Peter Lechner (Ed.)

Waste matters. Integrating views

Peter Lechner (Ed.)

Waste matters. Integrating views

Proceedings of the 2nd BOKU Waste Conference

This Conference has been supported by:

BOKU - University of Natural Resources and Applied Life Sciences

City of Vienna Department for Waste Management (MA 48)

ARA Altstoff Recycling Austria AG

KOMPTECH GmbH

facultas.wuv

o. Univ.-Prof. DI Dr. Peter Lechner, Head of Institute of Waste Management, BOKU - University of Natural Resources and Life Sciences

Copyright © 2007 ABF-BOKU, Muthgasse 107/3, 1190 Vienna, Austria
This work is subject to copyright.
All rights are reserved, whether the whole part of the material is concerned,
specifically those of translation, reprinting, re-use of illustrations, broadcasting,
reproduction by photocopying machine or similar means, and storage in data banks.

Cover photography	Wind-row turner (KOMPTECH GmbH)
Paper editing	Johannes Tintner
Language editing	Anne Farmer
	Luis F. Diaz
Layout & Design	Gerald Raab
Printed in Austria by	Facultas Verlags- und Buchhandels AG

ISBN 978-3-7089-0060-5

Printed with the Sponsorship of the Federal Ministery of Agriculture, Forestry, Environment and Water Management in Vienna


...und wo studierst du?
www.boku4you.at
BOKU
Universität für Bodenkultur Wien



Calculate your own Ecological Footprint!

Preface

Since the beginning of the 20th century industrial and social development has given rise to systemic problems such as pollution, soil degradation and global warming.

The field of waste management should contribute increasingly towards solving these problems, providing a more integrated, holistic approach focusing on social, economical, scientific and technical aspects. To achieve this aim would entail:

- significant moderation in consumption to avoid the generation of wastes and unnecessary end-of-life products
- significant increase in the use of recycled products to save energy and natural resources
- significant improvement of waste treatment before landfilling to ensure that emissions released into the environment are acceptable and require no further treatment

Over the last decades an intensive application of numerous different disciplines concerning waste issues has occurred. The questions asked and solutions proposed have become increasingly specific. The spectrum of activities on one hand ranges from the development of scientific- analytical methods on lab scale up to optimization techniques on facility or process scale. On the other hand, it is important that the whole waste management system and the entire life cycle, respectively, should be taken into consideration by both social and other sciences.

Accordingly, the BOKU Waste Conference 2007 will embark on an intra-disciplinary strategy. Through a combination of different waste specific disciplines in the single sessions, participants will be afforded an excellent opportunity to extend their main emphasis gradually and perhaps even envisage fruitful approaches for the future.

In this respect, by means of an integrated and interdisciplinary approach the BOKU Waste Conference 2007 will focus on:

Assessment of Waste Minimisation - Waste prevention has been assigned the highest priority under European waste management law. However, initiatives taken so far seem to have had only a small effect on the total amount of municipal solid waste. In general, there is a discrepancy between the effect expected for a waste prevention measure and the effect achieved in practice. To solve this "discrepancy" waste prevention strategies should take place in up-stream processes in the life cycle of products, before they become waste. One particular problem in this field is how to evaluate the success of waste prevention activities. For this purpose, methods taking the whole life cycle of products or services into account, such as Life Cycle Assessment or related methods, can be applied.

Compost Quality and Soil Improvement - Composting is a method commonly used to process biogenous waste materials. Organic wastes such as yard and kitchen waste from separate collection are a main source for high quality composts. During composting humic substances are built up. Organic matter, particularly humic acids, plays a central role in maintaining key soil functions. Stable organic matter is an essential factor against erosion and the fertility of soil is determined to a very large extent by the content of humic acids. With regard to environmental aspects the role of carbon sequestration should be pointed out.

Utilization of Landfill Gas and Emission Mitigation – Landfills represent an important source of the greenhouse gas methane. The latter is caused by incomplete gas collection at sanitary landfills, abandoned gas collection on older landfill sites with negligible amounts of gas production, and emissions from unauthorized open dumping. In the lack of additional measures, permanent maintenance of gas mitigation units, as well as monitoring and control in after-care are mandatory. Methane oxidation covers are already state of the art, or, as is the case of on-site biofilters, are undergoing development, not providing for utilization of the gas. On the other hand, the growing market price for natural gas provides the opportunity to extend the utilization of landfill gas. Adequate technical systems are under development, envisaging use even in the presence of an excessively low or reduced methane content of the gas.

Final Storage Quality - The term "*final storage quality*" was first defined twenty years ago by Baccini and Henseler and other members of a Swiss working group on landfills. In the meantime, the definition has been modified by several authors. Usually, final storage is used to imply an *"environmentally sound flux/load for short, medium and long term periods"*, although numerous interpretations of this definition are reported. Therefore, how can a sustainable landfill be defined today? Additional questions which should be answered, include: Which criteria should be applied in determining the transition from active aftercare to passive aftercare? Which operational measures should be used to achieve a final storage quality? Which accelerated physical, chemical and biological stabilisation techniques are required? An attempt should be made to provide answers to the above.

Our thanks to Anne and Luis for proof-reading.

Peter Lechner April 2007

Nachhaltigkeit ist heute anerkanntes Leitprinzip im Umweltschutz.
Dies gilt auch im Bereich der Abfallwirtschaft, die sich ausgehend von einer am Vorsorgeprinzip orientierten Beseitigung angefallener Abfälle hin zur Bewirtschaftung von Ressourcen, insbesondere Rohstoffen, Energie und Deponieraum entwickelt. Dazu kommt die Sanierung von in der Vergangenheit eingetretenen Schäden (Altlasten).

In einer auf Abfallvermeidung und Recycling ausgerichteten Strategie spielen nicht nur Wirtschaft und hohe technologische Standards eine zentrale Rolle, sondern auch die Konsumentinnen und Konsumenten, die durch ihr Sammel- und Abfalltrennverhalten sowie durch ihre Kaufentscheidungen ganz wesentlich zur Zielerreichung beitragen.

Grundlage für eine umfassende Regelung dieses Bereiches bildet das Abfallwirtschaftsgesetz aus dem Jahr 2002, in dem die anerkannten Ziele und Grundsätze einer nachhaltigen Abfallwirtschaft als Leitlinien für staatliches und privates Handeln verankert sind. Vorrangiges Ziel ist der Schutz von Mensch und Umwelt. Dieses Ziel wird erreicht bzw. begleitet durch möglichst geringe Emissionen und bestmögliche Nutzung vorhandener Ressourcen.



Kern einer nachhaltigen Wirtschaftsweise im Sinne des Vorsorgeprinzips ist die Steigerung der Ökoeffizienz, wobei die Erhöhung der Materialeffizienz für die Abfallwirtschaft maßgebend ist. Daraus lässt sich schlüssig ableiten, dass neben der Vermeidung die Verwertung von Abfall im Sinne einer nachhaltigen Entwicklung hohe Priorität verdient.

Vermeidung und Verwertung
Insbesondere Maßnahmen zur Abfallvermeidung können Umweltbeeinträchtigungen an ihrem Ursprung bekämpfen. Mit einer verstärkten Betonung der Produzentenverantwortung soll hier auch dem Verursacherprinzip Nachdruck verliehen werden. Vorrang hat die Verwertung von bereits entstandenem Abfall, so weit dies ökologisch und wirtschaftlich zweckmäßig und technisch möglich ist. Die daraus gewonnenen Stoffe dürfen jedenfalls kein höheres Gefährdungspotenzial aufweisen als Primärrohstoffe. Keinesfalls darf es dadurch zu einer Verteilung von Schadstoffen in der Umwelt kommen. Nicht vermeid- und verwertbare Abfälle sind einer umweltgerechten Beseitigung zuzuführen, bei der organische Schadstoffe zerstört und anorganische Schadstoffe in den Rückständen konzentriert werden. Aus der Ablagerung von Abfällen darf keine Gefährdung für nachfolgende Generationen resultieren.

Abfallwirtschaft ist aktiver Umweltschutz
Die Abfallwirtschaft ist ein wichtiger Teil der Umweltpolitik. Kern der österreichischen Strategie ist die Weiterentwicklung der klassischen Abfallwirtschaft (Beseitigung bereits angefallener Abfälle) zu einer Ressourcenbewirtschaftung (Vermeidung und Verwertung) auf Basis stoffstrom- und güterstromgesteuerter wirtschaftlicher Überlegungen.

In Verfolgung dieser Grundsätze hat das Lebensministerium eine Reihe von Maßnahmen gesetzt, welche Österreichs abfallpolitische Vorreiterrolle erkennbar machen, beispielsweise die Festlegung einer eigenen österreichischen Vermeidungs- und Verwertungsstrategie oder die Forderung der Behandlung vor einer Ablagerung von Abfall in der Deponieverordnung.

KOMPTECH GmbH
A-8130 Frohnleiten, Kühau 37
[t] +43 3126 505 - 0
[f] +43 3126 505 - 505
info@komptech.com

KOMPTECH
Technology for a better environment

Composting Technology



TOPTURN X
self-propelled compost turner
for triangular windrows



MULTISTAR L3
mobile star screen

KOMPTECH has been manufacturing professional machine technology for the composting of organic waste since 1992.
Be they the composting of green waste, biowaste, municipal solid waste or sewage sludge - KOMPTECH has the necessary expertise, the right machinery and the right plant technology.

www.komptech.com



Seit seiner Gründung im Jahr 1993 hat sich das ARA System als kompetenter Partner der österreichischen Wirtschaft bei der Erfüllung der Verpackungsverordnung etabliert. Es sammelt und verwertet jährlich rund 760.000 Tonnen Verpackungsabfälle und 14.000 Unternehmen erhalten die nachhaltig günstigsten Preise. Denn alle Überschüsse, die das ARA System erwirtschaftet, fließen über Tarifsenkungen an die Kunden zurück. Und das bedeutet für 2007 eine Einsparung von 142 Mio. Euro gegenüber 1996. Kein Wunder, dass dieses einzigartige österreichische Erfindung ein Vorbild für ganz Europa ist.

www.arasystem.at

ARA SYSTEM

University of Natural Resources
and Applied Life Sciences

Institute of Waste Management
Muthgasse 107/3
1190 Vienna - Austria
Email. abf@boku.ac.at



Compost Quality
Landfill Gas
Final Storage
Waste Minimisation

Contents

Compost Quality and Soil Improvement

Soil Carbon Stocks and Global Change **19**
H. Kromp-Kolb and M.H. Gerzabek

Organic Solid Waste Management in a Framework of Millennium Development Goals and Clean Development Mechanism – How Can Research Contribute? **29**
C. Zurbrügg, S. Rothenberger, Y. Vögeli and S. Diener

Comparison of the Energy Recovery and Usage of Compost from Green Waste under Aspects of Primary Resources **39**
M. Kranert, G. Hafner, R. Gottschall and C. Brems

Potential of Compost-Nitrogen to Improve Environmental Quality **43**
I. Körner

Compost Quality – Trends and Tools **51**
E. Smidt, E. Binner, K. Meissl and J. Tintner

Standardized Determination and Classification of Stability of Organic Matter in Compost **63**
A. Veeken, W. Blok, S. Moolenaar and M. Grigatti

Enzymatic Activity as a Parameter for the Evaluation of Two-phase Olive Mill Wastes Composting **73**
M. L. Cayuela, C. Mondini, M. A. Sánchez-Monedero and A. Roig

Soil Improvement Using Earthworm Compost Elutriate **81**
S. Haindl, J. I. Fritz and R. Braun

Compost Amendments Affect Yield and Mycorrhizal Colonization of Corn (*Zea mays L.*) in Marginal Soils **91**
Getinet Desalegn, E. Binner, E. Smidt, J. P. Toussaint, H. Vierheilig, P. Liebhard and P. Lechner

Decentralised Composting of Market Waste and Recirculation in Peri-Urban Agriculture - A Case Study in Guinea (West Africa) **101**
R. Linzner, M. Soumah, E. Binner and E. Smidt

Composting in the Backyard in Asia: Some Lessons Learned through Euro-Asian Collaboration in the Cases of Vietnam and the Philippines **109**
A. Karagiannidis, M. Theodoseli, A. Malamakis, B. Bilitewski, J. Reichenbach, T. Nguyen, A. Galang and P. Papayno

Utilization of Landfill Gas and Emission Mitigation

Dwindling Landfill Gas - Relevance and Aftercare Approaches **123**
M. Huber-Humer

Engineered Biocovers - Passive Mitigation Systems for Landfill Gas: Status for the Demonstration Project, BIOCOVER **133**
P. Kjeldsen, A.M. Fredenslund, C. Scheutz and G. Lemming

Potential and Limitations of Passively Vented Biofilters for the Microbial Oxidation of Landfill Methane 143
J. Gebert and A. Gröngröft

Biological methane oxidation in actively vented biofilters 153
J. Streese-Kleeberg and R. Stegmann

Development of Progressive Combustion Systems for Low Calorific Landfill Gas 165
A. Al-Halbouni, A. Giese, H. Rahms and K. Görner

New DN-ES+S Landfill Aftercare Conception Based on a Fluidized Bubbling Bed Combustion Plant Burning Very Poor Landfill Gas 175
D. Steinbrecht and V. Spiegelberg

Biomethane from Biogas: Expectations from Established vs. New Technologies 185
F. Scholwin, F. Hofmann and A. Plättner

Evaluation of Existing and Evolving Techniques for Landfill Gas Upgrading in Comparison with Conventional Mitigation Systems 195
P. Mostbauer and S. Lenz

Operation of a Pilot Plant for the Biogas Injection in Austria 209
J. Bergmair, N. Weran, W. Ahrer

Biological Methane Oxidation Influenced by Biochemicals 217
J. Berger, J. Jager

Hydraulic Aspects of the Design of a Passive Methane Oxidation Barrier (PMOB) 223
A. Cabral, S-É. Parent and B. El-Ghabi

Assessment of Waste Minimization

The Evaluation of Waste Prevention Programmes: a WRAP Perspective 233
J. P. Parfitt

The Whitebook on Waste Prevention and Recycling in Austria 243
H. Reisinger and H.-J. Krammer

Material Recovery of Plastics and Textile Waste – Reducing Greenhouse Gas Emissions? 251
M.-R. Hiltunen and H. Dahlbo

Present and Future Strategies for Biowaste Management 261
A. Veeken, W. Blok, A. Mels, S. Moolenaar and H. van Ewijk

Swedish Waste Prevention and Greenhouse Gas Emissions 271
T. Ekvall, M. Bisaillon and J. Sundberg

Waste Minimization through Integration of Energy-Agro-Waste Subsystems 283
L.F. Diaz, G.M. Savage and L.L. Eggerth

The Use of the LCA-IWM Tool to Assess the Sustainability of Waste Minimisation 293
J. den Boer, E. den Boer and J. Jager

Waste Minimization Using Behavioural Change Techniques: A Case Study for Students 303
H.B. Gunton and I.D. Williams

Ecodesign in a Life Cycle Perspective 315
M. Huber, R. Pamminger and W. Wimmer

Strategy for Waste Prevention in Salzburg 2007-2009 ..... **325**
C. Pladerer

Waste Prevention in Vienna **335**
U. Stocker

An Assessment of Variable Charging Scheme as a Means to Waste Minimization **337**
K. Watanabe

Final Storage Quality

Landfill Aftercare – Duration, Strategies and Closure Criteria **349**
R. Stegmann, K.-U. Heyer and K. Hupe

Sustainable Landfill and Final Storage Quality **359**
H. Scharff, J. Jacobs, H.A. van der Sloot and A. van Zomeren

Role of Organic Fraction MSW Selective Collection as Indirect Landfill Pre-treatment **369**
M. Ragazzi and E.C. Rada

Analytical Methods for the Determination of the Biological Activity of MSW **379**
J. Heerenklage and R. Stegmann

An Approach to Determine Long-Term Emissions of Metals from Landfills with Specific Consideration to Waste Pretreatment and Landfill Processes **389**
E. den Boer and J. den Boer

In-Situ Treatment Methods Capable to Achieve Final Storage Quality? **399**
J. Fellner, G. Döberl, G. Allgaier and P. H. Brunner

Reduction of the Residual Landfill Gas Production by Means of In-situ Aeration **407**
M. Ritzkowski and R. Stegmann

Preliminary Tests and Full Scale Applications of In Situ Aeration **417**
D. Rossetti, S. Cestaro, R. Cossu, R. Raga, M. Zane and A. Costa