Noise indicators under the Environmental Noise Directive

Methodology for estimating missing data

April 2019

Authors:
Maria José Ramos, Universitat Autònoma de Barcelona (UAB)

ETC/ATNI consortium partners:
NILU – Norwegian Institute for Air Research, Aether Limited, Czech Hydrometeorological Institute (CHMI), EMISIA SA, Institut National de l'Environnement Industriel et des risques (INERIS), Universitat Autònoma de Barcelona (UAB), Umweltbundesamt GmbH (UBA-V), 4sfera Innova, Transport & Mobility Leuven NV (TML)

European Environment Agency
European Topic Centre on Air pollution, transport, noise and industrial pollution

Author
Maria José Ramos, Universitat Autònoma de Barcelona (UAB)

ETC/ATNI c/o NILU
ISBN 978-82-93752-00-4

European Topic Centre on Air pollution,
transport, noise and industrial pollution
c/o NILU – Norwegian Institute for Air Research
P.O. Box 100, NO-2027 Kjeller, Norway
Tel.: +47 63 89 80 00
Web : https://www.eionet.europa.eu/etcs/etc-atni
Email: etc.atni@nilu.no

Contents

Summary

This report summarizes the methodology followed to gap fill the missing noise exposure data for 2012 and 2017 reference dataset.

Specific procedures have been implemented depending on the noise source expected to be gap filled, which are detailed in the different chapters of this document, distinguishing between major roads, major railways, major airports and the different sources inside agglomerations (road, rail, aircraft and industrial noise exposure).

The data being use for this exercise is data delivered by Member States in the corresponding Reportnet envelopes until 01/01/2019, for dataflows DF1_5 (and DF1) and DF4_8 (DF4) and considering the different reporting cycles.

Results have been posted in ETC/ATNI Forum and will be used in the different publications being issued during 2019 by the EEA.

Acknowledgements

This report has been written by the European Topic Centre on Air pollution, transport, noise and industry pollution (ETC/ATNI), updating a previous work developed under the context of the European Topic Centre on Air pollution and Climate Change Mitigation (ETC/ACM).

The author is Maria José Ramos, with review provided by Núria Blanes (both from ETC/ATNI).

1 Objectives

This methodological report summarizes the steps followed to obtain estimated results of a complete noise exposure covering the END sources.

The process followed is described in the next sections:

- Chapter 2: Input data
- Chapter 3: Identification of outliers based on the interquartile range
- Chapter 4: END major roads and major railways noise exposure data: gap filling exercise
- Chapter 5: END agglomerations – road noise exposure data: gap filling exercise
- Chapter 6: END data: rest of noise sources: gap filling exercise

2 Input data

The following datasets have been used as input data:

- END data reported by Member States until 01/01/2019: https://forum.eionet.europa.eu/etc-atni-consortium/library/subvention-2019/task-deliveries-action-plan-2019/task-1.1.5.1-noise-data-operational-compilation-and-management/subtask-1.1-update-database-cws/datasets

3 Identification of outliers based on the interquartile range

In a first step, the identification of outliers for each END noise source has been made based on the interquartile range of the change of people exposed reported between 2012 and 2017.

This statistical parameter measures the variability of the dataset by calculating the difference between the first and third quartiles. For each noise source, the lower and higher limit of variability has been set, allowing to identify those changes between 2012 and 2017 corresponding to outliers.

The outliers identified have been excluded in the gap filling exercise for both periods (2012 and 2017).

3.1 END agglomeration air

The analysis of the interquartile range identifies as outliers those agglomerations with a change between 2012 and 2017 higher or lower than:

L_{den}			L_{night}		
Lower	-152	+1,5 IQR	Lower	-167	+1,5 IQR
Higher	172	-1,5 IQR	Higher	138	-1,5 IQR

The next agglomerations have been identified as outliers:

L_{den}			L_{night}		
Country	**Region**	**City**	**Country**	**Region**	**City**
EE	-	Tallinn	CH	-	Zurich
FR	-	Paris	FR	-	Nice
NL	-	Amsterdam	FR	-	Paris
			IE	-	Dublin
			NL	-	Amsterdam

3.2 END agglomeration industry

The analysis of the interquartile range identifies as outliers those agglomerations with a change between 2012 and 2017 higher or lower than:

L_{den}			L_{night}		
Lower	-133	+1,5 IQR	Lower	-111	+1,5 IQR
Higher	107	-1,5 IQR	Higher	122	-1,5 IQR

The next agglomerations have been identified as outliers:

L_{den}			L_{night}		
Country	**Region**	**City**	**Country**	**Region**	**City**
BE	F	Ghent	DE	HE	Wiesbaden
BG	-	Burgas	DE	NW	Bochum
DE	HE	Darmstadt	ES	-	A Coruna
DE	NW	Bochum	NL	-	Nijmegen
DE	NW	Duisburg	PL	-	Bielsko-Biala
ES	-	A Coruna	PL	-	Krakow
FR	-	Nice	PL	-	Sosnowiec
NL	-	Nijmegen			
PL	-	Bielsko-Biala			
PL	-	Dabrowa Gornicza			
PL	-	Krakow			
PL	-	Lublin			
PL	-	Sosnowiec			
SE	-	Malmo			

3.3 END agglomeration rail

The analysis of the interquartile range identifies as outliers those agglomerations with a change between 2012 and 2017 higher or lower than:

L_{den}			L_{night}		
Lower	-129	+1,5 IQR	Lower	-131	+1,5 IQR
Higher	150	-1,5 IQR	Higher	160	-1,5 IQR

The next agglomerations have been identified as outliers:

L_{den}			L_{night}		
Country	**Region**	**City**	**Country**	**Region**	**City**
CZ	-	Ostrava	BG	-	Plovdiv
FI	-	Lahti	CZ	-	Ostrava
FI	-	Oulu	FI	-	Lahti
FR	-	Paris	FI	-	Oulu
LU	-	Luxembourg	FR	-	Nice
NL	-	Alkmaar	FR	-	Paris
NL	-	Almere	LU	-	Luxembourg
NL	-	Amersfoort	NL	-	Alkmaar
NL	-	Amsterdam	NL	-	Almere
NL	-	Apeldoorn	NL	-	Amersfoort
NL	-	Arnhem	NL	-	Amsterdam
NL	-	Eindhoven	NL	-	Apeldoorn

L_{den}			L_{night}		
Country	**Region**	**City**	**Country**	**Region**	**City**
NL	-	Enschede	NL	-	Arnhem
NL	-	Gouda	NL	-	Eindhoven
NL	-	Groningen	NL	-	Enschede
NL	-	Hilversum	NL	-	Gouda
NL	-	Maastricht	NL	-	Groningen
NL	-	Nijmegen	NL	-	Hilversum
NL	-	Rotterdam	NL	-	Maastricht
NL	-	s Hertogenbosch	NL	-	Nijmegen
NL	-	The Hague	NL	-	Rotterdam
NL	-	Tilburg	NL	-	s Hertogenbosch
NL	-	Utrecht	NL	-	The Hague
NL	-	Zwolle	NL	-	Tilburg
PL	-	Bialystok	NL	-	Utrecht
PL	-	Czestochowa	NL	-	Zwolle
PL	-	Dabrowa Gornicza	PL	-	Bialystok
PL	-	Katowice	PL	-	Czestochowa
PL	-	Krakow	PL	-	Katowice
SE	-	Umea	PL	-	Krakow
SE	-	Vasteras	SE	-	Umea
			SE	-	Vasteras

3.4 END agglomeration road

The analysis of the interquartile range identifies as outliers those agglomerations with a change between 2012 and 2017 higher or lower than:

L_{den}			L_{night}		
Lower	-51	+1,5 IQR	Lower	-60	+1,5 IQR
Higher	53	-1,5 IQR	Higher	69	-1,5 IQR

The next agglomerations have been identified as outliers:

L_{den}			L_{night}		
Country	**Region**	**City**	**Country**	**Region**	**City**
AT	-	Innsbruck	AT	-	Innsbruck
AT	-	Vienna	AT	-	Vienna
DE	ST	Magdeburg	BG	-	Varna
ES	-	Granada	DE	NW	Bottrop
FI	-	Tampere	DE	ST	Magdeburg
FR	-	Paris	ES	-	Alcobendas
FR	-	Strasbourg	ES	-	Getafe
HU	-	Kecskemet	ES	-	San Sebastian - Donostia
MT	-	Valletta	ES	-	Vigo
NL	-	Maastricht	FI	-	Espoo
PL	-	Bialystok	FI	-	Helsinki
PL	-	Bielsko-Biala	FI	-	Kauniainen
PL	-	Bytom	FI	-	Tampere
PL	-	Kielce	HR	-	Zagreb
PL	-	Olsztyn	IS	-	Reykjavik
PL	-	Opole	NL	-	Almere
PL	-	Poznan	NL	-	Maastricht

L_{den}			L_{night}		
Country	**Region**	**City**	**Country**	**Region**	**City**
PL	-	Sosnowiec	PL	-	Bielsko-Biala
PL	-	Wloclawek	PL	-	Bytom
SE	-	Helsingborg	PL	-	Gorzow Wielkopolski
SE	-	Stockholm	PL	-	Katowice
			PL	-	Koszalin
			PL	-	Lublin
			PL	-	Olsztyn
			PL	-	Opole
			PL	-	Poznan
			PL	-	Ruda Slaska
			PL	-	Sosnowiec
			PL	-	Torun
			PL	-	Wloclawek

3.5 END major airports

The analysis of the interquartile range identifies as outliers those major airports with a change between 2012 and 2017 higher or lower than:

L_{den}			L_{night}		
Lower	-135	+1,5 IQR	Lower	-259	+1,5 IQR
Higher	77	-1,5 IQR	Higher	171	-1,5 IQR

The next major airports have been identified as outliers:

L_{den}			L_{night}		
Country	**Region**	**ICAO**	**Country**	**Region**	**ICAO**
CZ	-	LKPR	CZ	-	LKPR
DE	BB	EDDB	GB	E	EGCC
ES	-	GCTS	GB	E	EGLL
ES	-	LEMG	IE	-	EIDW
GB	E	EGLC	PT	-	LPPT
IE	-	EIDW			
LV	-	EVRA			
NL	-	EHAM			
PT	-	LPPT			

3.6 END major railways

The analysis of the interquartile range identifies as outliers those country-regions with a change between 2012 and 2017 higher or lower than:

L_{den}			L_{night}		
Lower	-151	+1,5 IQR	Lower	-91	+1,5 IQR
Higher	163	-1,5 IQR	Higher	122	-1,5 IQR

The next countries and regions have been identified as outliers:

L_{den}		L_{night}	
Country	**Region**	**Country**	**Region**
FR	-	FR	-
GB	N	GB	N
IE	-	IE	-

3.7 END major roads

The analysis of the interquartile range identifies as outliers those country-regions with a change between 2012 and 2017 higher or lower than:

L_{den}			L_{night}		
Lower	-44	+1,5 IQR	Lower	-63	+1,5 IQR
Higher	62	-1,5 IQR	Higher	82	-1,5 IQR

The next countries and regions have been identified as outliers:

L_{den}		L_{night}	
Country	**Region**	**Country**	**Region**
DE	NI	FR	-
DE	ST	GB	N
ES	-	LT	-
FR	-	MT	-
GB	N		
HU	-		
LT	-		
MT	-		

4 END major roads and major railways exposure data outside agglomerations: gap filling

4.1 Gap filling method

This method is based on the working paper establishing a methodological proposal to interpolate a complete coverage on noise exposure at EU level (ETC/ACM, 2015).

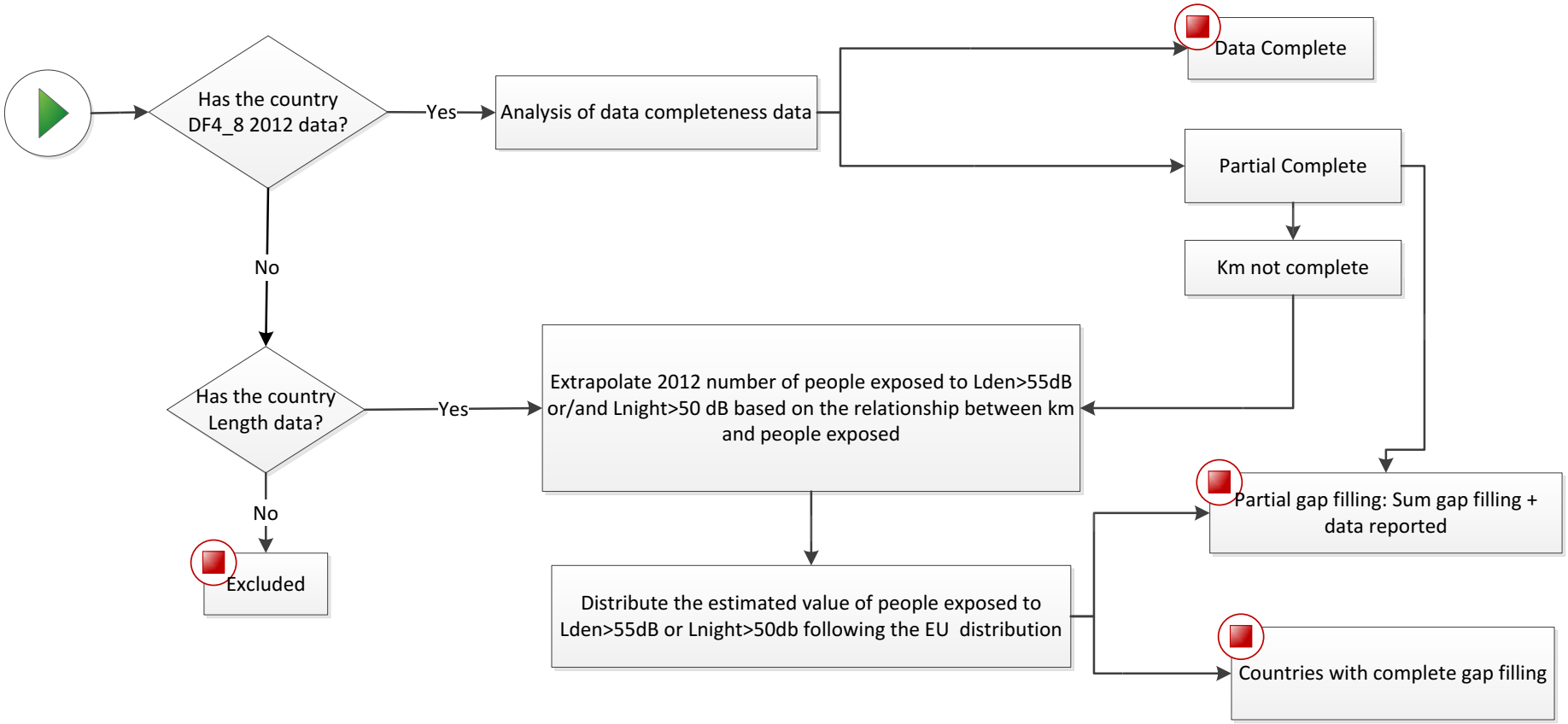
It should be noted that partial gap filling of the region or the country has been done where exposure information provided was clearly not complete (e.g. in the case of a country providing the information per road segment). In these cases, the reported information has been used and in top of that, gap filled values for the remaining kilometres have been added to the reported information, obtaining a value representing the complete territory. More explanations on the process followed can be found in section 4.1.2.

To gap fill 2017 reporting period, data considered complete for the 2012 reporting period has been directly used in the gap filling process (based on results found in ETC/ACM, 2016). If 2012 data is not available, the correlation between number of people exposed and kilometres of major roads or major railways have been calculated to estimate the number of people exposed.

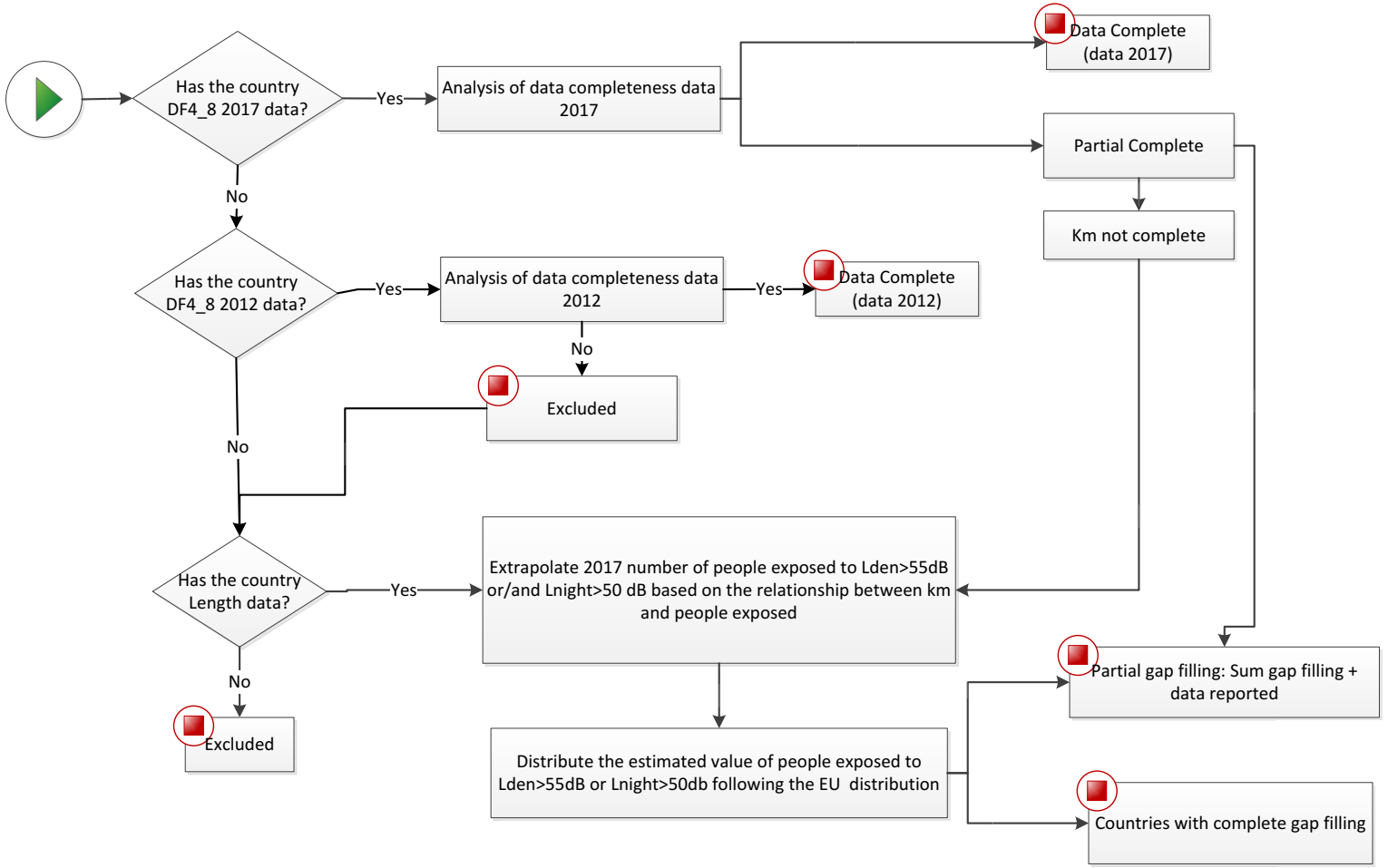
To gap fill 2012 reporting period, the correlation between number of people exposed and kilometres of major roads or major railways have been used.

The following schemas has been used to gap fill the major roads and major railways noise source reporting period 2012 and reporting period 2017.

Gap filling schema for reporting period 2012:



Gap filling schema for reporting period 2017:



4.1.1 *Evaluation of completeness of major roads/major railways exposure data at country level*

Due to how the information on exposure to major roads and major railways is requested by the END, a specific analysis combining DF4_8 and DF1_5 should be undertaken in order to evaluate the completeness of the information received.

When the exposure information has been delivered identifying the road and rail segments and the codification follows the DF1_5 dataflow, an analysis of completeness by codes comparison is possible between both datasets. This process allows us to identify the length that correspond to the exposure data and in the case of partial gap filling, the length that need to be gap filled concerning the number of people exposed.

When the exposure information has been delivered for the total network as only one row, the codes are delivered as -1 or -2 or the codes between dataflows (DF1_5 and DF4_8) do not match, then the codes comparison is not possible and the dataset is assumed as complete.

4.1.2 *Gap filling method for major roads and major rails*

Case 1: Gap filled or partial gap filled based on EU distribution and EU mean

Reporting Period 2012:

List of countries with complete/partial gap filling for major roads:

Country	Region	Gap fill	Country	Region	Gap fill
BE	W	Total	ME	-	Total
BG	-	Partial	MK	-	Total
CY	-	Total	PT	-	Partial
EE	-	Total	RO	-	Partial
ES	-	Partial	SK	-	Partial
GR	-	Total			

List of countries with complete/partial gap filling for major railways:

Country	Region	Gap fill	Country	Region	Gap fill
BE	B	Total	EE	-	Total
BE	W	Total	ES	-	Partial
GR	-	Total			

Reporting Period 2017:

List of countries with complete/partial gap filling for major roads:

Country	Region	Gap fill	Country	Region	Gap fill
BA	-	Total	MK	-	Total
CY	-	Total	PT	-	Partial
ES	-	Partial	RO	-	Total
GR	-	Total	SK	-	Total
ME	-	Total			

List of countries with complete/partial gap filling for major railways:

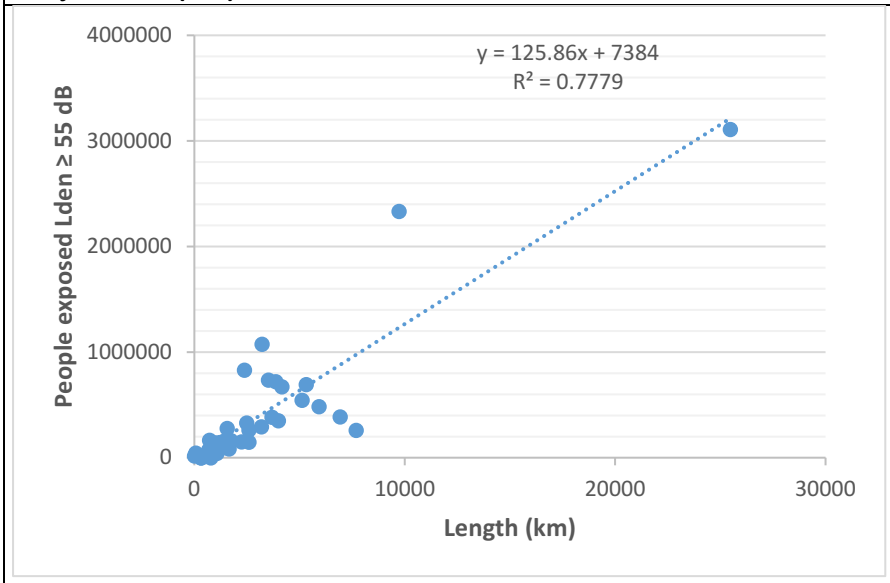
Country	Region	Gap fill	Country	Region	Gap fill
BA	-	Total	ES	-	Partial
BE	B	Total	GR	-	Total

The countries considered complete have been used to establish the correlation between length of major sources (roads and railways) and the total number of people exposed for L_{den} ≥ 55 dB and L_{night} ≥ 50 dB, which will be used to gap fill the incomplete countries (partial or total gap filling).

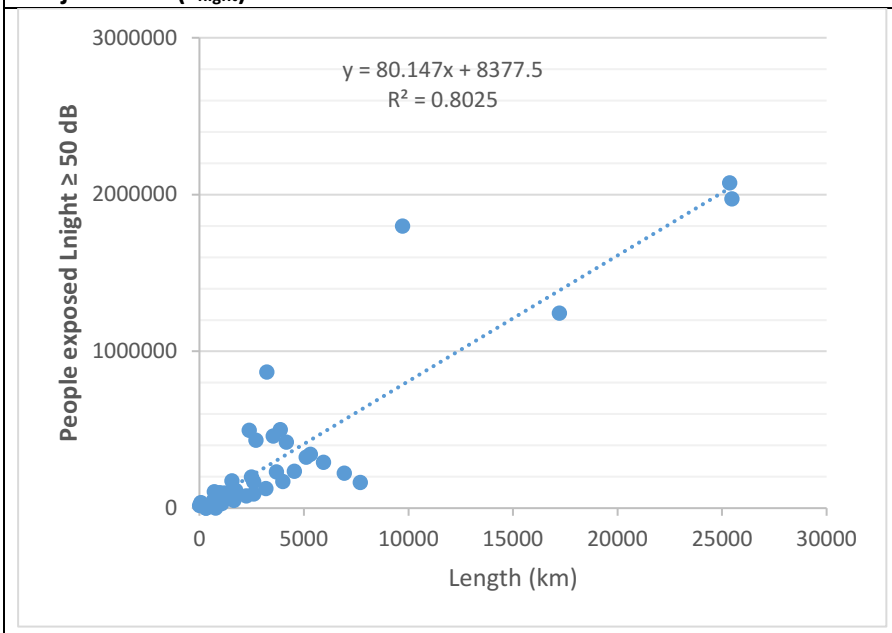
Reporting Period 2012:

The correlations used are the following ones:

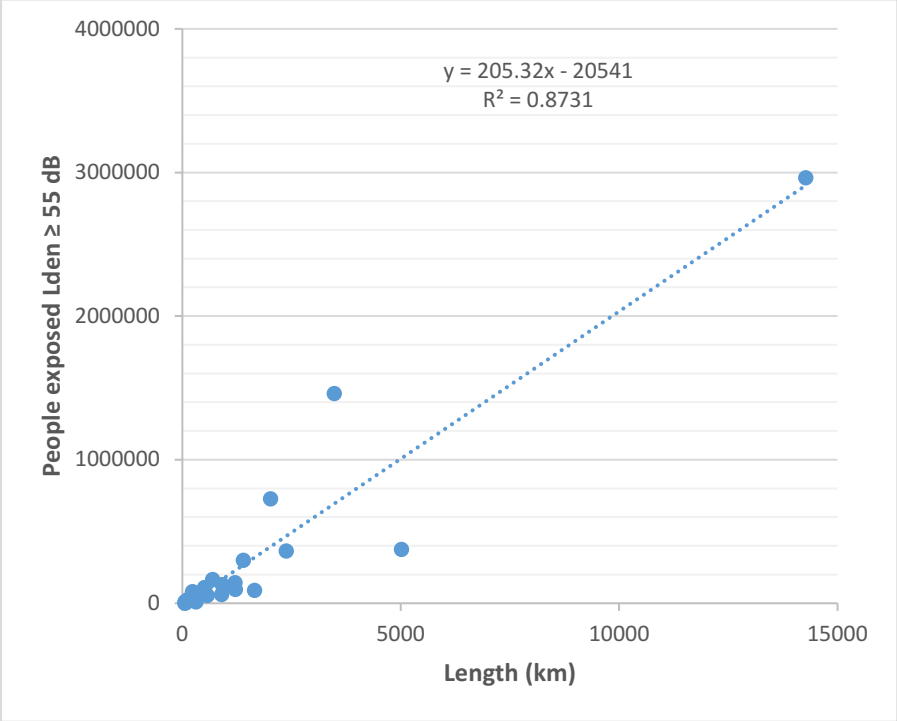
Major roads (L_{den})



Major roads (L_{night})

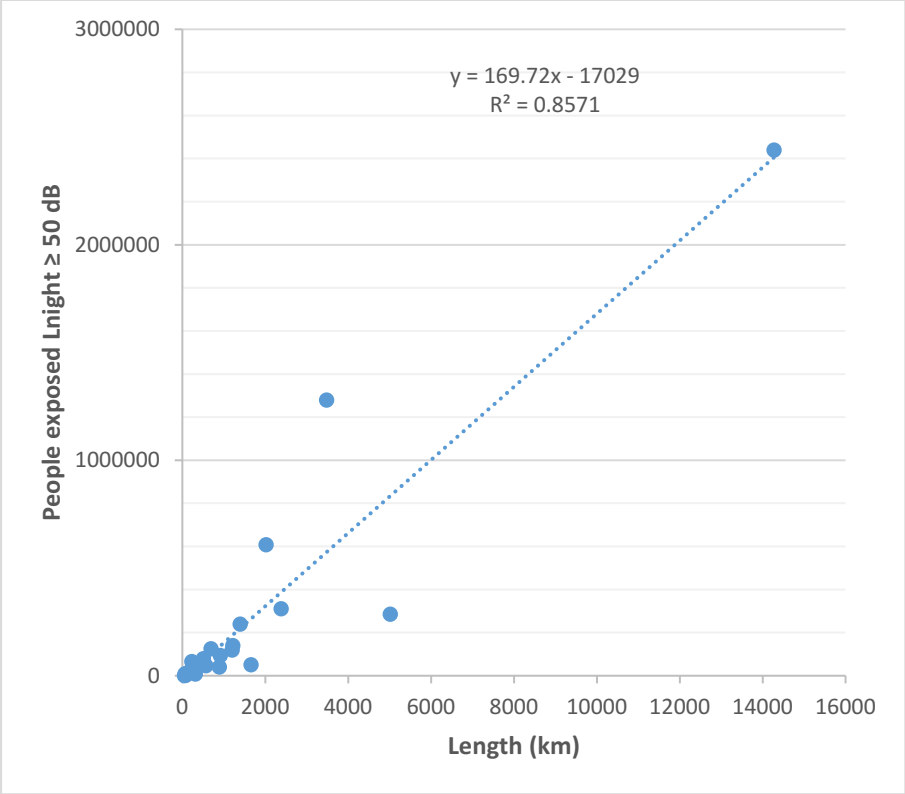


Major railways (L_{den})



DE has been included once as a total value for the whole country and not by region because major railways DF1_5 is mainly reported by Eisenbahn-Bundesamt.

Major railways (L_{night})

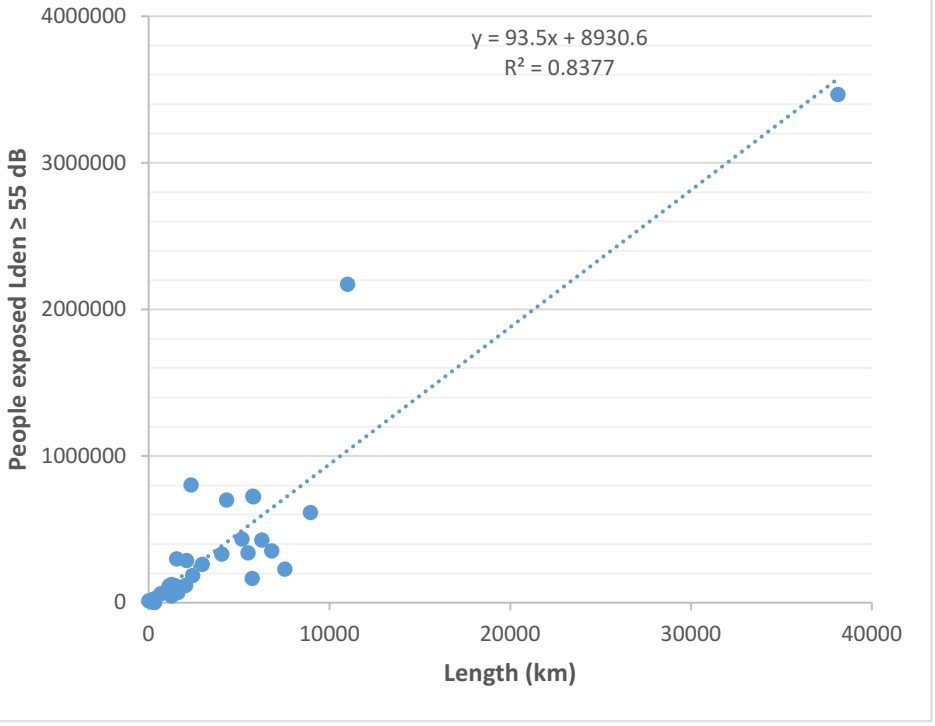


DE has been included once as a total value for the whole country and not by region because major railways DF1_5 is mainly reported by Eisenbahn-Bundesamt.

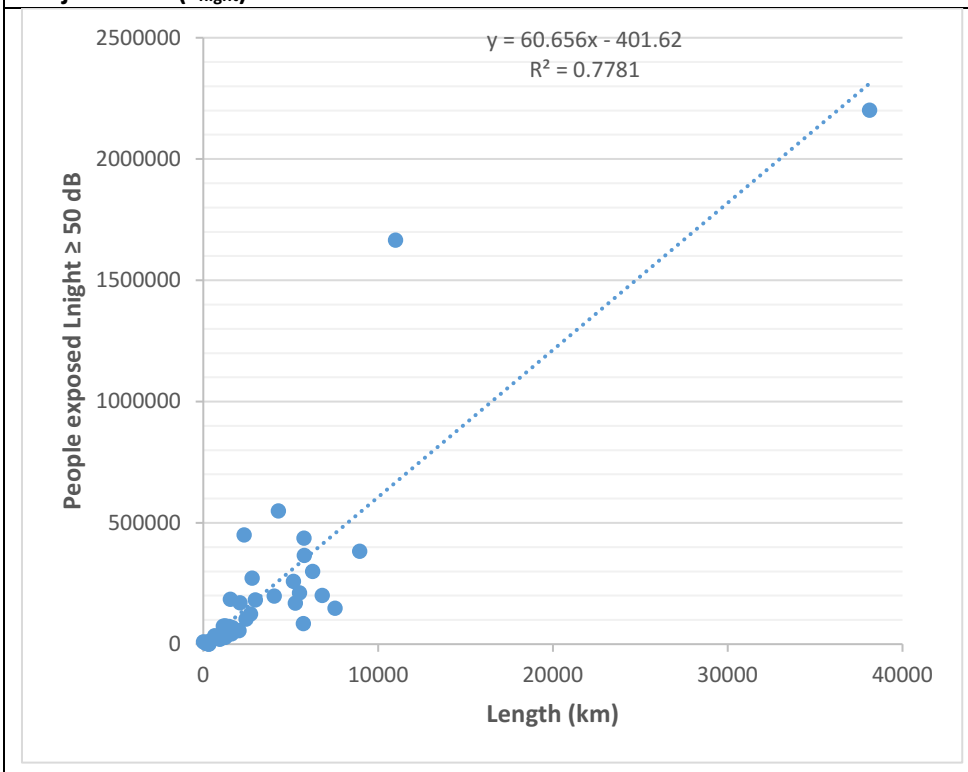
Reporting Period 2017:

The correlations used are the following ones:

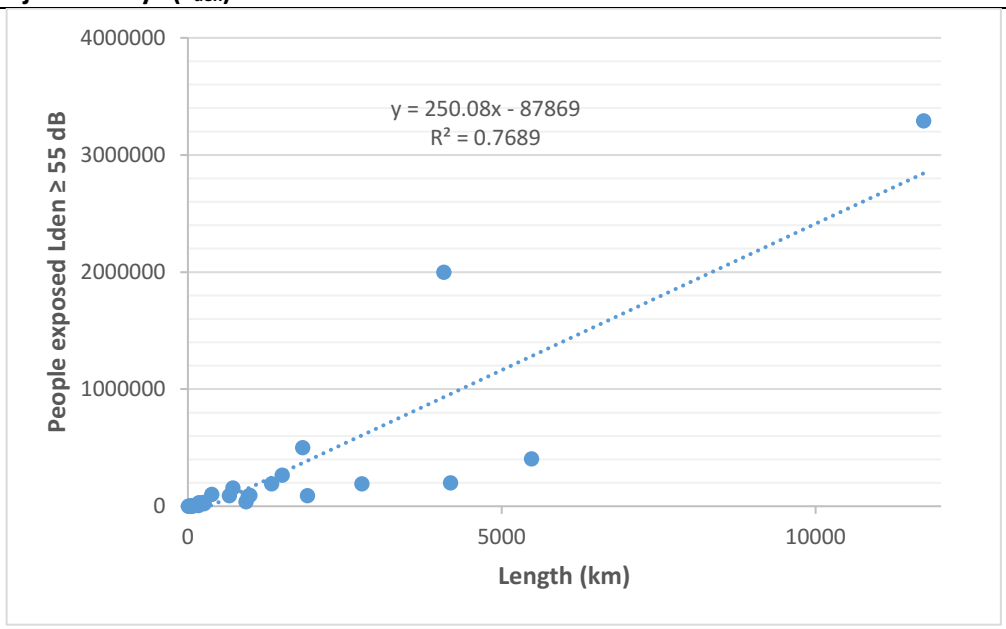
Major roads (L_{den})



Major roads (L_{night})

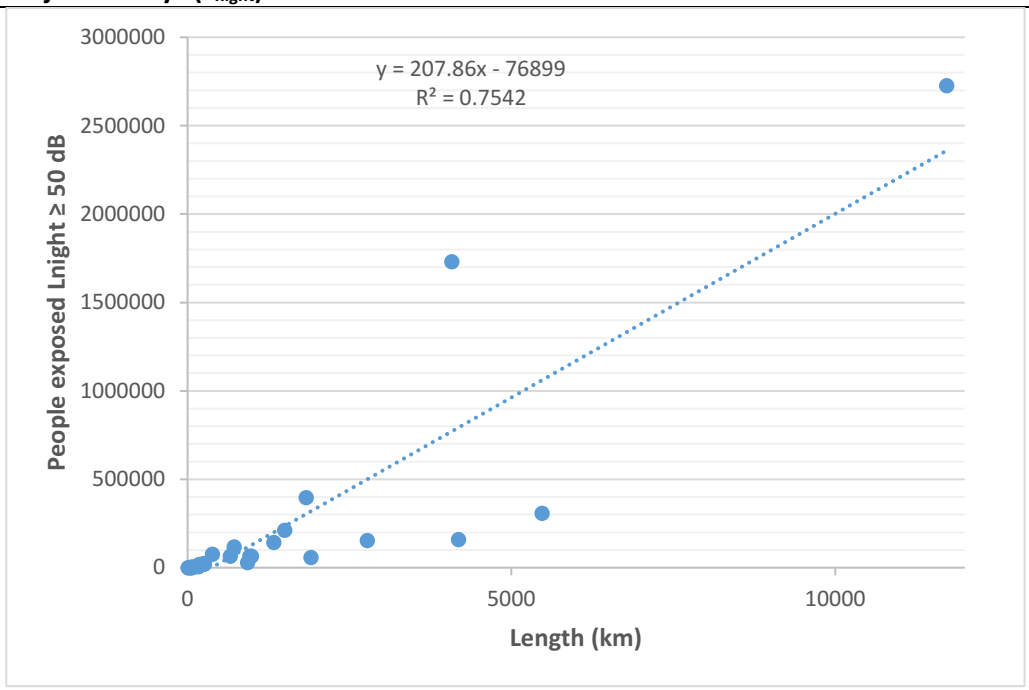


Major railways (L_{den})



DE has been included once as a total value for the whole country and not by region because major railways DF1_5 is mainly reported by Eisenbahn-Bundesamt.

Major railways (L_{night})



DE has been included once as a total value for the whole country and not by region because major railways DF1_5 is mainly reported by Eisenbahn-Bundesamt.

Once the total number of people exposed is obtained, we distribute the total population exposed between the different noise bands.

- In order to perform this distribution, all the countries has been included in the calculation (countries considered incomplete from the reporting point of view have been considered

correct from the noise bands distribution point of view, as representative for a specific area of the territory assuming to be as well representative for the complete territory).

- Based on the total number of people exposed per country, we calculate the percentage that each noise band represent versus the total number of people exposed, for L_{den} and for L_{night}, and then we derive the mean at European level.
    - It needs to be taken into consideration that the percentage values have been obtained discarding the countries or regions providing 0 people exposed in all noise bands (L_{den} and L_{night}, or L_{den}, or L_{night}). Due to the rounding process, 0 could mean 0 to 49 people exposed, although the distributions would not be accurate enough if calculated as 20% in each noise band, so those countries or regions have been discarded.

The percentages used to distribute the total number of people exposed in the different noise bands have been the following ones:

Reporting 2012:

MAJOR ROADS									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
48.58	25.17	17.23	7.73	1.29	51.15	31.07	14.15	3.31	0.32
MAJOR RAILWAYS									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
55.36	24.81	11.38	5.83	2.62	55.81	24.48	11.93	5.57	2.21

Reporting 2017:

MAJOR ROADS									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
51.29	24.51	16.95	6.32	0.93	54.33	30.32	13.09	1.94	0.32
MAJOR RAILWAYS									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
57.27	24.36	11.17	5.12	2.08	56.83	25.8	11.34	4.82	1.21

If the country has reported incomplete exposure information for second round, we have estimated the missing exposure information following the previous points for the missing length. The estimated results are added to the data already reported by the country.

Case 2: Gap filled or missing specific noise bands gap filled with data reported in 2012 (process only made for third round data -2017):

This process has been applied to those countries with data not reported or missing specific noise bands in 2017 but with data reported and considered complete in second round (2012)

List of countries with complete/partial gap filling for major roads:

Country	**Region**	**Gap fill**	**Country**	**Region**	**Gap fill**
IT	-	Total	NO	-	Missing bands
LI	-	Total			

List of countries with complete/partial gap filling for major railways:

Country	Region	Gap fill	Country	Region	Gap fill
RO	-	Total	SK	-	Missing bands

Case 3: Countries not providing information at all:

Countries discarded for the assessment in reporting 2012 and reporting 2017.

In the case of major roads, the region of Brussels (Belgium) and Turkey have been excluded. For major railways, Liechtenstein and Turkey.

5 END agglomerations data: gap filling

5.1 Gap filling method for agglomerations- road

This method is based on the working paper establishing a methodological proposal to interpolate a complete coverage on noise exposure at EU level (ETC/ACM, 2015).

When data not available concerning the total number of inhabitants, the following sources have been used:

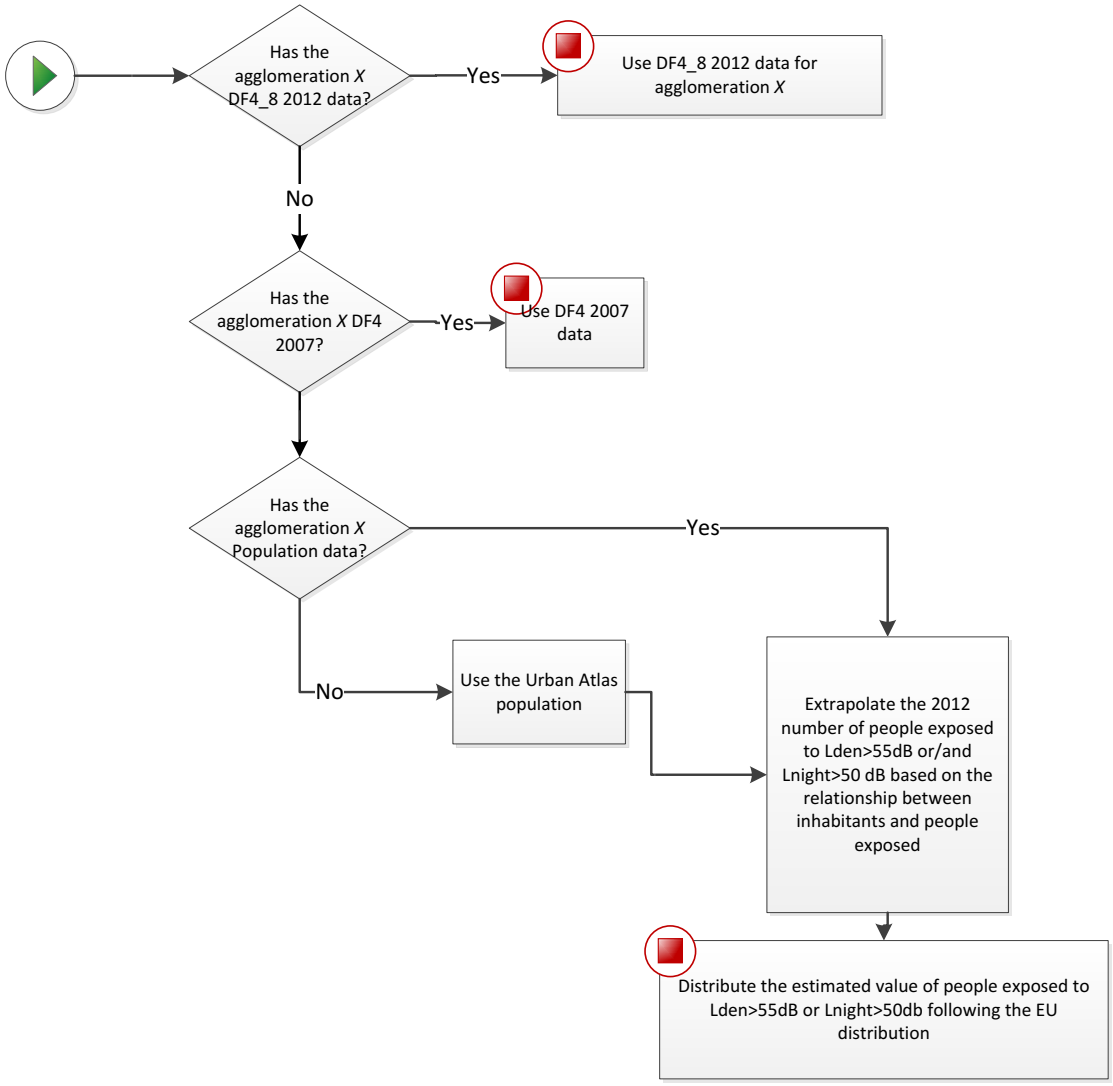
- Urban Audit
- Wikipedia

To gap fill 2017 reporting period, data considered complete for the 2012 reporting period has been directly used in the gap filling process (based on results found in ETC/ACM, 2016). If 2012 data is not available, the correlation between number of people exposed in 2017 and number of inhabitants have been calculated to estimate the number of people exposed.

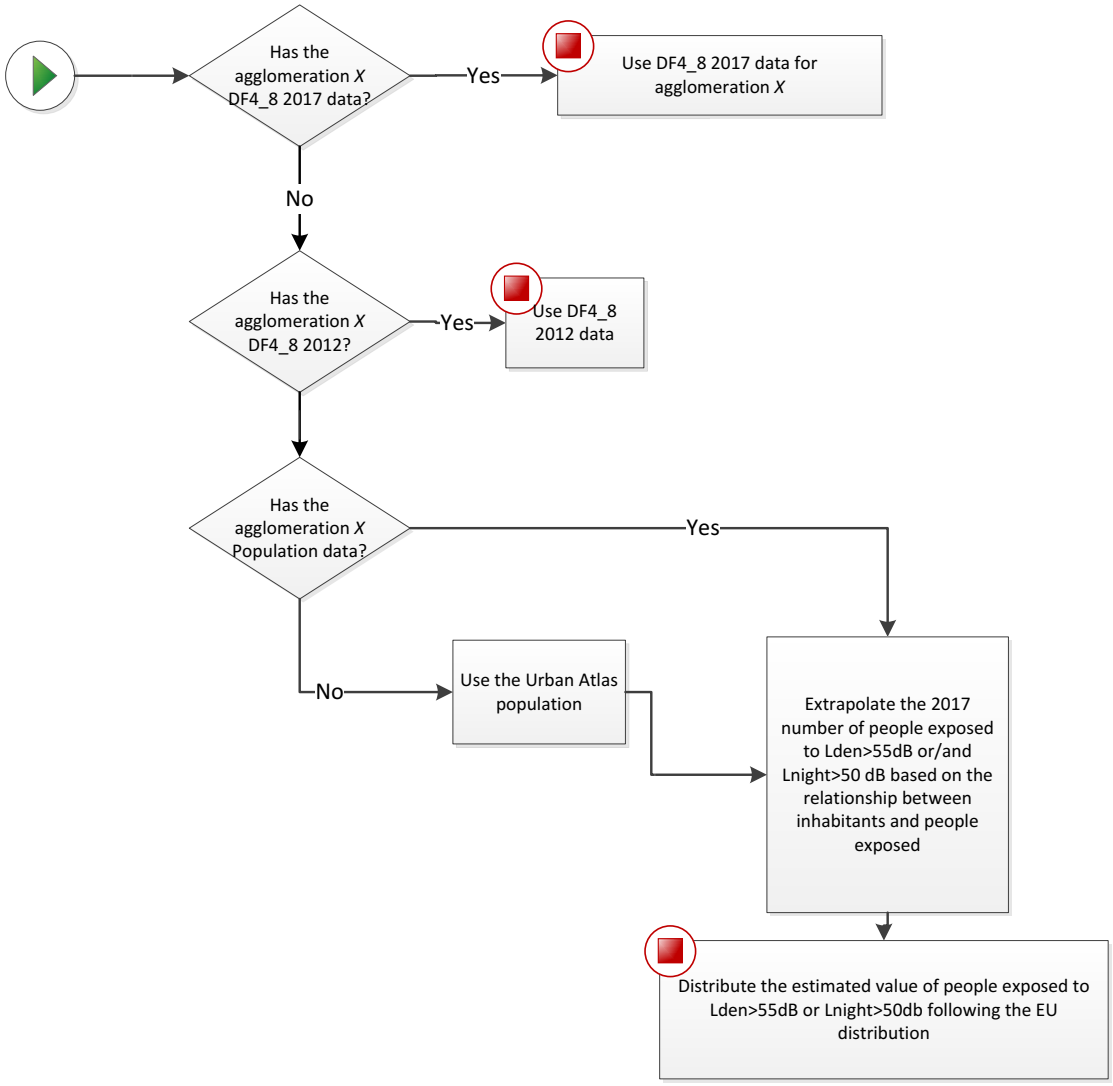
To gap fill 2012 reporting period, data considered complete for the 2007 reporting period has been directly used in the gap filling process. If 2007 data is not available, the correlation between number of people exposed in 2012 and number of inhabitants have been calculated to estimate the number of people exposed.

The following schemas has been used to gap fill the agglomerations not complete for reporting period 2012 and reporting period 2017.

Gap filling schema for reporting period 2012:



Gap filling schema for reporting period 2017:



Case 1: Gap filled based on EU distribution and EU mean

The agglomerations are gap filled as follows:

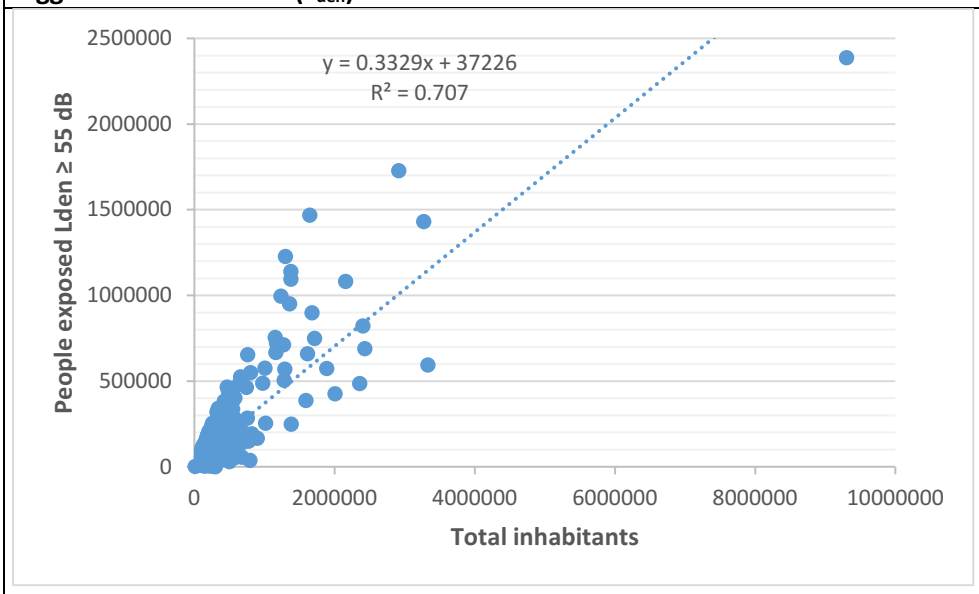
1) We calculate the correlation between the total number of inhabitants and the total number of people exposed to levels starting at 55 dB L_{den} and higher, and also to the total number of people exposed to levels starting at 50 dB L_{night} and higher.
   A small number of agglomerations declared more than 100% of the total population exposed. This is of course an error and while highlighted to the corresponding Member States, for the purpose of this exercise we have adjusted the exposed population to 100%. In order to adjust the exposed population to a maximum of 100%, the following steps have been implemented:
   - Calculate the number of people exposed that should be reduced: difference between the total inhabitants + 300 (due to rounded processes) and the sum of people exposed to noise levels starting at 55 dB L_{den} and higher, and to noise levels starting at 50 dB L_{night} and higher.
   - Calculate the percentage of people exposed per noise band

- Reduce the number of people exposed per noise band using the percentages obtained in the previous step (a different reduction of people is expected to be applied in each noise band)

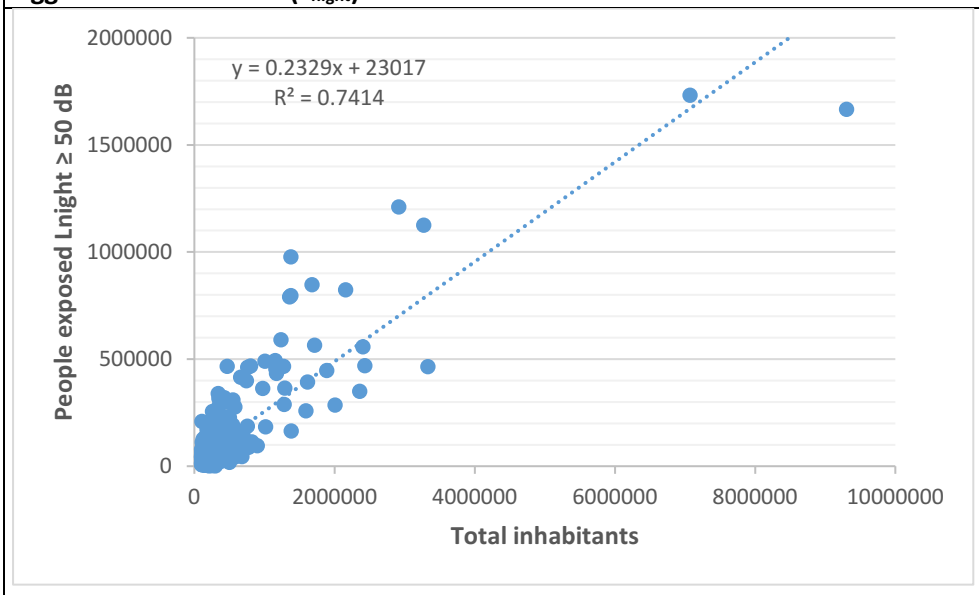
So, to calculate the correlation between the total number of inhabitants and the total number of people exposed, we used the adjusted table. The correlations used are the following ones:

Reporting 2012:

Agglomerations-roads (L_{den})

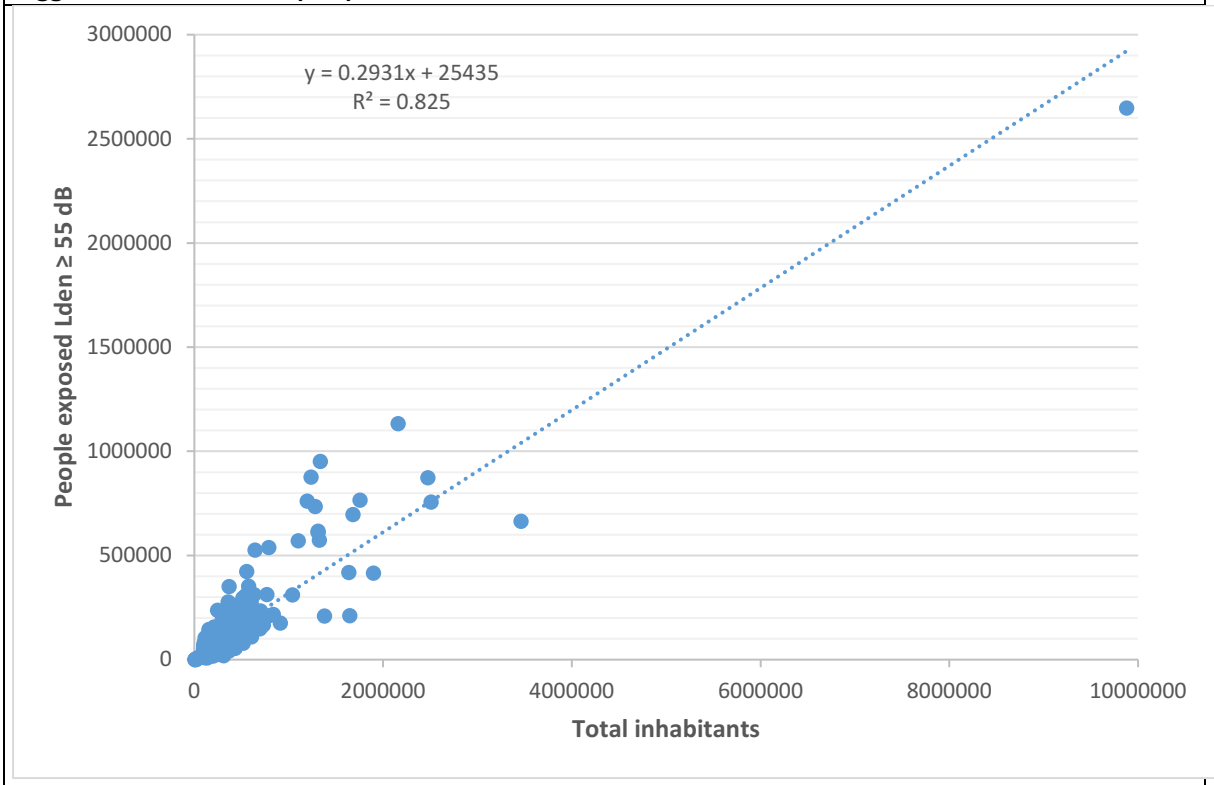


Agglomerations-roads (L_{night})

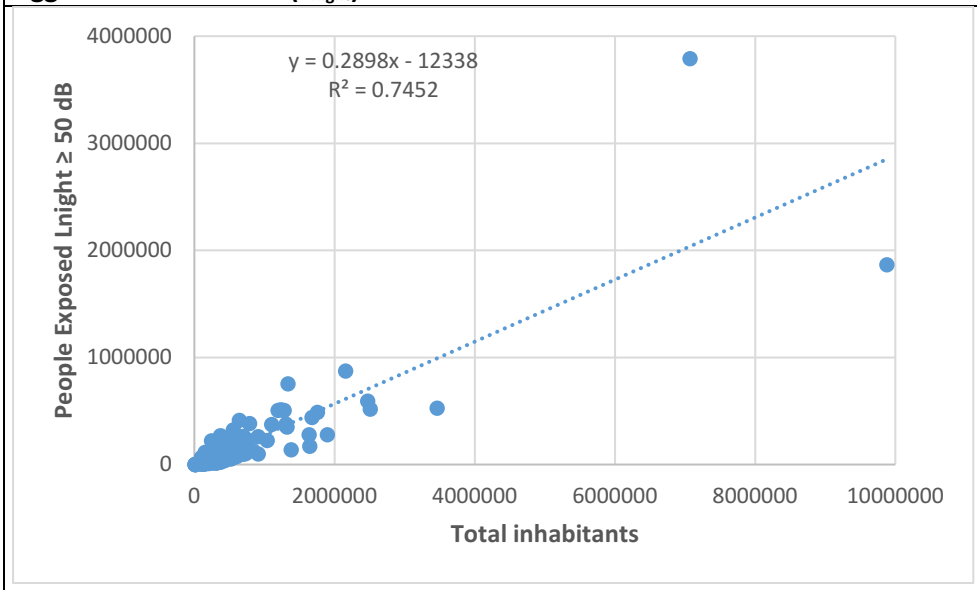


Reporting 2017:

Agglomerations-roads (L_{den})



Agglomerations-roads (L_{night})



2) Once the estimated total number of people exposed is obtained, we distribute the population between the different noise bands.
   - Based on the total number of people exposed per each agglomeration reported by Member States, we calculate the percentage that each noise band represent versus the total number of people exposed, for L_{den} and for L_{night}, and then we derive the mean at European level.

- It needs to be taken into consideration that the percentage values have been obtained discarding the agglomerations providing 0 people exposed in all noise bands (L_{den} and L_{night}, or L_{den}, or L_{night}). Due to the rounding process, 0 could mean 0 to 49 people exposed, although the distributions would not be accurate enough if calculated as 20% in each noise band, so those agglomerations have been discarded.

The percentages used to distribute the total number of people exposed in the different noise bands have been the following ones:

2012:

Agglomeration-roads									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
40.34	29.35	20.75	8.48	1.07	50.93	32.59	14.07	2.19	0.21

2017:

Agglomeration-roads									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
45.77	28.29	18.29	7.03	0.62	53.74	31.73	12.96	1.43	0.15

Case 2: Gap filled or missing specific noise bands gap filled based on previous round values

Reporting 2012:
The agglomeration will be gap filled with the same data reported for first round (DF4 2007).

Country	**Region**	**Nº Agg**	**Country**	**Region**	**Nº Agg**
BE	B	1	FR	-	5
ES	-	6	RO	-	1

Reporting 2017:
The agglomeration will be gap filled with the same data reported for second round (DF4_8 2012).

Country	**Region**	**Nº Agg**	**Country**	**Region**	**Nº Agg**
BE	F	1	ES	-	30
BE	W	2	FR	-	47
BG	-	1	IT	-	33
CY	-	2	NO	-	2
DE	NI	2	RO	-	15
DE	NW	3	SK	-	2

The missing agglomerations in 2012 and in 2017 do not necessarily need to be coincident, as it depends on the information being reported by Member States in each reporting period.

5.2 Gap filling method for railway noise, aircraft noise and industrial noise inside agglomerations

This section summarizes the method applied to gap fill exposure information for railways noise, aircraft noise and industrial noise inside agglomerations.

It should be taken into consideration that if noise exposure data is reported but some specific noise bands are missing in an agglomeration, the criteria has been to use the previous round values (2012 data in the case of third round and 2007 data in the case of second round) and if not available, the EU mean values. More detailed explanations of the process can be found below.

The methods described are based on the working paper establishing a methodological proposal to interpolate a complete coverage on noise exposure at EU level (ETC/ACM, 2015).

When data not available concerning the total number of inhabitants, the following sources have been used:

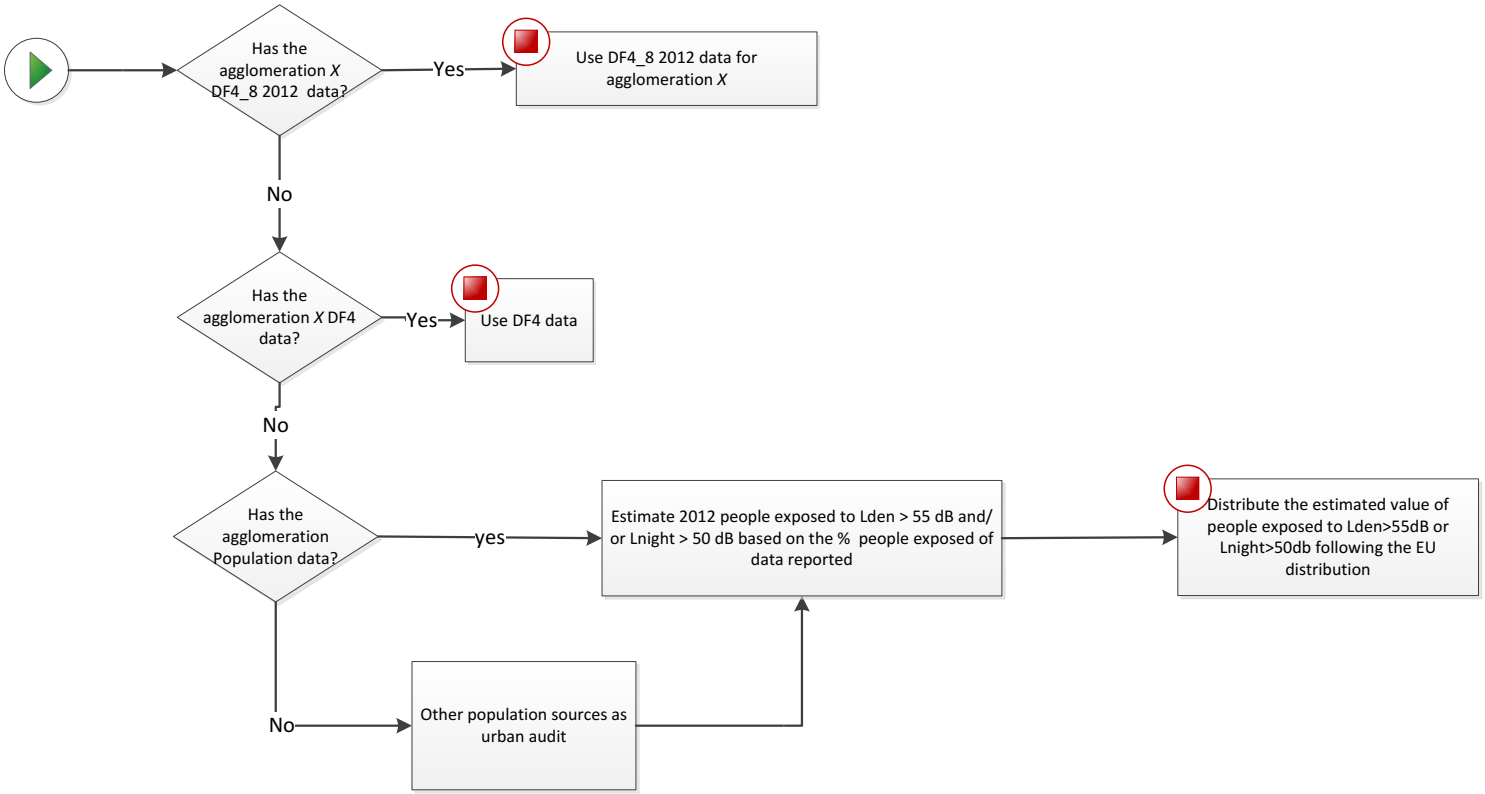
- Urban Audit
- Wikipedia

To gap fill 2017 reporting period, data considered complete for the 2012 reporting period has been directly used in the gap filling process (based on results found in ETC/ACM, 2016). If 2012 data is not available, the mean percentage of people exposed to that noise source for 2017 have been used to estimate the number of people exposed in each agglomeration.

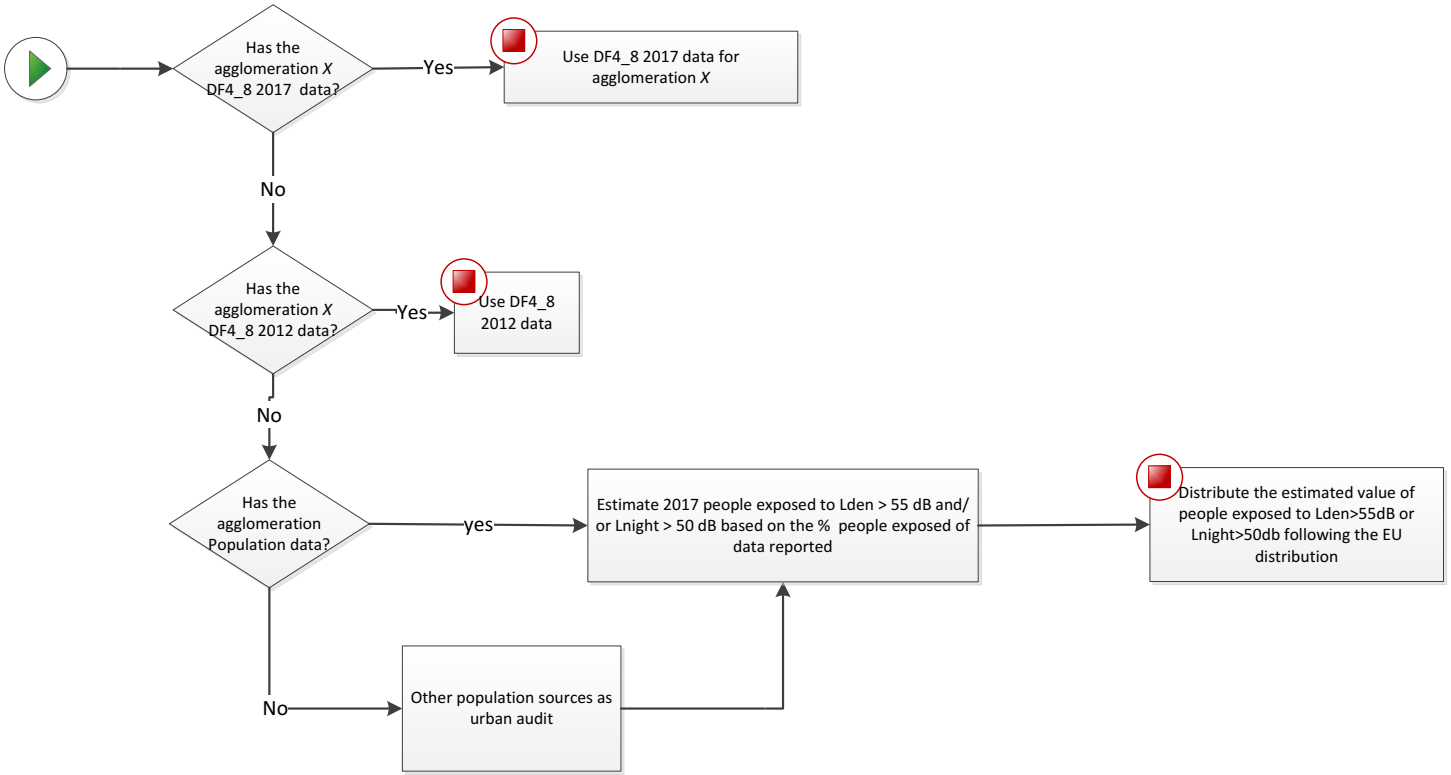
To gap fill 2012 reporting period, data considered complete for the 2007 reporting period has been directly used in the gap filling process. If 2007 data is not available, the mean percentage of people exposed to that noise source for 2012 have been used to estimate the number of people exposed in each agglomeration.

The following schemas has been used to gap fill exposure values for railway noise, aircraft noise and industrial noise inside agglomerations not complete for reporting period 2012 and reporting period 2017.

Gap filling schema for reporting period 2012:



Gap filling schema for reporting period 2017:



Case 1: Gap filled or missing specific noise bands gap filled based on previous round values

Reporting period 2012:
Use the exposure values reported in DF4 (2007)

Agglomerations - Air					
Country	**Region**	**Nº Agg**	**Country**	**Region**	**Nº Agg**
BE	B	1	RO	-	1
ES	-	7	SI	-	1
FR	-	11			
Agglomerations - Industry					
Country	**Region**	**Nº Agg**	**Country**	**Region**	**Nº Agg**
ES	-	6	RO	-	1
FR	-	14			
Agglomerations - Railways					
Country	**Region**	**Nº Agg**	**Country**	**Region**	**Nº Agg**
BE	B	1	FR	-	2
ES	-	4	RO	-	1

In the case of an agglomeration declaring -1 in DF4 (data not applicable, meaning that a source is not available), the -1 will be maintained in DF4_8 2012. Nevertheless, this assumption may underestimate the number of people exposed, especially to rail noise inside agglomerations due to the threshold change between round 1 and round 2 implying the inclusion of more railways in the noise mapping exercise.

Reporting period 2017:
Use the exposure values reported in DF4_8 (2012)

Agglomerations - Air					
Country	**Region**	**Nº Agg**	**Country**	**Region**	**Nº Agg**
BG	-	1	FR	-	13
DE	HB	1	IT	-	33
DE	NI	1	NO	-	5
DK	-	3	RO	-	17
ES	-	31	SE	-	11
FI	-	6	SK	-	2
Agglomerations - Industry					
Country	**Region**	**Nº Agg**	**Country**	**Region**	**Nº Agg**
BE	W	2	ES	-	28
BG	-	1	FI	-	6
CY	-	2	FR	-	23
DE	NI	3	IT	-	33
DE	NW	3	NO	-	5
DE	ST	1	RO	-	15
DK	-	3	SK	-	2

Reporting period 2017: (cont.)
Use the exposure values reported in DF4_8 (2012)

Agglomerations - Railways					
Country	**Region**	**Nº Agg**	**Country**	**Region**	**Nº Agg**
BE	F	1	FR	-	43
BE	W	2	IT	-	33
BG	-	1	NO	-	4
DE	NI	1	RO	-	18
DK	-	4	SK	-	2
ES	-	29			

In the case of an agglomeration declaring -1 in DF4_8 2012 (data not applicable, meaning that a source is not available), the -1 will be maintained in DF4_8 2017.

Case 2: Gap filled or missing specific noise bands gap filled based on EU mean

In order to obtain the total number of people exposed to the different noise sources per each agglomeration, we calculate the percentage of the people exposed per L_{den} and L_{night} per each source using all the agglomerations reporting data. Once obtained, we calculate the mean value at EEA level.

Reporting 2012:
The percentages of exposed population being used are the following ones:

Agglomerations - railways	
L_{den}	L_{night}
6.48	4.97
Agglomerations - air	
L_{den}	L_{night}
2.05	0,74
Agglomerations - industry	
L_{den}	L_{night}
0,49	0,25

Reporting 2017:
The percentages of exposed population being used are the following ones:

Agglomerations - railways	
L_{den}	L_{night}
6.29	4.77
Agglomerations - air	
L_{den}	L_{night}
1.72	0,5
Agglomerations - industry	
L_{den}	L_{night}
0,36	0,21

Once the total number of people exposed is obtained, we distribute the population between the different noise bands.

Based on the total number of people exposed per agglomeration, we calculate the percentage that each noise band represent versus the total number of people exposed, for L_{den} and for L_{night}, and then we derive the mean at European level.

It needs to be taken into consideration that the percentage values have been obtained discarding the agglomerations providing 0 people exposed in all noise bands (L_{den} and L_{night}, or L_{den}, or L_{night}). Due to the rounding process, 0 could mean 0 to 49 people exposed, although the distributions would not be accurate enough if calculated as 20% in each noise band, so those agglomerations have been discarded.

The percentages used to distribute the total number of people exposed in the different noise bands have been the following ones:

Reporting 2012:

Agglomeration-railways									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
56.23	26.32	11.57	4.4	1.48	60.17	25.24	9.9	3.69	1
Agglomeration-air									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
81.11	14.93	3.24	0.59	0.13	83.89	13.4	2.58	0.13	0.01
Agglomeration-industry									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
75.35	15.82	6.36	1.16	1.31	73.16	15.31	5.15	1.46	4.92

Reporting 2017:

Agglomeration-railways									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
58.48	26.16	11.07	3.45	0.84	62.21	25.53	9.04	2.69	0.53
Agglomeration-air									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
84.16	13.73	1.88	0.23	0	88.04	11.51	0.44	0.01	0
Agglomeration-industry									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
74.63	16.68	5.95	1.27	1.47	74.26	15.83	6.54	1.48	1.89

6 END Major airport exposure data outside agglomerations: gap filling

This section summarises the method applied to gap fill exposure information for major airports outside agglomerations.

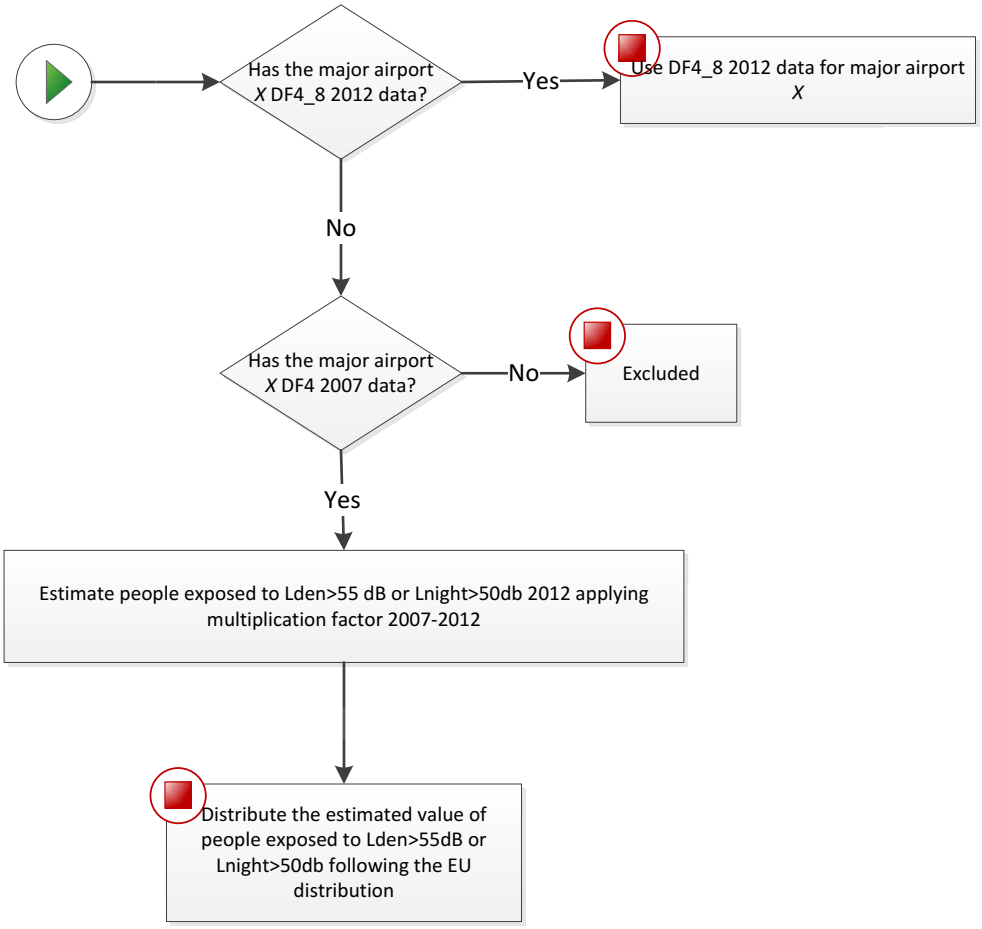
To gap fill 2017 reporting period, 2012 data has been used in the gap filling process applying a change multiplication factor between 2012 and 2017 (based on results found in ETC/ACM, 2016). If 2012 data

is not available, data from 2007 has been used but applying a multiplication factor between 2007 and 2017.

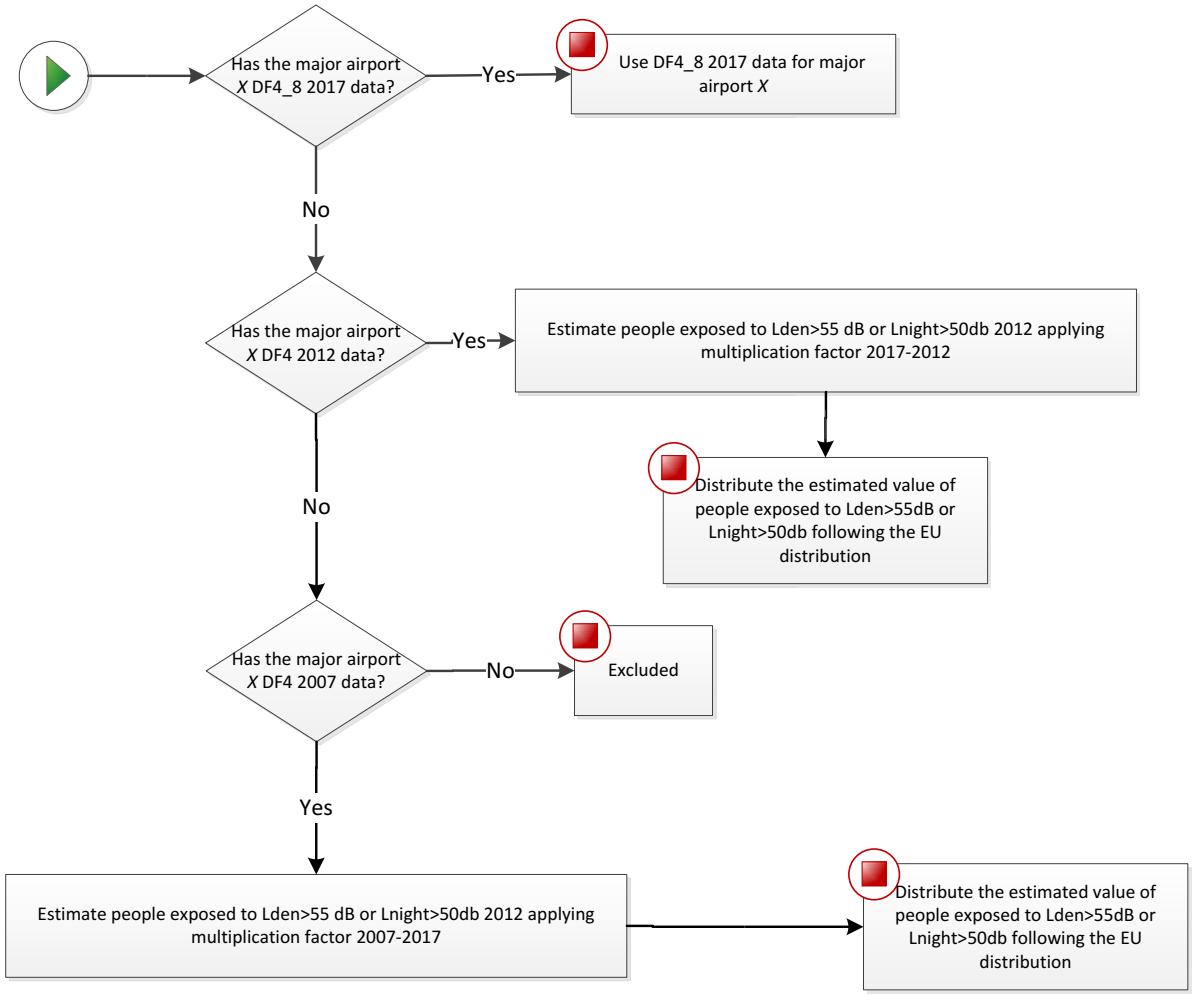
To gap fill 2012 reporting period, 2007 data has been used in the gap filling process applying a change multiplication factor between 2007 and 2012.

The following schemas has been used to gap fill the major airports exposure values not complete for reporting period 2012 and reporting period 2017.

Gap filling schema for reporting period 2012:



Gap filling schema for reporting period 2017:



Case 1: Gap filled based on previous round values plus multiplication factor

In this case, the people exposed to L_{den} ≥ 55 dB and/or people exposed to L_{night} ≥ 50dB has been estimated by applying a multiplication factor at the people exposed L_{den} ≥ 55 dB and/or people exposed L_{night} ≥ 50 dB from the previous round.

The multiplication factor has been proposed by Jones, N., 2013, and updated with the latest data available, provided by MS until 01/01/2019.

A multiplication factor for L_{den} and another for L_{night} has been calculated as the total percentage of change between two reporting periods. That is, the multiplication factor for L_{den} has been calculated as: (sum of people exposed to L_{den} ≥ 55 dB for all major airports from period 2) - (sum of people exposed to L_{den} ≥ 55 dB for all major airports from period 1) / (sum of people exposed to L_{den} ≥ 55 dB for all major airports from period 1) * 100.

In the case of reporting 2012, a multiplication factor for L_{den} and another for L_{night} has been calculated by comparing the data reported in 2007 vs 2012. For the reporting 2017, two multiplication factors have been calculated, one comparing the data reported in 2012 vs 2017, and a second one comparing data reported 2007 vs 2012.

The same formulas have been applied to calculate the multiplication factor for L_{night} values.

The values used are the following ones:

Reporting 2012

Multiplication factor 2007-2012

Major Airports	
L_{den}	L_{night}
-42.32	-52.07

Reporting 2017

Multiplication factor 2007-2017

Major Airports	
L_{den}	L_{night}
-47.01	-2.19

Multiplication factor 2012-2017

Major Airports	
L_{den}	L_{night}
15.24	48.83

Once the total number of people exposed is obtained, we distribute the population between the different noise bands.

Based on the total number of people exposed per each major airport, we calculate the percentage that each noise band represent versus the total number of people exposed, for L_{den} and for L_{night}, and then we derive the mean at European level.

It needs to be taken into consideration that the percentage values have been obtained discarding the major airports providing 0 people exposed in all noise bands (L_{den} and L_{night}, or L_{den}, or L_{night}). Due to the rounding process, 0 could mean 0 to 49 people exposed, although the distributions would not be accurate enough if calculated as 20% in each noise band, so those major airports have been discarded.

The percentages used to distribute the total number of people exposed in the different noise bands have been the following ones:

Reporting 2012

Major Airports									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
78.77	18.01	2.81	0.24	0.17	80.51	16.03	2.7	0.77	0

Reporting 2017

Major Airports									
L_{den} (dB bands)					L_{night} (dB bands)				
55-59	*60 – 64*	*65-69*	*70-74*	*>75*	*50-54*	*55-59*	*60 – 64*	*65-69*	*>70*
81.5	15.72	2.32	0.39	0.06	82.54	14.48	2.98	0.01	0

7 Results

The results of the gap filling process stating which method has been applied can be encountered in the following link:

https://forum.eionet.europa.eu/etc-atni-consortium/library/subvention-2019/task-deliveries-action-plan-2019/task-1.1.5.1-noise-data-operational-compilation-and-management/subtask-1.3-gap-filling

8 References

ETC/ACM (2015). Methodological proposal to interpolate a complete coverage on noise exposure at EU level. Fons, J., Sáinz, M., Blanes, N., Houthuijs, D.. ETC/ACM Working paper, December 2015.

ETC/ACM (2016). END gap filling data 2012: outcomes' evaluation. Comparison between gap filled data results in 2016 and 2017. Fons, J., Blanes, N., Ramos, M.. ETC/ATM Working paper, October 2017.

Jones, N. (2013). Forecasting ENDRM DF4_8 data to 2020, 2030 and 2050. Extrium P058, November 2013.

European Topic Centre on Air pollution,
transport, noise and industrial pollution
c/o NILU – Norwegian Institute for Air Research
P.O. Box 100, NO-2027 Kjeller, Norway
Tel.: +47 63 89 80 00
Web : https://www.eionet.europa.eu/etcs/etc-atni
Email: etc.atni@nilu.no

The European Topic Centre on Air pollution, transport, noise and industrial pollution (ETC/ATNI) is a consortium of European institutes under contract of the European Environment Agency.

European Environment Agency
European Topic Centre on Air pollution,
transport, noise and industrial pollution