

## Comment the TNO-report “LCA of Thermal treatment of waste streams in the clinker production in Belgium” d.d. 31.07.2007

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### 1 General comment on the document :

1. Philippe Decornet and M. Calozet will be mentioned “in the expert panel”, while they were only present in the last meeting.  
Phillippe Decornet was the independent chair person of the expert panel, and will be referred to as such. Michel Calozet and Benoit Lussit will be mentioned together as representatives of Febelcem.
2. The letter of the Minister of 30.01.2007 (KAB/HG/bp/2007-011; KO2.4-U-07-0353) suggested that both emissions and energy performance should be researched. This study does not give any information concerning energy performance. E.g. the differences between wet cement process and dry cement process towards energy efficiency is not mentioned in the study.  
This question will be answered by Febelcem apart from this report. This project was performed and this report was written to answer the first question only. Besides, it does not make sense to assess energy performance in this respect, because the energy performance of a cement kiln (or other installation) is exactly the same in case primary fuels are used, and in case secondary fuels are used; there is no discrimination.
3. In the document itself, in the conclusions (or at least as a very clear footnote in the conclusion) , has to *be added that the OVAM does not agree* with certain points of departure and for that reason can not subscribe the results based on the following remarks:  
In the conclusions a footnote is placed, in which your constraints are mentioned and a reference is made to this Annex and this remarks.
  - The study examines only the environmental aspects of the input of waste in both processes; not the energetic aspects. The fact that the amount of used energy/ton produced clinker is significantly different and the fact that there is a lot more loss of energy in the cement industry in comparison with the incineration plant have not been discussed.  
As stated above (comment no 2), energy efficiency was outside the scope of the project, and in the goal and scope of the report it is explained in more detail that this is not relevant, because in this study the thermal treatment of 1 ton of waste is the functional unit, and not the production of 1 ton of cement clinker.
  - The study makes a environmental comparison based on a set of environmental parameters. In the report the most important environmental effect in the LCA has been generated by “global warming”. Most important factor on this one is emission of CO<sub>2</sub>. There is a different energy requirement between the wet cement kilns and the dry cement kilns; this means that there will be a difference in CO<sub>2</sub>-emission (and on *global warming*) in the wet and the dry cement plants. The functional unit in this study is the input of one additional ton waste and the related change as a result of the energy content of the waste. The change in CO<sub>2</sub> emission is related to characteristics of the waste and not to the characteristics of the kiln (see also the response on the bullet above on energetic aspects).
  - If two different treatment technologies (e.g. cement plants and waste incineration plants) will be compared, the same reference situation has to be used : e.g. the same energy source, and not two different energy sources with a completely different environmental impact.  
The focus of this study is a realistic change for the 2006 situation in Belgium. Waste incineration plants generate electricity, avoiding electricity production by power plants. Cement kilns use both waste and fossil fuel. Input of additional waste will reduce the input from petcoke (or coal) as reported by the cement industry in Belgium. It is not realistic to assume that the same fuels are avoided in 2006. Such analysis would have a highly theoretical character instead of a realist one, which is not desired for this study.
  - The fact that some emission level values are more strict for the waste incineration plants in comparison with the cement industry has never been valorized in the LCA.

The LCA study is based on real emissions as a result of the input of one ton waste, based on the elemental waste composition and transfer coefficients. Legal limits are not relevant for the calculation of the realistic emissions.

- Unless the fact that the cement industry is a severe emitter of NO<sub>x</sub> these emission of NO<sub>x</sub> have not taken into account in the LCA.  
Based on the fact that not the clinker production, but the treatment of waste is the basic subject of the study, using the approach of **marginal change**, only changes in environmental burden, caused by the use of extra secondary fuels, are relevant. An explanation on the NO<sub>x</sub> emissions is given in chapter 3.3.
- Furthermore OVAM does not agree with the approach that the capture of heavy metals in the flue gas cleaning, immobilization and controlled landfill (in case of waste incineration) is considered negative (whereas from environmental point of view it is positive) and at the same time the effect of dilution of heavy metals in the cement is considered to be negligible.  
In the case of immobilization and land filling of highly contaminated flue gas cleaning residues, a potential environmental risk exists, and can be measured by means of leaching tests. The heavy metals that remain in the cement clinker are also immobilized during the hardening of the cement, but the concentrations are in this case that low, that the leaching of these elements cannot be quantitatively measured. This is the reason that we state in chapter 2.1 of the report that the **impact thereof** in the framework of this study will be surely negligible.

4. Emission of pollutants to water are taken into account for the waste incineration plants. Are the used data for the LCA data of pollutants *before* waste water treatment or *after* ?  
The emission to water as calculated using the transfercoefficients are based on release to surface water after neutralisation and precipitation of pollutants, in other words, after waste waste water treatment
5. Are the changes as marginal as stated ? The input of more or less than 500 000 tons of waste is not that marginal any more.  
Again, in both cases (cement clinker production and waste treatment) minor changes in emissions, due to the treatment of **one extra ton of waste**, are compared with each other in this study. And not the absolute changes, caused by the fact that the two systems are intrinsically different. This is explained in chapter 2.1 and in chapter 3.5.
6. OVAM seriously regrets that no representative of the incineration plants was permitted in the expert panel.  
From OVAM's point of view, TNO can understand this. However, the study was commissioned by Febelcem, and not by the waste incinerators.
7. Emission values are not always realistic or are dated.
  - Hg-emissions of 4 % towards the air are not realistic in the actual situation. In this study TNO refers to a study on the emission of heavy metals (Theunis et al., 2003) : in that document it is stated that the actual treatment facilities can clean the fluegasses up to 99,99 % for Hg.
  - Some data in tabel 3 & 4 date from 1988 !
 To know the effect of using (outdated) transfercoefficients for incineration, an additional sensitivity analysis is made in paragraph 4.3.7
8. The OVAM received general data (5 streams) of the input of waste (tons) in de cement industry after the last meeting. This information was more general than the one repeatedly asked in the different meetings (and asked in the excel-sheet that has been sent around). The data of the origin of the sludges and filter cakes have never been given.  
This question will be answered separately by Febelcem. TNO does not have that detailed information either. For the purpose of this study this information was not required.
9. This document still is not complete : annex 2 was not included in the document. We would like to see the *completed document* which includes *all* remarks before it will be spread.  
In the last expert panel meeting it was decided that the final version of the report would not be sent around again. We regret that Annex 2 was not completed in time. However, this Annex only comprises a description of the cement clinker production process.

## 2 Specific comment on the report

- 5/37 : It was agreed in de the meeting of 10 July that the fact that OVAM does not agree with the results is written in the report, not in the annex. !!  
It will be mentioned in the conclusions and in the goal and scope, as a footnote.
- 6/37 : energy efficiency is excluded from the study  
This is mentioned explicitly.
- 7/37 : tabel 2 : negative value for the substitution of petcoke by solvents ?  
This is explained in the paragraph above the table.
- 7/37 : reference of table 2 + 3  
This information was provided by the cement producers, the stakeholders of Febelcem.
- 10/37 : Are there no min/max values for fluff and filter cake ?  
In Annex 1 it is explained that in these cases only one value was available.
- 13/37 : 3,5 GJ/ton produced clinker (dry process); how much energy (in GJ/ton) is necessary for the wet process ?  
For the wet process this is approximately 5 GJ/ton clinker produced.
- 13/37 : “marginal changes”; the substitution of 500 ktons is not very marginal anymore...  
Not the total substitution is studied in this report, only the marginal change of 1 ton. This will be mentioned in the chapters 3.3 and 3.5 more explicitly.
- 13/37 “as agreed” : it was decided by the cement producers; the OVAM wanted figures of each plant (as mentioned in several meetings). OVAM does not subscribe “as agreed”  
OK, not all members of the expert panel were happy with that, but from confidentiality viewpoint this was the only practical solution. We will make a footnote in the report.
- 14/37 : effect of waste on NOx : reference of this proof ? Emissions of NOx by the cement industry are significantly higher than the NOx-emissions of the waste incinerator.  
The measurements mentioned, were done at the ENCI plant in Maastricht (Netherlands). However, the actual data are confidential. As is explained in the report, most of the NO<sub>x</sub> produced in a clinker kiln is not caused by the nitrogen from the raw materials or the fuels, and is therefore process intrinsic. This means that it will not change as a consequence of the marginal change of 1 ton of fuel. This will be explained more extensively in the report.
- 14/37 “streams not leaving the plant” e.g. heavy metals in cement  
Actually it concerns the fine particles (dust) from the E-filter. This will be added in the report.
- 14/37 and the following pages : Indaver is mentioned, while they were not allowed to participate in the steering committee  
See the reaction on general remark, no 6.
- 17/37 : Is this a different figure than figure 6 ?  
No, the figure exists 2 times; one of them is removed.
- 23/37 : not correct : there is no pretreatment for the sludges in case of a waste incinerator (fluidised bed incinerator - FBI)  
This is adapted in the report
- 24/37 : it is written that there will be an *avoided production* of petcoke. This is not realistic. Petcoke is not produced in behalf of the cement industry. It is a by-product of the petrochemistry in the production of petrochemical products.  
The approach of avoided (by) products is common practice in the LCA field. In the LCA study a second scenario is calculated where coal is avoided instead of petcoke. Coal is not a by product. The results for coal point in the same direction nfor each waste stream and do not change the conclusions.
- 24/37 : there is no pretreatment of sludges in FBI.  
This is adapted in the report
- 24/37 : the actual used fluegas cleaning for the FBI allows a better Hg-captation than the technique used in the cement industry. Why should the result of the cement industry be better ?  
The transfer coefficients for the cement industry are calculated for the real, measured 2006 emissions. This has resulted in a transfer coefficient for Hg emissions to air of 2%-4%. The used data for the incinerators are indeed a little outdated. We therefore have made an additional sensitivity analysis on this point, with a transfer coefficient of 0,05% Hg to air for waste incineration – see paragraph 4.3.7. However Hg and other metal

emissions have a limited contribution to the results, and other impacts (CO<sub>2</sub> emissions) and the avoided energy determine the outcomes.

- 27/37 : last paragraph is not clear.  
The paragraph is adapted to improve understanding
- 28/37 : wrong basic assumption : fluff will not be incinerated in a rotary kiln  
Filtercake is treated in the rotary kiln (see paragraph 4.2.5.) and fluff in a fluidised bed (see paragraph 4.2.4)
- 28/37 : 4.2.5 : filter cakes : “treatment of fluff”  
We have erased the sentence on fluff in the paragraph on filtercake
- 29/37 : this paragraph suggests that there are no significant NO<sub>x</sub>-emissions in the cement industry, while the rotary kiln causes NO<sub>x</sub>-emissions (with impact on toxicity, acidification, eutrofication). OVAM disagrees.  
What is meant is that the NO<sub>x</sub> emission caused by one ton of secondary fuel is supposed to be equally high as the NO<sub>x</sub> emission caused by one ton of substitute (pet coke or coal). This will be clarified. This is also more extensively explained in chapter 3.3.
- annex 3 : reference of tables 3,4 5 ? What are the capacities of the installations ? It is not clear which technique is used in the scenarios (Swiss or Austrian) ? Are those data still representative (1988) ? Incineration plants became more performant  
TNO preferred to use recent data from Indaver, but as these data were not available public data on waste incineration were used. A sensitivity analysis is made using more lower transfer coefficients for emissions to air and waste water – see paragraph 4.3.7
- annex 3 : we never discussed *the behaviour of Hg in a waste incineration plant*. What about this behaviour in the cement kilns ?  
Most of the Hg is caught in the E-filter in a cement kiln, and is recycled internally in the plant, or added to the end product (see the remark on the comment on page 14/37).

Luk Umans

(24.07.2007)

Evert Mulder and Suzanne de Vos

(26.09.2007)