Change of Mechanical-Biological Waste Treatment in Austria

Josef Mitterwallner and Wilhelm Himmel

The development of mechanical-biological waste treatment in Austria is inextricably linked to the development of the Austrian landfill law. Based on the provisions of the Austrian Landfill Ordinance 1996, only pre-treated, poor reactive waste is allowed to be deposited in Austria since 1 January 2004. The most essential deposition criterion is the proportion of organic carbon (TOC) in the deposited waste. According to the regulations of the Landfill Ordinance, a maximum TOC-content of five percent by dry mass is determined for the depositing of waste at a so called mass-waste disposal site. To reach this TOC-limit it usually requires a thermal treatment of waste. In order not to be excluded by that provision, the mechanical-biological waste treatment technology has been established as an alternative waste treatment method in the Landfill Ordinance. Mechanically biologically pre-treated waste must not exceed the limit of the gross calorific value of 6,000 kJ/kg DM. In this case the TOC-limit value becomes obsolete. These requirements ensure that only low reaction wastes go to final disposal sites and high calorific fractions will be used to produce energy. Furthermore, mechanically biologically pre-treated waste must comply with the limit values of the so called stability parameters (breathability, gas formation potential, gas donation) to detect the biological stabilization of the material prior to deposition. The pretreatment-bid of waste causes next to a reduction in volume, above all, a decrease in gas formation potential and thus leads to a shortening of the follow-up service period of landfills.

In Austria MBT has a long tradition. Since the mid-1970s plants have been operated with the objective of residual waste composting or so called *Restmüllhygienisierung*. The aim was to separate impurities and valuable material from the residual waste and save landfill volume due to the residual waste composting. Some of these old plants have been adapted to the new requirements, defined in the Austrian MBT-Guidlines of 2002, and were now operated as MBT systems [7]. At the time when the provisions of the Landfill Ordinance 1996 came into force (1.1.2004) in Austria a total of 16 MBT plants were in operation.

Site	Province	Capacity
		t/a
Aich Assach	Styria	15,250
Allerheiligen	Styria	17,100
Fischamend	Lower Austria	27,000
Frohnleiten	Styria	65,000
Frojach-Katsch	Styria	4,000
Halbenrain	Styria	70,000
Kufstein	Tyrol	9,500
Liezen	Styria	25,000
Linz	Upper Austria	65,000
Neunkirchen	Lower Austria	28,500
Oberpullendorf	Burgenland	82,000
Ort im Innkreis	Upper Austria	15,000
Siggerwiesen	Salzburg	140,000
St. Pölten	Lower Austria	42,000
Wiener Neustadt	Lower Austria	24,000
Zell am See	Salzburg	40,000
Total capacity		**669,350**

Table 1:

MBT-plants in operation, 2004

Source: Neubauer; Öhlinger (2006): The situation of mechanical-biological waste treatment in Austria, Vienna, Umweltbundesamt GmbH

Due to overcapacities of national and foreign incineration plants, currently waste can be treated in these thermal recovery facilities to a much more favourable price than in MBT plants. Thus, waste streams were withdrawn from the MBT and diverted into waste incineration or co-incineration plants, often at the expense of domestic plant operators or high recycling rates.

With the implementation of the Landfill Ordinance 2008, the successor document to the Landfill Ordinance 1996, a ban on dumping of residues from thermal processes to mass waste landfills was stated. Since many MBT plant operators were running a mass waste landfill to deposit their MBT residues at their own landfill, this provision of the Landfill Ordinance 2008, caused a weakening of the mass waste landfill category. Thus, from 2008 on, the deposition of the increasing amounts of ashes and slags was no longer an option for mass waste landfill operators.

Due to the changed framework conditions the operation mode of many MBT plants in Austria has been changed fundamentally or plants even were shut down.

Referring to the situation of MBT at the province of Styria, the Office of the Provincial Styrian Government Department 14 – water management, resources and sustainability will have to consider the changing framework conditions of MBT in the forthcoming update of the Styrian Waste Management Plan 2010. Especially the impact of the recent developments on the disposal safety has to be taken into account. The key parameter for assessing the disposal safety is among other the presence of adequate landfill capacity. The past has shown that authorization of new mass waste landfills needs a time period of up to 10 years, hence, the remaining volume of mass waste landfills has become an

important measure of disposal safety. This measure is essential in the course of the updating process of the Styrian Waste Management Plan in which appropriate waste management strategies and objectives will have to be formulated [1].

1. Legal frameworks

By the end of 2010 the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW), started its work to develop a regulation for the mechanical-biological waste treatment sector (MBT-ordinance). In this course a working group consisting of representatives of the provincial governments, the Federal Environment Agency, the Interest Association MBT in Austria (IV-MBA), the Association of Austrian Disposal Companies (VÖEB), and the Austrian Water and Waste Management Association (ÖWAV) has been established. Due to provisions of the European Industrial Emissions Directive (2010/75/EU) and the corresponding BAT-reference documents the Federal Ministry of Agriculture, Forestry, Environment and Water Management was convinced that there is a need for adjustment of the Austrian legislation in the field of mechanical-biological waste treatment. In Annex I, point 5 of the European Industrial Emissions Directive, the mechanical-biological waste treatment is defined as follows:

- Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving the following activities, and excluding activities which are covered by Directive 91/271/EEC of 21 March 1991 on the treatment of urban waste water.
  - Biological treatment, and
  - Waste pre-treatment for incineration or co-incineration.
- Recovery – or a combination of recovery and disposal – of non-hazardous waste with a capacity exceeding 75 tonnes per day involving one of the following activities, and excluding activities covered by Directive 91/271 / EEC.
  - Biological treatment (eg. the production of waste compost),
  - Waste pretreatment for incineration or co-incineration.

Thus, the recent IPPC activities were divided into several categories and expanded. In addition to the disposal operations, recovery operations were therefore included in the directive.

In a working paper of the Federal Ministry of Agriculture, Forestry, Environment and Water Management published in June 2012, the cornerstones of a future regulation on plants for mechanical-biological waste treatment were defined as follows (Division VI/3, 2012).

- The regulation should cover only plants in which municipal waste is treated biologically or mechanically-biologically. Single mechanical systems, composting plants or fermentation plants should not be covered by the regulation.
- The application documents to get a new permit or the content of existing plant permits should be concretized.

- Requirements for the implementation of the input control;
- Requirements for the construction, equipping and operation of MBT plants;
- Emission-related requirements on waste entrance facilities, mechanical processing, physical material separation, storage and for internal transport;
- Emission-related requirements on equipment for biological treatment, process water and vapor condensates;
- Approval of exceptions;
- Discharge of exhaust air;
- Limiting exhaust emissions;
- Protection of soil and water;
- Rules of metrology, measuring stations and measuring distances, measuring instruments and measuring devices and systems, measurements, individual measurements and continuous measurements;
- Calibration, maintenance and functional testing;
- Emission limits;
- Air emission declaration;
- Other than normal operating conditions – disturbances of operation;
- Monitoring.

The high demands on future facilities and operation modes of MBT plants caused concerns at some members of the working group whether the economic sustainability of the MBT technology and their competitiveness with other waste treatment techniques such as the total waste incineration. In particular, the strict emission-related requirements raised fears in the working group that in some individual plant-investments, the new emission targets can only be achieved through more sophisticated process engineering, such as the regenerative thermal oxidation (RTO) of the exhaust gas. Also the use of energy and the resulting additional climate-relevant emissions by this technology were seen critically in the experts group. Furthermore, experiences from Germany show that the RTO technology is fraught with many problems and therefore downtimes are recorded regularly. This resulted in massive criticism of MBT- site representatives and plant operators about the content of the planned MBT Ordinance, which almost rule out an economic continued operation of the existing facilities. The fact that the preparation of the key points was based at a large extent on experience from Germany led to the situation that some plant operators conducted emission measurements at their own facilities. These measurements confirmed in a first step the different basic conditions in Austrian plants compared to German MBT-plants. The results of these in-house emission measurements were subsequently provided to the Federal Ministry of Agriculture, Forestry, Environment and Water.

2. Emission measurements

The evaluation of the provided emission data and a corresponding discussion in the working group has confirmed that the knowledge about actual airborne emissions of Austrian MBT plants is insufficient. The emission-documents from three individual sites provided by plant operators and the Interest Association MBT Austria (IV MBA) allowed only a limited statement about the emission behaviour of MBT in Austria. To improve the knowledge about the emissions of Austrian MBT plants, a measurement institute was commissioned in 2013 with the implementation of emission measurements at two Styrian plant locations (Halbenrain, Frohnleiten) and one location in Salzburg (Siggerwiesen). The Federal Environment Agency accompanied the measurement program and provided expertise concerning measurement planning and metrology available [6].

In the course of continuous measurements, the parameter total organic carbon (TOC), methane (CH_4) and nitrous oxide (N_2O) were measured at each of the three plant locations. The measurement results correspond with a measurement period of at least four weeks in about a monthly average.

Table 2: Selected emission data, MBT Halbenrain and (M)BT Frohnleiten

Halbenrain	**Unit**	**Before scrubber/ BF raw gas**	**after scrubber/ BF clean gas**
HHA number		1,371	1,372
TOC concentration mean value (measurement)	mg/m³	22	14
Load per ton of biologically treated waste (calculation)	g/tBT	238	180
HHA number		1,371	1,377
Nitrous oxide concentration average (measurement)	mg/m³	37	46
Load per ton of biologically treated waste (calculation)	g/tBT	400	591
Frohnleiten			
HHA number		1,383	1,318
TOC concentration mean value (measurement)	mg/m³	118	55
Load per ton of biologically treated waste (calculation)	g/tBT	447	301
HHA number		1,383	1,318
Nitrous oxide concentration average (measurement)	mg/m³	1	1
Load per ton of biologically treated waste (calculation)	g/tBT	4	5

BT = biological treated waste; HHA = half-hour average; BF = biofilter

Source: Neubauer, C.; Buxbaum, I. (2014): Measurement of airborne emissions at MBT-sites in Austria, Vienna, Umweltbundesamt GmbH

Halbenrain location (treatment duration 12 weeks tunnel composting as intensive and final composting with air circulation and cascading multiple use of exhaust air from intensive care and post-rotting; Goal: Biological wet fermentation) showed low TOC values and high N_2O values in the raw gas. Moreover in Halbenrain the N_2O values in the clean gas were slightly higher than the values in the raw gas. The documented N_2O loads in Halbenrain are attributable to the following aspects of plant-management: co-treatment of sewage sludge, temperature level in the rotting, simultaneous detection of exhaust air and from the maturing process and pollution control without an acid scrubber.

At the Frohnleiten plant (treatment time 4 weeks, tunnel composting as intensive rotting with air circulation; Goal: Biological wet fermentation) the lowest N_2O values were measured in total.

The results obtained should have been an important basis for discussion within the *Working Group MBT Regulation* and for the textual content of the proposed regulation, respectively [6]. Meanwhile, however, it was notified by the BMLFUW, that the national MBT- legislation plan (MBT-ordinance) will not be pursued, since the relevant BAT-documents will be directly applicable after their completion presumably in 2017. The extent, to which market-specific conditions, described above, have played a role in the rejection of the ordinance by the ministry, could not be ascertained.

3. Current MBT-plants status in Austria

As shown in the table below (Table 3) only 12 MBT-plants are currently in operation in Austria. Compared to the situation in the year 2004 there is a loss of four plants to register. The total plant capacity has decreased from 669,350 t/a in the year 2004 to 536,750 t/a in 2014.

At Austrian MBT-plants an amount of 378,643 t of waste has been processed in the year 2013. Hence, the degree of capacity utilization was only at approximately 70 percent.

Site	Province	Capacity
		t/a
Aich Assach	Styria	15,250
Fischamend	Lower Austria	27,000
Frohnleiten	Styria	65,000
Halbenrain	Styria	80,000
Hartberg	Styria	4,500
Kufstein	Tyrol	15,000
Lavant	Tyrol	17,000
Liezen	Styria	25,000
Oberpullendorf	Burgenland	82,000
Siggerwiesen	Salzburg	140,000
St. Pölten	Lower Austria	42,000
Wiener Neustadt	Lower Austria	24,000
Total capacity		**536,750**

Table 3:

MBT-plants in operation, 2015

Source: Loidl (2015): Actual Situation of MBT in Austria, PP-Presentation 19 May 2015, ÖWAV working group

As shown in figure 1 the main portion of the input material can be assigned to the category of municipal waste. From the total output of 277,733 t in the year 2013 approximately 195,000 t went into landfills, this is approximately 50 percent of the total input fraction.

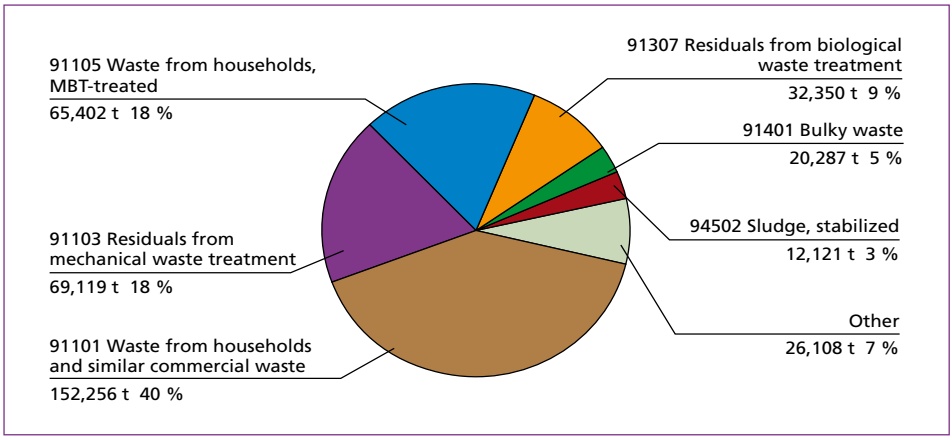

Figure 1: Waste input to Austrian MBT-plants 2013

Source: Loidl (2015): Actual Situation of MBT in Austria, PP-Presentation 19 May 2015, ÖWAV working group

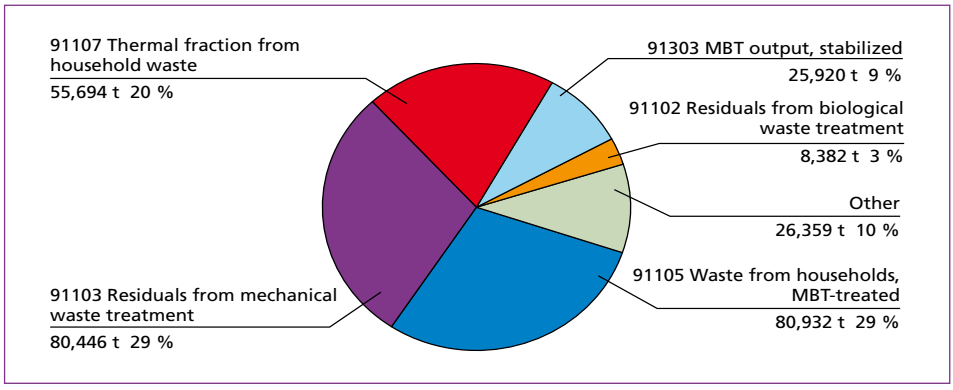

Figure 2: Waste output from MBT-plants in Austria 2013

Source: Loidl (2015): Actual Situation of MBT in Austria, PP-Presentation 19 May 2015, ÖWAV working group

4. Changes in the plant structure in Styria

The Province of Styria is, related to its waste management, within Austria the declared province of MBT, since mechanical-biological waste treatment held a very important position in comparison to thermal waste treatment. The MBT-plant situation in Styria should therefore be illuminated more closely, representative for the development of MBT in Austria.

High investment costs incurred by public and private waste management industry enabled the implementation of the content of the Landfill Ordinance 1996 by January 2004 in a comprehensive MBT waste treatment approach for Styria. According to the principles of the EU Waste Framework Directive, which requires self-sufficiency and proximity of the plants to the waste, a functioning network of small-scale waste treatment facilities has developed in Styria. At the same time very high level treatment standards and appropriate disposal safety were achieved. In the discussion mechanical-biological waste treatment or thermal waste treatment Styria always represented the point of view that only an intelligent combination of mechanical, biological and thermal treatment methods, depending on the waste composition, ensures the achievement of the waste management objectives. The regional structure of the Styrian waste treatment plants guarantees that waste can be treated differentiated and targeted and that transport routes are minimized. This plant structure was an important contribution to achieve the objectives of the Austrian climate strategy in the waste management sector, which is one of the few positive balancing sectors. In addition to environmental and economic benefits of the existing investment structure in Styria the social component of the 3-pillar sustainability model must not be forgotten. A total number of about 2,600 jobs were created within the Styrian waste management [3].

According to the Styrian Waste Management Plan 2010 municipal waste were fed in Styria in seven mechanical-biological waste treatment plants. For deposition of the resulting residues were at this time a total of 7 mass landfills available. The high degree of recycling rates was figurehead of the Styrian waste management for many years.

Upgraded incineration capacities in Austria and Europe coupled with falling incineration prices has occurred serious changes in the waste-infrastructure system of Styria. Many plants have switched their treatment process from a rotting-mode to a so-called drying mode. The fine fraction (landfill fraction) is instead of the rotting process subjected to a drying process and fed to a thermal treatment step, corresponding to the degree of reduction of the water content. The former well-established concept of differentiated regional treatment of municipal waste in Styria will be increasingly replaced by the concept of total waste incineration.

Site	Capacity t/a	Status
Aich-Assach	15,250	Drying mode
Allerheiligen	17,000	closed
Frohnleiten	65,000	Drying mode
Frojach-Katsch	4,000	closed
Halbenrain	80,000	Drying/rotting mode
Hartberg	4,500	Rotting mode
Liezen	25,000	Drying mode

Table 4:

Status of MBT plants in Styria in July 2014

Source: Mitterwallner (2014): Auslaufmodell MBA? Ein Situationsbericht aus der Steiermark, Conference proceedings DepoTech 2014, Leoben

5. Summary and conclusions

In the former classical MBT-Province of Styria only one out of seven MBT-plants is operated in the classical rotting-mode. Another plant is performed in a combination of rotting- and drying mode. Four plants have switched to exclusive drying operation and one system has been provisionally closed down. Despite existing thermal plant capacities in the field of waste incineration or co-incineration in the Province of Styria the bulk of thermal fractions leaves the province borders to be treated in incineration plants in the neighbouring provinces and abroad.

The consequently increasing amount of residues from thermal processes has caused that nearly 500,000 m^3 of mass waste landfill volume (Massenabfalldeponie) were converted to residual material landfill volume (Reststoffdeponie) since the implementation of the Landfill Ordinance 2008 in July 2009.

This means for the Styrian waste management planning, that residual material landfill volume must be integrated into the relevant parameter list for the disposal safety, in addition to the available mass waste landfill volume.

As a result of new tenders for disposal services of three waste management associations approximately 50,000 tonnes of residual waste were redirected from Styria recently. This development has significant impacts on the regional employment situation in the Styrian waste economy and the emission balance due to increasing transport distances.

6. Literature

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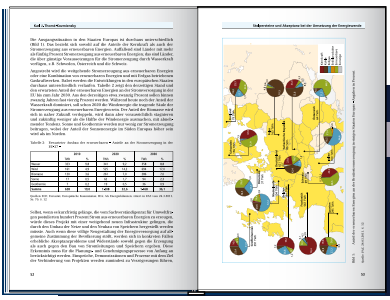

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Dorfstraße 51
D-16816 Nietwerder-Neuruppin
Tel. +49.3391-45.45-0 • Fax +49.3391-45.45-10
E-Mail: tkverlag@vivis.de

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