Environmental-related health costs in Flanders: overview of the current assessment methods, problems and possible solutions

SUMMARY

The objectives of this study consisted in a review and a critical analysis of the existing calculations of environmental health costs (which are based on the ExternE method) in Flanders. The objectives and the approach to the study are further developed in chapter 1. The health effects covered in this study are limited to the effects on human health of air pollution due to particulates (PM2.5 and PM10) and tropospheric ozone. Initially, the effects of NO_2 were also included in the scope of the study, but these were omitted later, for reasons explained in chapter 2.

The quantification of the costs of the environmental effects is based upon the Impact Pathway Approach, which consists of the following steps:

- Emissions inventory;
- Dispersion modelling;
- Exposure to concentration;
- Quantification of physical impacts (based upon the concentration-response functions (CRF));
- Monetary valuation of these physical impacts.

In chapter 2, we describe the ExDALY model, which is currently used in Flanders for the quantification of environment related health costs.

For each step in the impact pathway, we describe the method that is currently in use, followed by a critical analysis of the method and a first indication of possible extensions or improvement. Because the current model uses ambient concentrations, it is not relevant to undertake a critical analysis of emissions and dispersion modelling (step 1 and 2 in the impact pathway).

Impact functions are necessary in step 4 of the impact pathway: they describe the relationship between exposure to certain pollutants and certain health effects. In chapter 3, we describe the impact functions that are currently in use in Flanders. We also provide a short overview of the statistical techniques that are used to estimate these functions, and we discuss the specific issues related to the impact functions for mortality effects.

Chapter 4 shows that it would make little sense at this stage to work on more detailed inventories of ambient concentrations or on more refined exposure scenarios. Indeed, the CRFs that are currently used are not differentiated across time and space anyway. Moreover, a lot of uncertainty surrounds the relative magnitude of the variance of exposure across the Flemish territory compared to the variance per grid of 4x4 km. If, in the future, more detailed CRFs would become available, then it would be possible to use the exposure scenario described in section 4.2.3.

In chapter 5, we discuss the methods that can be used in step 5 of the impact pathway approach, the calculation of the monetary value of the health effects. Health costs include direct medical costs, direct not-medical costs, the productivity losses due to poor health and

the costs made to avoid illness, but also the "subjective" costs linked to the pain and suffering linked to illness. These "subjective" costs can be evaluated, either by observing behaviour in the markets for goods that are linked to environmental quality ("revealed preference") or by surveys asking the respondents to directly reveal their preferences ("revealed preference").

This chapter is complemented by an extensive description of the current status of international research in this field, and of the applications of this research in Flanders (chapter 6).

Next, we proceed with an inventory of the data that are needed for an update of the current estimates of environmental health costs in Flanders (chapter 7). We limit ourselves to those health effects for which ExternE has published a CRF. In the case of particulates, we consider the effect on premature deaths, on new cases of chronic bronchitis, on hospital admissions because of respiratory or heart problems, on consultations with primary care physicians, on absenteeism and (in more general terms) the activity levels, on the use of bronchodilators and on the number of symptom days. In the case of ozone, we consider premature deaths, hospital admissions because of respiratory problems, consultations with primary care physicians, reduced activity levels, bronchodilator use and symptom days.

Chapter 8 provides an overview of the data sources that we have considered for possible use. The direct medical costs and the productivity losses are estimated using administrative databases of the Belgian health authorities on the one hand, and existing surveys of absenteeism in the private corporate sector on the other hand. The WTP to reduce premature mortality and morbidity are based upon transfers of the values used in European studies such as CAFE.

We use these data for a rough assessment of the health costs that correspond to small changes in the existing ambient concentrations of ozone and particulates (chapter 9). Despite the large uncertainty corresponding to each individual calculation, we can safely assert that the direct medical costs and the productivity losses due to particulates and ozone correspond to several tens of millions EUR. If we include the WTP to reduce premature deaths and illness, the estimates run within the billions of EUR.

Chapter 10 concludes and assesses the priority steps needed for further refinement of the existing estimates. The essential problem is that all our calculations are based upon epidemiological studies and administrative databases that have not been organised with the research questions of this study in mind. In an ideal world, a study of environment related health costs would start with an inventory of the health endpoints that need to be studied. Based upon this inventory, one would draft an exhaustive and non-overlapping list of studies that need to be performed in Flanders. Due to budget restrictions, this is probably not possible, and one will have to do with the results of "ad hoc" studies that have been undertaken in a different context and with other objectives in mind. Our research has shown however that relatively small changes in existing surveys and in the organisation of administrative databases could lead to significant improvements compared to the current situation.