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TINOS 2015

Sustainable Solid Waste Management

Evaluation of actual and future residual fluxes deriving from two Italian MSW landfills

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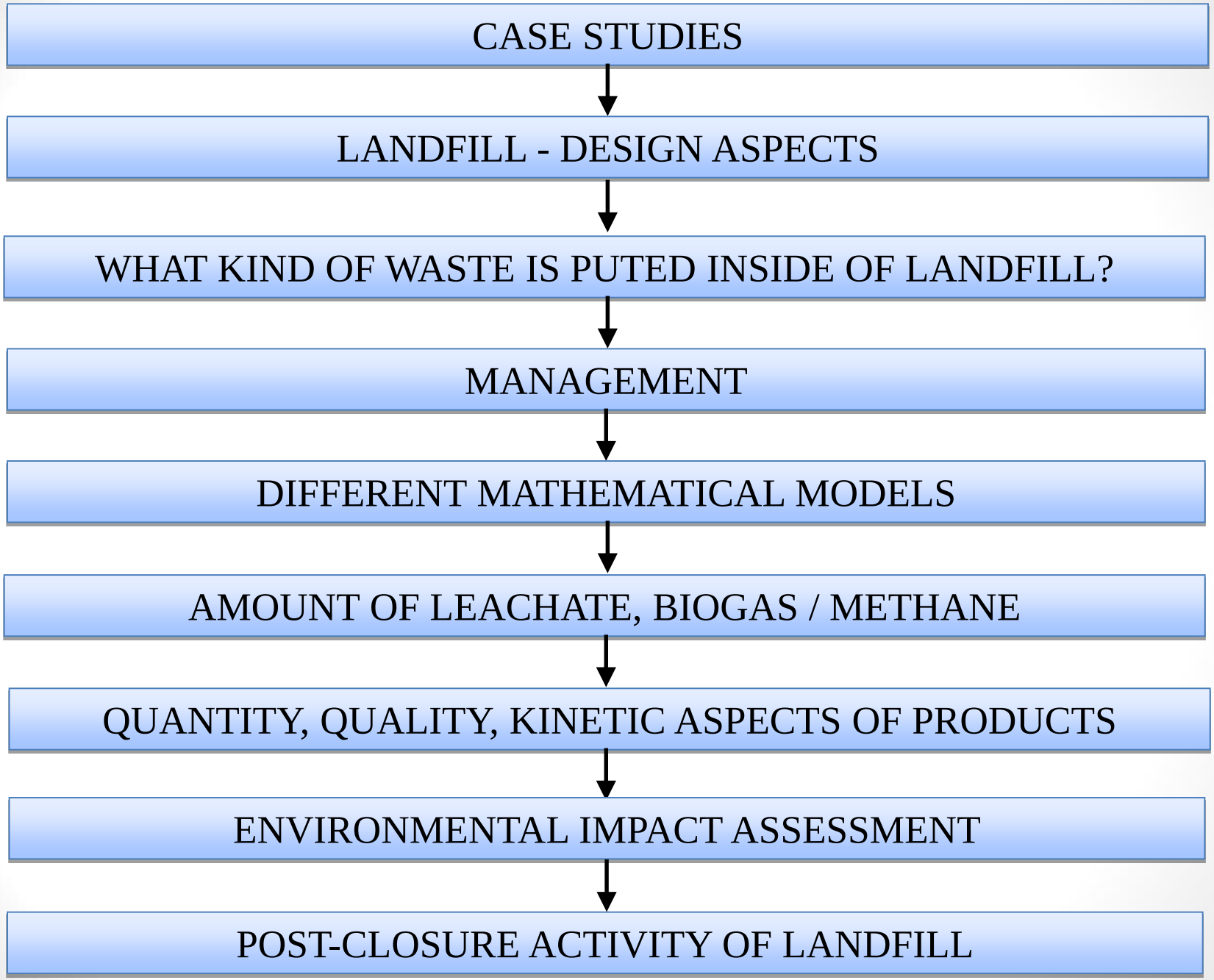
Tinos, 2015


CASE STUDIES
LANDFILL - DESIGN ASPECTS
WHAT KIND OF WASTE IS PUTED INSIDE OF LANDFILL?
MANAGEMENT
DIFFERENT MATHEMATICAL MODELS
AMOUNT OF LEACHATE, BIOGAS / METHANE
QUANTITY, QUALITY, KINETIC ASPECTS OF PRODUCTS
ENVIRONMENTAL IMPACT ASSESSMENT
POST-CLOSURE ACTIVITY OF LANDFILL

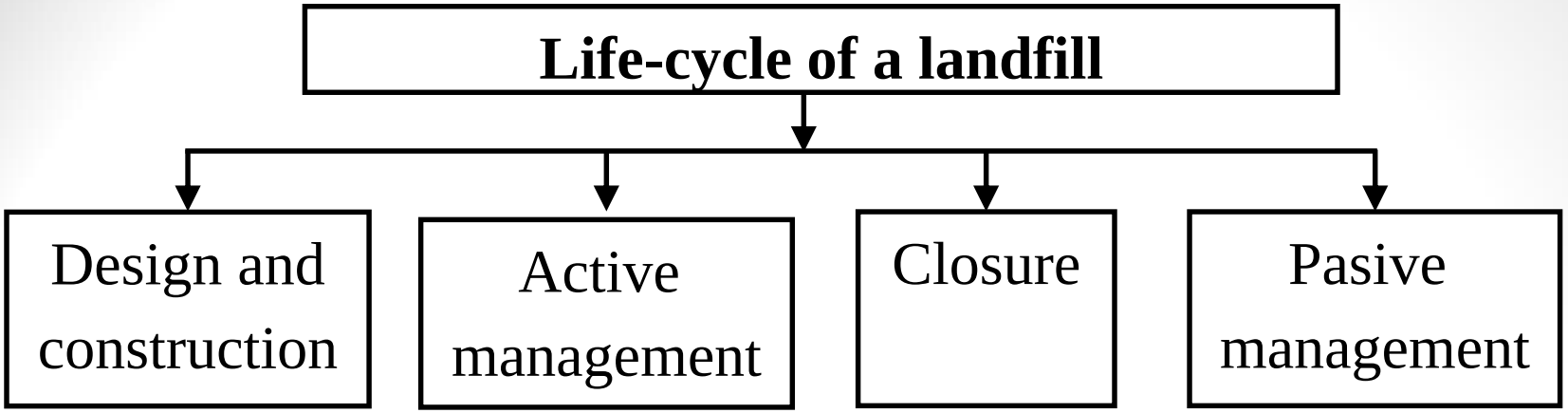


Figure 1. Life-cycle of a landfill

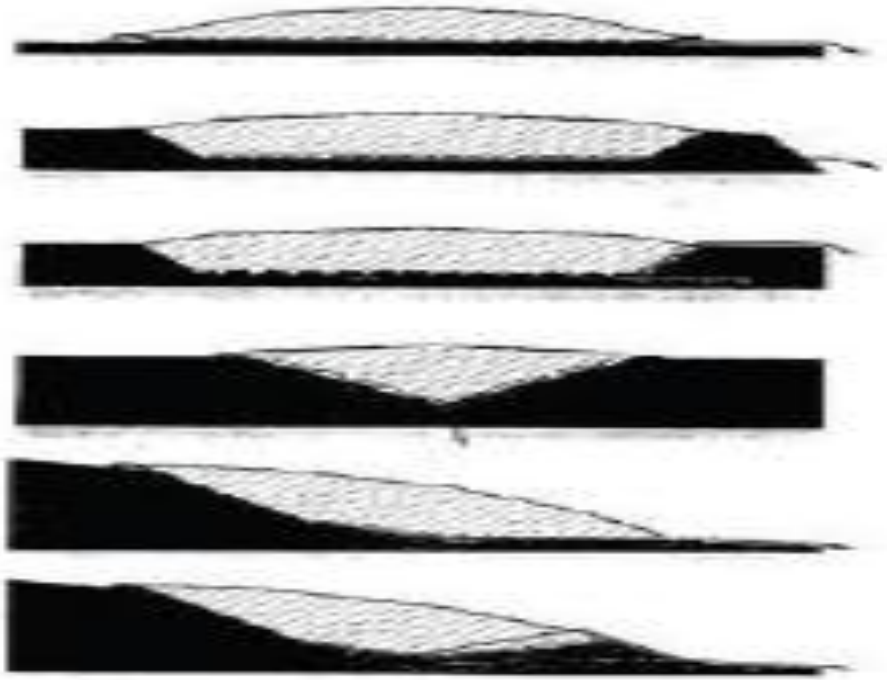


Figure 2. Types of landfills

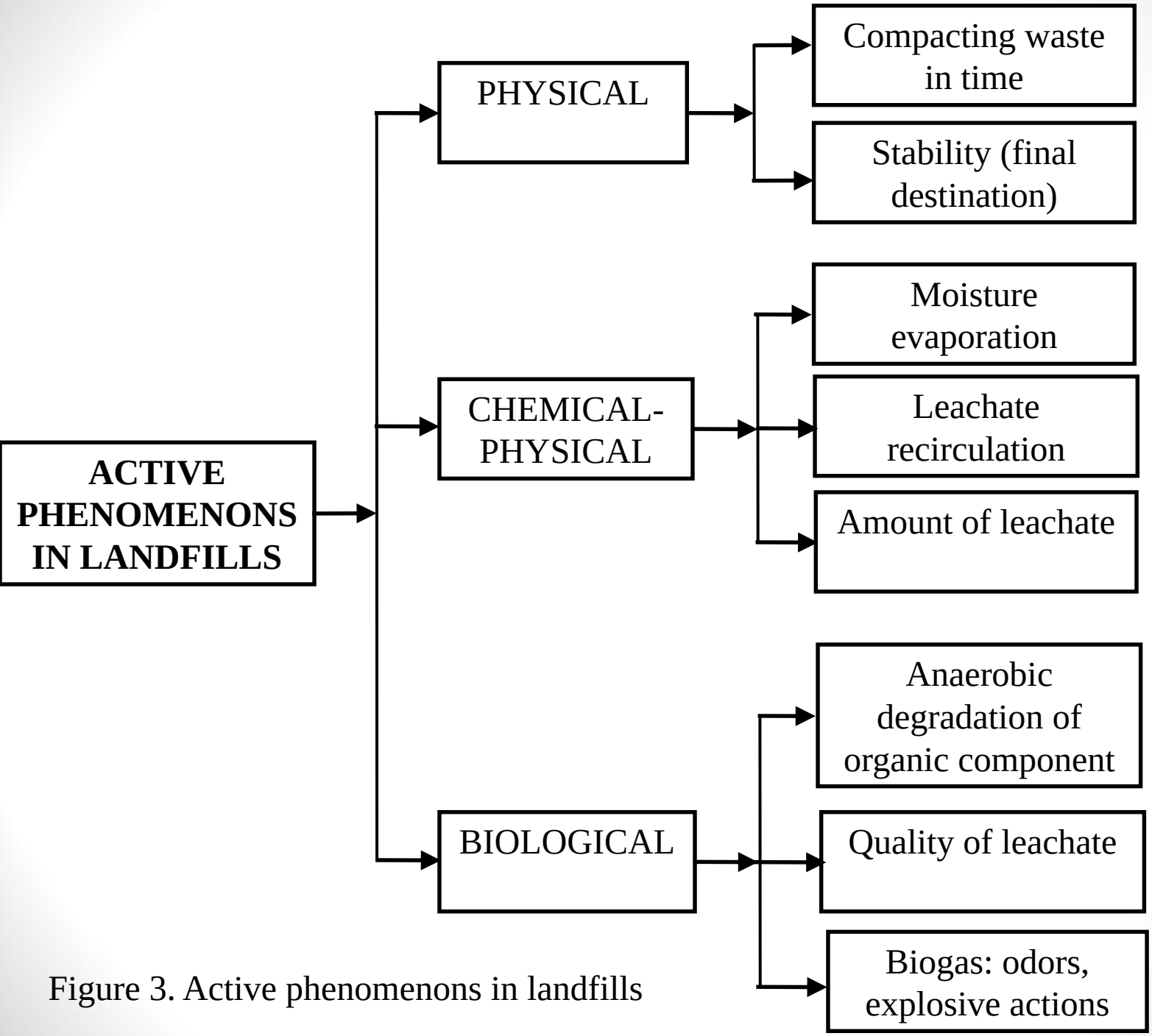


Figure 3. Active phenomenons in landfills

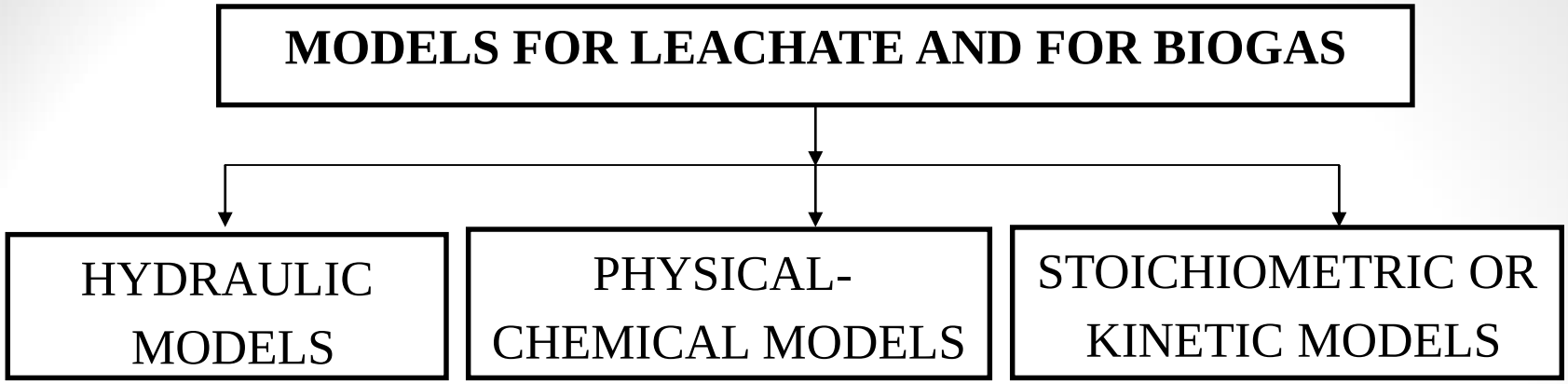


Figure 4. Mathematical models used for leachate and for biogas

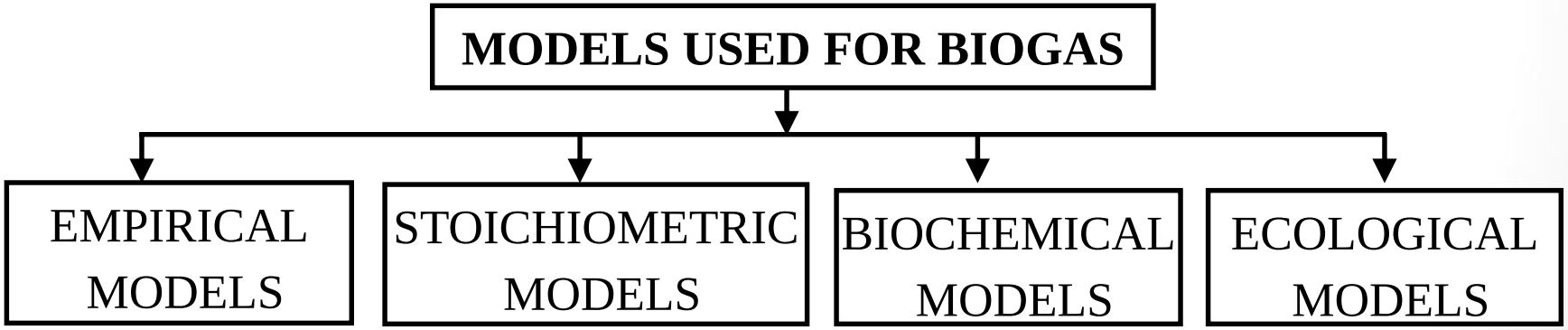


Figure 5. Mathematical models used for biogas

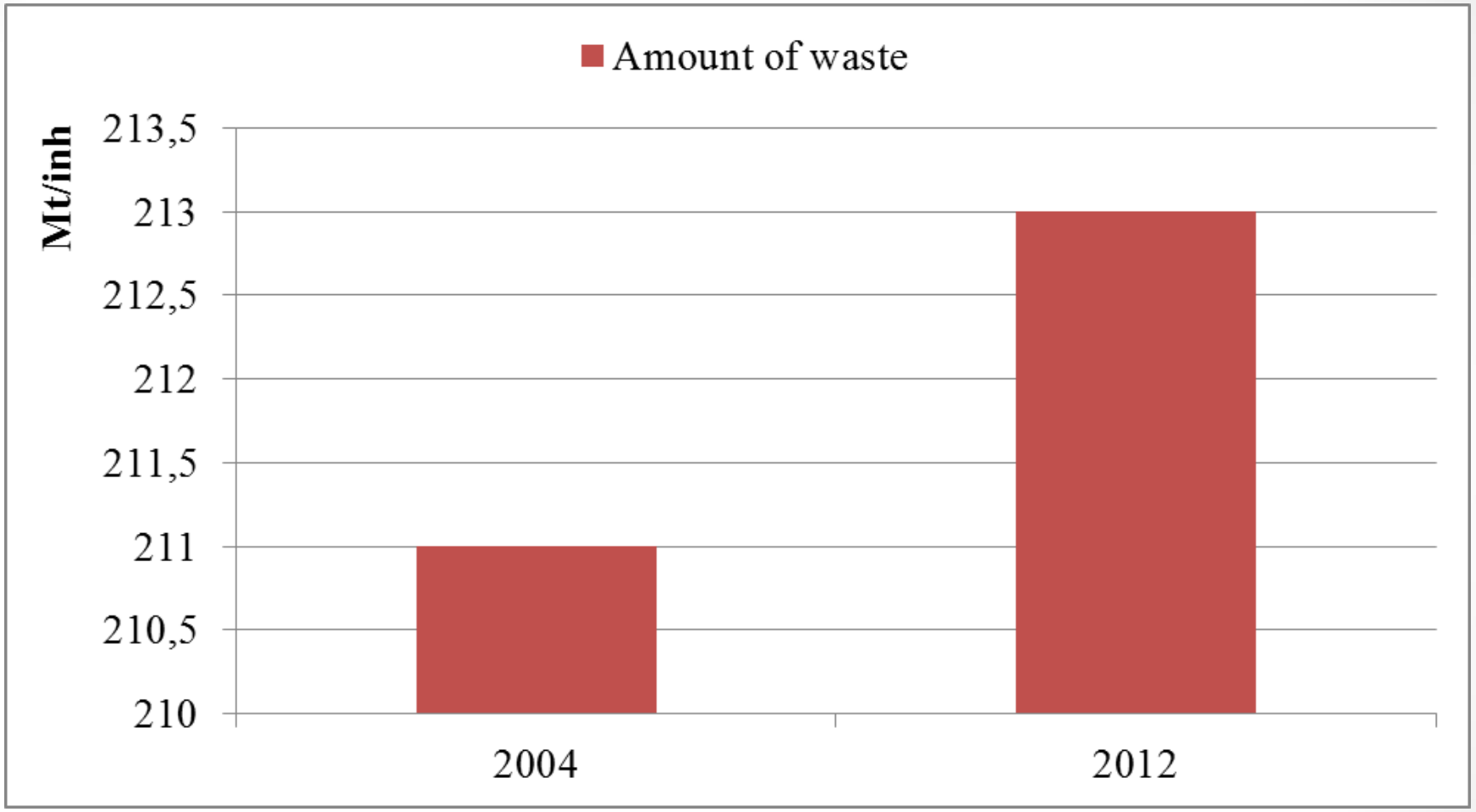
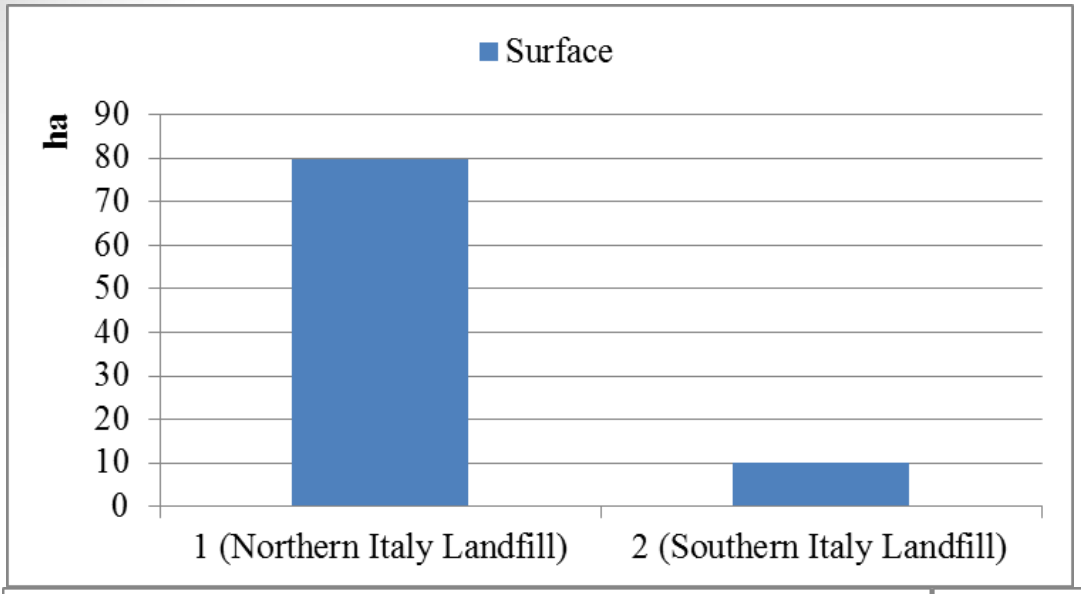


Figure 6. The total amount of waste generated by economic activities and households in EU-27 (Eurostat, 2015)

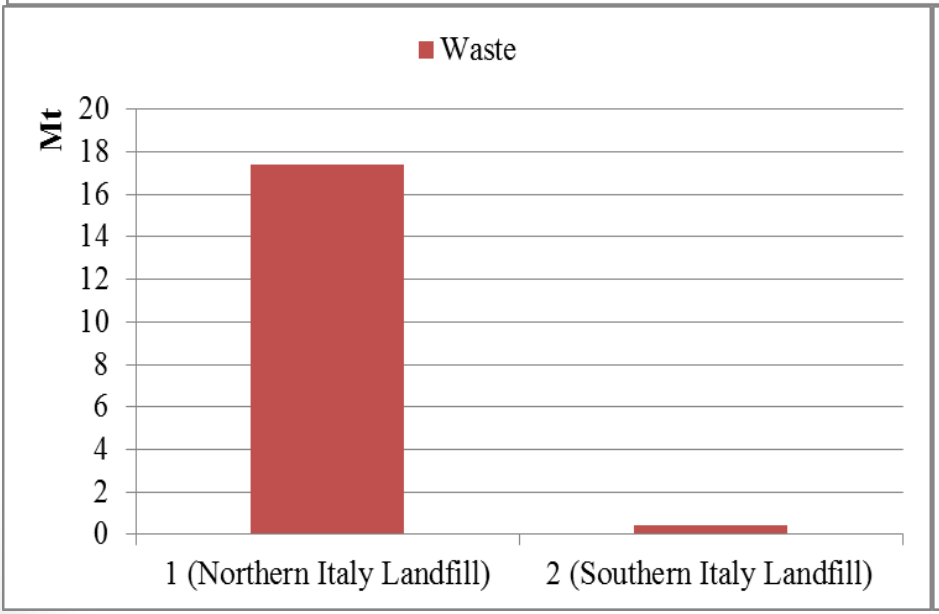


Activity period :

1. (Northern Italy Landfill)
   1984 – 2009
2. (Southern Italy Landfill)
   1989 – 2004

Number of cells :

1. (Northern Italy Landfill) - 9
2. (Southern Italy Landfill) - 7



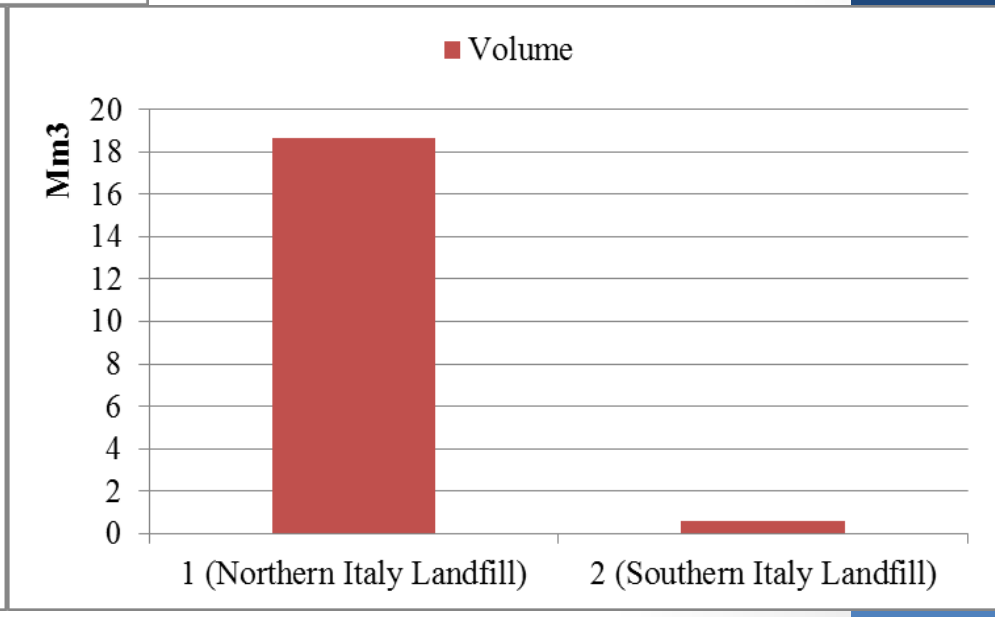


Figure 7. General data about the considered case studies. Data about Landfill 2 were derived from Alfieri (Alfieri et al., 2004).

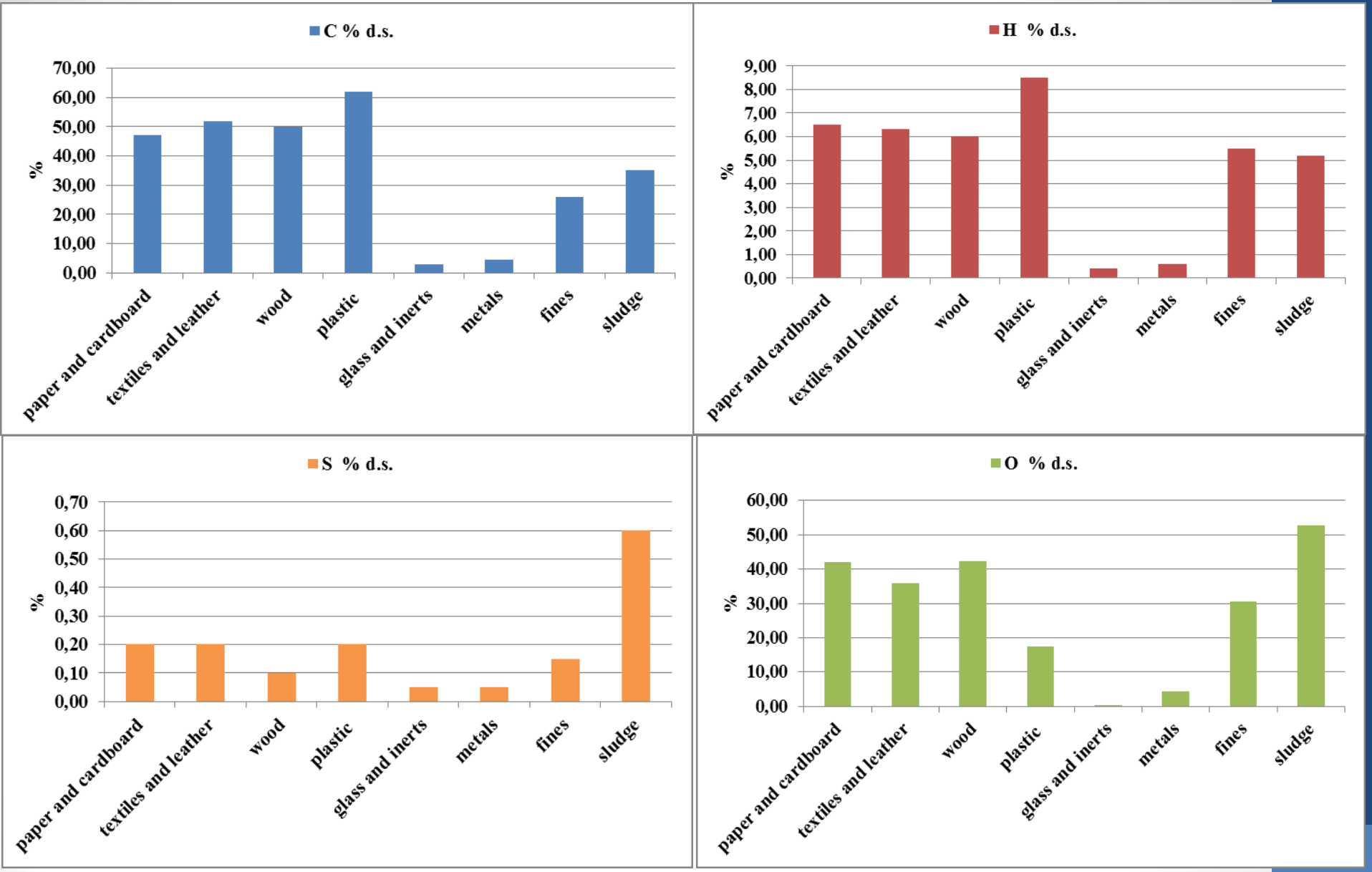
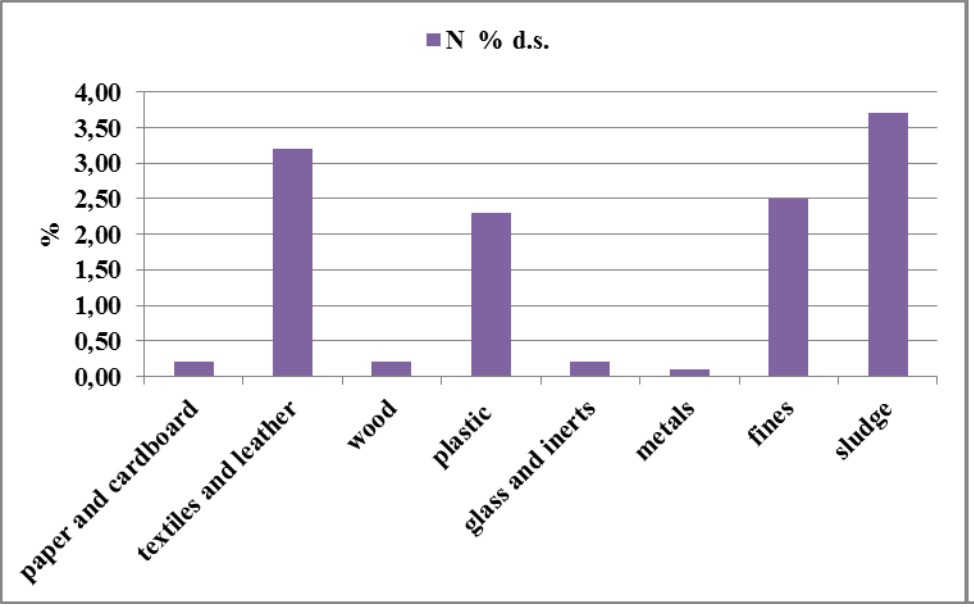


Figure 8. Elemental analysis and moisture content of waste materials (Panepinto and Genon, 2012)



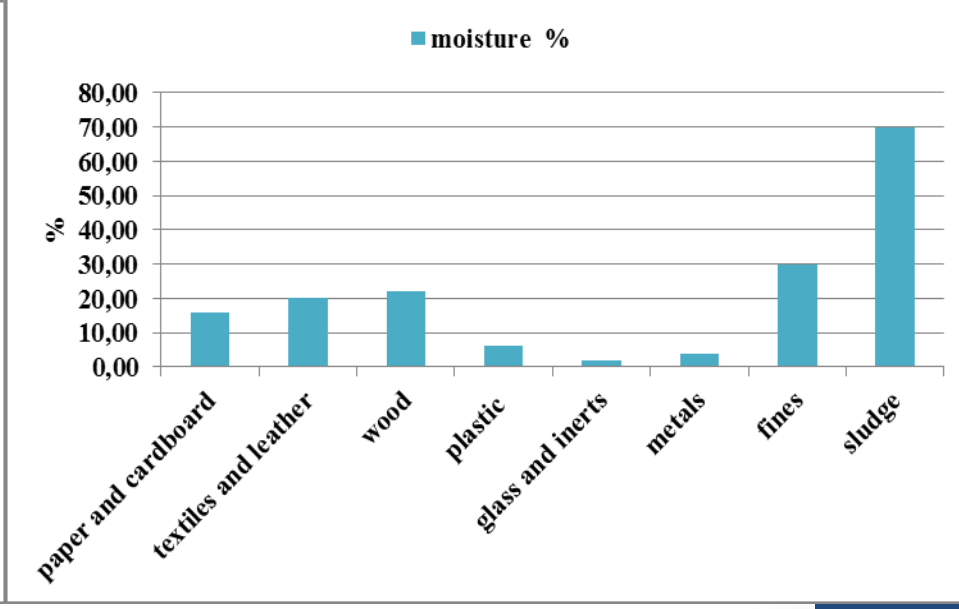


Figure 8. cont. Elemental analysis and moisture content of waste materials (Panepinto and Genon, 2012)

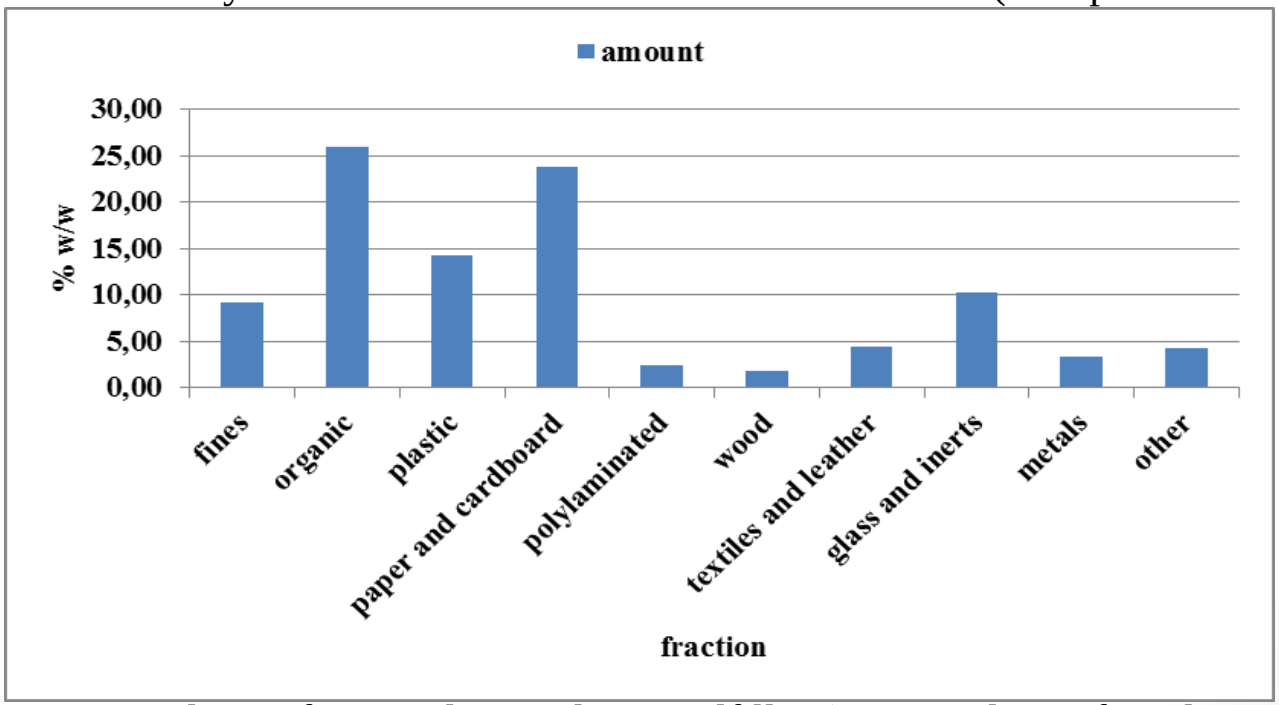


Figure 9. Component analysis of MSW disposed in Landfill 1 (average data referred to 2000-2009)

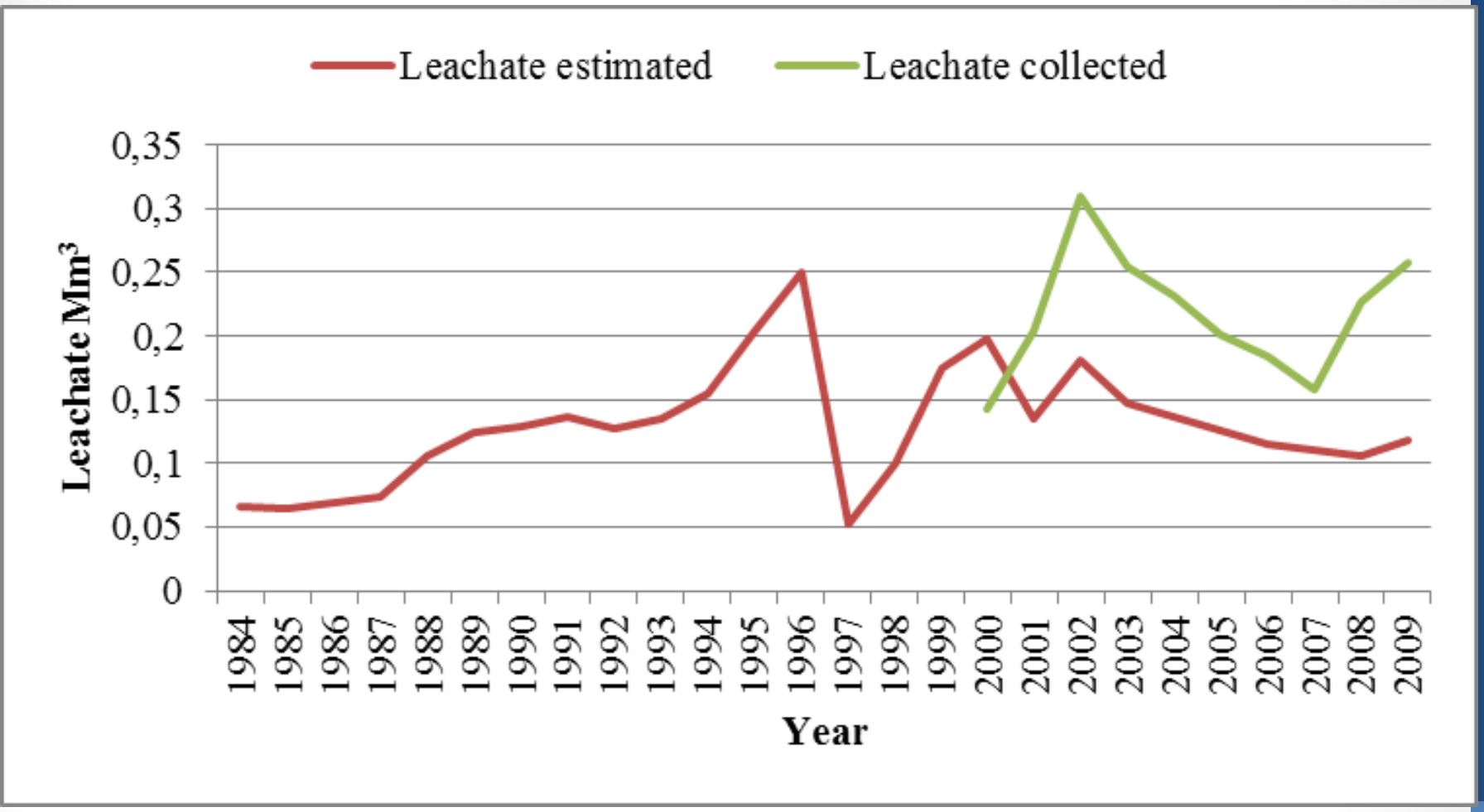


Figure 10. Estimation of the amount of leachate for Landfill 1 by means of Hydrological Mass Balance Model and comparison with field data

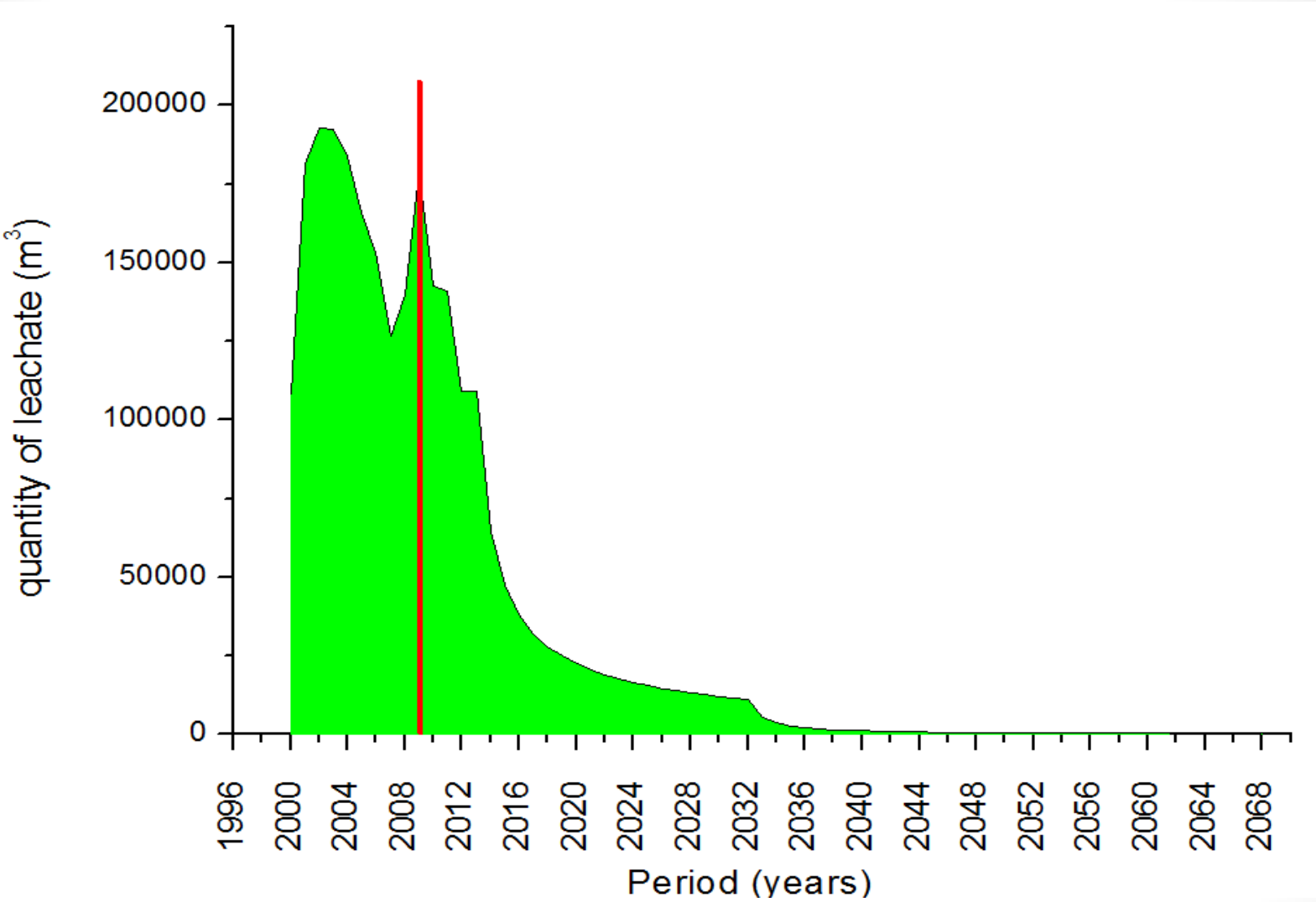


Figure 11. Estimation of amount of leachate for Landfill 1 using Serial Water Balance Model (the red line represents the beginning of post-closure phase)

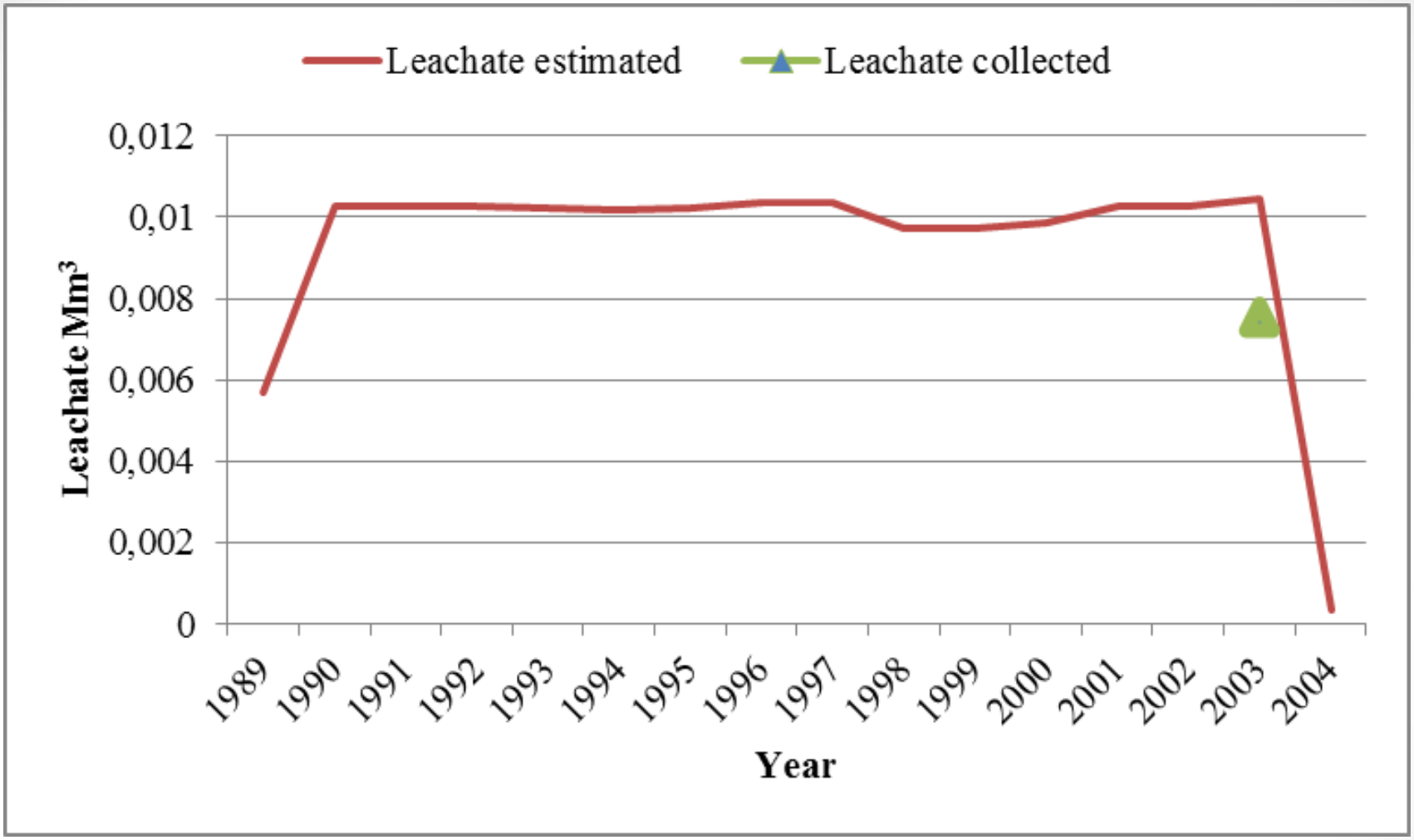


Figure 12. Estimation of the amount of leachate for Landfill 2 using Hydrological Mass Balance Model

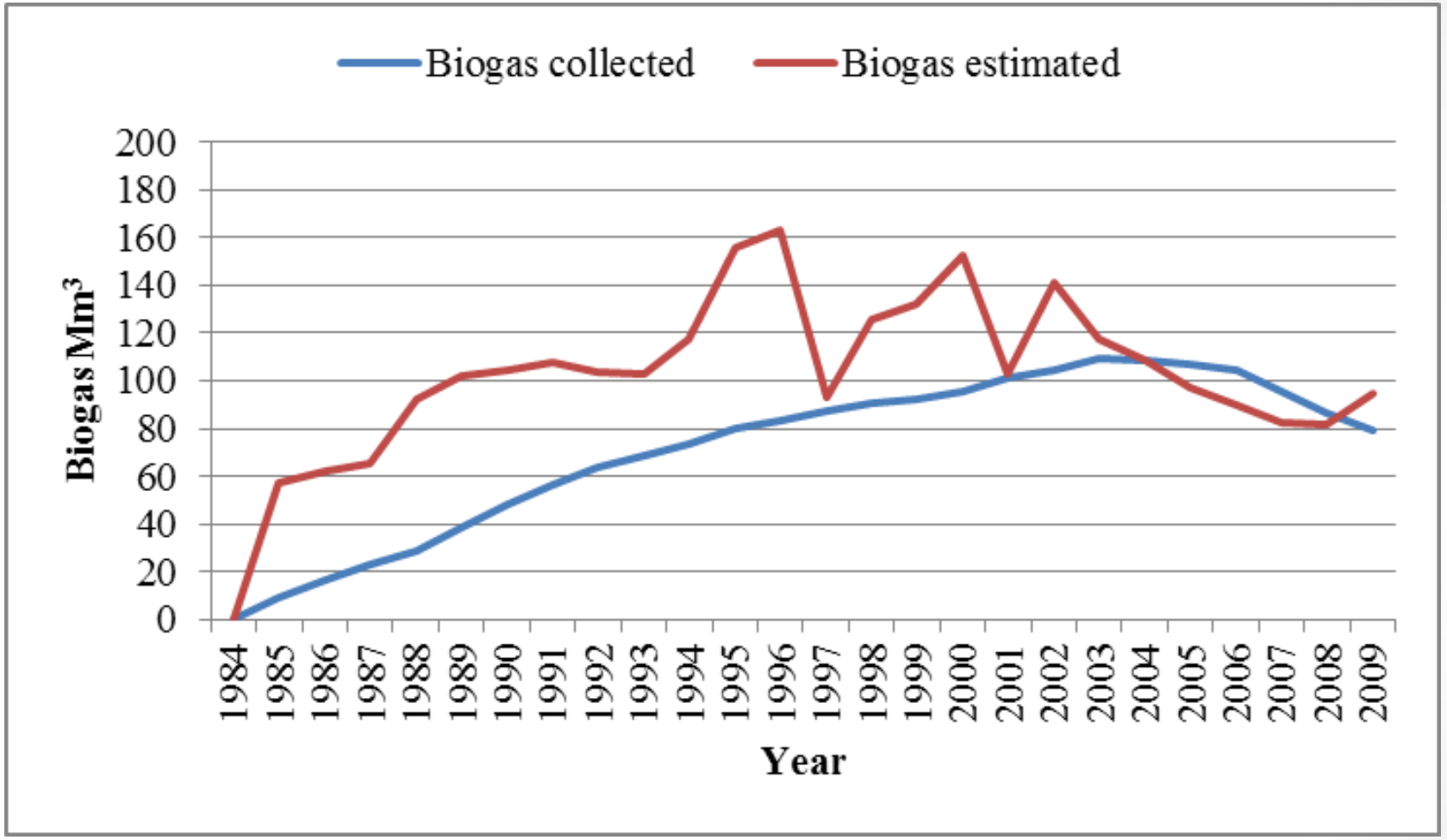


Figure 13. Comparison between the real quantity of biogas generated in Landfill 1 and the volume estimated by means of Stoichiometric model

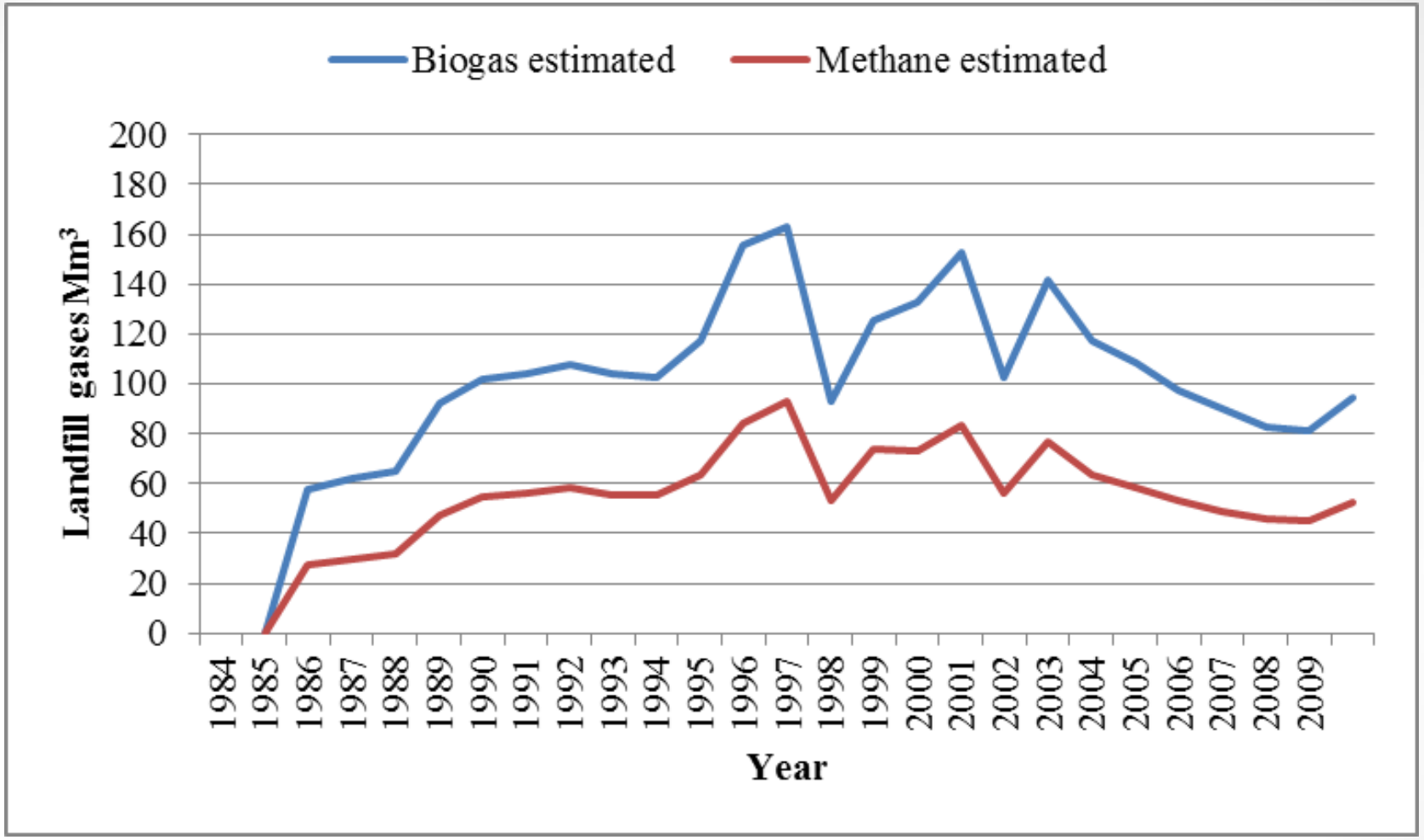


Figure 14. Estimated amount of biogas and methane for Landfill 1 by means of Stoichiometric model

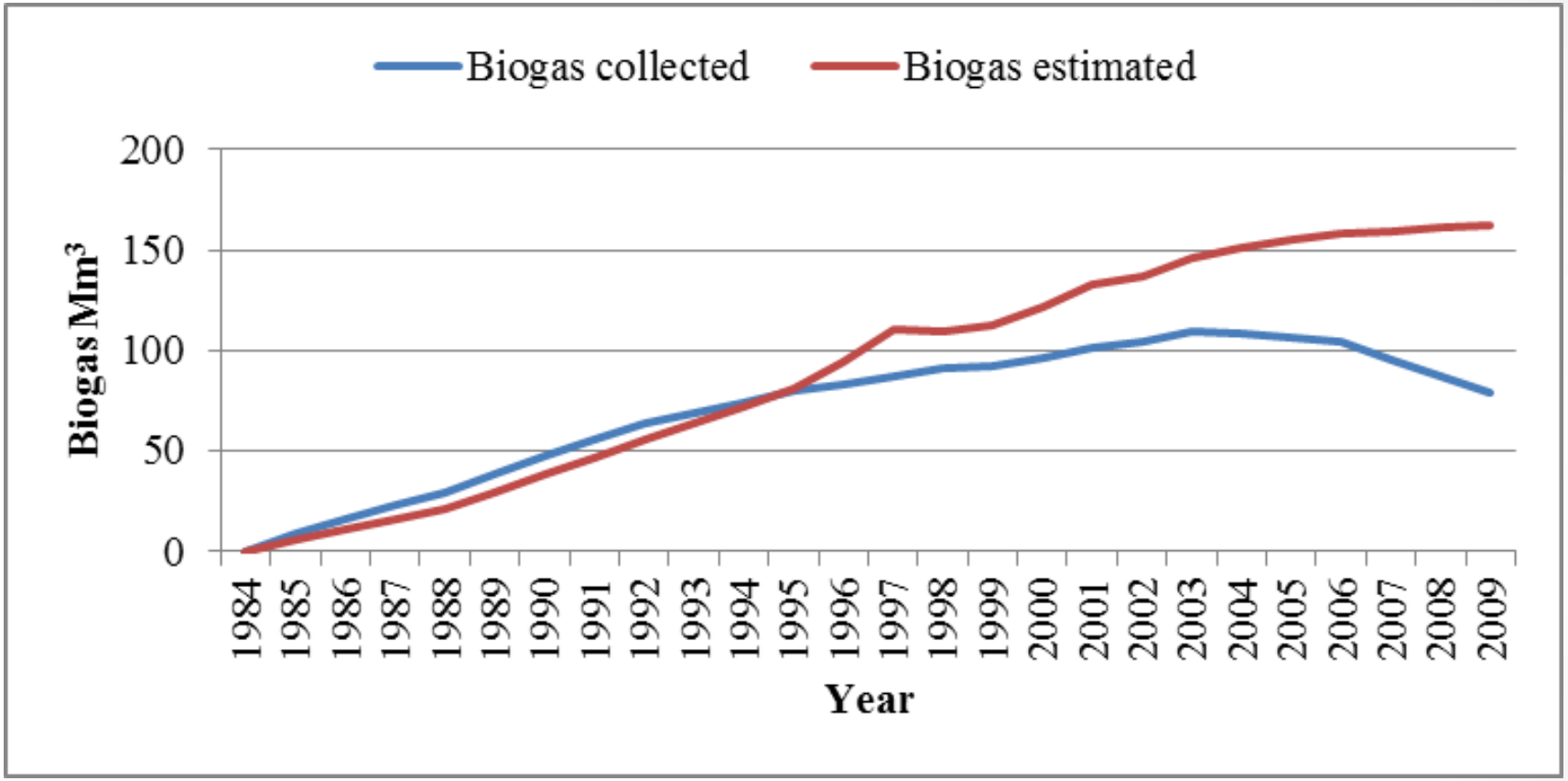


Figure 15. Comparison between the real quantity of biogas generated in Landfill 1 and the volume estimated by means of LandGEM model

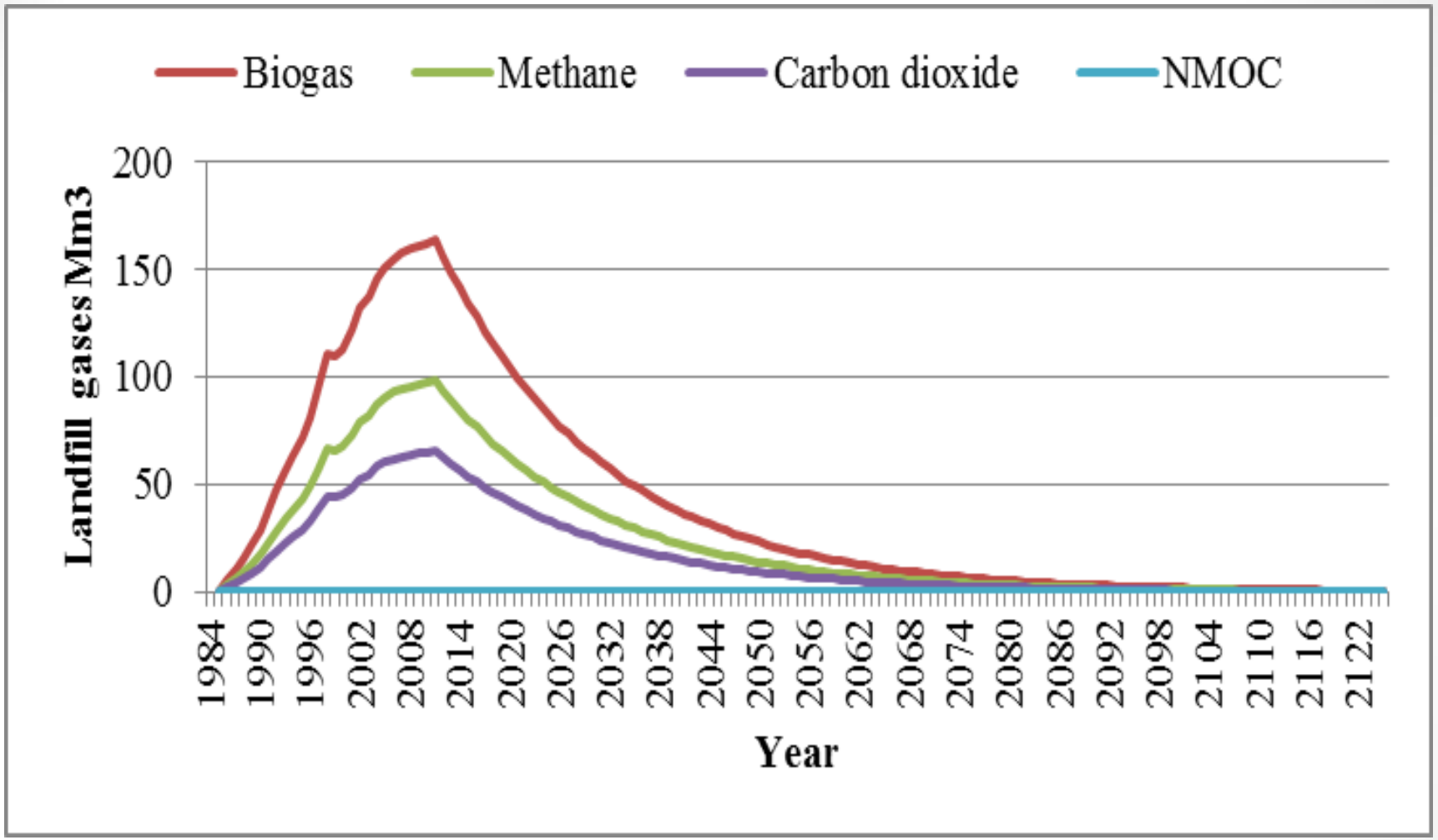


Figure 16**.** Estimated biogas production of Landfill 1 by means of LandGEM model

Conclusions

- The characterization of the products arising from landfills is important from different points of view. In fact it is necessary to know the quantities of leachate and of biogas which can be formed during all the phases of landfill cultivation in account of their influence on receiving environment. If the good quantities of products are extracted, we can prevent disasters (explosions done by accumulations of biogas), and we can reduce the operating costs (reuse of products, recirculation of leachate); chiefly we can protect our environment.
- On the basis of the implemented monitoring activities and of the elaborated stabilization reports, the obtained leachate and biogas in the landfill can be maintained within normal parameters.
- After the landfills are closed, it can be observed that both leachate and biogas preserve their quantitative and qualitative properties, while their flow rate decreases gradually in time.
- The Northern Italy landfill is one of the oldest sites in Italy. It is the beneficiary of specific treatment for the post-closure phase for the extraction of leach and biogas in optimal conditions.
- A landfill located in South of Italy, with similar operating conditions but with different technological control measures, has been considered for the sake of comparison.

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