Letters to the Editor

Long-Term Emissions from Landfills Should Not be Disregarded

Göran Finnveden[1], Per H. Nielsen[2]

[1] fms (Environmental Strategies Research Group), National Defence Research Establishment, Box 2142, S-103 14 Stockholm, Sweden; phone: +46 8 402 38 27, fax: +46 8 402 38 01; http://www.ecology.su.se/research/fields/FMS/fmshome.htm
[2] Department of Manufacturing Engineering, Technical University of Denmark, Building 424, DK-2800 Lyngby, Denmark

Corresponding author: Dr. Göran Finnveden

In the beginning of the 1990s, when the interest in LCA increased rapidly, landfills were a forgotten part of LCA (FINNVEDEN, 1992). It is a pleasure to see that this is now changing, as exemplified by the recent papers in this journal on models for municipal solid waste landfills, BEZ et al. (1998), NIELSEN and HAUSCHILD (1998) and NIELSEN et al. (1998).

One important difference between landfilling and most other processes that may occur in an LCA is the time-frame (FINNVEDEN et al., 1995). Emissions from landfills may prevail for a very long time, often thousands of years or longer. In order to make the (potential) emissions from landfills comparable to emissions during the life cycle, the emissions have to be integrated over a certain time period. A choice concerning which time perspectives are of interest must therefore be taken. This is a topic which has been discussed at several international workshops (e.g. FINNVEDEN and HUPPES, 1995; SUNDBERG et al, 1998) but there is currently no consensus on which perspectives to be chosen. A wide range of different approaches have been discussed and used. In relation to a specific time-frame, a range between 15 years and infinite time have been discussed (e.g. WHITE, 1995; FINNVEDEN, 1999).

In the recent papers, BEZ et al. (1998) and NIELSEN and HAUSCHILD (1998) independently choose a time frame of 100 years. The motivations for this are interesting. BEZ et al. (1998) assumes that an almost inert residue remains after 100 years although no arguments supporting this assumption is presented. NIELSEN and HAUSCHILD (1998) acknowledge that emissions continue for hundreds of years but delimit their modelling to a hundred year period because the fate of the disposed compounds is more or less unpredictable hereafter.

It is important at this moment to stress that the environmental impacts from landfills can be seriously underestimated if the period after 100 years is neglected, and that we are facing a new "forgotten point" in LCA if we don't treat this period with the greatest care.

1) Because emissions from landfilled materials do continue after 100 years. For example, only a small fraction of the landfilled metals are expected to be emitted during the first century, typically between 0,001 and 0,1% of the landfilled amount (FINNVEDEN, 1996). If only emissions during the first century are considered, the total emissions may therefore be underestimated by a factor of more than thousand.

2) Because the residues in the landfill (e.g. glass, plastic, metal pieces, concrete, heavy metals and organic chemicals) may be unpleasant or toxic and hence limit the utility of the land above the landfill as well as the underground (the abandoned landfill it self) far beyond the 100 year period.

To summarise in short: it is obvious that there will be environmental impacts from landfilled materials after 100 years 1) because of emissions and 2) because of recalcitrant residues remaining in the underground. Therefore, the period after 100 years should in one way or another be included in LCAs unless impacts on future generations are to be neglected.

To neglect impacts on future generations is an ethical valuation which can be used and which is linked to the valuation (weighting) element of an LCA (FINNVEDEN, 1997). If this position is taken it should, however, also influence other aspects of the LCA, e.g. the impact assessment, and should be explicitly declared. We think that it would be preferable to avoid this approach in LCA.

There are essentially two different approaches to handle the long term emissions from landfills. One is to try to model the emissions also for longer time periods while acknowledging the difficulties (FINNVEDEN et al, 1995; FINNVEDEN, 1996 and SUNDQVIST et al, 1997). The other approach is to say that it is impossible to model the long term emissions from landfills in a meaningful manner and future studies should address how residues remaining in landfills after 100 years shall be treated in the LCA impact assessment step. Only future research can reveal which approach is most useful. For the moment however, our message is clear: Long-term emissions from landfills should not be disregarded.

Acknowledgements

This work is supported by the Swedish National Energy Administration and the Danish Agency for Trade and Industry.

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News & Views

When Does the 21st Century Start?

Time is still relatively ill-defined in LCA, but you will agree that we should at least know in which Century we'll live next year. Actually, there has been considerable confusion about the starting point of the next century and, thus, the third millennium within the framework of the Gregorian calendar which is nearly exclusively used in the Western world and in international relations. Since "The International Journal of Life Cycle Assessment" is being read in many countries outside Europe and the Western world, we feel obliged to give some relevant information.

The Gregorian calendar, which was introduced by Pope Gregory XIII in 1582, improved the older Roman calendar, last time reformed by Julius Caesar (thus called "Julian calendar"). The improvement aimed at a better coincidence of the calendar years with the solar year. The starting point of the earlier Roman calendar (called "ab urbe condita"[1]) was the assumed founding year of Rome, 753 BC[2] in the Christian numeration. This new numeration was introduced in AD[3] 525, about hundred years after the decline of the (West-)Roman Empire.

The source of the confusion about the correct end and start of centuries and millennia lies in the fact that there is no year zero in the Christian numeration: the year AD 1 follows immediately the year 1 BC. Since this is a fact, simple counting tells us that the first decade ended with the completion of the year AD 10, the first Century at the end of the year 100 and the first millennium at the end of the year 1000, etc. The last day of the 20th Century is therefore December 31, 2000 and the first day of the 3rd Millennium is January 1, 2001.

What, if not the next century, are we going to celebrate at the New Year's Eve 1999? Evidently the dawning of the year 2000 – the last year of the 20th Century – and Volume 5 of our Journal!

More information about the Gregorian calendar and the millennium problem can be found at the following websites:

- Royal Greenwich Observatory, Information Leaflet No. 52: "The Year AD 2000" http://www.compinfo.co.uk/y2k/greenwch.htm
- U.S. Naval Observatory, Washington D.C.: When is the New Millennium? http://www.usno.navy.mil/millennium/whenIs.html
- Walter Schittek: The Next Millennium Starts 2001. E-mail: schittek@mailer.uni-marburg.de http://staff-www.uni-marburg.de/~schittek/millenni.htm
- Physikalisch-Technische Bundesanstalt: Gregorianischer Kalender. http://www.ptb.de/deutsch/org/4/43/432/greg.htm
- Wiener Arbeitsgemeinschaft für Astronomie: Countdown ins dritte Jahrtausend. http://members.eunet.at/waa/waa_special/count2000/count2000.html

[1] Ab urbe condita (Latin): "Since the foundation of the town"
[2] BC: Before Christ (i.e. before the assumed birth date of Jesus Christ)
[3] AD: Anno Domini (Latin): "in the year of the Lord"

Walter Klöpffer, editor-in-chief