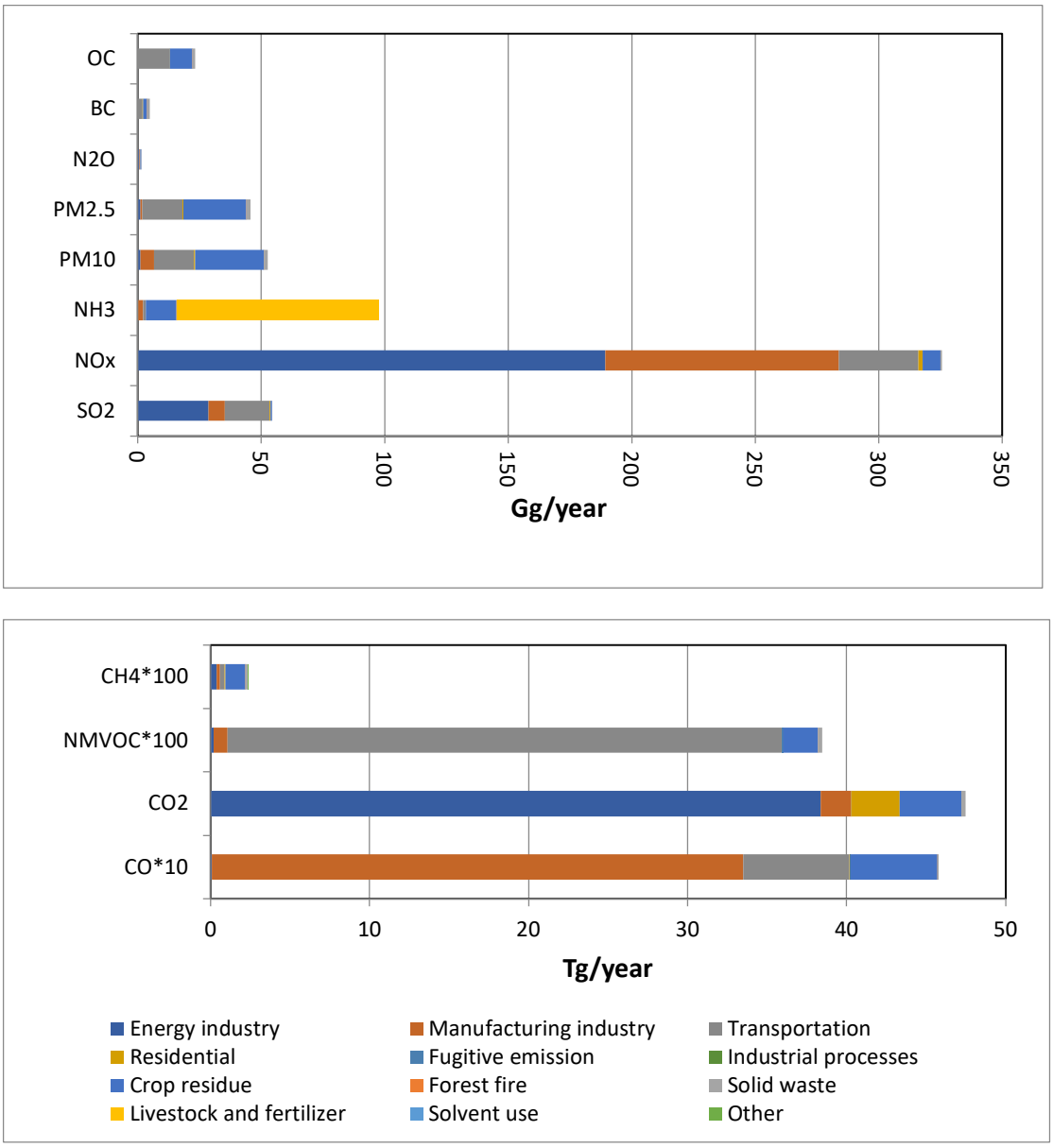


Figure 4 Total emission and share in Banten, 2019

Figure 4 presents the total emission by pollutants and sectors in Banten for the base year of 2019. On-road mobile sector dominated the total emission of NMVOC, OC and BC while energy industry (power plant) contributed dominantly to the total emissions of NOx and SO_2. Manufacturing industry contributed the most to the total emission of CO and contributed 2nd highest to the total emission NOx. NH_3 emission is dominated by the livestock activity while PM and CH_4 total emissions are mainly contributed by both crop residue open burning and transportation.

III.1.4 Lampung

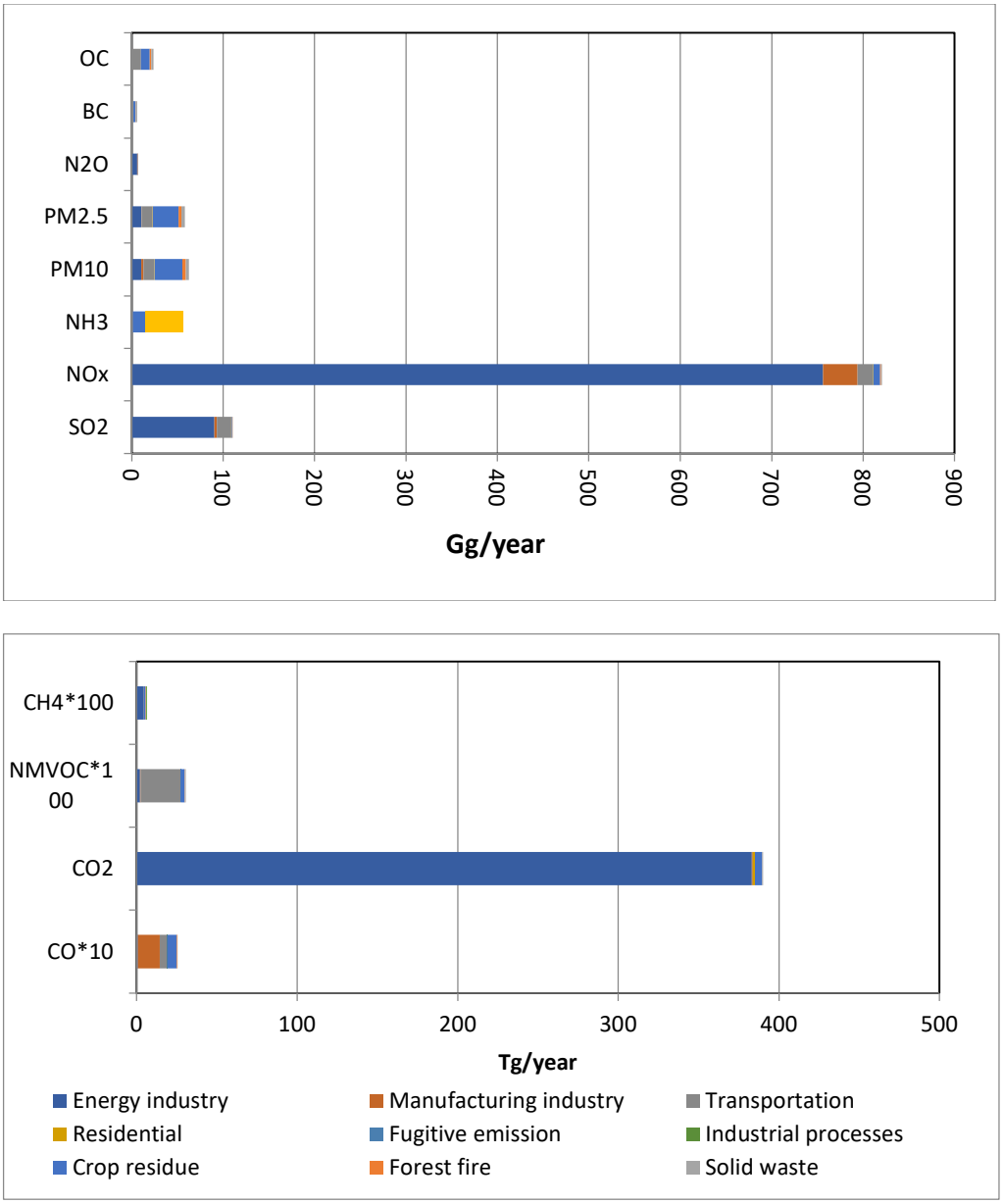


Figure 5 Total emission and share in Lampung, 2019

Total emission and share of the source wise emission is presented in Figure 5. Power plant contributed the most to the total emissions of NOx and SO_2, while on-road mobile source contributed dominantly to the total emission of NMVOC, BC and OC. Manufacturing industry is the major contributor of CO emission followed by forest fire and on-road mobile source. PM emissions are mainly contributed by the crop residue open burning followed by the on-road mobile source. Livestock activity contributed the most to the total emission of NH_3.

III.1.5 Central Java

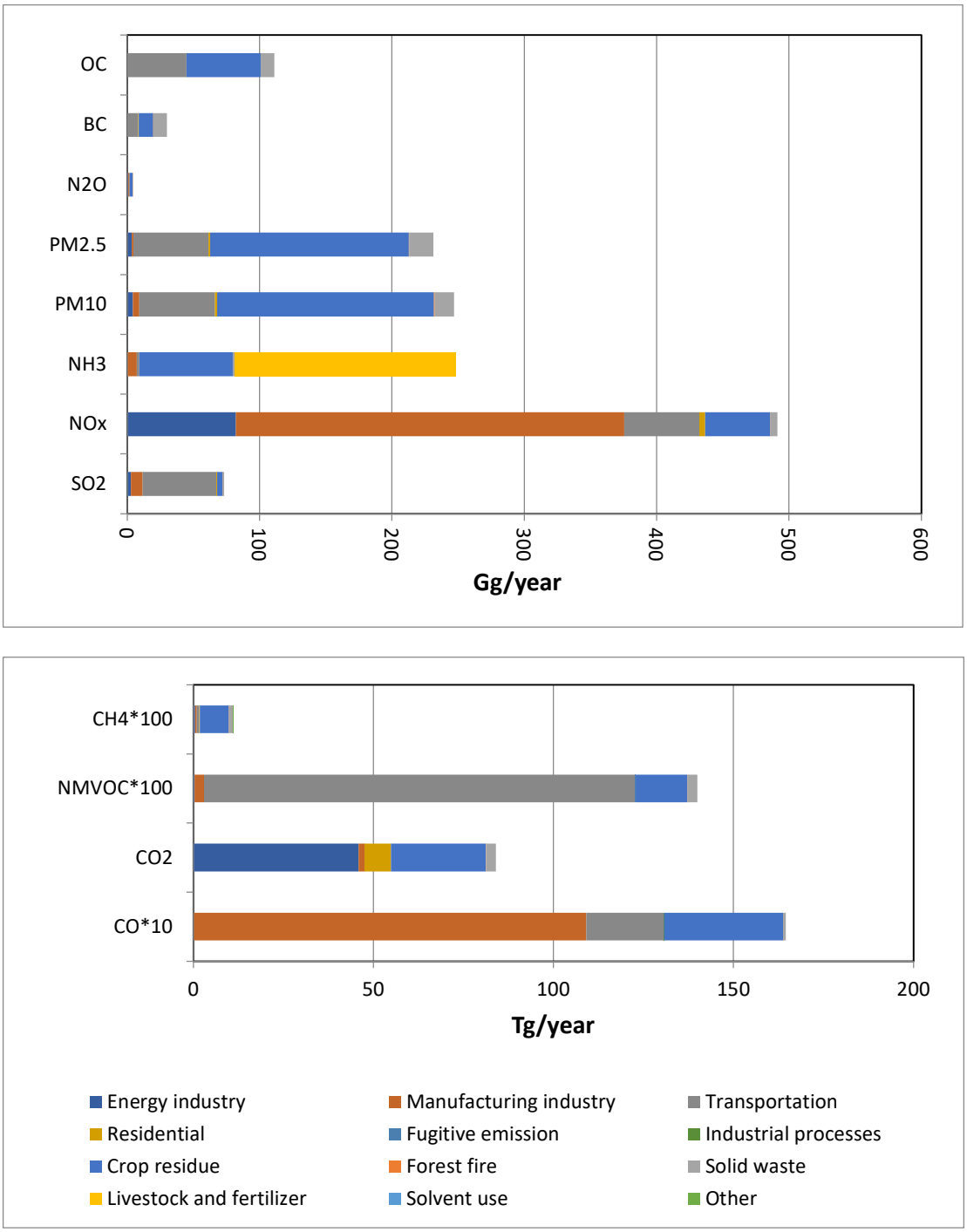


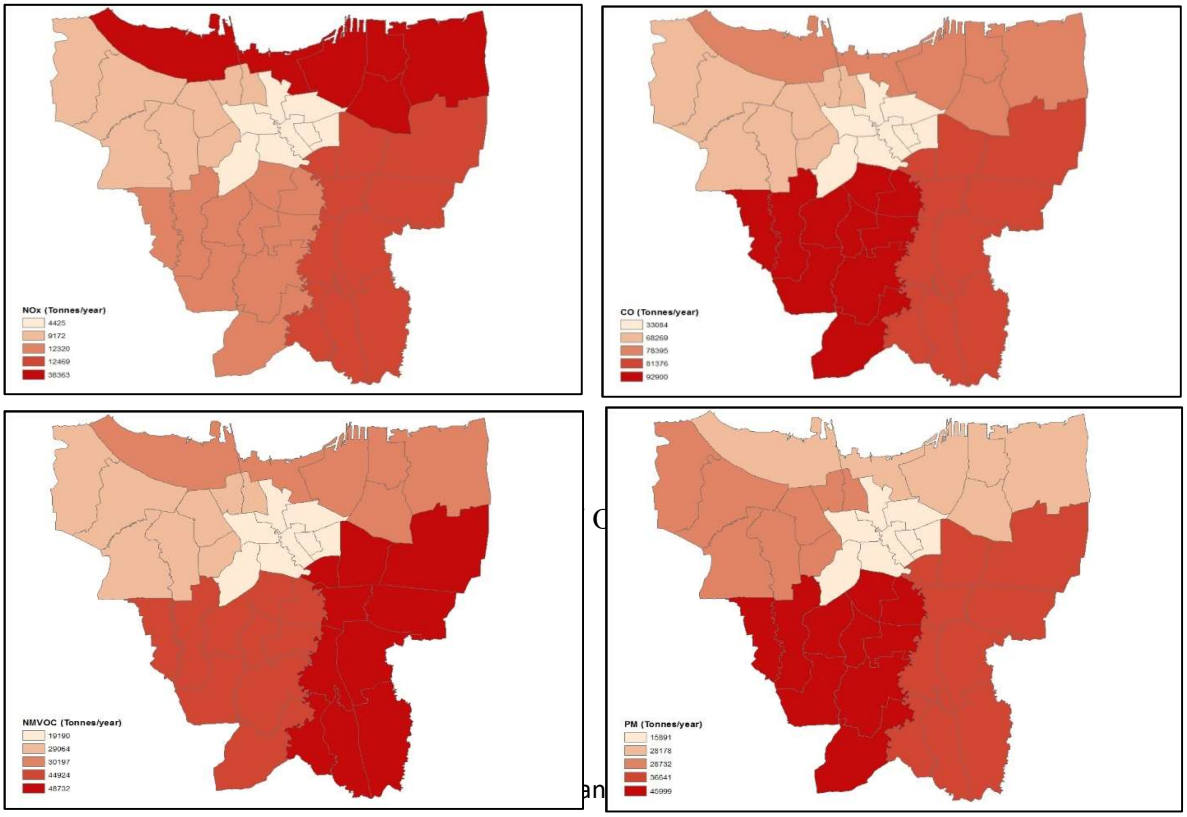
Figure 6 Total emission and share in Central Java, 2019

Figure 6 presents the total emission by pollutants and sectors in Central Java for the base year of 2019. On-road mobile sector dominated the total emission of NMVOC and SO2 while crop residue open burning is the major contributor to the total emissions of CH4, PM and OC. Ammonia emission is again

contributed dominantly by the livestock activity. Manufacturing industry contributed dominantly to the total emission of CO and NOx.

III.2 Spatial distribution of emission in 2019

III.2.1 DKI Jakarta Province



Total annual emissions of NOx, CO, NMVOC and PM were allocated to cities in DKI Jakarta Province. For NOx, highest emission was seen in the North Jakarta while for CO was highest in South Jakarta. PM emission was also estimated the highest in the South Jakarta while NMVOC was the highest in the East Jakarta. This allocation was affected by the emission source contribution in each city. Higher NOx in the North Jakarta was due to the transportation and also the power plants that were located there in Tanjung Priok and Muara Karang. Higher PM and CO emissions in the West Jakarta were mainly due to on-road mobile source as well as for NMVOC in the East Jakarta.

III.2.2 West Java

Figure 8 presents the total annual emissions of NOx, CO, NMVOC and PM were allocated to cities in West Java province. NOx emission was estimated higher in the Kota and Kabupaten Bekasi which was due to the significant contribution of the manufacturing industry. Higher PM and NMVOC emission in Indramayu was due to the on-road transportation at the north beach line and Cipali toll way and also the crop residue open burning. Indramayu was known as the paddy production center in West Java. Manufacturing industry was estimated higher in Kota and Kabupaten Cirebon due to the massive activity of manufacturing industry there.

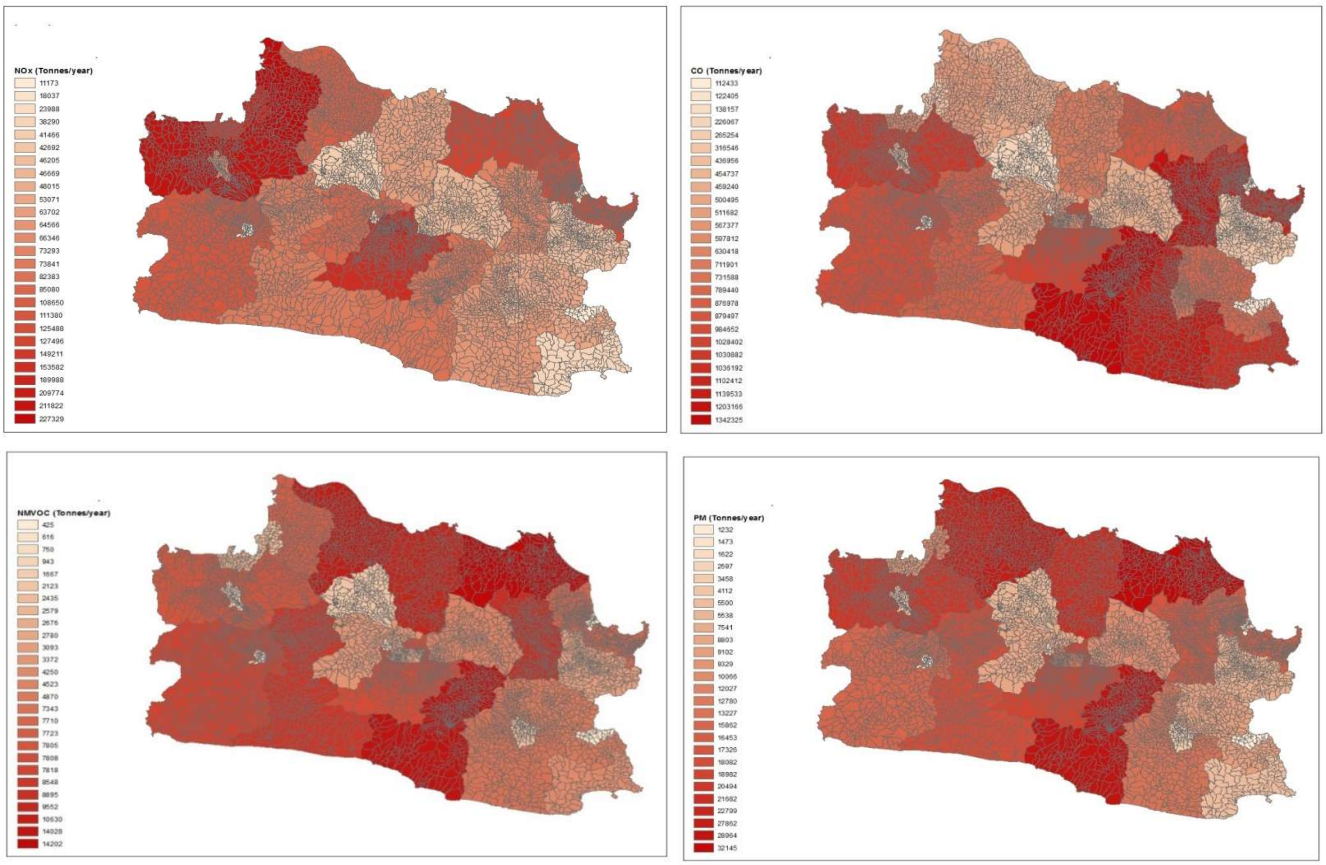


Figure 8 Spatial distribution of NOx, CO, NMVOC, and PM emissions in West Java Province, 2019

III.2.3 Banten

Total annual emissions of NOx, CO, NMVOC and PM were allocated to cities in Banten Province as presented in Figure 9. For NOx, highest emission was seen in Cilegon which was due to the existence of big power plant there. PM and NMVOC emissions were estimated higher in Tangerang which were due to the significant contribution of on-road mobile source and air traffic emission. Higher emission of CO estimated in Sukabumi was due to the crop residue open burning as well as the manufacturing industry.

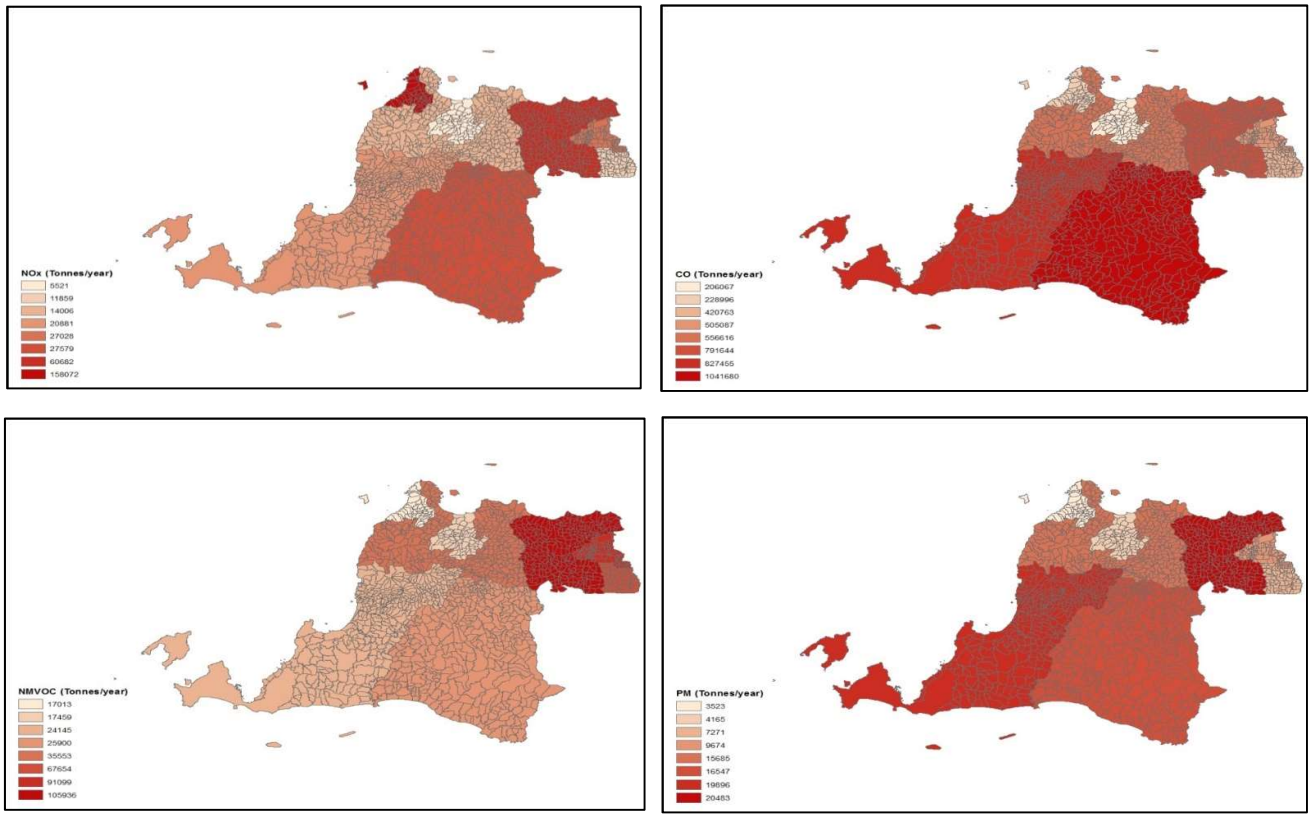


Figure 9 Spatial distribution of NOx, CO, NMVOC, and PM emissions in Banten Province, 2019

III.2.4 Central Java

Figure 10 presents the total annual emissions of NOx, CO, NMVOC and PM were allocated to cities in Central Java province. NOx emission was estimated higher than others in Jepara City which was due to the existence of Tanjung Jati B Power Plant as well as the manufacturing industry activity in the city. CO was also estimated higher in Jepara for the same reason of the manufacturing industrial activity in the city. NMVOC was estimated higher in Rembang and Cilacap which was due to the traffic and crop residue open burning activity in the two cities. PM emission was higher in Grobogan and Wonogiri which was due to the significant contribution of the crop residue open burning activity in the two cities.

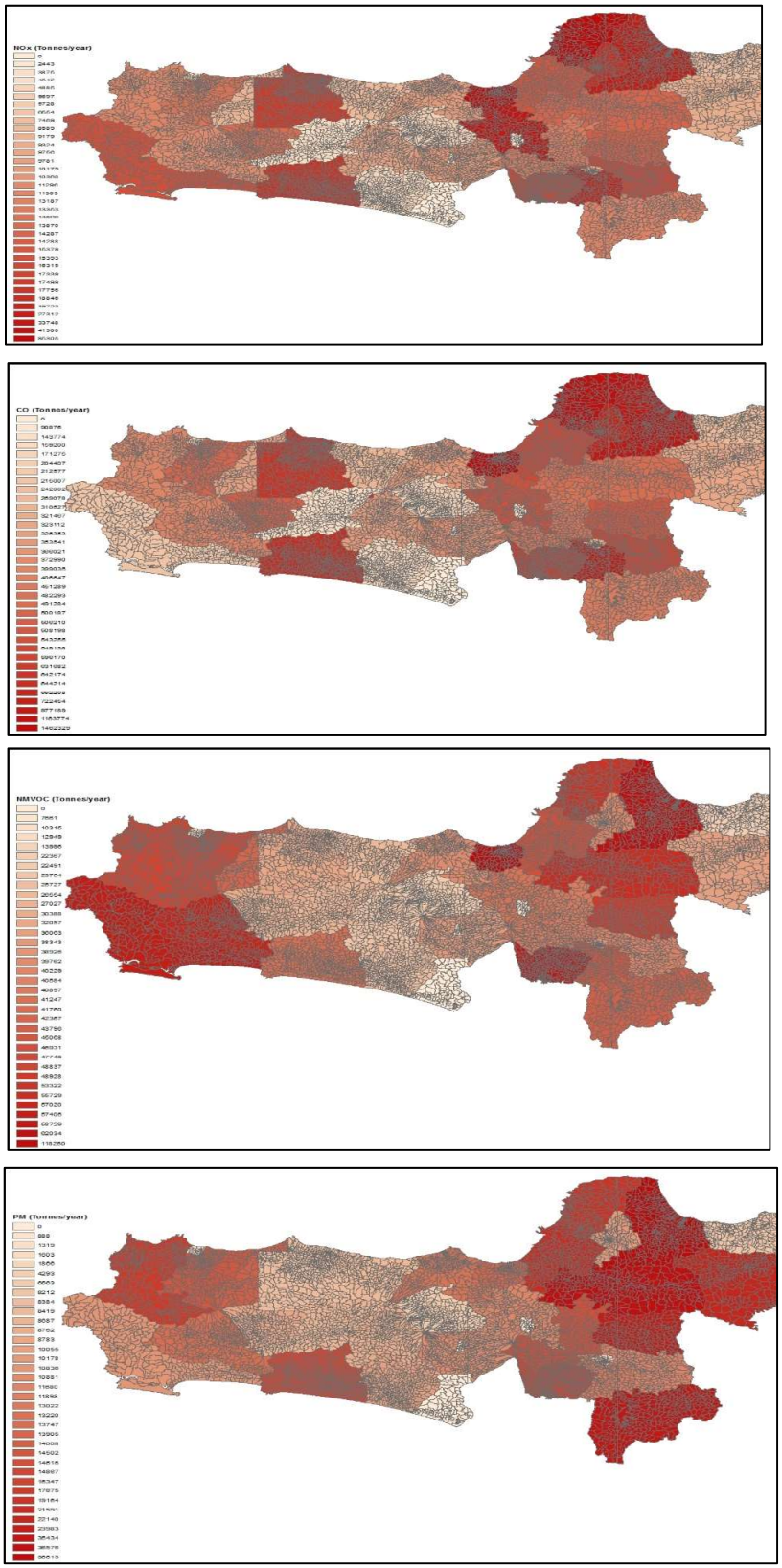


Figure 10 Spatial distribution of NOx, CO, NMVOC, and PM emissions in Central Java Province, 2019

III.2.5 Lampung

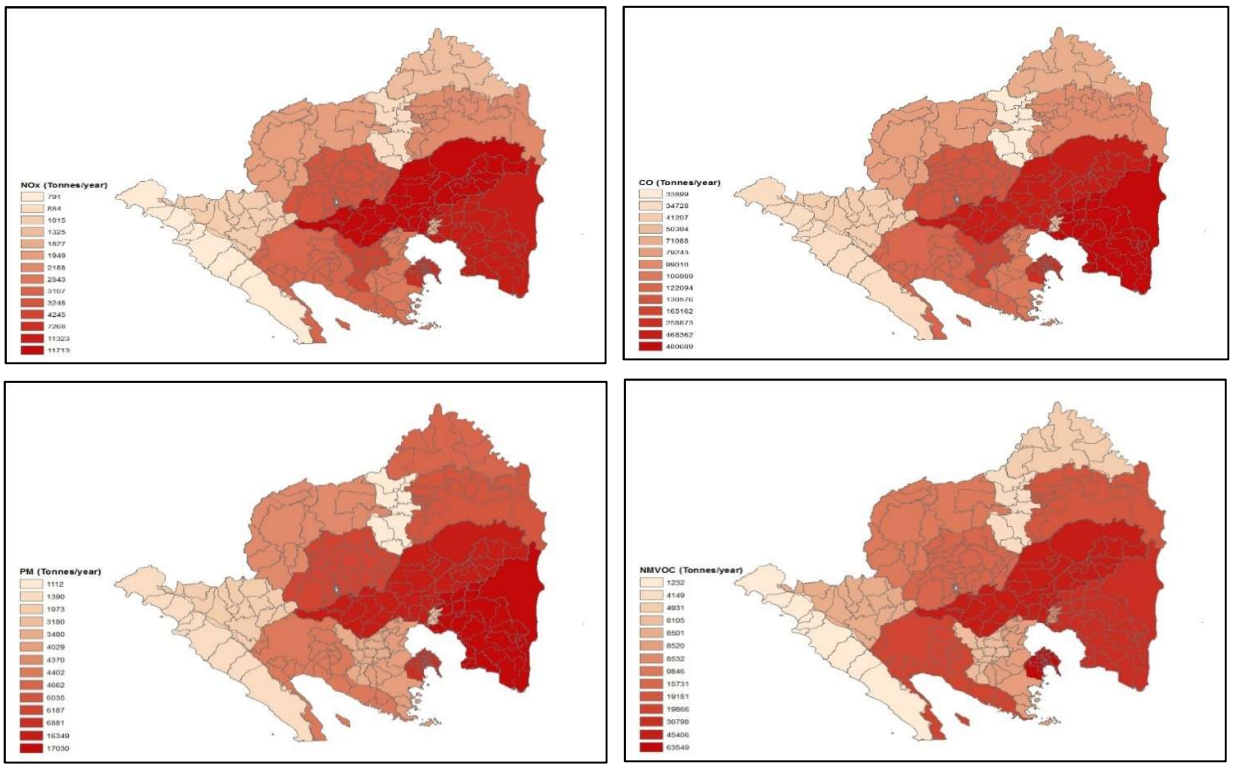


Figure 11 Spatial distribution of NOx, CO, NMVOC, and PM emissions in Lampung Province, 2019

Total annual emissions of NOx, CO, NMVOC and PM were allocated to cities in Lampung Province as presented in Figure 11. NOx, CO and PM emissions were estimated higher in Lampung Tengah and Lampung Timur which were due to the significant emission from the Power Generation, industrial activities and transportation (on-road mobile source and Bakauheuni Harbour). NMVOC emission was also estimated higher in Lampung Tengah which was due to the on-road mobile source and crop residue open burning occurred in the area.

References

Annexes. Total Emission by Sources Allocated to Cities

Annex 1. Power Generation

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	0	0	0	0	0	0	0	0	0
East Jakarta	0	0	0	0	0	0	0	0	0
Central Jakarta	0	0	0	0	0	0	0	0	0
West Jakarta	0	0	0	0	0	0	0	0	0
North Jakarta	204,33	28393,68	13461,16	3366,00	882,56	1009,52	674,33	0,08	0,65
Sub-total 1	204,33	28.393,68	13.461,16	3.366,00	882,56	1.009,52	674,33	0,08	0,65
West Java Province									
Bogor Regency	0	0	0	0	0	0	0	0	0
Sukabumi Regency	547,46	24769,81	1155,52	289,00	10,14	311,58	512,84	0,77	7,21
Cianjur Regency	0,00	0	0	0	0	0	0	0	0
Bandung Regency	0,00	0	0	0	0	0	0	0	0
Garut Regency	0,00	0	0	0	0	0	0	0	0
Tasikmalaya Regency	0,00	0	0	0	0	0	0	0	0
Ciamis Regency	0,00	0	0	0	0	0	0	0	0
Kuningan Regency	0,00	0	0	0	0	0	0	0	0
Cirebon Regency	344,12	15569,59	726,33	181,66	6,37	195,85	322,36	0,49	4,53
Majalengka Regency	0,00	0	0	0	0	0	0	0	0
Sumedang Regency	0,00	0	0	0	0	0	0	0	0
Indramayu Regency	1042,78	47180,58	2200,99	550,48	19,31	593,48	976,84	1,47	13,74
Subang Regency	0,00	0	0	0	0	0	0	0	0
Purwakarta Regency	0,00	0	0	0	0	0	0	0	0

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Karawang Regency	0,00	0	0	0	0	0	0	0	0
Bekasi Regency	927,03	41943,54	1956,68	489,38	17,17	527,60	868,41	1,31	12,21
Bandung Barat Regency	0,00	0	0	0	0	0	0	0	0
Pangandaran Regency	0,00	0	0	0	0	0	0	0	0
Bogor City	0,00	0	0	0	0	0	0	0	0
Sukabumi City	0,00	0	0	0	0	0	0	0	0
Bandung City	0,00	0	0	0	0	0	0	0	0
Cirebon City	0,00	0	0	0	0	0	0	0	0
Bekasi City	0,00	0	0	0	0	0	0	0	0
Depok City	0,00	0	0	0	0	0	0	0	0
Cimahi City	0,00	0	0	0	0	0	0	0	0
Tasikmalaya City	0,00	0	0	0	0	0	0	0	0
Banjar City	0,00	0	0	0	0	0	0	0	0
Sub-total 2	2861,39	129463,52	6039,51	1510,53	52,99	1628,51	2680,45	4,04	37,70
Banten Province									
Kab. Pandeglang	0	0	0	0	0	0	0	0	0
Kab. Lebak	0	0	0	0	0	0	0	0	0
Kab. Tangerang	5981,67	39591,82	1671,47	417,90	1,01	220,75	834,87	1,25	11,69
Kab. Serang	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Tangerang	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Cilegon	22621,14	149726,23	6321,08	1580,41	3,83	834,82	3157,28	4,74	44,20
Kota Serang	0	0	0	0	0	0	0	0	0
Kota Tangerang Selatan	0	0	0	0	0	0	0	0	0
Sub-total 3	28.602,81	189.318,05	7.992,55	1.998,31	4,85	1.055,56	3.992,15	5,99	55,89
Lampung Province									

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Lampung Barat	0	0	0	0	0	0	0	0	0
Tanggamus	0	0	0	0	0	0	0	0	0
Lampung Selatan	90464,13	755912,88	79737,69	19934,43	39,89	20891,47	39868,77	59,80	558,16
Lampung Timur	0	0	0	0	0	0	0	0	0
Lampung Tengah	0	0	0	0	0	0	0	0	0
Lampung Utara	0	0	0	0	0	0	0	0	0
Way Kanan	0	0	0	0	0	0	0	0	0
Tulang Bawang	0	0	0	0	0	0	0	0	0
Pesawaran	0	0	0	0	0	0	0	0	0
Pringsewu	0	0	0	0	0	0	0	0	0
Mesuji	0	0	0	0	0	0	0	0	0
Tulang Bawang Barat	0	0	0	0	0	0	0	0	0
Pesisir Barat	0	0	0	0	0	0	0	0	0
Kota Bandar Lampung	0	0	0	0	0	0	0	0	0
Kota Metro	0	0	0	0	0	0	0	0	0
Sub-total 4	90.464,13	755.912,88	79.737,69	19.934,43	39,89	20.891,47	39.868,77	59,80	558,16
Central Java Province									
Kab. Cilacap	337,18	9406,298458	1213,13014	303,338681	19,20691	477,151075	478,36641	0,72502	6,766757
Kab. Banyumas	0	0	0	0	0	0	0	0	0
Kab. Purbalingga	0	0	0	0	0	0	0	0	0
Kab. Banjarnegara	0	0	0	0	0	0	0	0	0
Kab. Kebumen	0	0	0	0	0	0	0	0	0
Kab. Purworejo	0	0	0	0	0	0	0	0	0
Kab. Wonosobo	0	0	0	0	0	0	0	0	0
Kab. Magelang	0	0	0	0	0	0	0	0	0
Kab. Boyolali	0	0	0	0	0	0	0	0	0
Kab. Klaten	0	0	0	0	0	0	0	0	0

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Sukoharjo	0	0	0	0	0	0	0	0	0
Kab. Wonogiri	0	0	0	0	0	0	0	0	0
Kab. Karanganyar	0	0	0	0	0	0	0	0	0
Kab. Sragen	0	0	0	0	0	0	0	0	0
Kab. Grobogan	0	0	0	0	0	0	0	0	0
Kab. Blora	0	0	0	0	0	0	0	0	0
Kab. Rembang	0	0	0	0	0	0	0	0	0
Kab. Pati	0	0	0	0	0	0	0	0	0
Kab. Kudus	0	0	0	0	0	0	0	0	0
Kab. Jepara	1926,756992	53750,2769	6932,1722	1733,36389	109,7538	2726,57757	2733,52234	4,142971	38,66718
Kab. Demak	0	0	0	0	0	0	0	0	0
Kab. Semarang	0	0	0	0	0	0	0	0	0
Kab. Temanggung	0	0	0	0	0	0	0	0	0
Kab. Kendal	0	0	0	0	0	0	0	0	0
Kab Batang	0	0	0	0	0	0	0	0	0
Kab. Pekalongan	0	0	0	0	0	0	0	0	0
Kab. Pemalang	0	0	0	0	0	0	0	0	0
Kab. Tegal	0	0	0	0	0	0	0	0	0
Kab. Brebes	0	0	0	0	0	0	0	0	0
Kota Magelang	0	0	0	0	0	0	0	0	0
Kota Surakarta	0	0	0	0	0	0	0	0	0
Kota Salatiga	0	0	0	0	0	0	0	0	0
Kota Semarang	678,7001503	18933,53504	2441,85766	610,57743	38,66076	960,43695	962,883246	1,459361	13,62051
Kota Pekalongan	0	0	0	0	0	0	0	0	0
Kota Tegal	0	0	0	0	0	0	0	0	0
Sub-total 5	2.943	82.090	10.587	2.647	168	4.164	4.175	6	59

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Grand total domain	125.075,30	1.185.178,24	117.818,06	29.456,54	1.147,91	28.749,22	51.390,47	76,25	711,45

Annex 2 Manufacturing Industry

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	55,50	85,90	1554,17	6,92	1,01	69,09	2,23	0,18	0,16
East Jakarta	240,79	372,67	6742,37	30,03	4,36	299,73	9,66	0,80	0,68
Central Jakarta	52,24	80,85	1462,75	6,52	0,95	65,03	2,10	0,17	0,15
West Jakarta	388,52	601,33	10879,21	48,46	7,04	483,63	15,59	1,29	1,09
North Jakarta	413,83	640,49	11587,73	51,62	7,49	515,13	16,60	1,37	1,16
Sub-total 1	1150,88	1781,24	32226,23	143,55	20,84	1432,60	46,17	3,81	3,23
West Java Province									
Bogor Regency	952,98	23420,81	854982,40	2178,36	559,94	951,13	448,44	13,83	11,53
Sukabumi Regency	939,37	23086,23	842768,37	2147,24	551,94	937,55	442,03	13,64	11,37
Cianjur Regency	790,32	19423,11	709045,28	1806,54	464,37	788,78	371,90	11,47	9,56
Bandung Regency	956,87	23516,30	858468,20	2187,25	562,23	955,01	450,27	13,89	11,58
Garut Regency	1188,82	29216,99	1066573,39	2717,47	698,52	1186,52	559,42	17,26	14,38
Tasikmalaya Regency	1139,02	27992,94	1021889,24	2603,62	669,25	1136,81	535,98	16,53	13,78
Ciamis Regency	790,59	19429,87	709292,30	1807,17	464,53	789,06	372,03	11,48	9,57
Kuningan Regency	274,82	6754,07	246558,81	628,19	161,48	274,29	129,32	3,99	3,33
Cirebon Regency	1063,15	26128,30	953820,01	2430,19	624,67	1061,09	500,28	15,43	12,86
Majalengka Regency	1159,97	28507,97	1040690,62	2651,52	681,57	1157,73	545,84	16,84	14,03
Sumedang Regency	405,67	9969,82	363950,77	927,29	238,36	404,88	190,89	5,89	4,91
Indramayu Regency	627,99	15433,67	563410,07	1435,48	368,99	626,77	295,51	9,12	7,60
Subang Regency	557,29	13696,10	499979,43	1273,87	327,44	556,21	262,24	8,09	6,74
Purwakarta Regency	195,06	4793,94	175003,78	445,88	114,61	194,68	91,79	2,83	2,36
Karawang Regency	249,40	6129,26	223750,13	570,08	146,54	248,91	117,36	3,62	3,02
Bekasi Regency	394,90	9705,16	354289,34	902,68	232,03	394,13	185,83	5,73	4,78

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Bandung Barat Regency	482,21	11851,00	432623,84	1102,26	283,33	481,28	226,91	7,00	5,83
Pangandaran Regency	1107,20	27211,00	993344,08	2530,89	650,56	1105,06	521,01	16,07	13,40
Bogor City	469,97	11550,26	421644,93	1074,29	276,14	469,06	221,15	6,82	5,69
Sukabumi City	139,63	3431,54	125269,33	319,17	82,04	139,36	65,70	2,03	1,69
Bandung City	534,89	13145,73	479888,03	1222,68	314,29	533,86	251,70	7,76	6,47
Cirebon City	110,99	2727,79	99578,69	253,71	65,22	110,78	52,23	1,61	1,34
Bekasi City	365,93	8993,14	328296,77	836,45	215,01	365,22	172,19	5,31	4,43
Depok City	613,03	15066,01	549988,36	1401,29	360,20	611,84	288,47	8,90	7,42
Cimahi City	271,58	6674,37	243649,40	620,78	159,57	271,05	127,79	3,94	3,29
Tasikmalaya City	787,87	19362,96	706849,49	1800,94	462,93	786,34	370,74	11,44	9,53
Banjar City	124,55	3060,87	111737,83	284,69	73,18	124,30	58,61	1,81	1,51
Sub-total 2	16694,04	410279,20	14977342,89	38159,98	9808,91	16661,70	7855,65	242,32	201,98
Banten Province									
Kab. Pandeglang	1240,37	17604,73	622720,53	1610,92	407,87	1185,03	339,32	14,55	10,80
Kab. Lebak	1741,03	24710,69	874074,86	2261,15	572,50	1663,36	476,28	20,42	15,17
Kab. Tangerang	1007,31	14296,90	505714,74	1308,24	331,23	962,37	275,56	11,81	8,77
Kab. Serang	752,89	10685,90	377985,35	977,81	247,57	719,30	205,96	8,83	6,56
Kota Tangerang	652,37	9259,15	327517,93	847,26	214,52	623,26	178,46	7,65	5,68
Kota Cilegon	377,22	5353,98	189382,89	489,92	124,04	360,39	103,19	4,42	3,29
Kota Serang	304,05	4315,38	152645,15	394,88	99,98	290,48	83,18	3,57	2,65
Kota Tangerang Selatan	583,40	8280,20	292890,23	757,68	191,84	557,37	159,59	6,84	5,08
Sub-total 3	6658,65	94506,94	3342931,67	8647,85	2189,53	6361,57	1821,55	78,09	58,00
Lampung Province									
Lampung Barat	32,47	442,53	15982,69	41,15	10,46	29,56	8,60	0,26	0,22

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Tanggamus	132,29	1803,14	65123,06	167,67	42,64	120,46	35,02	1,07	0,90
Lampung Selatan	263,46	3590,96	129692,55	333,92	84,91	239,90	69,75	2,12	1,80
Lampung Timur	602,48	8211,62	296573,94	763,60	194,17	548,58	159,50	4,85	4,11
Lampung Tengah	593,80	8093,32	292301,49	752,59	191,37	540,68	157,20	4,78	4,05
Lampung Utara	140,66	1917,12	69239,38	178,27	45,33	128,07	37,24	1,13	0,96
Way Kanan	77,22	1052,49	38012,11	97,87	24,89	70,31	20,44	0,62	0,53
Tulang Bawang	53,52	729,43	26344,46	67,83	17,25	48,73	14,17	0,43	0,36
Pesawaran	127,59	1739,08	62809,40	161,72	41,12	116,18	33,78	1,03	0,87
Pringsewu	259,95	3543,01	127960,86	329,46	83,78	236,69	68,82	2,09	1,77
Mesuji	43,89	598,17	21603,60	55,62	14,14	39,96	11,62	0,35	0,30
Tulang Bawang Barat	42,62	580,87	20979,05	54,02	13,73	38,81	11,28	0,34	0,29
Pesisir Barat	42,59	580,48	20964,86	53,98	13,73	38,78	11,28	0,34	0,29
Kota Bandar Lampung	290,77	3963,14	143134,47	368,53	93,71	264,76	76,98	2,34	1,98
Kota Metro	62,11	846,55	30574,34	78,72	20,02	56,55	16,44	0,50	0,42
Sub-total 4	2765,41	37691,92	1361296,26	3504,96	891,24	2518,03	732,12	22,28	18,84
Central Java Province									
Kab. Cilacap	60,64	2078,63	77171,00	194,96	50,54	43,78	39,61	1,24	0,92
Kab. Banyumas	185,83	6369,99	236491,79	597,46	154,88	134,17	121,39	3,79	2,82
Kab. Purbalingga	316,88	10862,51	403280,73	1018,83	264,11	228,79	207,00	6,47	4,81
Kab. Banjarnegara	44,99	1542,21	57255,91	144,65	37,50	32,48	29,39	0,92	0,68
Kab. Kebumen	371,65	12739,98	472983,58	1194,93	309,76	268,33	242,77	7,59	5,64
Kab. Purworejo	43,03	1475,16	54766,52	138,36	35,87	31,07	28,11	0,88	0,65
Kab. Wonosobo	199,52	6839,36	253917,50	641,49	166,29	144,05	130,33	4,07	3,03
Kab. Magelang	191,69	6571,15	243959,95	616,33	159,77	138,40	125,22	3,91	2,91
Kab. Boyolali	244,51	8381,56	311173,41	786,13	203,79	176,54	159,72	4,99	3,71
Kab. Klaten	338,40	11600,08	430663,99	1088,01	282,05	244,33	221,05	6,91	5,13
Kab. Sukoharjo	444,03	15220,92	565090,91	1427,62	370,08	320,59	290,05	9,06	6,73

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Wonogiri	50,86	1743,37	64724,07	163,52	42,39	36,72	33,22	1,04	0,77
Kab. Karanganyar	356,00	12203,56	453068,48	1144,61	296,72	257,04	232,55	7,27	5,40
Kab. Sragen	183,87	6302,94	234002,40	591,17	153,25	132,76	120,11	3,75	2,79
Kab. Grobogan	68,46	2346,84	87128,55	220,12	57,06	49,43	44,72	1,40	1,04
Kab. Blora	60,64	2078,63	77171,00	194,96	50,54	43,78	39,61	1,24	0,92
Kab. Rembang	136,92	4693,68	174257,11	440,24	114,12	98,86	89,44	2,80	2,08
Kab. Pati	447,94	15355,02	570069,68	1440,20	373,35	323,41	292,61	9,14	6,79
Kab. Kudus	445,98	15287,97	567580,29	1433,91	371,72	322,00	291,33	9,10	6,76
Kab. Jepara	758,95	26016,37	965882,25	2440,16	632,57	547,97	495,77	15,49	11,51
Kab. Demak	238,64	8180,41	303705,24	767,27	198,90	172,30	155,89	4,87	3,62
Kab. Semarang	322,75	11063,66	410748,90	1037,70	269,00	233,03	210,83	6,59	4,89
Kab. Temanggung	99,76	3419,68	126958,75	320,74	83,15	72,03	65,17	2,04	1,51
Kab. Kendal	164,31	5632,41	209108,53	528,28	136,95	118,63	107,33	3,35	2,49
Kab Batang	166,27	5699,46	211597,92	534,57	138,58	120,04	108,61	3,39	2,52
Kab. Pekalongan	426,42	14617,45	542686,42	1371,02	355,41	307,88	278,55	8,71	6,47
Kab. Pemalang	127,14	4358,41	161810,17	408,79	105,97	91,80	83,05	2,60	1,93
Kab. Tegal	258,20	8850,93	328599,12	830,16	215,20	186,42	168,66	5,27	3,92
Kab. Brebes	154,53	5297,15	196661,59	496,84	128,80	111,57	100,94	3,15	2,34
Kota Magelang	60,64	2078,63	77171,00	194,96	50,54	43,78	39,61	1,24	0,92
Kota Surakarta	197,56	6772,30	251428,11	635,20	164,66	142,64	129,05	4,03	3,00
Kota Salatiga	97,80	3352,63	124469,36	314,45	81,52	70,61	63,89	2,00	1,48
Kota Semarang	979,99	33593,31	1247183,01	3150,83	816,80	707,56	640,16	20,01	14,86
Kota Pekalongan	170,18	5833,57	216576,69	547,15	141,84	122,87	111,16	3,47	2,58
Kota Tegal	148,66	5095,99	189193,43	477,97	123,91	107,33	97,11	3,03	2,25
Sub-total 5	8563,63	293555,87	10898537,38	27533,59	7137,59	6183,00	5594,02	174,83	129,87
Grand total domain	35.832,61	837.815,18	30.612.334,44	77.989,94	20.048,11	33.156,90	16.049,51	521,33	411,93

Annex 3 Shipping in Harbour

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
East Jakarta	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Central Jakarta	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
West Jakarta	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
North Jakarta	1267,07	1866,19	142,24	0,00	0,00	312,36	0,00	42,10	59,74
Sub-total 1	1267,07	1866,19	142,24	0,00	0,00	312,36	0,00	42,10	59,74
West Java Province									
Bogor Regency	-	-	-	-	-	-	-	-	-
Sukabumi Regency	-	-	-	-	-	-	-	-	-
Cianjur Regency	-	-	-	-	-	-	-	-	-
Bandung Regency	-	-	-	-	-	-	-	-	-
Garut Regency	-	-	-	-	-	-	-	-	-
Tasikmalaya Regency	-	-	-	-	-	-	-	-	-
Ciamis Regency	-	-	-	-	-	-	-	-	-
Kuningan Regency	-	-	-	-	-	-	-	-	-
Cirebon Regency	-	-	-	-	-	-	-	-	-
Majalengka Regency	-	-	-	-	-	-	-	-	-

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Sumedang Regency	-	-	-	-	-	-	-	-	-
Indramayu Regency	-	-	-	-	-	-	-	-	-
Subang Regency	-	-	-	-	-	-	-	-	-
Purwakarta Regency	-	-	-	-	-	-	-	-	-
Karawang Regency	-	-	-	-	-	-	-	-	-
Bekasi Regency	-	-	-	-	-	-	-	-	-
Bandung Barat Regency	-	-	-	-	-	-	-	-	-
Pangandaran Regency	-	-	-	-	-	-	-	-	-
Bogor City	-	-	-	-	-	-	-	-	-
Sukabumi City	-	-	-	-	-	-	-	-	-
Bandung City	-	-	-	-	-	-	-	-	-
Cirebon City	-	-	-	-	-	-	-	-	-
Bekasi City	-	-	-	-	-	-	-	-	-
Depok City	-	-	-	-	-	-	-	-	-
Cimahi City	-	-	-	-	-	-	-	-	-

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Tasikmalaya City	-	-	-	-	-	-	-	-	-
Banjar City	-	-	-	-	-	-	-	-	-
Sub-total 2	-	-	-	-	-	-	-	-	-
Banten Province									
Kab. Pandeglang	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kab. Lebak	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kab. Tangerang	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kab. Serang	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Tangerang	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Cilegon	1445,81	2129,44	162,30	0,00	0,00	356,42	0,00	48,04	68,17
Kota Serang	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Tangerang Selatan	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Sub-total 3	1445,81	2129,44	162,30	0,00	0,00	356,42	0,00	48,04	68,17
Lampung Province									
Lampung Barat	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Tanggamus	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Lampung Selatan	2527,06	3683,97	280,53	0,00	0,00	620,48	0,00	83,61	118,70
Lampung Timur	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Lampung Tengah	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Lampung Utara	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Way Kanan	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Tulang Bawang	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Pesawaran	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Pringsewu	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Mesuji	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Tulang Bawang Barat	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Pesisir Barat	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Bandar Lampung	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Metro	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Sub-total 4	2527,06	3683,97	280,53	0,00	0,00	620,48	0,00	83,61	118,70
Central Java Province									
Kab. Cilacap	0	0	0	0	0	0	0	0	0
Kab. Banyumas	0	0	0	0	0	0	0	0	0
Kab. Purbalingga	0	0	0	0	0	0	0	0	0
Kab. Banjarnegara	0	0	0	0	0	0	0	0	0
Kab. Kebumen	0	0	0	0	0	0	0	0	0
Kab. Purworejo	0	0	0	0	0	0	0	0	0
Kab. Wonosobo	0	0	0	0	0	0	0	0	0
Kab. Magelang	0	0	0	0	0	0	0	0	0
Kab. Boyolali	0	0	0	0	0	0	0	0	0
Kab. Klaten	0	0	0	0	0	0	0	0	0
Kab. Sukoharjo	0	0	0	0	0	0	0	0	0
Kab. Wonogiri	0	0	0	0	0	0	0	0	0
Kab. Karanganyar	0	0	0	0	0	0	0	0	0
Kab. Sragen	0	0	0	0	0	0	0	0	0
Kab. Grobogan	0	0	0	0	0	0	0	0	0
Kab. Blora	0	0	0	0	0	0	0	0	0
Kab. Rembang	0	0	0	0	0	0	0	0	0
Kab. Pati	0	0	0	0	0	0	0	0	0
Kab. Kudus	0	0	0	0	0	0	0	0	0
Kab. Jepara	0	0	0	0	0	0	0	0	0

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Demak	0	0	0	0	0	0	0	0	0
Kab. Semarang	0	0	0	0	0	0	0	0	0
Kab. Temanggung	0	0	0	0	0	0	0	0	0
Kab. Kendal	0	0	0	0	0	0	0	0	0
Kab Batang	0	0	0	0	0	0	0	0	0
Kab. Pekalongan	0	0	0	0	0	0	0	0	0
Kab. Pemalang	0	0	0	0	0	0	0	0	0
Kab. Tegal	0	0	0	0	0	0	0	0	0
Kab. Brebes	0	0	0	0	0	0	0	0	0
Kota Magelang	0	0	0	0	0	0	0	0	0
Kota Surakarta	0	0	0	0	0	0	0	0	0
Kota Salatiga	0	0	0	0	0	0	0	0	0
Kota Semarang	0	0	0	0	0	0	0	0	0
Kota Pekalongan	0	0	0	0	0	0	0	0	0
Kota Tegal	0	0	0	0	0	0	0	0	0
Sub-total 5	-	-	-	-	-	-	-	-	-
Grand total domain	5.239,94	7.679,59	585,07	-	-	1.289,26	-	173,75	246,61

Annex 4 Residential and Commercial

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	428,83	2287,26	4835,41	305,42	0,00	1352,21	727,80	259,92	39,01
East Jakarta	556,34	2967,39	6273,24	396,23	0,00	1754,29	944,22	337,21	50,61
Central Jakarta	175,76	937,44	1981,80	125,18	0,00	554,21	298,29	106,53	15,99
West Jakarta	490,45	2615,96	5530,31	349,31	0,00	1546,54	832,40	297,28	44,61
North Jakarta	343,31	1831,14	3871,14	244,51	0,00	1082,55	582,67	208,09	31,23
Sub-total 1	1994,68	10639,18	22491,91	1420,64	0,00	6289,80	3385,38	1209,03	181,44
West Java Province									
Bogor Regency	147,51	786,43	1663,65	105,11	0,00	465,20	250,96	89,43	13,49
Sukabumi Regency	60,98	325,13	687,80	43,45	0,00	192,33	103,76	36,97	5,58
Cianjur Regency	55,90	298,02	630,45	39,83	0,00	176,29	95,10	33,89	5,11
Bandung Regency	93,35	497,70	1052,86	66,52	0,00	294,41	158,82	56,60	8,54
Garut Regency	64,84	345,72	731,35	46,21	0,00	204,51	110,32	39,31	5,93
Tasikmalaya Regency	43,37	231,25	489,20	30,91	0,00	136,79	73,80	26,30	3,97
Ciamis Regency	29,55	157,56	333,31	21,06	0,00	93,20	50,28	17,92	2,70
Kuningan Regency	26,72	142,48	301,42	19,04	0,00	84,29	45,47	16,20	2,44
Cirebon Regency	54,22	289,09	611,56	38,64	0,00	171,01	92,25	32,87	4,96
Majalengka Regency	29,80	158,86	336,06	21,23	0,00	93,97	50,70	18,06	2,73
Sumedang Regency	28,50	151,92	321,38	20,30	0,00	89,87	48,48	17,28	2,61
Indramayu Regency	42,74	227,87	482,04	30,45	0,00	134,79	72,72	25,91	3,91
Subang Regency	39,46	210,38	445,05	28,12	0,00	124,45	67,14	23,92	3,61
Purwakarta Regency	23,81	126,94	268,53	16,97	0,00	75,09	40,51	14,43	2,18
Karawang Regency	58,20	310,32	656,47	41,47	0,00	183,57	99,03	35,29	5,32
Bekasi Regency	93,07	496,20	1049,68	66,32	0,00	293,52	158,35	56,42	8,51
Bandung Barat Regency	42,03	224,10	474,07	29,95	0,00	132,56	71,51	25,48	3,84

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Pangandaran Regency	9,87	52,64	111,35	7,04	0,00	31,14	16,80	5,99	0,90
Bogor City	27,50	146,61	310,14	19,59	0,00	86,72	46,78	16,67	2,52
Sukabumi City	8,13	43,33	91,66	5,79	0,00	25,63	13,83	4,93	0,74
Bandung City	62,01	330,62	699,41	44,19	0,00	195,57	105,51	37,60	5,67
Cirebon City	7,90	42,10	89,05	5,63	0,00	24,90	13,43	4,79	0,72
Bekasi City	74,28	396,01	837,74	52,93	0,00	234,26	126,37	45,03	6,79
Depok City	59,51	317,30	671,22	42,41	0,00	187,69	101,25	36,08	5,44
Cimahi City	15,19	80,98	171,32	10,82	0,00	47,91	25,84	9,21	1,39
Tasikmalaya City	16,41	87,47	185,04	11,69	0,00	51,74	27,91	9,95	1,50
Banjar City	4,53	24,14	51,07	3,23	0,00	14,28	7,70	2,75	0,41
Sub-total 2	1219,39	6501,19	13752,92	868,88	0,00	3845,71	2074,64	739,27	111,54
Banten Province									
Kab. Pandeglang	31,46	167,81	354,70	22,41	0,00	99,16	53,39	19,07	2,86
Kab. Lebak	33,82	180,37	381,24	24,08	0,00	106,59	57,39	20,50	3,07
Kab. Tangerang	98,68	526,29	1112,40	70,27	0,00	311,00	167,46	59,81	8,97
Kab. Serang	39,16	208,87	441,47	27,89	0,00	123,42	66,46	23,73	3,56
Kota Tangerang	57,89	308,77	652,64	41,23	0,00	182,46	98,25	35,09	5,26
Kota Cilegon	11,35	60,54	127,96	8,08	0,00	35,77	19,26	6,88	1,03
Kota Serang	17,88	95,35	201,54	12,73	0,00	56,34	30,34	10,84	1,63
Kota Tangerang Selatan	45,38	242,03	511,57	32,32	0,00	143,02	77,01	27,50	4,13
Sub-total 3	335,63	1790,03	3783,52	239,01	0,00	1057,78	569,56	203,41	30,51
Lampung Province									
Lampung Barat	4,12	21,97	46,48	2,94	0,00	13,00	7,01	2,50	0,38
Tanggamus	8,14	43,40	91,82	5,80	0,00	25,68	13,85	4,94	0,74
Lampung Selatan	13,76	73,36	155,21	9,81	0,00	43,40	23,42	8,34	1,26

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Lampung Timur	14,21	75,76	160,27	10,13	0,00	44,82	24,18	8,62	1,30
Lampung Tengah	17,43	92,95	196,65	12,42	0,00	54,99	29,67	10,57	1,60
Lampung Utara	8,39	44,75	94,68	5,98	0,00	26,47	14,28	5,09	0,77
Way Kanan	6,12	32,65	69,08	4,36	0,00	19,32	10,42	3,71	0,56
Tulang Bawang	6,14	32,71	69,20	4,37	0,00	19,35	10,44	3,72	0,56
Pesawaran	6,05	32,24	68,20	4,31	0,00	19,07	10,29	3,67	0,55
Pringsewu	5,45	29,03	61,42	3,88	0,00	17,17	9,27	3,30	0,50
Mesuji	2,72	14,52	30,73	1,94	0,00	8,59	4,64	1,65	0,25
Tulang Bawang Barat	3,72	19,82	41,93	2,65	0,00	11,72	6,33	2,25	0,34
Pesisir Barat	2,11	11,24	23,77	1,50	0,00	6,65	3,59	1,28	0,19
Kota Bandar Lampung	14,31	76,28	161,38	10,20	0,00	45,13	24,35	8,67	1,31
Kota Metro	50,26	267,98	566,93	35,82	0,00	158,53	85,54	30,47	4,60
Sub-total 4	162,94	868,67	1837,73	116,11	0,00	513,89	277,27	98,78	14,91
Central Java Province									
Kab. Cilacap	43,15	215,09	533,06	34,26	0,00	154,08	109,50	27,83	8,51
Kab. Banyumas	42,30	210,84	522,54	33,58	0,00	151,04	107,33	27,28	8,34
Kab. Purbalingga	23,34	116,32	288,27	18,53	0,00	83,32	59,21	15,05	4,60
Kab. Banjarnegara	23,07	114,97	284,94	18,31	0,00	82,36	58,53	14,88	4,55
Kab. Kebumen	29,93	149,19	369,75	23,76	0,00	106,88	75,95	19,30	5,90
Kab. Purworejo	17,95	89,46	221,71	14,25	0,00	64,08	45,54	11,57	3,54
Kab. Wonosobo	19,75	98,45	243,99	15,68	0,00	70,52	50,12	12,74	3,90
Kab. Magelang	32,25	160,73	398,34	25,60	0,00	115,14	81,82	20,80	6,36
Kab. Boyolali	24,61	122,65	303,96	19,53	0,00	87,86	62,44	15,87	4,85
Kab. Klaten	29,36	146,33	362,66	23,31	0,00	104,82	74,49	18,93	5,79
Kab. Sukoharjo	22,29	111,08	275,29	17,69	0,00	79,57	56,55	14,37	4,40
Kab. Wonogiri	23,97	119,49	296,14	19,03	0,00	85,60	60,83	15,46	4,73
Kab. Karanganyar	22,15	110,40	273,62	17,58	0,00	79,09	56,20	14,29	4,37

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Sragen	22,25	110,90	274,86	17,66	0,00	79,45	56,46	14,35	4,39
Kab. Grobogan	34,43	171,59	425,25	27,33	0,00	122,92	87,35	22,20	6,79
Kab. Blora	21,61	107,73	266,98	17,16	0,00	77,17	54,84	13,94	4,26
Kab. Rembang	15,95	79,48	196,97	12,66	0,00	56,93	40,46	10,28	3,15
Kab. Pati	31,47	156,87	388,77	24,98	0,00	112,37	79,86	20,30	6,21
Kab. Kudus	21,77	108,51	268,93	17,28	0,00	77,73	55,24	14,04	4,29
Kab. Jepara	31,43	156,66	388,25	24,95	0,00	112,22	79,75	20,27	6,20
Kab. Demak	29,05	144,81	358,90	23,06	0,00	103,74	73,72	18,74	5,73
Kab. Semarang	26,33	131,24	325,25	20,90	0,00	94,01	66,81	16,98	5,19
Kab. Temanggung	19,29	96,15	238,28	15,31	0,00	68,87	48,95	12,44	3,80
Kab. Kendal	24,26	120,94	299,72	19,26	0,00	86,63	61,57	15,65	4,79
Kab Batang	19,20	95,72	237,22	15,25	0,00	68,57	48,73	12,38	3,79
Kab. Pekalongan	22,43	111,80	277,08	17,81	0,00	80,09	56,91	14,47	4,42
Kab. Pemalang	32,55	162,25	402,11	25,84	0,00	116,23	82,60	20,99	6,42
Kab. Tegal	36,00	179,42	444,67	28,58	0,00	128,53	91,34	23,21	7,10
Kab. Brebes	45,20	225,30	558,37	35,88	0,00	161,39	114,69	29,15	8,92
Kota Magelang	3,05	15,21	37,69	2,42	0,00	10,89	7,74	1,97	0,60
Kota Surakarta	12,98	64,71	160,37	10,31	0,00	46,35	32,94	8,37	2,56
Kota Salatiga	4,85	24,17	59,90	3,85	0,00	17,31	12,30	3,13	0,96
Kota Semarang	45,33	225,92	559,92	35,98	0,00	161,84	115,01	29,23	8,94
Kota Pekalongan	7,67	38,25	94,78	6,09	0,00	27,40	19,47	4,95	1,51
Kota Tegal	6,24	31,12	77,13	4,96	0,00	22,29	15,84	4,03	1,23
Sub-total 5	867,50	4323,72	10715,64	688,65	0,00	3097,31	2201,10	559,44	171,09
Grand total domain	4.580,13	24.122,79	52.581,71	3.333,29	-	14.804,48	8.507,94	2.809,94	509,49

Annex 5 Fugitive Emission

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	0	0	0	8048,60	0	0	0	0	0
East Jakarta	0	0	0	19829,88	0	0	0	0	0
Central Jakarta	0	0	0	6532,20	0	0	0	0	0
West Jakarta	0	0	0	6765,49	0	0	0	0	0
North Jakarta	0	0	0	5832,32	0	0	0	0	0
Sub-total 1	-	-	-	47008,48	-	-	-	-	-
West Java Province									
Bogor Regency	0	0	0	333,70	0	0	0	0	0
Sukabumi Regency	0	0	0	41,73	0	0	0	0	0
Cianjur Regency	0	0	0	82,31	0	0	0	0	0
Bandung Regency	0	0	0	83,05	0	0	0	0	0
Garut Regency	0	0	0	24,52	0	0	0	0	0
Tasikmalaya Regency	0	0	0	10,44	0	0	0	0	0
Ciamis Regency	0	0	0	13,63	0	0	0	0	0
Kuningan Regency	0	0	0	24,81	0	0	0	0	0
Cirebon Regency	0	0	0	35,80	0	0	0	0	0
Majalengka Regency	0	0	0	32,73	0	0	0	0	0
Sumedang Regency	0	0	0	42,41	0	0	0	0	0
Indramayu Regency	0	0	0	27,71	0	0	0	0	0
Subang Regency	0	0	0	0,00	0	0	0	0	0
Purwakarta Regency	0	0	0	25,14	0	0	0	0	0
Karawang Regency	0	0	0	43,90	0	0	0	0	0
Bekasi Regency	0	0	0	192,38	0	0	0	0	0
Bandung Barat Regency	0	0	0	27,90	0	0	0	0	0
Pangandaran Regency	0	0	0	1,33	0	0	0	0	0

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Bogor City	0	0	0	62,79	0	0	0	0	0
Sukabumi City	0	0	0	66,31	0	0	0	0	0
Bandung City	0	0	0	128,47	0	0	0	0	0
Cirebon City	0	0	0	11,11	0	0	0	0	0
Bekasi City	0	0	0	289,61	0	0	0	0	0
Depok City	0	0	0	128,75	0	0	0	0	0
Cimahi City	0	0	0	27,10	0	0	0	0	0
Tasikmalaya City	0	0	0	10,05	0	0	0	0	0
Banjar City	0	0	0	3,93	0	0	0	0	0
Sub-total 2	-	-	-	1771,61	-	-	-	-	-
Banten Province									
Kab. Pandeglang	0	0	0	46,11	0	0	0	0	0
Kab. Lebak	0	0	0	28,75	0	0	0	0	0
Kab. Tangerang	0	0	0	89,72	0	0	0	0	0
Kab. Serang	0	0	0	61,96	0	0	0	0	0
Kota Tangerang	0	0	0	121,43	0	0	0	0	0
Kota Cilegon	0	0	0	29,18	0	0	0	0	0
Kota Serang	0	0	0	57,14	0	0	0	0	0
Kota Tangerang Selatan	0	0	0	164,45	0	0	0	0	0
Sub-total 3	-	-	-	598,74	-	-	-	-	-
Lampung Province									
Lampung Barat	0	0	0	65,15	0	0	0	0	0
Tanggamus	0	0	0	0,00	0	0	0	0	0
Lampung Selatan	0	0	0	325,73	0	0	0	0	0
Lampung Timur	0	0	0	81,43	0	0	0	0	0

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Lampung Tengah	0	0	0	130,29	0	0	0	0	0
Lampung Utara	0	0	0	114,01	0	0	0	0	0
Way Kanan	0	0	0	0,00	0	0	0	0	0
Tulang Bawang	0	0	0	0,00	0	0	0	0	0
Pesawaran	0	0	0	0,00	0	0	0	0	0
Pringsewu	0	0	0	0,00	0	0	0	0	0
Mesuji	0	0	0	0,00	0	0	0	0	0
Tulang Bawang Barat	0	0	0	0,00	0	0	0	0	0
Pesisir Barat	0	0	0	0,00	0	0	0	0	0
Kota Bandar Lampung	0	0	0	228,01	0	0	0	0	0
Kota Metro	0	0	0	0,00	0	0	0	0	0
Sub-total 4	-	-	-	944,63	-	-	-	-	-
Central Java Province									
Kab. Cilacap	0	0	0	31,93	0	0	0	0	0
Kab. Banyumas	0	0	0	13,02	0	0	0	0	0
Kab. Purbalingga	0	0	0	8,66	0	0	0	0	0
Kab. Banjarnegara	0	0	0	7,46	0	0	0	0	0
Kab. Kebumen	0	0	0	43,04	0	0	0	0	0
Kab. Purworejo	0	0	0	21,40	0	0	0	0	0
Kab. Wonosobo	0	0	0	3,83	0	0	0	0	0
Kab. Magelang	0	0	0	6,36	0	0	0	0	0
Kab. Boyolali	0	0	0	1,30	0	0	0	0	0
Kab. Klaten	0	0	0	20,62	0	0	0	0	0
Kab. Sukoharjo	0	0	0	0,09	0	0	0	0	0
Kab. Wonogiri	0	0	0	0,01	0	0	0	0	0
Kab. Karanganyar	0	0	0	1,84	0	0	0	0	0
Kab. Sragen	0	0	0	7,62	0	0	0	0	0

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Grobogan	0	0	0	30,23	0	0	0	0	0
Kab. Blora	0	0	0	36,28	0	0	0	0	0
Kab. Rembang	0	0	0	26,39	0	0	0	0	0
Kab. Pati	0	0	0	62,69	0	0	0	0	0
Kab. Kudus	0	0	0	43,63	0	0	0	0	0
Kab. Jepara	0	0	0	54,35	0	0	0	0	0
Kab. Demak	0	0	0	29,70	0	0	0	0	0
Kab. Semarang	0	0	0	20,85	0	0	0	0	0
Kab. Temanggung	0	0	0	20,02	0	0	0	0	0
Kab. Kendal	0	0	0	4,94	0	0	0	0	0
Kab Batang	0	0	0	3,53	0	0	0	0	0
Kab. Pekalongan	0	0	0	8,72	0	0	0	0	0
Kab. Pemalang	0	0	0	14,14	0	0	0	0	0
Kab. Tegal	0	0	0	37,92	0	0	0	0	0
Kab. Brebes	0	0	0	14,52	0	0	0	0	0
Kota Magelang	0	0	0	28,32	0	0	0	0	0
Kota Surakarta	0	0	0	3,81	0	0	0	0	0
Kota Salatiga	0	0	0	5,91	0	0	0	0	0
Kota Semarang	0	0	0	108,12	0	0	0	0	0
Kota Pekalongan	0	0	0	8,05	0	0	0	0	0
Kota Tegal	0	0	0	3,77	0	0	0	0	0
Sub-total 5	-	-	-	733,10	-	-	-	-	-
Grand total domain	-	-	-	51.057	-	-	-	-	-

Annex 6 Agro-residue Open Burning

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
East Jakarta	0,03	0,40	31,66	1,24	0,73	3,08	0,73	0,09	0,53
Central Jakarta	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
West Jakarta	0,02	0,26	20,63	0,81	0,47	2,00	0,47	0,06	0,34
North Jakarta	0,38	4,77	374,84	14,66	8,59	36,44	8,59	1,07	6,26
Sub-total 1	0,43	5,44	427,13	16,70	9,78	41,52	9,78	1,22	7,13
West Java Province									
Bogor Regency	67,06	818,62	59356,26	2442,24	1315,44	5708,12	1402,21	183,47	997,97
Sukabumi Regency	114,82	1401,52	101620,72	4181,22	2252,09	9772,57	2400,64	314,10	1708,57
Cianjur Regency	150,26	1834,11	132986,57	5471,78	2947,22	12788,93	3141,61	411,05	2235,93
Bandung Regency	101,73	1241,72	90034,47	3704,50	1995,32	8658,35	2126,93	278,29	1513,77
Garut Regency	273,95	3343,92	242459,74	9976,10	5373,33	23316,64	5727,76	749,43	4076,52
Tasikmalaya Regency	107,28	1309,46	94945,96	3906,59	2104,17	9130,67	2242,96	293,47	1596,34
Ciamis Regency	66,35	809,94	58726,58	2416,33	1301,48	5647,56	1387,33	181,52	987,38
Kuningan Regency	51,30	626,18	45403,08	1868,13	1006,21	4366,28	1072,58	140,34	763,37
Cirebon Regency	109,62	1338,08	97020,88	3991,96	2150,15	9330,21	2291,98	299,89	1631,23
Majalengka Regency	153,35	1871,88	135725,79	5584,49	3007,92	13052,35	3206,32	419,52	2281,98
Sumedang Regency	82,70	1009,46	73193,84	3011,59	1622,10	7038,84	1729,10	226,24	1230,62
Indramayu Regency	312,32	3812,30	276421,12	11373,45	6125,98	26582,61	6530,05	854,40	4647,52
Subang Regency	205,47	2508,01	181849,92	7482,29	4030,11	17487,97	4295,94	562,09	3057,48
Purwakarta Regency	32,37	395,14	28650,88	1178,85	634,95	2755,27	676,84	88,56	481,71

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Karawang Regency	244,33	2982,43	216249,17	8897,66	4792,46	20796,05	5108,57	668,42	3635,84
Bekasi Regency	119,61	1460,01	105861,93	4355,73	2346,09	10180,43	2500,83	327,21	1779,88
Bandung Barat Regency	39,42	481,21	34891,38	1435,62	773,25	3355,40	824,26	107,85	586,64
Pangandaran Regency	39,70	484,60	35137,11	1445,73	778,70	3379,03	830,06	108,61	590,77
Bogor City	0,11	1,29	93,66	3,85	2,08	9,01	2,21	0,29	1,57
Sukabumi City	3,33	40,59	2943,31	121,10	65,23	283,05	69,53	9,10	49,49
Bandung City	1,59	19,44	1409,26	57,98	31,23	135,52	33,29	4,36	23,69
Cirebon City	0,24	2,90	210,47	8,66	4,66	20,24	4,97	0,65	3,54
Bekasi City	0,69	8,37	606,91	24,97	13,45	58,36	14,34	1,88	10,20
Depok City	0,10	1,24	89,56	3,69	1,98	8,61	2,12	0,28	1,51
Cimahi City	0,09	1,08	78,30	3,22	1,74	7,53	1,85	0,24	1,32
Tasikmalaya City	8,22	100,35	7275,80	299,37	161,24	699,69	171,88	22,49	122,33
Banjar City	6,49	79,22	5744,10	236,34	127,30	552,39	135,70	17,75	96,58
Sub-total 2	2292,47	27983,09	2028986,76	83483,45	44965,91	195121,70	47931,86	6271,49	34113,75
Banten Province									
Kab. Pandeglang	185,76	2310,57	174776,26	7006,84	3943,46	16907,53	4061,69	517,42	2927,96
Kab. Lebak	140,54	1748,17	132235,34	5301,36	2983,61	12792,20	3073,07	391,48	2215,29
Kab. Tangerang	97,51	1212,86	91743,22	3678,02	2069,99	8875,07	2132,05	271,60	1536,94
Kab. Serang	129,29	1608,25	121651,72	4877,06	2744,82	11768,36	2827,11	360,15	2037,99
Kota Tangerang	1,25	15,56	1176,87	47,18	26,55	113,85	27,35	3,48	19,72
Kota Cilegon	5,29	65,86	4981,97	199,73	112,41	481,95	115,78	14,75	83,46
Kota Serang	23,93	297,69	22518,16	902,76	508,08	2178,36	523,31	66,66	377,24
Kota Tangerang Selatan	0,37	4,57	345,83	13,86	7,80	33,45	8,04	1,02	5,79
Sub-total 3	583,94	7263,53	549429,37	22026,80	12396,72	53150,77	12768,39	1626,57	9204,39

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Lampung Province									
Lampung Barat	12,05	129,24	10473,72	396,95	231,93	1012,18	269,56	32,48	166,55
Tanggamus	25,61	274,77	22266,51	843,89	493,07	2151,83	573,07	69,05	354,08
Lampung Selatan	165,62	1776,73	143982,48	5456,89	3188,36	13914,41	3705,66	446,49	2289,59
Lampung Timur	157,51	1689,75	136934,15	5189,76	3032,28	13233,26	3524,26	424,64	2177,51
Lampung Tengah	100,35	1076,49	87236,31	3306,23	1931,77	8430,48	2245,19	270,52	1387,22
Lampung Utara	29,89	320,67	25986,78	984,89	575,45	2511,35	668,82	80,59	413,24
Way Kanan	19,76	212,00	17179,75	651,11	380,43	1660,24	442,15	53,27	273,19
Tulang Bawang	44,65	478,99	38816,29	1471,13	859,55	3751,19	999,01	120,37	617,25
Pesawaran	35,44	380,23	30812,91	1167,80	682,32	2977,75	793,03	95,55	489,98
Pringsewu	28,16	302,14	24485,01	927,97	542,20	2366,22	630,17	75,93	389,36
Mesuji	50,02	536,60	43484,66	1648,06	962,93	4202,34	1119,16	134,85	691,49
Tulang Bawang Barat	6,54	70,17	5686,66	215,52	125,93	549,56	146,36	17,63	90,43
Pesisir Barat	14,24	152,73	12377,28	469,10	274,08	1196,14	318,55	38,38	196,82
Kota Bandar Lampung	0,54	5,81	470,91	17,85	10,43	45,51	12,12	1,46	7,49
Kota Metro	2,69	28,81	2334,99	88,50	51,71	225,65	60,10	7,24	37,13
Sub-total 4	693,08	7435,14	602528,41	22835,65	13342,45	58228,11	15507,20	1868,45	9581,33
Central Java Province									
Kab. Cilacap	43,92	519,89	34892,17	1514,85	746,34	3318,64	849,63	116,61	590,90
Kab. Banyumas	91,14	1078,86	72406,73	3143,55	1548,78	6886,71	1763,11	241,98	1226,22
Kab. Purbalingga	66,89	791,85	53144,50	2307,28	1136,76	5054,65	1294,07	177,61	900,01
Kab. Banjarnegara	71,65	848,10	56919,26	2471,16	1217,50	5413,67	1385,99	190,22	963,94
Kab. Kebumen	132,40	1567,28	105186,84	4566,71	2249,95	10004,47	2561,30	351,53	1781,36
Kab. Purworejo	95,04	1125,06	75507,27	3278,17	1615,10	7181,60	1838,61	252,34	1278,73
Kab. Wonosobo	77,96	922,88	61938,56	2689,08	1324,87	5891,06	1508,21	207,00	1048,94
Kab. Magelang	81,54	965,17	64776,49	2812,29	1385,57	6160,98	1577,31	216,48	1097,00

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Boyolali	133,57	1581,15	106117,24	4607,10	2269,85	10092,96	2583,96	354,64	1797,11
Kab. Klaten	131,25	1553,60	104268,34	4526,83	2230,30	9917,11	2538,94	348,46	1765,80
Kab. Sukoharjo	106,39	1259,43	84525,47	3669,69	1808,00	8039,34	2058,20	282,48	1431,45
Kab. Wonogiri	419,00	4959,89	332878,59	14452,00	7120,28	31660,55	8105,61	1112,46	5637,36
Kab. Karanganyar	97,17	1150,28	77199,77	3351,65	1651,31	7342,58	1879,82	258,00	1307,39
Kab. Sragen	254,31	3010,40	202040,30	8771,63	4321,65	19216,34	4919,69	675,21	3421,59
Kab. Grobogan	413,20	4891,19	328268,16	14251,84	7021,67	31222,05	7993,35	1097,06	5559,28
Kab. Blora	246,12	2913,36	195527,79	8488,88	4182,35	18596,92	4761,11	653,44	3311,30
Kab. Rembang	74,60	883,03	59264,08	2572,96	1267,66	5636,69	1443,08	198,06	1003,65
Kab. Pati	405,17	4796,10	321886,47	13974,78	6885,16	30615,08	7837,95	1075,73	5451,20
Kab. Kudus	73,73	872,75	58573,71	2542,99	1252,89	5571,03	1426,27	195,75	991,96
Kab. Jepara	138,22	1636,18	109810,56	4767,45	2348,85	10444,24	2673,89	366,98	1859,66
Kab. Demak	220,12	2605,58	174871,39	7592,08	3740,50	16632,26	4258,13	584,41	2961,48
Kab. Semarang	78,77	932,42	62578,48	2716,86	1338,56	5951,93	1523,79	209,13	1059,78
Kab. Temanggung	50,09	592,94	39794,59	1727,69	851,21	3784,92	969,00	132,99	673,93
Kab. Kendal	116,31	1376,85	92406,39	4011,84	1976,58	8788,90	2250,10	308,82	1564,92
Kab Batang	70,08	829,55	55674,46	2417,12	1190,88	5295,28	1355,68	186,06	942,86
Kab. Pekalongan	59,01	698,52	46880,68	2035,34	1002,78	4458,89	1141,55	156,67	793,93
Kab. Pemalang	119,56	1415,31	94987,53	4123,91	2031,79	9034,40	2312,95	317,44	1608,63
Kab. Tegal	116,95	1384,43	92914,59	4033,91	1987,45	8837,24	2262,47	310,52	1573,52
Kab. Brebes	154,72	1831,46	122917,02	5336,47	2629,20	11690,81	2993,04	410,78	2081,62
Kota Magelang	0,28	3,30	221,37	9,61	4,74	21,05	5,39	0,74	3,75
Kota Surakarta	0,08	0,91	61,27	2,66	1,31	5,83	1,49	0,20	1,04
Kota Salatiga	1,53	18,10	1214,84	52,74	25,99	115,54	29,58	4,06	20,57
Kota Semarang	6,95	82,27	5521,29	239,71	118,10	525,14	134,44	18,45	93,50
Kota Pekalongan	2,37	28,03	1881,32	81,68	40,24	178,94	45,81	6,29	31,86
Kota Tegal	0,95	11,23	753,56	32,72	16,12	71,67	18,35	2,52	12,76
Sub-total 5	4151,06	49137,33	3297811,09	143175,23	70540,29	313659,47	80301,85	11021,12	55848,99

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Grand total domain	7.720,98	91.824,53	6.479.182,77	271.537,84	141.255,15	620.201,57	156.519,09	20.788,85	108.755,59

Annex 7 Forest Fire

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	-	-	-	-	-	-	-	-	-
East Jakarta	-	-	-	-	-	-	-	-	-
Central Jakarta	-	-	-	-	-	-	-	-	-
West Jakarta	-	-	-	-	-	-	-	-	-
North Jakarta	-	-	-	-	-	-	-	-	-
Sub-total 1	-	-	-	-	-	-	-	-	-
West Java Province									
Bogor Regency	3,00	12,89	547,30	42,63	4,00	103,14	35,78	3,47	27,36
Sukabumi Regency	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Cianjur Regency	8,89	38,22	1622,22	126,35	11,85	305,73	106,07	10,29	81,11
Bandung Regency	3,81	16,38	695,52	54,17	5,08	131,08	45,48	4,41	34,78
Garut Regency	5,67	24,38	1034,73	80,59	7,56	195,01	67,66	6,57	51,74
Tasikmalaya Regency	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Ciamis Regency	5,03	21,62	917,63	71,47	6,71	172,94	60,00	5,82	45,88
Kuningan Regency	4,40	18,90	802,37	62,49	5,86	151,22	52,46	5,09	40,12
Cirebon Regency	2,55	10,98	466,01	36,29	3,41	87,82	30,47	2,96	23,30
Majalengka Regency	2,26	9,70	411,90	32,08	3,01	77,63	26,93	2,61	20,59
Sumedang Regency	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Indramayu Regency	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Subang Regency	3,22	13,83	587,02	45,72	4,29	110,63	38,38	3,73	29,35

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Purwakarta Regency	1,37	5,89	250,02	19,47	1,83	47,12	16,35	1,59	12,50
Karawang Regency	0,46	1,98	83,97	6,54	0,61	15,82	5,49	0,53	4,20
Bekasi Regency	0,16	0,70	29,72	2,31	0,22	5,60	1,94	0,19	1,49
Bandung Barat Regency	0,24	1,01	43,00	3,35	0,31	8,10	2,81	0,27	2,15
Pangandaran Regency	5,95	25,59	1086,20	84,60	7,94	204,71	71,02	6,89	54,31
Bogor City	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Sukabumi City	6,26	26,90	1142,02	88,95	8,35	215,23	74,67	7,25	57,10
Bandung City	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Cirebon City	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Bekasi City	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Depok City	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Cimahi City	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Tasikmalaya City	0,84	3,59	152,50	11,88	1,11	28,74	9,97	0,97	7,63
Banjar City	0,32	1,37	58,00	4,52	0,42	10,93	3,79	0,37	2,90
Sub-total 2	54,42	233,93	9930,11	773,40	72,57	1871,44	649,28	63,02	496,51
Banten Province									
Kab. Pandeglang	0,02	0,09	3,87	0,30	0,03	0,73	0,25	0,02	0,19
Kab. Lebak	0,02	0,07	2,99	0,23	0,02	0,56	0,20	0,02	0,15
Kab. Tangerang	0,01	0,03	1,44	0,11	0,01	0,27	0,09	0,01	0,07
Kab. Serang	0,00	0,02	0,65	0,05	0,00	0,12	0,04	0,00	0,03
Kota Tangerang	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Cilegon	0,00	0,01	0,41	0,03	0,00	0,08	0,03	0,00	0,02
Kota Serang	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Tangerang Selatan	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Sub-total 3	0,05	0,22	9,36	0,73	0,07	1,76	0,61	0,06	0,47

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Lampung Province									
Lampung Barat	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Tanggamus	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Lampung Selatan	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Lampung Timur	9,21	39,57	1679,68	130,82	12,27	316,56	109,83	10,66	83,98
Lampung Tengah	82,85	356,13	15117,16	1177,39	110,47	2849,00	988,43	95,94	755,86
Lampung Utara	55,24	237,42	10078,11	784,93	73,65	1899,34	658,95	63,96	503,91
Way Kanan	46,03	197,85	8398,42	654,11	61,37	1582,78	549,13	53,30	419,92
Tulang Bawang	9,21	39,57	1679,68	130,82	12,27	316,56	109,83	10,66	83,98
Pesawaran	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Pringsewu	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Mesuji	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Tulang Bawang Barat	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Pesisir Barat	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Bandar Lampung	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Metro	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Sub-total 4	202,53	870,53	36953,05	2878,07	270,04	6964,23	2416,16	234,51	1847,65
Central Java Province									
Kab. Cilacap	2,29	519,89	417,64	32,53	3,05	78,71	27,31	2,65	20,88
Kab. Banyumas	1,14	1078,86	208,55	16,24	1,52	39,30	13,64	1,32	10,43
Kab. Purbalingga	0,96	791,85	175,12	13,64	1,28	33,00	11,45	1,11	8,76
Kab. Banjarnegara	1,06	848,10	193,20	15,05	1,41	36,41	12,63	1,23	9,66
Kab. Kebumen	0,79	1567,28	143,87	11,21	1,05	27,11	9,41	0,91	7,19
Kab. Purworejo	1,04	1125,06	190,41	14,83	1,39	35,89	12,45	1,21	9,52
Kab. Wonosobo	0,82	922,88	150,31	11,71	1,10	28,33	9,83	0,95	7,52

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Magelang	0,75	965,17	136,27	10,61	1,00	25,68	8,91	0,86	6,81
Kab. Boyolali	0,80	1581,15	146,11	11,38	1,07	27,54	9,55	0,93	7,31
Kab. Klaten	0,30	1553,60	54,22	4,22	0,40	10,22	3,55	0,34	2,71
Kab. Sukoharjo	0,18	1259,43	32,32	2,52	0,24	6,09	2,11	0,21	1,62
Kab. Wonogiri	1,28	4959,89	233,82	18,21	1,71	44,07	15,29	1,48	11,69
Kab. Karanganyar	0,52	1150,28	94,04	7,32	0,69	17,72	6,15	0,60	4,70
Kab. Sragen	0,58	3010,40	105,24	8,20	0,77	19,83	6,88	0,67	5,26
Kab. Grobogan	1,90	4891,19	346,08	26,95	2,53	65,22	22,63	2,20	17,30
Kab. Blora	2,12	2913,36	387,57	30,19	2,83	73,04	25,34	2,46	19,38
Kab. Rembang	0,81	883,03	148,13	11,54	1,08	27,92	9,69	0,94	7,41
Kab. Pati	1,21	4796,10	221,58	17,26	1,62	41,76	14,49	1,41	11,08
Kab. Kudus	0,19	872,75	35,20	2,74	0,26	6,63	2,30	0,22	1,76
Kab. Jepara	0,74	1636,18	134,66	10,49	0,98	25,38	8,80	0,85	6,73
Kab. Demak	0,19	2605,58	34,23	2,67	0,25	6,45	2,24	0,22	1,71
Kab. Semarang	0,59	932,42	107,82	8,40	0,79	20,32	7,05	0,68	5,39
Kab. Temanggung	0,72	592,94	130,83	10,19	0,96	24,66	8,55	0,83	6,54
Kab. Kendal	1,00	1376,85	182,66	14,23	1,33	34,42	11,94	1,16	9,13
Kab Batang	0,69	829,55	126,63	9,86	0,93	23,86	8,28	0,80	6,33
Kab. Pekalongan	0,99	698,52	181,06	14,10	1,32	34,12	11,84	1,15	9,05
Kab. Pemalang	1,09	1415,31	198,06	15,43	1,45	37,33	12,95	1,26	9,90
Kab. Tegal	0,68	1384,43	123,77	9,64	0,90	23,33	8,09	0,79	6,19
Kab. Brebes	1,50	1831,46	274,42	21,37	2,01	51,72	17,94	1,74	13,72
Kota Magelang	0,00	3,30	0,19	0,02	0,00	0,04	0,01	0,00	0,01
Kota Surakarta	0,00	0,91	0,19	0,01	0,00	0,04	0,01	0,00	0,01
Kota Salatiga	0,06	18,10	11,70	0,91	0,09	2,20	0,76	0,07	0,58
Kota Semarang	0,18	82,27	33,38	2,60	0,24	6,29	2,18	0,21	1,67
Kota Pekalongan	0,00	28,03	0,36	0,03	0,00	0,07	0,02	0,00	0,02
Kota Tegal	0,06	11,23	11,69	0,91	0,09	2,20	0,76	0,07	0,58
Sub-total 5	27,25	49137,33	4971,29	387,19	36,33	936,90	325,05	31,55	248,56

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Grand total domain	284	50.242	51.864	4.039	379	9.774	3.391	329	2.593

Annex 8 Solid Waste Open Burning

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	2,92	17,51	245,08	87,53	5,49	103,87	37,93	32,09	32,09
East Jakarta	3,79	22,71	317,96	113,56	7,12	134,75	49,21	41,64	41,64
Central Jakarta	1,20	7,17	100,45	35,87	2,25	42,57	15,55	13,15	13,15
West Jakarta	3,34	20,02	280,30	100,11	6,27	118,80	43,38	36,71	36,71
North Jakarta	2,34	14,01	196,21	70,07	4,39	83,16	30,37	25,69	25,69
Sub-total 1	13,57	81,43	1140,00	407,14	25,51	483,14	176,43	149,29	149,29
West Java Province									
Bogor Regency	89,13	534,77	7486,74	2673,83	167,56	3172,95	1158,66	980,41	980,41
Sukabumi Regency	36,85	221,09	3095,23	1105,44	69,27	1311,79	479,02	405,33	405,33
Cianjur Regency	33,78	202,65	2837,13	1013,26	63,50	1202,40	439,08	371,53	371,53
Bandung Regency	56,41	338,43	4738,07	1692,17	106,04	2008,04	733,27	620,46	620,46
Garut Regency	39,18	235,09	3291,21	1175,43	73,66	1394,85	509,35	430,99	430,99
Tasikmalaya Regency	26,21	157,25	2201,47	786,24	49,27	933,01	340,70	288,29	288,29
Ciamis Regency	17,86	107,14	1499,98	535,71	33,57	635,70	232,14	196,43	196,43
Kuningan Regency	16,15	96,89	1356,44	484,44	30,36	574,87	209,92	177,63	177,63
Cirebon Regency	32,76	196,58	2752,15	982,91	61,60	1166,39	425,93	360,40	360,40
Majalengka Regency	18,00	108,02	1512,35	540,12	33,85	640,95	234,05	198,05	198,05
Sumedang Regency	17,22	103,31	1446,29	516,53	32,37	612,95	223,83	189,40	189,40
Indramayu Regency	25,82	154,95	2169,27	774,74	48,55	919,36	335,72	284,07	284,07
Subang Regency	23,84	143,06	2002,80	715,29	44,82	848,81	309,96	262,27	262,27
Purwakarta Regency	14,39	86,32	1208,45	431,59	27,05	512,15	187,02	158,25	158,25
Karawang Regency	35,17	211,02	2954,22	1055,08	66,12	1252,03	457,20	386,86	386,86
Bekasi Regency	56,24	337,41	4723,77	1687,06	105,72	2001,98	731,06	618,59	618,59
Bandung Barat Regency	25,40	152,39	2133,41	761,93	47,75	904,16	330,17	279,38	279,38

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Pangandaran Regency	5,97	35,79	501,11	178,97	11,22	212,38	77,55	65,62	65,62
Bogor City	16,62	99,69	1395,69	498,46	31,24	591,51	216,00	182,77	182,77
Sukabumi City	4,91	29,46	412,50	147,32	9,23	174,82	63,84	54,02	54,02
Bandung City	37,47	224,82	3147,46	1124,09	70,44	1333,92	487,11	412,17	412,17
Cirebon City	4,77	28,62	400,74	143,12	8,97	169,84	62,02	52,48	52,48
Bekasi City	44,88	269,29	3770,00	1346,43	84,38	1597,76	583,45	493,69	493,69
Depok City	35,96	215,76	3020,63	1078,80	67,60	1280,17	467,48	395,56	395,56
Cimahi City	9,18	55,07	770,97	275,35	17,25	326,74	119,32	100,96	100,96
Tasikmalaya City	9,91	59,48	832,73	297,40	18,64	352,92	128,87	109,05	109,05
Banjar City	2,74	16,41	229,81	82,07	5,14	97,39	35,57	30,09	30,09
Sub-total 2	736,79	4420,76	61890,62	22103,79	1385,17	26229,83	9578,31	8104,72	8104,72
Banten Province									
Kab. Pandeglang	8,62	51,73	724,27	258,67	16,21	306,95	112,09	94,85	94,85
Kab. Lebak	9,27	55,61	778,48	278,03	17,42	329,93	120,48	101,94	101,94
Kab. Tangerang	27,04	162,25	2271,47	811,24	50,84	962,67	351,54	297,45	297,45
Kab. Serang	10,73	64,39	901,46	321,95	20,18	382,05	139,51	118,05	118,05
Kota Tangerang	15,86	95,19	1332,66	475,95	29,83	564,79	206,24	174,51	174,51
Kota Cilegon	3,11	18,66	261,29	93,32	5,85	110,74	40,44	34,22	34,22
Kota Serang	4,90	29,40	411,53	146,98	9,21	174,41	63,69	53,89	53,89
Kota Tangerang Selatan	12,44	74,61	1044,60	373,07	23,38	442,71	161,66	136,79	136,79
Sub-total 3	91,97	551,84	7725,76	2759,20	172,91	3274,25	1195,65	1011,71	1011,71
Lampung Province									
Lampung Barat	4,88	29,27	409,76	146,34	9,17	173,66	63,41	53,66	53,66
Tanggamus	9,64	57,83	809,55	289,13	18,12	343,10	125,29	106,01	106,01
Lampung Selatan	16,29	97,74	1368,36	488,70	30,63	579,93	211,77	179,19	179,19

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Lampung Timur	16,82	100,93	1413,06	504,66	31,63	598,87	218,69	185,04	185,04
Lampung Tengah	20,64	123,84	1733,72	619,19	38,80	734,77	268,31	227,04	227,04
Lampung Utara	9,94	59,62	834,72	298,11	18,68	353,76	129,18	109,31	109,31
Way Kanan	7,25	43,50	609,04	217,51	13,63	258,12	94,26	79,75	79,75
Tulang Bawang	7,26	43,58	610,11	217,90	13,65	258,57	94,42	79,89	79,89
Pesawaran	7,16	42,95	601,28	214,74	13,46	254,83	93,06	78,74	78,74
Pringsewu	6,45	38,68	541,48	193,39	12,12	229,48	83,80	70,91	70,91
Mesuji	3,22	19,35	270,89	96,75	6,06	114,80	41,92	35,47	35,47
Tulang Bawang Barat	4,40	26,41	369,68	132,03	8,27	156,67	57,21	48,41	48,41
Pesisir Barat	2,50	14,97	209,59	74,85	4,69	88,83	32,44	27,45	27,45
Kota Bandar Lampung	16,94	101,63	1422,77	508,13	31,84	602,98	220,19	186,32	186,32
Kota Metro	59,50	357,02	4998,30	1785,11	111,87	2118,33	773,55	654,54	654,54
Sub-total 4	192,88	1157,31	16202,31	5786,54	362,62	6866,69	2507,50	2121,73	2121,73
Central Java Province									
Kab. Cilacap	45,98	275,86	3861,99	1379,28	86,44	1636,75	597,69	505,74	505,74
Kab. Banyumas	45,07	270,41	3785,76	1352,06	84,73	1604,44	585,89	495,75	495,75
Kab. Purbalingga	24,86	149,18	2088,51	745,90	46,74	885,13	323,22	273,49	273,49
Kab. Banjarnegara	24,58	147,45	2064,36	737,27	46,20	874,90	319,48	270,33	270,33
Kab. Kebumen	31,89	191,34	2678,83	956,72	59,95	1135,31	414,58	350,80	350,80
Kab. Purworejo	19,12	114,73	1606,24	573,66	35,95	680,74	248,58	210,34	210,34
Kab. Wonosobo	21,04	126,26	1767,66	631,31	39,56	749,15	273,57	231,48	231,48
Kab. Magelang	34,36	206,14	2885,91	1030,68	64,59	1223,08	446,63	377,92	377,92
Kab. Boyolali	26,22	157,30	2202,14	786,48	49,29	933,29	340,81	288,38	288,38
Kab. Klaten	31,28	187,67	2627,40	938,36	58,80	1113,52	406,62	344,06	344,06
Kab. Sukoharjo	23,74	142,46	1994,42	712,29	44,64	845,25	308,66	261,17	261,17
Kab. Wonogiri	25,54	153,25	2145,53	766,26	48,02	909,30	332,05	280,96	280,96
Kab. Karanganyar	23,60	141,60	1982,36	707,99	44,37	840,14	306,79	259,59	259,59

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Sragen	23,71	142,24	1991,30	711,18	44,57	843,93	308,18	260,77	260,77
Kab. Grobogan	36,68	220,06	3080,89	1100,32	68,95	1305,71	476,80	403,45	403,45
Kab. Blora	23,03	138,16	1934,27	690,81	43,29	819,76	299,35	253,30	253,30
Kab. Rembang	16,99	101,93	1427,06	509,66	31,94	604,80	220,85	186,88	186,88
Kab. Pati	33,53	201,18	2816,59	1005,92	63,04	1193,70	435,90	368,84	368,84
Kab. Kudus	23,19	139,17	1948,35	695,84	43,61	825,73	301,53	255,14	255,14
Kab. Jepara	33,49	200,92	2812,84	1004,58	62,95	1192,11	435,32	368,35	368,35
Kab. Demak	30,95	185,73	2600,17	928,63	58,19	1101,98	402,41	340,50	340,50
Kab. Semarang	28,05	168,31	2356,39	841,57	52,74	998,66	364,68	308,57	308,57
Kab. Temanggung	20,55	123,31	1726,32	616,54	38,64	731,63	267,17	226,07	226,07
Kab. Kendal	25,85	155,10	2171,46	775,52	48,60	920,29	336,06	284,36	284,36
Kab Batang	20,46	122,76	1718,64	613,80	38,46	728,38	265,98	225,06	225,06
Kab. Pekalongan	23,90	143,38	2007,39	716,92	44,93	850,75	310,67	262,87	262,87
Kab. Pemalang	34,68	208,09	2913,24	1040,44	65,20	1234,66	450,86	381,50	381,50
Kab. Tegal	38,35	230,11	3221,57	1150,56	72,10	1365,33	498,58	421,87	421,87
Kab. Brebes	48,16	288,95	4045,35	1444,77	90,54	1714,46	626,07	529,75	529,75
Kota Magelang	3,25	19,50	273,05	97,52	6,11	115,72	42,26	35,76	35,76
Kota Surakarta	13,83	82,99	1161,86	414,95	26,00	492,41	179,81	152,15	152,15
Kota Salatiga	5,17	31,00	433,99	155,00	9,71	183,93	67,17	56,83	56,83
Kota Semarang	48,29	289,75	4056,56	1448,77	90,79	1719,21	627,80	531,22	531,22
Kota Pekalongan	8,18	49,05	686,70	245,25	15,37	291,03	106,28	89,93	89,93
Kota Tegal	6,65	39,92	558,82	199,58	12,51	236,83	86,48	73,18	73,18
Sub-total 5	924,21	5545,28	77633,90	27726,39	1737,52	32901,99	12014,77	10166,34	10166,34
Grand total domain	1.959,44	11.756,61	164.592,60	58.783,07	3.683,74	69.755,91	25.472,66	21.553,79	21.553,79

Annex 9 Livestock

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	0	0	0	0	41,82	0	0	0	0
East Jakarta	0	0	0	0	33,46	0	0	0	0
Central Jakarta	0	0	0	0	2,11	0	0	0	0
West Jakarta	0	0	0	0	15,35	0	0	0	0
North Jakarta	0	0	0	0	36,93	0	0	0	0
Sub-total 1	-	-	-	-	129,66	-	-	-	-
West Java Province									
Bogor Regency	-	-	-	-	70093,25	-	-	-	-
Sukabumi Regency	-	-	-	-	29119,92	-	-	-	-
Cianjur Regency	-	-	-	-	21498,82	-	-	-	-
Bandung Regency	-	-	-	-	15056,54	-	-	-	-
Garut Regency	-	-	-	-	4984,41	-	-	-	-
Tasikmalaya Regency	-	-	-	-	16278,80	-	-	-	-
Ciamis Regency	-	-	-	-	46372,98	-	-	-	-
Kuningan Regency	-	-	-	-	10134,74	-	-	-	-
Cirebon Regency	-	-	-	-	9029,57	-	-	-	-

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Majalengka Regency	-	-	-	-	10081,93	-	-	-	-
Sumedang Regency	-	-	-	-	7847,95	-	-	-	-
Indramayu Regency	-	-	-	-	20016,82	-	-	-	-
Subang Regency	-	-	-	-	35907,77	-	-	-	-
Purwakarta Regency	-	-	-	-	24978,51	-	-	-	-
Karawang Regency	-	-	-	-	36058,87	-	-	-	-
Bekasi Regency	-	-	-	-	6510,70	-	-	-	-
Bandung Barat Regency	-	-	-	-	6937,87	-	-	-	-
Pangandaran Regency	-	-	-	-	1187,54	-	-	-	-
Bogor City	-	-	-	-	573,99	-	-	-	-
Sukabumi City	-	-	-	-	2653,60	-	-	-	-
Bandung City	-	-	-	-	107,66	-	-	-	-
Cirebon City	-	-	-	-	14,06	-	-	-	-
Bekasi City	-	-	-	-	1301,26	-	-	-	-
Depok City	-	-	-	-	1512,87	-	-	-	-

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Cimahi City	-	-	-	-	122,09	-	-	-	-
Tasikmalaya City	-	-	-	-	3681,62	-	-	-	-
Banjar City	-	-	-	-	1858,71	-	-	-	-
Sub-total 2	-	-	-	-	383922,86	-	-	-	-
Banten Province									
Kab. Pandeglang	0	0	0	0	9708,98	0	0	0	0
Kab. Lebak	0	0	0	0	18117,80	0	0	0	0
Kab. Tangerang	0	0	0	0	27959,12	0	0	0	0
Kab. Serang	0	0	0	0	18797,90	0	0	0	0
Kota Tangerang	0	0	0	0	152,88	0	0	0	0
Kota Cilegon	0	0	0	0	274,98	0	0	0	0
Kota Serang	0	0	0	0	6099,67	0	0	0	0
Kota Tangerang Selatan	0	0	0	0	707,15	0	0	0	0
Sub-total 3	-	-	-	-	81818,49	-	-	-	-
Lampung Province									
Lampung Barat	-	-	-	-	1594,82	-	-	-	-
Tanggamus	-	-	-	-	641,45	-	-	-	-
Lampung Selatan	-	-	-	-	16408,83	-	-	-	-
Lampung Timur	-	-	-	-	7049,63	-	-	-	-

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Lampung Tengah	-	-	-	-	3118,32	-	-	-	-
Lampung Utara	-	-	-	-	1399,11	-	-	-	-
Way Kanan	-	-	-	-	1929,69	-	-	-	-
Tulang Bawang	-	-	-	-	544,05	-	-	-	-
Pesawaran	-	-	-	-	3295,48	-	-	-	-
Pringsewu	-	-	-	-	2190,24	-	-	-	-
Mesuji	-	-	-	-	329,19	-	-	-	-
Tulang Bawang Barat	-	-	-	-	986,10	-	-	-	-
Pesisir Barat	-	-	-	-	70,49	-	-	-	-
Kota Bandar Lampung	-	-	-	-	51,89	-	-	-	-
Kota Metro	-	-	-	-	970,00	-	-	-	-
Sub-total 4	-	-	-	-	40579,28	-	-	-	-
Central Java Province									
Kab. Cilacap	0	0	0	0	7888,66	0	0	0	0
Kab. Banyumas	0	0	0	0	8200,50	0	0	0	0
Kab. Purbalingga	0	0	0	0	3963,41	0	0	0	0
Kab. Banjarnegara	0	0	0	0	3433,88	0	0	0	0

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Kebumen	0	0	0	0	3899,96	0	0	0	0
Kab. Purworejo	0	0	0	0	3684,02	0	0	0	0
Kab. Wonosobo	0	0	0	0	1645,60	0	0	0	0
Kab. Magelang	0	0	0	0	2574,25	0	0	0	0
Kab. Boyolali	0	0	0	0	8907,55	0	0	0	0
Kab. Klaten	0	0	0	0	4477,28	0	0	0	0
Kab. Sukoharjo	0	0	0	0	3161,16	0	0	0	0
Kab. Wonogiri	0	0	0	0	5315,63	0	0	0	0
Kab. Karanganyar	0	0	0	0	5925,92	0	0	0	0
Kab. Sragen	0	0	0	0	1849,35	0	0	0	0
Kab. Grobogan	0	0	0	0	4252,25	0	0	0	0
Kab. Blora	0	0	0	0	3185,12	0	0	0	0
Kab. Rembang	0	0	0	0	1771,14	0	0	0	0
Kab. Pati	0	0	0	0	9775,93	0	0	0	0
Kab. Kudus	0	0	0	0	10730,78	0	0	0	0
Kab. Jepara	0	0	0	0	535,96	0	0	0	0
Kab. Demak	0	0	0	0	13972,10	0	0	0	0
Kab. Semarang	0	0	0	0	8426,87	0	0	0	0
Kab. Temanggung	0	0	0	0	5710,12	0	0	0	0
Kab. Kendal	0	0	0	0	9736,99	0	0	0	0
Kab Batang	0	0	0	0	9268,77	0	0	0	0
Kab. Pekalongan	0	0	0	0	4181,11	0	0	0	0
Kab. Pemalang	0	0	0	0	7318,85	0	0	0	0
Kab. Tegal	0	0	0	0	5328,54	0	0	0	0
Kab. Brebes	0	0	0	0	5751,16	0	0	0	0
Kota Magelang	0	0	0	0	165,07	0	0	0	0
Kota Surakarta	0	0	0	0	9,30	0	0	0	0
Kota Salatiga	0	0	0	0	483,12	0	0	0	0
Kota Semarang	0	0	0	0	993,27	0	0	0	0

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kota Pekalongan	0	0	0	0	105,98	0	0	0	0
Kota Tegal	0	0	0	0	492,33	0	0	0	0
Sub-total 5	-	-	-	-	167121,91	-	-	-	-
Grand total domain	-	-	-	-	673.572,20	-	-	-	-

Annex 10 Methane from Landfill

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	-	-	-	-	-	-	0,00	-	-
East Jakarta	-	-	-	-	-	-	0,00	-	-
Central Jakarta	-	-	-	-	-	-	0,00	-	-
West Jakarta	-	-	-	-	-	-	0,00	-	-
North Jakarta	-	-	-	-	-	-	0,00	-	-
Sub-total 1	-	-	-	-	-	-	0,00	-	-
West Java Province									
Bogor Regency	-	-	-	-	-	-	164,96	-	-
Sukabumi Regency	-	-	-	-	-	-	64,79	-	-
Cianjur Regency	-	-	-	-	-	-	62,51	-	-
Bandung Regency	-	-	-	-	-	-	32,36	-	-
Garut Regency	-	-	-	-	-	-	95,36	-	-
Tasikmalaya Regency	-	-	-	-	-	-	0,00	-	-
Ciamis Regency	-	-	-	-	-	-	41,31	-	-

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kuningan Regency	-	-	-	-	-	-	41,10	-	-
Cirebon Regency	-	-	-	-	-	-	75,80	-	-
Majalengka Regency	-	-	-	-	-	-	38,99	-	-
Sumedang Regency	-	-	-	-	-	-	39,83	-	-
Indramayu Regency	-	-	-	-	-	-	59,75	-	-
Subang Regency	-	-	-	-	-	-	55,16	-	-
Purwakarta Regency	-	-	-	-	-	-	33,28	-	-
Karawang Regency	-	-	-	-	-	-	76,16	-	-
Bekasi Regency	-	-	-	-	-	-	156,13	-	-
Bandung Barat Regency	-	-	-	-	-	-	58,76	-	-
Pangandaran Regency	-	-	-	-	-	-	0,00	-	-
Bogor City	-	-	-	-	-	-	64,58	-	-
Sukabumi City	-	-	-	-	-	-	11,36	-	-
Bandung City	-	-	-	-	-	-	86,69	-	-
Cirebon City	-	-	-	-	-	-	0,00	-	-

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Bekasi City	-	-	-	-	-	-	100,10	-	-
Depok City	-	-	-	-	-	-	0,00	-	-
Cimahi City	-	-	-	-	-	-	42,30	-	-
Tasikmalaya City	-	-	-	-	-	-	23,49	-	-
Banjar City	-	-	-	-	-	-	5,70	-	-
Sub-total 2	-	-	-	-	-	-	1.430,48	-	-
Banten Province									
Kab. Pandeglang	-	-	-	-	-	-	36,06	-	-
Kab. Lebak	-	-	-	-	-	-	38,76	-	-
Kab. Tangerang	-	-	-	-	-	-	113,08	-	-
Kab. Serang	-	-	-	-	-	-	44,88	-	-
Kota Tangerang	-	-	-	-	-	-	66,35	-	-
Kota Cilegon	-	-	-	-	-	-	13,01	-	-
Kota Serang	-	-	-	-	-	-	20,49	-	-
Kota Tangerang Selatan	-	-	-	-	-	-	52,01	-	-

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Sub-total 3	-	-	-	-	-	-	384,62	-	-
Lampung Province									
Lampung Barat	-	-	-	-	-	-	0	-	-
Tanggamus	-	-	-	-	-	-	0	-	-
Lampung Selatan	-	-	-	-	-	-	0	-	-
Lampung Timur	-	-	-	-	-	-	0	-	-
Lampung Tengah	-	-	-	-	-	-	0	-	-
Lampung Utara	-	-	-	-	-	-	0	-	-
Way Kanan	-	-	-	-	-	-	0	-	-
Tulang Bawang	-	-	-	-	-	-	0	-	-
Pesawaran	-	-	-	-	-	-	0	-	-
Pringsewu	-	-	-	-	-	-	0	-	-
Mesuji	-	-	-	-	-	-	0	-	-
Tulang Bawang Barat	-	-	-	-	-	-	0	-	-
Pesisir Barat	-	-	-	-	-	-	0	-	-

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kota Bandar Lampung	-	-	-	-	-	-	40,66	-	-
Kota Metro	-	-	-	-	-	-	0	-	-
Sub-total 4	-	-	-	-	-	-	40,66	-	-
Central Java Province									
Kab. Cilacap	0	0	0	0	0	0	59,70	0	0
Kab. Banyumas	0	0	0	0	0	0	0,00	0	0
Kab. Purbalingga	0	0	0	0	0	0	38,74	0	0
Kab. Banjarnegara	0	0	0	0	0	0	0,00	0	0
Kab. Kebumen	0	0	0	0	0	0	0,00	0	0
Kab. Purworejo	0	0	0	0	0	0	0,00	0	0
Kab. Wonosobo	0	0	0	0	0	0	0,00	0	0
Kab. Magelang	0	0	0	0	0	0	53,53	0	0
Kab. Boyolali	0	0	0	0	0	0	0,00	0	0
Kab. Klaten	0	0	0	0	0	0	81,23	0	0
Kab. Sukoharjo	0	0	0	0	0	0	29,10	0	0
Kab. Wonogiri	0	0	0	0	0	0	13,27	0	0
Kab. Karanganyar	0	0	0	0	0	0	24,52	0	0
Kab. Sragen	0	0	0	0	0	0	49,25	0	0
Kab. Grobogan	0	0	0	0	0	0	57,15	0	0
Kab. Blora	0	0	0	0	0	0	35,88	0	0
Kab. Rembang	0	0	0	0	0	0	26,47	0	0
Kab. Pati	0	0	0	0	0	0	104,50	0	0
Kab. Kudus	0	0	0	0	0	0	12,05	0	0
Kab. Jepara	0	0	0	0	0	0	46,61	0	0
Kab. Demak	0	0	0	0	0	0	48,23	0	0

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Semarang	0	0	0	0	0	0	80,14	0	0
Kab. Temanggung	0	0	0	0	0	0	32,02	0	0
Kab. Kendal	0	0	0	0	0	0	40,28	0	0
Kab Batang	0	0	0	0	0	0	31,88	0	0
Kab. Pekalongan	0	0	0	0	0	0	37,24	0	0
Kab. Pemalang	0	0	0	0	0	0	54,04	0	0
Kab. Tegal	0	0	0	0	0	0	79,68	0	0
Kab. Brebes	0	0	0	0	0	0	78,04	0	0
Kota Magelang	0	0	0	0	0	0	6,75	0	0
Kota Surakarta	0	0	0	0	0	0	14,37	0	0
Kota Salatiga	0	0	0	0	0	0	2,68	0	0
Kota Semarang	0	0	0	0	0	0	125,42	0	0
Kota Pekalongan	0	0	0	0	0	0	12,74	0	0
Kota Tegal	0	0	0	0	0	0	0,00	0	0
Sub-total 5	-	-	-	-	-	-	1.275,52	-	-
Grand total domain	-	-	-	-	-	-	3.131,29	-	-

Annex 11 On-road Mobile Sources

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	830,51	9930,03	86265,81	36476,00	1311,64	44474,52	5192,98	6671,18	11118,63
East Jakarta	642,87	7686,47	66775,19	28234,73	1015,29	34426,09	4019,69	5163,91	8606,52
Central Jakarta	284,39	3400,34	29539,99	12490,47	449,14	15229,40	1778,23	2284,41	3807,35
West Jakarta	496,38	5934,91	51558,69	21800,70	783,93	26581,19	3103,70	3987,18	6645,30
North Jakarta	469,45	5612,96	48761,86	20618,11	741,41	25139,28	2935,34	3770,89	6284,82
Sub-total 1	2723,60	32564,72	282901,54	119620,01	4301,41	145850,49	17029,94	21877,57	36462,62
West Java Province									
Bogor Regency	4686,40	186249,46	106845,70	30,13	5046,74	10093,47	341,25	679,98	3982,35
Sukabumi Regency	1549,40	61576,98	35324,85	9,96	1668,53	3337,06	112,82	224,81	1316,63
Cianjur Regency	1309,56	52045,37	29856,86	8,42	1410,26	2820,51	95,36	190,01	1112,82
Bandung Regency	3220,03	127972,11	73413,74	20,70	3467,62	6935,23	234,48	467,21	2736,28
Garut Regency	1238,41	49217,51	28234,60	7,96	1333,63	2667,26	90,18	179,69	1052,36
Tasikmalaya Regency	877,54	34875,79	20007,19	5,64	945,02	1890,03	63,90	127,33	745,71
Ciamis Regency	818,92	32545,80	18670,54	5,26	881,88	1763,76	59,63	118,82	695,89
Kuningan Regency	970,42	38566,91	22124,67	6,24	1045,03	2090,07	70,66	140,80	824,63
Cirebon Regency	2062,18	81956,32	47015,87	13,26	2220,74	4441,48	150,16	299,21	1752,37
Majalengka Regency	1069,14	42490,22	24375,36	6,87	1151,34	2302,69	77,85	155,13	908,52
Sumedang Regency	891,62	35435,18	20328,09	5,73	960,17	1920,35	64,93	129,37	757,67
Indramayu Regency	1527,00	60687,04	34814,33	9,82	1644,42	3288,83	111,19	221,56	1297,60
Subang Regency	1185,91	47130,99	27037,63	7,62	1277,09	2554,18	86,36	172,07	1007,75

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Purwakarta Regency	907,29	36057,97	20685,37	5,83	977,05	1954,10	66,07	131,64	770,98
Karawang Regency	2491,41	99015,17	56802,02	16,02	2682,98	5365,96	181,42	361,49	2117,12
Bekasi Regency	4362,74	173386,53	99466,62	28,04	4698,19	9396,39	317,69	633,01	3707,32
Bandung Barat Regency	1821,00	72371,25	41517,20	11,71	1961,02	3922,04	132,60	264,22	1547,43
Pangandaran Regency	263,71	10480,47	6012,33	1,70	283,99	567,97	19,20	38,26	224,09
Bogor City	1372,54	54548,39	31292,77	8,82	1478,08	2956,16	99,95	199,15	1166,34
Sukabumi City	363,99	14466,08	8298,75	2,34	391,98	783,96	26,51	52,81	309,31
Bandung City	4908,83	195089,39	111916,90	31,55	5286,27	10572,54	357,45	712,25	4171,36
Cirebon City	533,10	21186,89	12154,28	3,43	574,09	1148,19	38,82	77,35	453,01
Bekasi City	4537,25	180321,90	103445,24	29,17	4886,12	9772,24	330,39	658,33	3855,61
Depok City	3361,92	133611,54	76648,91	21,61	3620,43	7240,85	244,81	487,80	2856,86
Cimahi City	902,85	35881,48	20584,12	5,80	972,27	1944,54	65,74	131,00	767,21
Tasikmalaya City	714,63	28401,35	16293,00	4,59	769,58	1539,16	52,04	103,69	607,27
Banjar City	201,08	7991,30	4584,37	1,29	216,54	433,08	14,64	29,18	170,87
Sub-total 2	48148,85	1913559,41	1097751,30	309,51	51851,06	103702,11	3506,11	6986,19	40915,37
Banten Province									
Kab. Pandeglang	694,31	746,91	28875,59	15200,53	48,84	1397,19	123,49	80,22	560,68
Kab. Lebak	822,51	884,82	34207,30	18007,22	57,85	1655,18	146,29	95,04	664,21
Kab. Tangerang	4547,59	4892,13	189130,10	99560,83	319,87	9151,38	808,82	525,45	3672,36
Kab. Serang	1337,74	1439,09	55635,38	29287,27	94,10	2692,01	237,93	154,57	1080,28
Kota Tangerang	4003,67	4307,00	166509,02	87652,76	281,61	8056,82	712,08	462,60	3233,12
Kota Cilegon	667,45	718,01	27758,46	14612,46	46,95	1343,14	118,71	77,12	538,99
Kota Serang	728,33	783,52	30290,76	15945,49	51,23	1465,67	129,54	84,16	588,16
Kota Tangerang Selatan	3028,95	3258,43	125971,09	66313,01	213,05	6095,32	538,72	349,98	2445,99

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Sub-total 3	15830,54	17029,92	658377,69	346579,57	1113,50	31856,70	2815,56	1829,14	12783,78
Lampung Province									
Lampung Barat	413,03	392,52	14295,16	7848,67	12,05	744,79	41,61	50,92	292,88
Tanggamus	976,71	928,20	33803,96	18559,85	28,50	1761,22	98,39	120,42	692,58
Lampung Selatan	1675,15	1591,94	57977,05	31831,93	48,88	3020,67	168,76	206,53	1187,85
Lampung Timur	1269,22	1206,18	43927,95	24118,36	37,04	2288,70	127,86	156,48	900,01
Lampung Tengah	2073,87	1970,86	71776,89	39408,65	60,52	3739,66	208,92	255,69	1470,58
Lampung Utara	703,36	668,42	24343,27	13365,52	20,52	1268,31	70,86	86,72	498,75
Way Kanan	432,67	411,18	14974,91	8221,88	12,63	780,21	43,59	53,34	306,81
Tulang Bawang	909,87	864,68	31490,67	17289,75	26,55	1640,70	91,66	112,18	645,19
Pesawaran	366,89	348,67	12698,08	6971,80	10,71	661,58	36,96	45,23	260,16
Pringsewu	350,01	332,62	12113,74	6650,97	10,21	631,14	35,26	43,15	248,19
Mesuji	164,65	156,47	5698,64	3128,80	4,80	296,91	16,59	20,30	116,76
Tulang Bawang Barat	197,11	187,32	6822,14	3745,65	5,75	355,44	19,86	24,30	139,77
Pesisir Barat	33,32	31,66	1153,09	633,10	0,97	60,08	3,36	4,11	23,62
Kota Bandar Lampung	3284,69	3121,54	113683,53	62417,22	95,85	5923,04	330,90	404,97	2329,18
Kota Metro	344,40	327,30	11919,86	6544,52	10,05	621,04	34,70	42,46	244,22
Sub-total 4	13194,95	12539,58	456678,95	250736,66	385,03	23793,49	1329,27	1626,82	9356,55
Central Java Province									
Kab. Cilacap	2501,86	2377,50	96918,52	53915,60	81,49	5127,05	283,25	360,82	2007,91
Kab. Banyumas	2406,71	2287,08	93232,32	51864,98	78,39	4932,05	272,48	347,10	1931,55
Kab. Purbalingga	1219,28	1158,67	47233,13	26275,71	39,71	2498,66	138,04	175,84	978,55
Kab. Banjarnegara	1096,67	1042,15	42483,19	23633,32	35,72	2247,39	124,16	158,16	880,15
Kab. Kebumen	1622,47	1541,82	62852,03	34964,47	52,84	3324,91	183,69	233,99	1302,14
Kab. Purworejo	1006,32	956,30	38983,43	21686,41	32,78	2062,25	113,93	145,13	807,64

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Wonosobo	917,01	871,43	35523,55	19761,69	29,87	1879,22	103,82	132,25	735,96
Kab. Magelang	1570,37	1492,31	60833,94	33841,81	51,15	3218,15	177,79	226,48	1260,33
Kab. Boyolali	1609,53	1529,52	62350,67	34685,57	52,42	3298,39	182,22	232,13	1291,75
Kab. Klaten	2418,94	2298,70	93706,24	52128,61	78,78	4957,12	273,86	348,86	1941,36
Kab. Sukoharjo	1820,82	1730,31	70536,01	39239,06	59,30	3731,40	206,15	262,60	1461,33
Kab. Wonogiri	1316,82	1251,36	51011,50	28377,61	42,89	2698,54	149,09	189,91	1056,83
Kab. Karanganyar	1640,54	1558,99	63552,13	35353,94	53,43	3361,95	185,74	236,60	1316,64
Kab. Sragen	1801,41	1711,87	69784,11	38820,77	58,67	3691,62	203,95	259,80	1445,76
Kab. Grobogan	1859,53	1767,10	72035,40	40073,17	60,56	3810,72	210,53	268,18	1492,40
Kab. Blora	1234,56	1173,19	47824,94	26604,93	40,21	2529,97	139,77	178,05	990,82
Kab. Rembang	872,12	828,77	33784,80	18794,43	28,40	1787,24	98,74	125,78	699,94
Kab. Pati	2111,76	2006,79	81806,64	45508,89	68,78	4327,62	239,09	304,56	1694,83
Kab. Kudus	1646,98	1565,12	63801,70	35492,77	53,64	3375,15	186,47	237,53	1321,81
Kab. Jepara	2008,68	1908,84	77813,40	43287,46	65,42	4116,38	227,42	289,69	1612,10
Kab. Demak	1744,21	1657,51	67568,25	37588,10	56,81	3574,40	197,47	251,55	1399,85
Kab. Semarang	1670,08	1587,06	64696,36	35990,47	54,39	3422,48	189,08	240,86	1340,35
Kab. Temanggung	917,92	872,29	35558,86	19781,33	29,90	1881,09	103,92	132,38	736,69
Kab. Kendal	1596,66	1517,30	61852,40	34408,38	52,00	3272,03	180,77	230,27	1281,43
Kab Batang	1065,43	1012,47	41273,00	22960,10	34,70	2183,37	120,62	153,66	855,08
Kab. Pekalongan	1294,38	1230,04	50142,32	27894,08	42,16	2652,56	146,54	186,68	1038,83
Kab. Pemalang	1704,82	1620,07	66042,04	36739,07	55,53	3493,66	193,01	245,87	1368,23
Kab. Tegal	1933,04	1836,96	74883,30	41657,45	62,96	3961,37	218,85	278,78	1551,40
Kab. Brebes	1925,18	1829,49	74578,72	41488,01	62,70	3945,26	217,96	277,65	1545,09
Kota Magelang	340,06	323,15	13173,29	7328,28	11,08	696,88	38,50	49,04	272,92
Kota Surakarta	1753,51	1666,35	67928,33	37788,41	57,11	3593,45	198,53	252,89	1407,31
Kota Salatiga	453,93	431,37	17584,56	9782,26	14,78	930,23	51,39	65,47	364,31
Kota Semarang	5248,83	4987,92	203331,88	113113,17	170,95	10756,38	594,25	756,99	4212,54
Kota Pekalongan	608,25	578,02	23562,79	13107,94	19,81	1246,49	68,86	87,72	488,16
Kota Tegal	567,47	539,26	21983,04	12229,13	18,48	1162,92	64,25	81,84	455,43

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Sub-total 5	55506,17	52747,09	2150226,80	1196167,36	1807,82	113748,33	6284,21	8005,10	44547,43
Grand total domain	135.404,12	2.028.440,72	4.645.936,27	1.913.413,10	59.458,83	418.951,12	30.965,09	40.324,82	144.065,75

Annex 12 Air Traffic

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
DKI Jakarta Province									
South Jakarta	0	0	0	0	0	0	0	0	0
East Jakarta	92,77	1420,07	1235,76	127,06	0,00	23,98	6,21	4,56	6,95
Central Jakarta	0	0	0	0	0	0	0	0	0
West Jakarta	0	0	0	0	0	0	0	0	0
North Jakarta	0	0	0	0	0	0	0	0	0
Sub-total 1	92,77	1.420,07	1.235,76	127,06	-	23,98	6,21	4,56	6,95
West Java Province									
Bogor Regency	0	0	0	0	0	0	0	0	0
Sukabumi Regency	0	0	0	0	0	0	0	0	0
Cianjur Regency	0	0	0	0	0	0	0	0	0
Bandung Regency	0	0	0	0	0	0	0	0	0
Garut Regency	0	0	0	0	0	0	0	0	0
Tasikmalaya Regency	0	0	0	0	0	0	0	0	0
Ciamis Regency	0	0	0	0	0	0	0	0	0
Kuningan Regency	0	0	0	0	0	0	0	0	0
Cirebon Regency	0	0	0	0	0	0	0	0	0
Majalengka Regency	8,92	146,48	114,00	25,98	0,00	1,37	0,37	0,26	0,39
Sumedang Regency	0	0	0	0	0	0	0	0	0
Indramayu Regency	0	0	0	0	0	0	0	0	0
Subang Regency	0	0	0	0	0	0	0	0	0
Purwakarta Regency	0	0	0	0	0	0	0	0	0
Karawang Regency	0	0	0	0	0	0	0	0	0
Bekasi Regency	0	0	0	0	0	0	0	0	0
Bandung Barat Regency	0	0	0	0	0	0	0	0	0

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Pangandaran Regency	0	0	0	0	0	0	0	0	0
Bogor City	0	0	0	0	0	0	0	0	0
Sukabumi City	0	0	0	0	0	0	0	0	0
Bandung City	58,78	964,92	750,95	171,12	0,00	9,05	2,46	1,70	2,62
Cirebon City	0	0	0	0	0	0	0	0	0
Bekasi City	0	0	0	0	0	0	0	0	0
Depok City	0	0	0	0	0	0	0	0	0
Cimahi City	0	0	0	0	0	0	0	0	0
Tasikmalaya City	0	0	0	0	0	0	0	0	0
Banjar City	0	0	0	0	0	0	0	0	0
Sub-total 2	67,70	1.111,40	864,94	197,10	-	10,42	2,83	1,96	3,01
Banten Province									
Kab. Pandeglang	0	0	0	0	0	0	0	0	0
Kab. Lebak	0	0	0	0	0	0	0	0	0
Kab. Tangerang	0	0	0	0	0	0	0	0	0
Kab. Serang	0	0	0	0	0	0	0	0	0
Kota Tangerang	835,28	13042,87	7898,63	1913,80	0,00	132,89	39,06	25,24	38,50
Kota Cilegon	0	0	0	0	0	0	0	0	0
Kota Serang	0	0	0	0	0	0	0	0	0
Kota Tangerang Selatan	0	0	0	0	0	0	0	0	0
Sub-total 3	835,28	13.042,87	7.898,63	1.913,80	-	132,89	39,06	25,24	38,50
Lampung Province									
Lampung Barat	0	0	0	0	0	0	0	0	0
Tanggamus	0	0	0	0	0	0	0	0	0
Lampung Selatan	23,70	370,46	308,85	28,44	0,00	6,32	1,58	1,20	1,83

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Lampung Timur	0	0	0	0	0	0	0	0	0
Lampung Tengah	0	0	0	0	0	0	0	0	0
Lampung Utara	0	0	0	0	0	0	0	0	0
Way Kanan	0	0	0	0	0	0	0	0	0
Tulang Bawang	0	0	0	0	0	0	0	0	0
Pesawaran	0	0	0	0	0	0	0	0	0
Pringsewu	0	0	0	0	0	0	0	0	0
Mesuji	0	0	0	0	0	0	0	0	0
Tulang Bawang Barat	0	0	0	0	0	0	0	0	0
Pesisir Barat	0	0	0	0	0	0	0	0	0
Kota Bandar Lampung	0	0	0	0	0	0	0	0	0
Kota Metro	0	0	0	0	0	0	0	0	0
Sub-total 4	23,70	370,46	308,85	28,44	-	6,32	1,58	1,20	1,83
Central Java Province									
Kab. Cilacap	0	0	0	0	0	0	0	0	0
Kab. Banyumas	0	0	0	0	0	0	0	0	0
Kab. Purbalingga	0	0	0	0	0	0	0	0	0
Kab. Banjarnegara	0	0	0	0	0	0	0	0	0
Kab. Kebumen	0	0	0	0	0	0	0	0	0
Kab. Purworejo	0	0	0	0	0	0	0	0	0
Kab. Wonosobo	0	0	0	0	0	0	0	0	0
Kab. Magelang	0	0	0	0	0	0	0	0	0
Kab. Boyolali	0	0	0	0	0	0	0	0	0
Kab. Klaten	0	0	0	0	0	0	0	0	0
Kab. Sukoharjo	0	0	0	0	0	0	0	0	0
Kab. Wonogiri	0	0	0	0	0	0	0	0	0
Kab. Karanganyar	0	0	0	0	0	0	0	0	0

	Emission (Tonnes/year)								
Province/Cities	**SO2**	**NOx**	**CO**	**NMVOC**	**NH3**	**PM**	**CH4**	**BC**	**OC**
Kab. Sragen	0	0	0	0	0	0	0	0	0
Kab. Grobogan	0	0	0	0	0	0	0	0	0
Kab. Blora	0	0	0	0	0	0	0	0	0
Kab. Rembang	0	0	0	0	0	0	0	0	0
Kab. Pati	0	0	0	0	0	0	0	0	0
Kab. Kudus	0	0	0	0	0	0	0	0	0
Kab. Jepara	0	0	0	0	0	0	0	0	0
Kab. Demak	0	0	0	0	0	0	0	0	0
Kab. Semarang	0	0	0	0	0	0	0	0	0
Kab. Temanggung	0	0	0	0	0	0	0	0	0
Kab. Kendal	0	0	0	0	0	0	0	0	0
Kab Batang	0	0	0	0	0	0	0	0	0
Kab. Pekalongan	0	0	0	0	0	0	0	0	0
Kab. Pemalang	0	0	0	0	0	0	0	0	0
Kab. Tegal	0	0	0	0	0	0	0	0	0
Kab. Brebes	0	0	0	0	0	0	0	0	0
Kota Magelang	0	0	0	0	0	0	0	0	0
Kota Surakarta	72,25	1168,17	727,32	71,24	0,00	12,94	3,34	2,46	3,75
Kota Salatiga	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Kota Semarang	163,21	2639,00	1643,08	160,94	0,00	29,24	7,56	5,56	8,48
Kota Pekalongan	0	0	0	0	0	0	0	0	0
Kota Tegal	0	0	0	0	0	0	0	0	0
Sub-total 5	235,46	3.807,17	2.370,39	232,18	-	42,19	10,90	8,02	12,23
Grand total domain	1.254,91	19.751,97	12.678,57	2.498,57	-	215,79	60,58	40,97	62,53