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2017**

CHAPTER 10: REPORTING OF GRIDDED EMISSIONS AND LPS

**SUBMITTED UNDER
THE NEC DIRECTIVE (EU) 2016/2284 AND
THE UNECE
CONVENTION ON LONG-RANGE TRANSBOUNDARY
AIR POLLUTION**

Amadora

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Technical Reference

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10 REPORTING OF GRIDDED EMISSIONS AND LPS

10.1 Background information

In December 2013, the Executive Body for the Convention on Long-range Transboundary Air Pollution adopted new reporting guidelines (ECE/EB.AIR/128), which include the requirement of four-year reporting of gridded emissions and LPS from 2017.

This document refers to a chapter which was not included in the 2017 IIR submitted in March 2017, and consists on the description of data as well as the methods used to grid the emissions for the year 2015.

Previous reporting of gridded emissions was last updated in 2012, referring to year 2010. This report was based in previous Guidelines.

The 2017 reporting follows the latest Guidance from the EMEP/EEA 2016 Guidebook and the new Reporting Guidelines. The new EMEP grid of 0.1 x 0.1 degrees was used and all substances referred in paragraph 7 of the reporting Guidelines were included: SO_x, NO_x, NH₃, NMVOCs, PM_{2.5}, PM₁₀, Cd, Pb, Hg, PAHs, PCDD/F, PCBs and HCB. Gridded data is reported using NFR2014 reporting table: ANNEX V - Template file for gridded sector data for each of the relevant aggregated Gridding NFR sectors (GNFR).

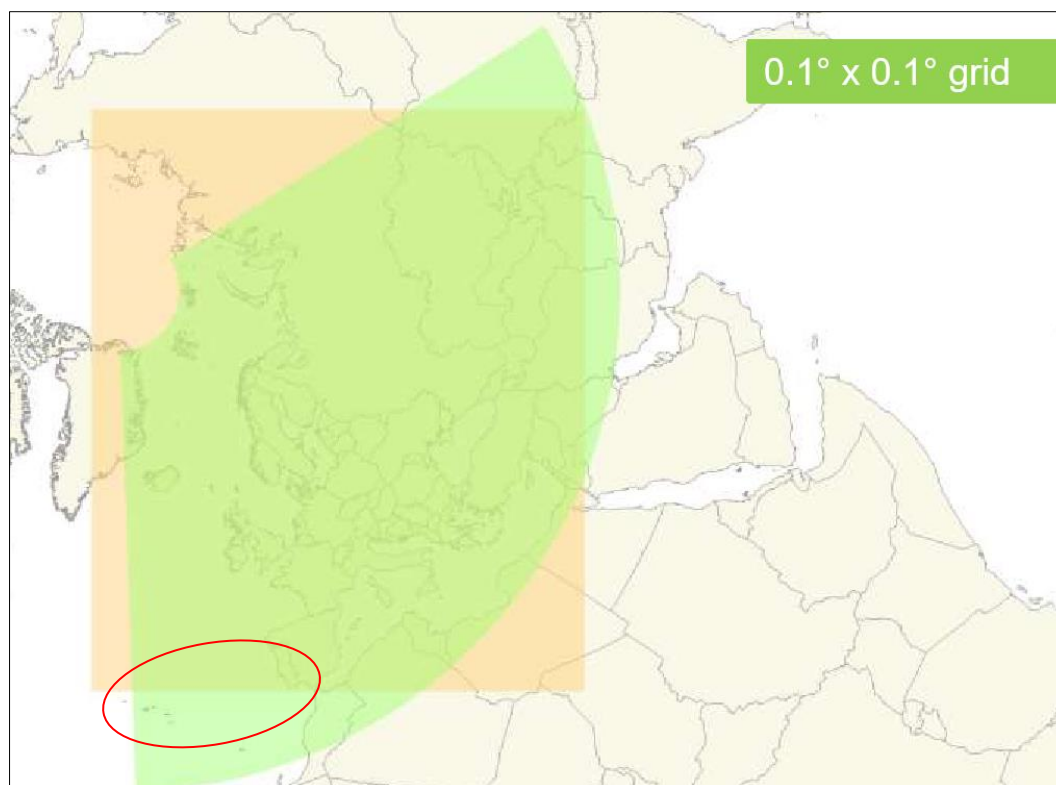
The 2017 reporting also includes emissions from Large Point Sources (LPS) with information on the location and altitude at which they occur. LPS data is submitted using the NFR2014 reporting table: ANNEX VI - Template for LPS data for each relevant aggregated Gridding NFR sectors (GNFR).

10.2 Gridded emissions data

10.2.1 The EMEP Grid

Emission data calculated by Portugal within the geographic scope of EMEP were spatially allocated in the EMEP Grid (in green), as shown in the figure below.

Figure 10.1 – The EMEP grid. Portugal's location.



Under the EMEP domain, Portugal's geographical area is covered by 1151 grid cells, which do not include the occidental group of the Azores islands - Corvo and Flores. These two islands are not covered by the EMEP Grid and therefore are excluded from this reporting.

In order to spatially disaggregate emissions, Portugal downloaded the EMEP ESRI shapefile with the grid definition, as well as the grid definition tables in excel file, which contain specific data for the country, from the CEIP website.

10.2.2 Methods and data for disaggregation of emission data

The spatial disaggregation of emission data consists on the attribution of an emission amount of an air pollutant to a geographical location.

The Portuguese emission inventory covers both point, line and area sources.

In the case of point sources, emissions are allocated to the geographical coordinates of the individual plants and other facilities included in the national inventory. When gridded, the emission is allocated to the grid cell containing the point or points.

Emissions from area sources, are calculated on the basis of several datasets with different levels of spatial disaggregation, e.g. national statistical data, Land Use cover. The most current disaggregation level used is the territorial unit – *Concelho (Municipality)*, which is the designation of a territory associated with one municipal administrative authority. There are 308 *concelhos* in Portugal, 278 in Portugal Mainland, 19 in the Autonomous Region of Açores and 11 in the

Autonomous Region of Madeira. In these cases, a spatial correlation between each *concelho* area and the area of each cell grid was established in order to obtain the gridded emissions.

The information used to report spatial emissions included also linear sources, (e.g. highways and railways). In the case of highways, the total emissions were allocated based on traffic volume data for each road segment. Then, the highways were distributed through the grid, hence obtaining the corresponding share of emissions.

When no spatial information on the emission sources is available, surrogate information were used as proxy data to spatially allocate emissions.

The different area shapefiles were intersected via a GIS (ArcGIS 10.2.1) with the EMEP Grid shapefile and all the different spatial datasets (point, linear, area) were combined together into a unique gridded dataset according to the reporting guidelines: the EMEP grid (0.1° x 0.1° longitude/latitude).

Table 10.1 lists the categories (sectors) used for reporting the 2017 gridded emission data and the corresponding geographical information used in the spatial emission disaggregation.

Table 100.1 – List of GNFR classes, corresponding NFR categories and geographical datasets used in the emission gridding.

GNFR sector	NFR sector	NFR sector name	Type of Emissions	Methodology/ allocation criteria
A_PublicPower	1A1a	Public electricity and heat production	Point Source	Information on Public electricity and heat production facilities Portuguese Environmental Agency/ Agência Portuguesa do Ambiente, I.P. (APA). Emissions were based on 2015 quantities of waste incinerated and biogas combusted for energy purposes in landfills, courtesy of waste management systems, APA.
B_Industry	1A1b	Petroleum refining	Point Source	Emissions of each refinery were estimated based on 2015 fuel combustion from Emissions Trading Scheme (ETS) and from EMEP/EEA emission factors.
B_Industry	1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	Point Source	Emissions were estimated based on 2015 fuel consumption data provided by the facilities under ETS and on plant specific emission factors derived from monitoring data.
B_Industry	1A2c	Stationary combustion in manufacturing industries and construction: Chemicals	Point Source Area source	Information on Point sources APA; Emissions were based on 2015 Fuel sales by activity sector for each <i>concelho</i> (municipality) territorial unit* (Area sources), General Directorate for Energy and Geology / Direção Geral de Energia e Geologia (DGEG).
B_Industry	1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print	Point Source Area Source	Information on Point sources; Emissions were based on 2015 Fuel sales by activity sector for each <i>concelho</i> (Area Sources), DGEG.
B_Industry	1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco	Area Source	Emissions were based on 2015 Fuel sales by activity sector for each <i>concelho</i> , DGEG.
B_Industry	1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Point Source Area Source	Information on Point sources; Emissions were based on 2015 Fuel sales by activity sector for each <i>concelho</i> (Area sources), DGEG.
B_Industry	1A2gviii	Stationary combustion in manufacturing industries and construction: Other (please specify in the IIR)	Point Source Area Source	Information on Point sources; Emissions were based on 2015 Fuel sales by activity sector for each <i>concelho</i> (Area sources), DGEG.
H_Aviation	1A3ai(i)	International aviation LTO (civil)	Point Source	Emissions were based on 2015 national Fuel sales for international operations, DGEG, and total international LTO for each national airport, courtesy of the Portuguese Civil Aviation Authority / Instituto Nacional da Aviação Civil, IP (INAC).
H_Aviation	1A3aii(i)	Domestic aviation LTO (civil)	Point Source	Emissions were based on 2015 national Fuel sales for domestic operations, DGEG and total domestic LTO for each national airport, courtesy of INAC.

GNFR sector	NFR sector	NFR sector name	Type of Emissions	Methodology/ allocation criteria
F_RoadTransport	1A3bi	Road transport: Passenger cars	Line Source Area Source	Highway emission totals (see methodology in IIR 2015, under section 3.2.3.2), were distributed according to the average annual daily traffic and the length of each highway (2015 data), courtesy of the Institute for Mobility and Transportation/ Instituto da Mobilidade e dos Transportes, IP (IMT) (Line Source); Rural and urban emission totals (see methodology in IIR 2015, under section 3.2.3.2), were distributed according to 2015 population density in rural and urban areas, respectively, the National Statistics Institute / Instituto Nacional de Estatística, I.P. (INE) (Area Source).
F_RoadTransport	1A3bii	Road transport: Light duty vehicles		
F_RoadTransport	1A3biii	Road transport: Heavy duty vehicles and buses		
F_RoadTransport	1A3biv	Road transport: Mopeds & motorcycles		
I_Offroad	1A3c	Railways	Line Source	Railway emission totals (see methodology in IIR 2015, under section 3.2.3.3), were distributed according to the length of national railway (2015 data), courtesy of IMT.
G_Shipping	1A3dii	National navigation (shipping)	Point Source	Emissions were based on 2015 national Fuel sales, DGEG, and total of ship docks for each national seaport (2015 data), courtesy of IMT and Port authorities/ Administrações Portuárias.
C_OtherStationary Comb	1A4ai	Commercial/institutional: Stationary	Area Source	Emissions were based on 2015 Fuel sales by activity sector for each <i>concelho</i> , DGEG.
C_OtherStationary Comb	1A4bi	Residential: Stationary plants	Area Source	Emissions were based on 2015 Fuel sales by activity sector for each <i>concelho</i> , DGEG.
C_OtherStationary Comb	1A4ci	Agriculture/Forestry/Fishing: Stationary	Area Source	Emissions were based on 2015 Fuel sales by activity sector for each <i>concelho</i> , DGEG.
I_Offroad	1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	Area Source	Off-road vehicles emissions (tractors) were based on 2015 Fuel sales by agricultural activity code for each <i>concelho</i> , DGEG.
I_Offroad	1A4ciii	Agriculture/Forestry/Fishing: National fishing	Point Source	Emissions from National fishing were based on tons of fish caught at national seaports in 2015, INE.
I_Offroad	1A5b	Other, Mobile (including military, land based and recreational boats)	Point Source	Emissions were based on 2015 national Fuel sales for military operations, DGEG, and total domestic LTO for each national airport, courtesy of INAC.
D_Fugitive	1B2ai	Fugitive emissions oil: Exploration, production, transport	Point Source	Data on petroleum products loading operations in ports was obtained in 2005 from Ports Authorities and Depots Companies and extrapolated in the period 1990-2004 and onwards using crude oil stock changes from DGEG Energy Balance; The emission factors are from USEPA.
D_Fugitive	1B2aiv	Fugitive emissions oil: Refining / storage	Point Source	Activity data was obtained from Refineries; The emission factors are from monitoring data, EMEP/EEA Guidebook and USEPA/AP-42.
D_Fugitive	1B2av	Distribution of oil products	Area Source	Activity data was obtained from Energy Balance; The emission factors are from Concawe; Spatial Allocation was based on 2015 Gasoline sales by Municipality.

GNFR sector	NFR sector	NFR sector name	Type of Emissions	Methodology/ allocation criteria
D_Fugitive	1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)	Area Source	Fugitive emissions from Natural gas transportation were based on 2015 Natural gas sales for each concelho, DGEG.
D_Fugitive	1B2c	Venting and flaring (oil, gas, combined oil and gas)	Point Source	Information on flare emissions.
D_Fugitive	1B2d	Other fugitive emissions from energy production	Point Source	Information on fugitive emissions from geothermal energy production facilities, Regional Directorate of Environment – Azores Island / Direção Regional da Energia (Açores).
B_Industry	2A1	Cement production	Point Source	Emissions were estimated based on 2015 kiln specific clinker production data provided by the facilities, 2015 fuel consumption data provided also by the facilities and on plant specific emission factors derived from monitoring data.
B_Industry	2A2	Lime production	Point Source	Emissions were estimated based on 2015 plant specific lime production data provided by the facilities and on emission factors from EMEP/EEA Guidebook and USEPA/AP-42.
B_Industry	2A3	Glass production	Point Source	Emissions of each glass production plant were estimated based on 2015 glass production from each plant (data from annual reports under PRTR), fuel consumption (ETS data) and USEPA/AP-42 emission factors.
B_Industry	2B2	Nitric acid production	Point Source	Emissions were estimated based on 2015 plant specific nitric acid production data provided by the facilities under PRTR and on plant specific emission factors derived from monitoring data.
B_Industry	2B10a	Chemical industry: Other (please specify in the IIR)	Point Source	Emissions were estimated based on 2015 plant specific production data provided by the facilities under PRTR and on EMEP/EEA emission factors.
B_Industry	2B10a	Chemical industry: Other (please specify in the IIR)	Area Source	Emissions were estimated based on 2015 production data provided by the National Statistics and on USEPA/AP-42 and EMEP/EEA emission factors; Spatial Allocation was based on 2015 Fuel sales by activity sector for each Municipality.
B_Industry	2C1	Iron and steel production	Point Source	Emissions were estimated based on 2015 plant specific steel production data provided under PRTR, fuel consumption data provided also by the facilities under ETS and on plant specific emission factors derived from monitoring data.
E_Solvents	2D3a	Domestic solvent use including fungicides	Area Source	Emissions were estimated based on 2015 production data provided by the National Statistics and on EMEP/EEA emission factors; Spatial Allocation was based on Population by Municipality.
E_Solvents	2D3b	Road paving with asphalt	Area Source	Emissions were estimated based on asphalt applied in road paving ("Asphalt in Figures" publication) during 2015 and on emission factors from EMEP/EEA Guidebook and USEPA/AP-42; Spatial Allocation was based on Asphalt consumption in construction and public works by municipality (data from DGEG) in 2015.

GNFR sector	NFR sector	NFR sector name	Type of Emissions	Methodology/ allocation criteria
B_Industry	2D3d	Coating applications	Area Source	Emissions were estimated based on 2015 production data provided by INE and on EMEP/EEA emission factors; Spatial Allocation was based on Population by Municipality.
E_Solvents	2D3e	Degreasing	Area Source	Emissions were estimated based on 2015 production data provided by INE and on EMEP/EEA emission factors; Spatial Allocation was based on Population by Municipality (some cases) and by 2015 fuel sales by activity sector (other cases).
E_Solvents	2D3f	Dry cleaning	Area Source	Emissions were estimated based on 2015 production data provided by INE and on EMEP/EEA emission factors; Spatial Allocation was based on Population by Municipality.
E_Solvents	2D3g	Chemical products	Area Source	Emissions were estimated based on 2015 production data provided by INE and on EMEP/EEA emission factors; Spatial Allocation was based on Population by Municipality (some cases) and by 2015 fuel sales by activity sector (other cases).
E_Solvents	2D3h	Printing	Area Source	Emissions were estimated based on 2015 production data provided by INE and on EMEP/EEA emission factors; Spatial Allocation was based on Population by Municipality.
E_Solvents	2D3i	Other solvent use (please specify in the IIR)	Area Source	Emissions were estimated based on 2015 production data provided by INE and on EMEP/EEA emission factors; Spatial Allocation was based on 2015 Fuel sales by activity sector for each Municipality.
E_Solvents	2G	Other product use (please specify in the IIR)	Area Source	Emissions were estimated based on 2015 production data provided by INE and on emission factors derived from national statistics on solvents use; Spatial Allocation was based on Population by Municipality.
B_Industry	2H1	Pulp and paper industry	Point Source	Emissions were estimated based on 2015 plant specific production data provided by the facilities under PRTR (RAA) and on USEPA/AP-42 emission factors.
B_Industry	2H2	Food and beverages industry	Area Source	Emissions were estimated based on 2015 production data provided by INE and on EMEP/EEA emission factors; Spatial Allocation was based on 2015 Fuel sales by activity sector for each Municipality.
B_Industry	2I	Wood processing	Area Source	Emissions were estimated based on 2015 production data provided by INE and on EMEP/EEA emission factors; Spatial Allocation was based on 2015 Fuel sales by activity sector for each Municipality.

GNFR sector	NFR sector	NFR sector name	Type of Emissions	Methodology/ allocation criteria
B_Industry	2L	Other production, consumption, storage, transportation or handling of bulk products (please specify in the IIR)	Area Source	Emissions were estimated based on 2015 production data provided by INE and on EMEP/EEA emission factors; Spatial Allocation was based on 2015 Fuel sales by activity sector for each Municipality.
K_AgriLivestock	3B1a	Manure management - Dairy cattle	Area Source	Emissions were estimated based on Livestock numbers per animal type and subtype for each <i>concelho</i> , 2009 Agricultural General Census**, published by INE.
K_AgriLivestock	3B1b	Manure management - Non-dairy cattle		
K_AgriLivestock	3B2	Manure management - Sheep		
K_AgriLivestock	3B3	Manure management - Swine		
K_AgriLivestock	3B4d	Manure management - Goats		
K_AgriLivestock	3B4e	Manure management - Horses		
K_AgriLivestock	3B4f	Manure management - Mules and asses		
K_AgriLivestock	3B4g	Manure management - Poultry		
K_AgriLivestock	3B4h	Manure management - Other animals (please specify in IIR)		
L_AgriOther	3Da1	Inorganic N-fertilizers (includes also urea application)	Area Source	Emissions were estimated based on Permanent and annual crop areas for each <i>concelho</i> , 2009 Agricultural General Census, published by INE.
L_AgriOther	3Da2a	Animal manure applied to soils		
L_AgriOther	3Da2b	Sewage sludge applied to soils		
L_AgriOther	3Da2c	Other organic fertilisers applied to soils (including compost)		
L_AgriOther	3Da3	Urine and dung deposited by grazing animals		
L_AgriOther	3Da4	Crop residues applied to soils		
L_AgriOther	3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products		
L_AgriOther	3De	Cultivated crops		
L_AgriOther	3F	Field burning of agricultural residues		

GNFR sector	NFR sector	NFR sector name	Type of Emissions	Methodology/ allocation criteria
J_Waste	5A	Biological treatment of waste - Solid waste disposal on land (SWDL)	Point Source Area Source	Emissions from Point sources (more recent years) were estimated based on 2015 quantities of solid waste (municipal and industrial waste) disposed in landfills, data reported to APA by waste management systems. Emissions from Urban waste (Historical data) were estimated based on 2015 quantities of SWDL (controlled and uncontrolled) by Municipality (area Sources). Emissions from Industrial waste disposal (Area Sources) were estimated based on the same distribution as urban waste.
J_Waste	5B1	Biological treatment of waste - Composting	Point Source	Information on biological treatment units, data reported to the APA by waste management systems.
J_Waste	5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities	Point Source	Information on biological treatment units, data reported to the APA by waste management systems.
J_Waste	5C1a	Municipal waste incineration	-	<i>Reported in 1A1a</i>
J_Waste	5C1bi	Industrial waste incineration	Area Source	Emissions were estimated based on 2015 quantity of industrial waste incinerated, APA data; Spatial disaggregation based on the electrical consumption in industry by municipality.
J_Waste	5C1bii	Hazardous waste incineration	-	<i>Included in 5C1bi</i>
J_Waste	5C1biii	Clinical waste incineration	Point Source	Emissions were estimated based on 2015 quantities of hospital waste incinerated in the hospital incinerator, data reported to APA.
J_Waste	5C1biv	Sewage sludge incineration	-	<i>Included in 5C1bi</i>
J_Waste	5C1bv	Cremation	Point Source	Emissions were estimated based on 2015 number of human corpses cremated by crematorium, data collected from Servilusa.
J_Waste	5D1	Domestic wastewater handling	Area Source	Emission totals (see methodology in IIR 2015, under section 6.2.5.1) were distributed according to population by Municipality.
J_Waste	5D2	Industrial wastewater handling	Area Source	Emissions were estimated based on 2015 Fuel sales by Municipality and economic sector, courtesy of DGEG.

GNFR sector	NFR sector	NFR sector name	Type of Emissions	Methodology/ allocation criteria
J_Waste	5E	Other waste: i)Quantities of biogas combusted without energy recovery in landfills; ii) Car and house fires in urban areas	Point Source Area Source	Emissions from Point sources were estimated based on 2015 data received from landfills; Emissions from Area sources were estimated based on 2015 data on occurrences, collected from the Civil Protection National Authority and the Lisbon City Hall Fire Brigade; aggregated data on the number of occurrences were spatially allocated by population in urban areas.
N_Natural	11B	Forest fires	Area Source	Cartography of burnt areas in 2015, published by the Institute for Nature Conservation and Forest/ Instituto da Conservação da Natureza e das Florestas, I.P. (ICNF); Cartography of Land Use in 2010, published by the General Directorate for spatial planning / Direção Geral do Território (DGT).
N_Natural	11C	Other natural emissions: NMVOC Biogenic Emissions	Area Source	Cartography of Land Use in 2010, published by DGT.

*Concelho territorial unit in Portugal is the designation to land areas associated with one municipal administrative authority. There are 308 concelhos in Portugal.

**Recenseamento Geral da Agricultura 2009 – extensive agriculture census made by INE every 10 years.

10.3 LPS

Information providing Large Point Sources (LPS) refers to the industrial units considered individually in the Portuguese inventory.