Case study title:	**Poly Aromatic Hydrocarbon (Risk assessment case)**
Target group:	**General practitioners, Public health professionals**
Linked to modules:	**Indoor air pollution, Outdoor air pollution**
Source of case study:	**Bureau Medische Milieukunde, the Netherlands**
Case handling:	**This is a calculating exercise. Use powerpoint presentation and/or handouts based on the case description.**

This is an exercise to calculate the health risks for Poly Aromatic Hydrocarbons (PAH) in air in a local community.
An electricity plant makes electricity out of coal. Except several gasses like sulphur dioxide, nitrogen dioxide and also PM 10, the plant also emits PAH. These PAH are attached to the PM 10.
You are working as an environmental health officer in the regional inspectorate and you are asked to calculate the carcinogenic risk for inhabitants living their whole life 5 kilometres east of the plant.
The environmental inspectorate had ordered the electricity plant to have measurements done of the PAH-emissions of the plant during normal process. These data were handed to you (table 1).

Table 1. Concentrations of several PAH-compounds in the emitted air in **mg**/m^3:

Compound	Concentration in emitted air (mg/m^3)
Acenaphtene	0.4
Acenaphtylene	4
Benz[a]anthracene	0.4
Benzo[b]fluoroanthene	2.6
Benzo[j]fluoroanthene	3.6
Benzo[k]fluoroanthene	8
Benzo[a]pyrene	1.4
Chrysene	6.0
Dibenz[a,h]anthracene	0.8
Fluoroanthene	10
Indeno[1,2,3-c,d]pyrene	9.4
Phenanthrene	2
Pyrene	2

These emission data are put into a dispersion-model. You also need to insert in this model the height of the emission, the temperature of the emission, the direction of the wind (year), the amount of m^3 air per second, etc. The model can calculate the average yearly immission concentration 5 kilometres east of the emission-point. The model calculated that there will be a yearly average immission concentration 5 km east, of 1/2.000.000 of the above given emission concentration.

Question 1: Calculate the yearly average immission concentration of these PAH in **nanogram**/m^3.

Answer 1

Divide the emission concentration by 2.000.000. This cab be done by dividing by 2 and transfer milligrammes/ m^3 into nanogrammes/ m^3

Compound	Concentration in immission air (nanogram/ m^3)
Acenaphtene	0.2
Acenaphtylene	2
Benz[a]anthracene	0.2
Benzo[b]fluoroanthene	1.3
Benzo[j]fluoroanthene	1.8
Benzo[k]fluoroanthene	4.0
Benzo[a]pyrene	0.7
Chrysene	3.0
Dibenz[a,h]anthracene	0.4
Fluoroanthene	5
Indeno[1,2,3-c,d]pyrene	4.7
Phenanthrene	1
Pyrene	1

Question 2: Calculate the total carcinogenic potency of the immission concentration of PAH in nanogram BaP equivalent/ m^3

Information
The carcinogenic potency of a compound is compared to the carcinogenic potency of Benzo[a]pyreen (b-a-p).

Table 2: the carcinogenic potency of the compounds

Compound	Carcinogenic potency
Acenaphtene	0.001
Acenaphtylene	0.01
Benz[a]anthracene	0.1
Benzo[b]fluoroanthene	0.1
Benzo[j]fluoroanthene	0.1
Benzo[k]fluoroanthene	0.1
Benzo[a]pyrene	1
Chrysene	0.01
Dibenz[a,h]anthracene	1
Fluoroanthene	0.01
Indeno[1,2,3-c,d]pyrene	0.1
Phenanthrene	< 0.001
Pyrene	0.001

Answer 2:
Multiply each immission concentration with the carcinogenic potenty and add up.
If you did everything well than the solution should be 2.4 ng b-a-p equivalent/ m^3

The Air Quality Guidelines of WHO (chapter 5.9) gives you the information that the life-time risk of (BaP) of 1 in 1,000,000 will be reached at a level of 0.012 nanogram Bap/ m^3.

Question 3: Calculate the risk level for a person living 5 km east of the emission-point for the total carcinogenic potency of PAH emitted by the electricity plant

Answer 3
Carcinogenic risk of total PAH is 2 x 10-4 or 2 per 10,000 lifetime.
(at 1,2 nanogram/ m^3 the life time risk is 1 per 10,000, so at 2,4 it is 2 per 10,000)

Question 4: Is this cancer risk lower than the negligible risk level or higher than maximum acceptable risk level?

Answer 4:
Risk is higher than maximum acceptable risk level of 1 per 10.000 lifetime