

Appendix 4

Health Impact Assessment of Outdoor Air Pollution

Guidelines for HIA calculations

French HIA software (PSAS-9)

Version 2005

User's book

Department of Health and Environment – Institut de Veille Sanitaire

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1. Background

The French HIA software (EIS-PA from the PSAS-9 programme) is a support tool to carry out health impact assessments (HIA) of urban air pollution according to the methodology recommended by the Institut de Veille Sanitaire (InVS).

The essential steps of HIA are presented in Box 1.

*Box 1. Essential steps in health impact calculation

An estimate of the impact can be based on the calculation of the attributable proportion (AP), indicating the fraction of the health outcome, which can be attributed to the exposure in a given population (provided there is a causal association between the exposure and the health outcome). With the population distribution of exposure determined in the exposure assessment stage, and the identified exposure - consequence function, one can calculate the attributable proportion using the formula:

$$AP = \frac{\sum \{ [RR(c) - 1] * p(c) \}}{\sum [RR(c) * p(c)]} \quad [1]$$

where: $RR(c)$ - relative risk for the health outcome in category c of exposure

$p(c)$ - proportion of target population in category c of exposure

Knowing (or, often, assuming) a certain underlying frequency of the outcome in the population, I , the rate (or number of cases per unit population) attributed to the exposure in the population can be calculated as:

$$I_E = I * AP$$

Consequently, the frequency of the outcome in the population free from the exposure can be estimated as:

$$I_{NE} = I - I_E = I * (1 - AP) \quad [2]$$

For a population of a given size N , this can be converted to the estimated number of cases attributed to the exposure, $N_E = I_E * N$.

Knowing the (estimated) incidence in non-exposed population and relative risk at a certain level of pollution, it is also possible to estimate an excess incidence ($I_+(c)$) and excess number of cases ($N_+(c)$), at a certain category of exposure:

$$I_+(c) = (RR(c) - 1) * p(c) * I_{NE} \quad [3]$$

$$N_+(c) = I_+(c) * N \quad [4]$$

*Obtained from APHEIS. Air Pollution and Health: A European Information System. Monitoring the Effects of Air Pollution on Public Health in Europe. Scientific Report 1999-2000

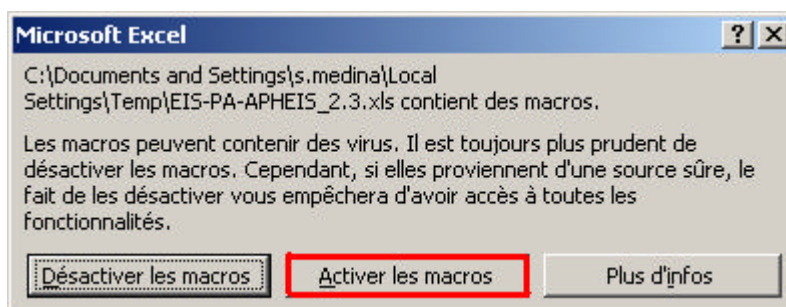
The EIS-PA software allows to carry out a standardized HIA, for several air pollution and health indicators and related to several scenarios.

2. Format

Warning: Once the data are entered, the size of this program might be big. Therefore, the time required to open, save and close this program might be relatively long.

2.1. Using Excel 2000

When opening the program, the following window may be displayed. Click on “Activer les macros” (“Activate the macros”) to continue.



2.2. Content

The EIS-PA has been adapted for ENHIS-1 use. Some columns are masked at the screen but not when printing. To print: 1) select what you want to print; 2) Print selection.

EIS-PA-ENHIS-1 is an excel file with 12 sheets,

- « Data » sheet with the data needed for the HIA,
- « AP descriptive findings » sheet with the specifications of the exposure indicators,
- 10 sheets for health impact calculations; each sheet is related to a different pollution indicator/scenario.

You have to enter your air pollution and health outcome data **only in the green cells** (if wanted, you can copy and paste these data, but remember only in the green cells)

NB: the excel sheets have different formulas that require data from some of the cells. **It is, therefore, extremely important not to add or erase lines, columns or cells or make any copy and paste, as it would change the calculation sheets.**

3. « Data » sheet

This sheet allows to enter the required data for the HIA of sheets number 3 to 12.

- The data must be **entered or pasted into the green parts** of the sheet, Column A corresponds to dates. In columns B to D are entered air pollution data and in column N health outcome data.
- The excel file recognises “,” as the indicator for decimals.
- In columns AI to AN of sheet 1 are the season definitions for summer and winter which must not be modified.
- **The white parts have values or calculation results that must not be altered.**
- Column titles are in yellow.

	A	B	C	D	G	H	K	M
1	Pollutants - Daily levels				Health outcomes - RR			
2	Dates	O3 8h max	O3 1h max	PM10	Effect type	Health outcome	Population	D
3	01/01/1998	31,73	43,23	32,00	Short term (ST)	Total mortality excluding external causes (ICD9 < 800 - ICD10 A00-R99)	all ages	
4	02/01/1998	50,54	54,39	25,00	Short term (ST)	Cardiovascular mortality (ICD9 390-459 - ICD10 I00-I99)	all ages	
5	03/01/1998	46,62	49,04	39,00	Short term (ST)	Respiratory mortality (ICD9 460-519 - ICD10 J00-J99)	all ages	
6	04/01/1998	44,69	55,19	49,00	Long term (LT)	Total postneonatal mortality ()	1 month - 1 year	
7	05/01/1998	44,74	48,56	28,00	Long term (LT)	Postneonatal respiratory mortality ()	1 month - 1 year	
8	06/01/1998	43,58	56,08	32,00	Long term (LT)	Postneonatal Sudden Infant Death Syndrom Mortality (ICD9 798.0 - ICD10 I00-I99)	1 month - 1 year	
9	07/01/1998	47,74	60,85	70,00	Short term (ST)	Emergency room visits for asthma ()	< 18 years	
10	08/01/1998	22,46	32,62	60,00				
11	09/01/1998	25,79	35,77	78,00				
12	10/01/1998	38,49	45,00	73,00				
13	11/01/1998	44,38	47,83	104,00				
14	12/01/1998	31,39	45,79	54,00				
15	13/01/1998	57,78	70,52	61,00				
16	14/01/1998	52,60	66,10	88,00				
17	15/01/1998	32,98	49,79	46,00				
18	16/01/1998	46,20	57,19	34,00				
19	17/01/1998	19,20	28,25	53,00				
20	18/01/1998	49,72	50,04	79,00				

	G	H	K	M	N	O	P	Q
1	Health outcomes - RR				RR - Increase of 10			
2	Effect type	Health outcome	Population	Daily mean of	RR lower	RR central	RR upper	Ref
3	Short term (ST)	Total mortality excluding external causes (ICD9 < 800 - ICD10 A00-R99)	all ages		1,0017	1,0031	1,0052	Grypa
4	Short term (ST)	Cardiovascular mortality (ICD9 390-459 - ICD10 I00-I99)	all ages		1,0022	1,0046	1,0073	Grypa
5	Short term (ST)	Respiratory mortality (ICD9 460-519 - ICD10 J00-J99)	all ages		1,0074	1,0113	1,0151	Grypa
6	Long term (LT)	Total postneonatal mortality ()	1 month - 1 year		1,022	1,048	1,075	Lac
7	Long term (LT)	Postneonatal respiratory mortality ()	1 month - 1 year		1,102	1,216	1,342	Lac
8	Long term (LT)	Postneonatal Sudden Infant Death Syndrom Mortality (ICD9 798.0 - ICD10 I00-I99)	1 month - 1 year		1,07	1,12	1,17	Woi
9	Short term (ST)	Emergency room visits for asthma () - Age < 18 years	< 18 years		1,0067	1,01155	1,01645	C/A
10	Short term (ST)	Hospital respiratory admissions () - Age < 15 years	< 15 years		0,998	1,01	1,021	And
11	Short term (ST)	Hospital respiratory admissions () - Age between 15 and 64 years	15 - 64 years		0,991	1,001	1,012	Anders
12	Short term (ST)	Hospital respiratory admissions () - Age > 64 years	> 64 years		0,998	1,005	1,012	Anders
13								
14								
15								
16								
17								
18								
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3.1. Air pollution exposure indicators

The chosen indicators are the ones decided by ENHIS-1 and for which there are informed exposure-response functions, i.e. particles less than 10 µm (PM10), ozone (O₃).

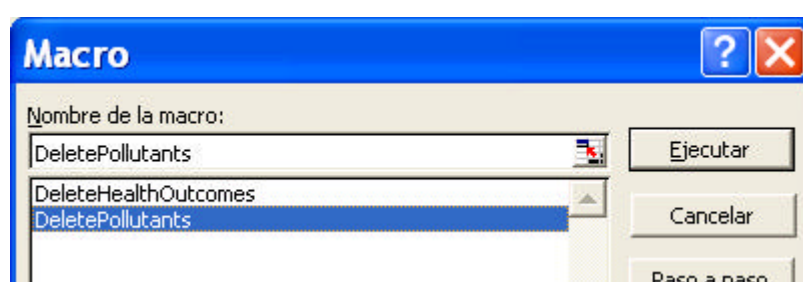
Be aware that for the HIA you enter a full year of data.

Check if you particles data need to be 'corrected'. In some cases, the monitoring methods used in your city may differ from that use in the populations in which RR have been

calculated. This is the case, for instance, of particles measured by automatic networks if the RR has been established in studies using gravimetric methods. **If your city uses automatic methods (TEOM or other) then you will have to convert your data using suitable conversion factors (Local from the Air Quality Network or European default correction factor 1.3).**

NB : on this «data » sheet, you are to paste the daily series of the pollution indicators calculated from the monitoring stations selected as suitable for the HIA. Procedure:

1. Before pasting the pollutant data, delete the existing data, if any, by using, from the menu bar, the function called “Tools/Macro/Macros/”. The window called “Macro” is displayed. Select the macro ‘DeletePollutants’ and click on “Execute”.



2. First, **enter or paste** your series for **the dates alone**. Paste into «A3 cell» the series of date, without the column titles, from the studied period chosen for your HIA. To do so, choose «Edition/special paste/values» from the menu.

	A	B
	Pollutants - Daily	
1		
2	Dates	O3 8h
3	01/01/1998	
4	02/01/1998	
5	03/01/1998	
6	04/01/1998	
7	05/01/1998	
8	06/01/1998	
9	07/01/1998	
10	08/01/1998	
11	09/01/1998	
12	10/01/1998	

3. Then paste your series for the air pollution indicators without the column titles (from the menu, choose «Edition/special paste/values».
 - In cell « B3 », the series for the 'O3 8h max' which are the maximum daily 8 hours mean, in $\mu\text{g}/\text{m}^3$

- In cell « C3 », the series for the 'O3 1h max', that is 1 hour maximum daily value in $\mu\text{g}/\text{m}^3$
- In cell « D3 », the series for the 'PM10' indicator, daily mean in $\mu\text{g}/\text{m}^3$

	A	B	C	D
1	Pollutants - Daily levels			
2	Dates	O3 8h max	O3 1h max	PM10
3	01/01/1998	31,73	43,23	32,00
4	02/01/1998	50,54	54,39	25,00
5	03/01/1998	46,62	49,04	39,00
6	04/01/1998	44,69	55,19	49,00
7	05/01/1998	44,74	48,56	28,00
8	06/01/1998	43,58	56,08	32,00
9	07/01/1998	47,74	60,85	70,00

4. If the studied periods are different for some of the indicators, remember to paste the data in the cell of the corresponding first date of the pollution indicator series.

	A	B	C	D
1	Pollutants - Daily levels			
2	Dates	O3 8h max	O3 1h max	PM10
3	01/01/1998	31,73	43,23	32,00
4	02/01/1998	50,54	54,39	25,00
5	03/01/1998	46,62	49,04	39,00
6	04/01/1998	44,69	55,19	49,00
7	05/01/1998	44,74	48,56	28,00
8	06/01/1998	43,58	56,08	32,00
9	07/01/1998	47,74	60,85	70,00

3.2. Health Outcomes

1. Before entering the health outcomes data, delete the existing data, if any, by using « Tools/ Macro/ Macros/ » from the menu bar. The window called "Macro" is then displayed. Select the macro 'DeleteHealthOutcomes' and click on "Execute".



2. The daily average number of health events for each health outcome (in the green area) must be entered or pasted.

	H	K	M	N	O	P	Q
1	Health outcomes - RR						RR - Increase of 10
2	Effect type	Health outcome	Population	Daily mean of outcome	RR lower	RR central	RR upper
3	Short term (ST)	Total mortality excluding external causes (ICD9 < 800 - ICD10 A00-R99)	all ages	17	1,0017	1,0031	1,0052
4	Short term (ST)	Cardiovascular mortality (ICD9 390-459 - ICD10 I00-I99)	all ages	5,6	1,0022	1,0046	1,0073
5	Short term (ST)	Respiratory mortality (ICD9 460-519 - ICD10 J00-J99)	all ages	1,6	1,0074	1,0113	1,0151
6	Long term (LT)	Total postneonatal mortality ()	1 month - 1 year	0,0219	1,022	1,048	1,075
7	Long term (LT)	Postneonatal respiratory mortality ()	1 month - 1 year		1,102	1,216	1,342
8	Long term (LT)	Postneonatal Sudden Infant Death Syndrom Mortality (ICD9 798.0 - ICD10 I00-I99)	1 month - 1 year		1,07	1,12	1,17
9	Short term (ST)	Emergency room visits for asthma () - Age < 18 years	< 18 years		1,0067	1,01155	1,01645
10	Short term (ST)	Hospital respiratory admissions () - Age < 15 years	< 15 years		0,998	1,01	1,021
11	Short term (ST)	Hospital respiratory admissions () - Age between 15 and 64 years	15 - 64 years		0,991	1,001	1,012
12	Short term (ST)	Hospital respiratory admissions () - Age > 64 years	> 64 years		0,998	1,005	1,012
13							
14							

3.3. The reference levels for the various HIA scenarios

Default values have already been entered for each of the scenarios chosen in ENHIS-1.

	T	V	W	Y	A
1	Scenarios				
2		O3 mean 8h - summer	O3 1h max - year	PM10 - year	
3	Short term (ST) HIA - Scenario 1 : reduction of all values above X to X $\mu\text{g.m}^{-3}$	120	180	20	
4	Short term (ST) HIA - Scenario 2 : reduction of all values above X to X $\mu\text{g.m}^{-3}$			50	
5	Short term (ST) HIA - Scenario 3 : reduction of all values by X $\mu\text{g.m}^{-3}$	10	10	5	
6					
7					
8	Long term (LT) HIA - Scenario 1 : reduction of annual mean above X to X $\mu\text{g.m}^{-3}$			20	
9	Long term (LT) HIA - Scenario 2 : reduction of annual mean above X to X $\mu\text{g.m}^{-3}$			40	
10	Long term (LT) HIA - Scenario 3 : reduction of annual mean by X $\mu\text{g.m}^{-3}$			5	
11					
12					
13					
14					
15					

3.4. Calculation of the number of days with air pollution by 10 $\mu\text{g}/\text{m}^3$ exposure category

This part of the «Data » sheet shows the number of days for each pollutant by year, by season and by 10 $\mu\text{g}/\text{m}^3$ exposure category. **These data allow creating figures in the “AP descriptive findings” sheet and therefore must not be altered.**

	A	CQ	CU	CV	CX	DC	DH	DI
1		categories 10 / number of days						
2		exposure category	O3 8h max - summer	O3 1h max - year	PM10 - year			
3		0 to 10	0	6	0			
4		10 to 20	0	15	21			
5		20 to 30	3	21	75			
6		30 to 40	20	30	97			
7		40 to 50	16	58	64			
8		50 to 60	53	55	40			
9		60 to 70	39	61	26			
10		70 to 80	30	57	20			
11		80 to 90	10	38	7			
12		90 to 100	5	9	5			
13		100 to 110	4	8	7			
14		110 to 120	1	4	2			

3.5. Relative risks of the exposure/response functions

The various **relative risks** used in this software and found in the columns O to Q are the ones decided for ENHIS-1 and **must not be altered** for the HIA. They are automatically imported for the calculations in the findings sheets.

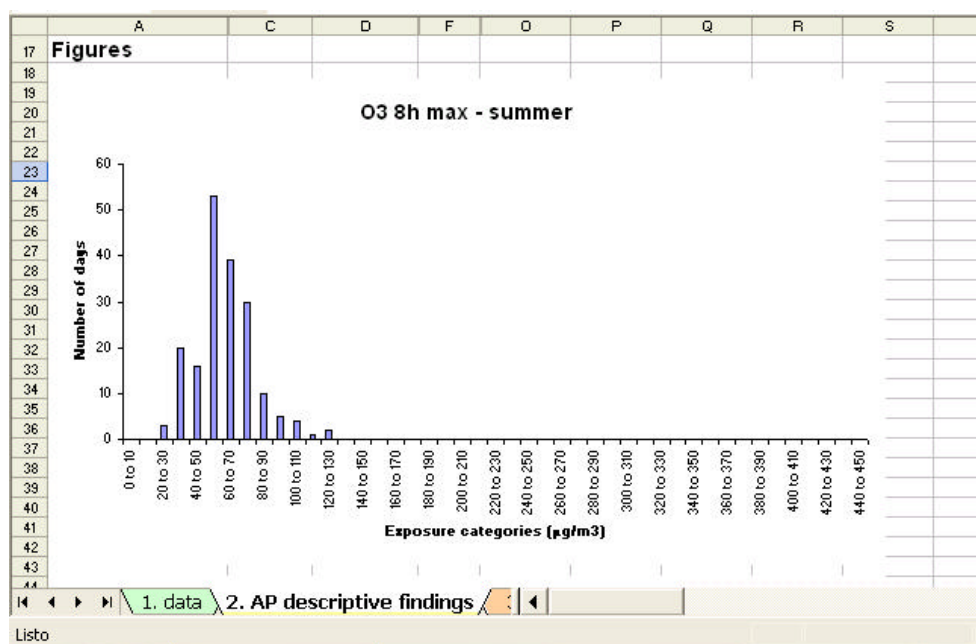
	K	M	N	O	P	Q	R
1	RR	RR - Increase of 10 µg.m-3					
2	Health outcome	Population	Daily mean of outcome	RR lower	RR central	RR upper	Reference paper
3	Total mortality excluding external causes (ICD9 < 800 - ICD10 A00-R99)	all ages	17	1,0017	1,0031	1,0052	Gryparis et al 2004
4	Cardiovascular mortality (ICD9 390-459 - ICD10 I00-I99)	all ages	5,6	1,0022	1,0046	1,0073	Gryparis et al 2004
5	Respiratory mortality (ICD9 460-519 - ICD10 J00-J99)	all ages	1,6	1,0074	1,0113	1,0151	Gryparis et al 2004
6	Total postneonatal mortality ()	1 month - 1 year	0,0219	1,022	1,048	1,075	Lacasana 2005
7	Postneonatal respiratory mortality ()	1 month - 1 year		1,102	1,216	1,342	Lacasana 2005
8	Postneonatal Sudden Infant Death Syndrom Mortality (ICD9 798.0 - ICD10 I00-I99)	1 month - 1 year		1,07	1,12	1,17	Woodruff 1997
9	Emergency room visits for asthma () - Age < 18 years	< 18 years		1,0067	1,0155	1,01645	CARB 2004
10	Hospital respiratory admissions () - Age < 15 years	< 15 years		0,998	1,01	1,021	Anderson 2004
11	Hospital respiratory admissions () - Age between 15 and 64 years	15 - 64 years		0,991	1,001	1,012	Anderson et al 2004
12	Hospital respiratory admissions () - Age > 64 years	> 64 years		0,998	1,005	1,012	Anderson et al 2004
13							

4. « AP descriptive findings» sheet

This sheet shows various descriptive results on pollution indicators for the entire studied period. Once copied, figures can be inserted into Word documents, using the function «Edition/ paste special/ image» from the menu.

- The tables with the distribution of exposure indicators;
- The figures showing the distribution of the various exposure indicators by categories of 10 µg/m³;

	A	C	D	F	O	P	Q	R	S
1	Distribution of air pollution indicators for the study period								
2	Note : calculation of % of missing values requires that data is entered for periods of 365 days, except for year 2000 you have to calculate missing values by hand using 366 days								
3		O3 8h - summer	O3 1h max - year	PM10 - year					
4	Number	183	365	365					
5	Minimum	27	8	14					
6	Percentile 5	33	18	19					
7	Percentile 25	52	44	29					
8	Median	60	60	38					
9	Percentile 75	72	74	55					
10	Percentile 95	94	93	84					
11	Percentile 98	103	110	101					
12	Maximum	129	149	120					
13	Daily mean	62	59	43					
14	standard error	18	23	20					
15	% missing values	0,00%	0,00%	0,00%					
16									



5. HIA findings sheets

The results of HIA in sheets 3 to 12 are automatically calculated from data contained in the “Data” sheet.

There are 10 findings sheets for HIA. Each sheet corresponds to the HIA results of a combination “pollution indicator – health indicator”. The title of the sheet is always displayed as following: **Type of HIA – pollution indicator – health indicator**.

The sheets are classified according to the health indicator in the following order :

- SHORT TERM

3. Ozone (8 hour max) -Total mortality
4. Ozone (8 hour max) -Cardiovascular mortality
5. Ozone (8 hour max) -Respiratory mortality
9. Ozone (1 hour) - Emergency room visits for asthma
10. PM₁₀ (daily mean)- Hospital respiratory admissions < 15 years
11. Ozone (8 hour max)- Hospital respiratory admissions 15-64 years
12. Ozone (8 hour max)- Hospital respiratory admissions >64

- "LONG TERM"

6. PM₁₀ Postneonatal total mortality
7. PM₁₀ Postneonatal respiratory mortality
8. PM₁₀ Postneonatal SIDS mortality

5.1. Summary description of data

Summary description of data is presented in tables for:

- Distribution of the air pollution indicator,
- Number of cases,
- Study period,
- Relative risk used.

	A	B	C	D	E	F
1	Health impact assessment (HIA) - Short term (ST)					
2						
3	Air pollution indicator	O3 8h max		Daily mean	Total number of cases	Study period (days)
4	Period	Summer		17	3111	183
5	Health outcome	Total mortality excluding external causes (ICD9 < 800 - ICD10 A00-R99)				
6						
7						
8	Air pollution indicator (µg/m3)	Value		lower	Relative risk central	upper
9	Percentile 5	33,1		1,0017	1,0031	1,0052
10	Percentile 25	51,9				
11	Percentile 50	60,0				
12	Percentile 75	71,8				
13	Mean	61,7		lower	β central	upper
14				0,000169856	0,00030952	0,000518653
15						
16						

5.2. HIA findings

1. The last table shows HIA findings, central estimates and 95% confidence intervals of the number of attributable cases, calculated for each scenario in the selected period.

[illegible]

6. Send the final excel file zipped.

Please name the file as follows: your cityname-EIS-PA-ENHIS-1.xls

Example:: Bilbao-EIS-PA-ENHIS-1.xls

Send the final excel file to a.letertre@invs.sante.fr and copy to s.medina@invs.sante.fr