STIFTUNG ZENTRUM FÜR NACHHALTIGE ABFALL- UND RESSOURCENNUTZUNG

Waste and Resource Management

innovative, ecological, economical

Annual Report/Activity Report 2018

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◄ Cover photo: Sedimentation machine – washing tests with mineral fraction

Foreword by the President

Climate protection and the recycling economy are two words that often shape the discussion today, both in private talks and in political debates. Both topics lead to comments in daily newspapers and magazines and are the focus of conferences.

The protection of our climate and the use of our resources are indeed very important for all of us and for our future. Often something of our everyday life is put on the «dock». Be it flying or plastic. Unfortunately it often remains with statements like «one should».

Thermal recycling is the process in which waste that cannot be directly recycled is thermally processed in order to use the energy released as efficiently as possible and to return the recyclable materials contained in the combustion residues to the economic cycle. If metals do not first have to be extracted in mines and then refined using a great deal of energy in processes that often pollute the environment, thermal recycling can save a great deal of CO_2 and make a major contribution to the recycling economy.

Last year, the employees of the ZAR Foundation again worked with great commitment on innovative solutions to optimize the recovery of recyclable materials from thermal waste treatment – or to make phosphorus possible in the first place.

My thanks go to all employees of the ZAR Foundation for their commitment. However, this work would not be possible if the vision and goals of the ZAR Foundation were not supported by many donors, some of whom have been donors for many years. In order for something new to emerge, a culture of open cooperation with many different partners is needed. I would like to take this opportunity to thank you all for your support and cooperation.

In the middle of 2018 I was allowed to take over the presidency of the ZAR Foundation from our long-time president Dr. Ueli Büchi. I would like to thank you, Ueli, very much for your engagement for the ZAR Foundation.

If we take climate protection and recycling management seriously, we in Switzerland must seize the opportunities offered by thermal recycling and exploit the potential that still exists. It is also important to spread the benefits of the thermo-re® brand throughout the world, because there are still many nations that have had the necessary means to thermally break down the waste that cannot be directly recycled and to reuse the energy and recyclable materials in the process. Compared to the landfilling of waste, this would be a gigantic climate project and a valuable element for recycling management.

Franz Adam
President of the Board of the Foundation

BOTTOM ASH TREATMENT

Stainless steel separator

Operating experiences

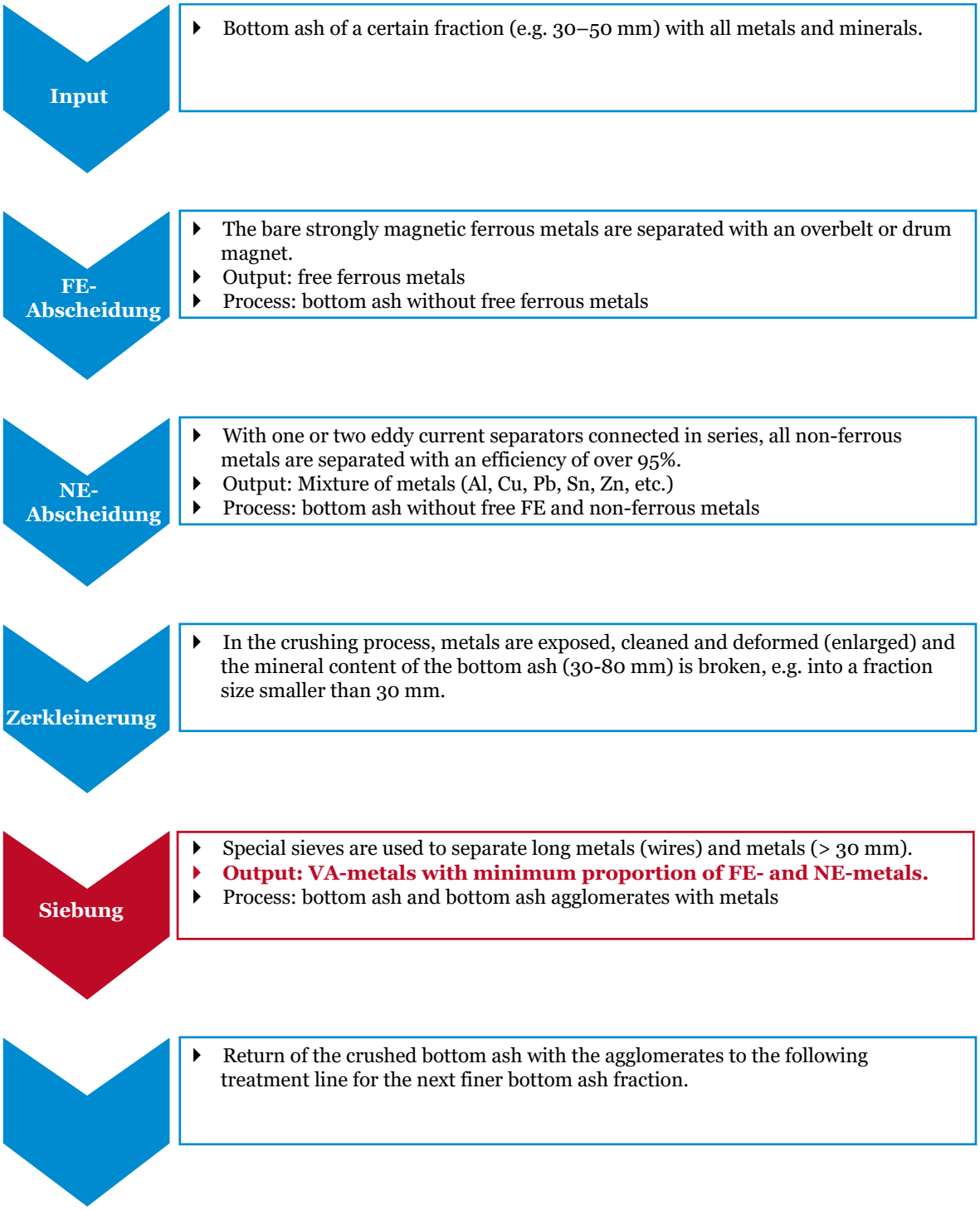
Despite extensive modifications to the stainless steel separators, the efficiency and also the quality of the separated stainless steel metals remained very limited. For this reason it was decided to test the sensor technology of another supplier. For this purpose, the first stainless steel separator of the 30–60 mm fraction was modified. Various tests were carried out with the new sensor over a period of about half a year. In summary, it can be said that better values were achieved with the new sensor, but the efficiency and purity of the stainless steel metals were still unsatisfactory. The result was the following conclusion: The sensor technology used, based on the measurement of the magnetic potential, is in our opinion not suitable for dry bottom ash. Magnetic inclusions in the mineral bottom ash agglomerates are characterized by the sensor as slightly magnetic, which is why they are unfortunately recognized and separated as potential stainless steel parts. The spectrum of slightly magnetic materials in the bottom ash is huge, therefore separation by type is only possible to a very limited extent. Furthermore, the sensor technology is expensive to purchase and the operating costs (compressed air consumption) are high.

New innovative approach

The negative experiences with sensor stainless steel separators led us to the new approach of «stainless steel separation according to the exclusion process». This means that the stainless steel parts are no longer actively separated, but are «left over» at the end after the final screening process. This means that the capital and operating cost-intensive stainless steel sensor separation machines can be dispensed with and the sorting result significantly improved.

Description

In concrete terms, this means that first a bottom ash is produced with the use of FE and NE separators, which no longer contains free FE and NE metals, but only mineral parts, stainless steel parts and agglomerates, which can still contain all metals. If this bottom ash stream is then broken in the crusher, the mineral materials are crushed, while the metals remain in their size. If a special screening machine is connected downstream of the crusher, which separates only large parts and elongated parts (wires), a stainless steel fraction is obtained which consists of up to 95% stainless steel metals with little FE and NE metals and mineral parts. The crushed bottom ash fraction with the smaller metals exposed from the agglomerates (ferrous, non-ferrous, stainless steel), which have not been separated from the special screen, goes to the next processing line, which functions according to the same concept, but sorts parts of smaller size. Figure 1 shows the material flow of this principle, which was successfully implemented in 2018.



▲ Fig.1: Principle „Stainless steel separation using to the exclusion procedure".

Optimization of NF-separators

Experiments with modified magnetic drum

SGM MAGNETICS S.P.A. provided us with a new magnetic drum with 40 poles and a slightly larger diameter for tests. It was hoped that the new magnetic drum would be more efficient in separating non-ferrous metals than the magnetic drums installed today.

Installed magnetic drum:
15 magnets – 30 poles – 3 700 gauss

Test magnetic drum:
20 magnets – 40 poles – 3 200 gauss

In the ZAV Recycling AG plant two identical lines for non-ferrous separation are installed. The test magnetic drum was installed at line 1. Although both lines are fed from the same silo, the material feed on both lines is not homogeneous. A direct comparison between the lines based on the separated non-ferrous metals or the residual non-ferrous content in the processed bottom ash therefore does not provide reliable results.

Trial set-up

The following approach was chosen. Similar to ball impact in athletics, standard NE parts were used to test the performance of the drum magnets with regard to repulsion or «long-distance throw« of the parts. For the tests, non-ferrous metals were selected which could be reproducibly positioned on the conveyor belt of the non-ferrous separator (see Fig. 1).

In addition, the maximum magnetic strength was determined on the drum in the axial direction and marked accordingly on the conveyor belt. By positioning the non-ferrous metals directly on this line, a systematic experimental error in the positioning of the non-ferrous metals could be ruled out for both magnetic drums.

The aluminium part number 3 (see Fig. 2) could not be used because no reproducibility could be achieved.

▲ Fig 2: Standard non-ferrous parts

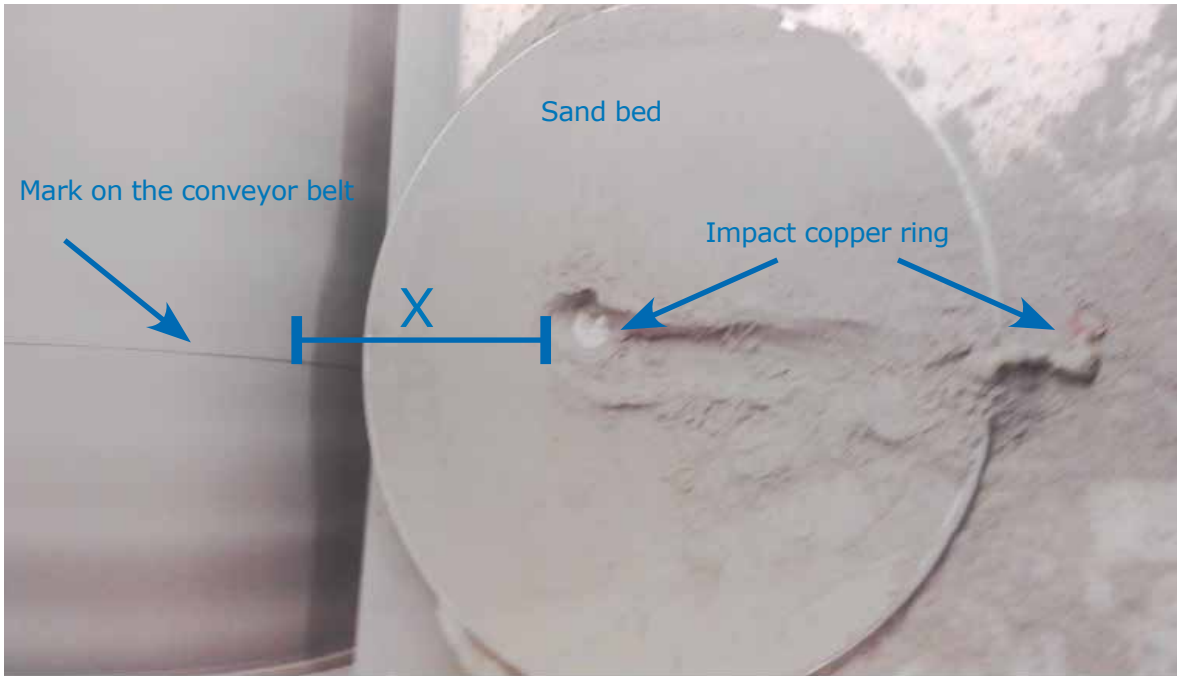
With this approach a measuring procedure could be found, which shows representative results for the comparison of different magnetic drums. For the experiments, the distance between the surface of the magnetic drum and the impact position of the metal part in a sand bed was measured (see Fig. 3). The measurements of this distance X are listed in Table 1.

	30 poles [cm]		40 poles [cm]	
Copper ring small	13.5	13.5	13.0	13.5
Copper ring large	17.0	16.5	14.0	14.5
Aluminium part # 1	15.5	16.0	13.0	14.0
Aluminium part # 2	24.5	25.0	22.5	22.0

▲ Table 1: Distance measurement results

Results

The new magnetic drum with the 40 poles showed no advantages over the standard version with regard to repulsion in the investigated test area. The latter tended to be judged worse, so that a change to the 40-pin magnetic drum was not necessary.



▲ Fig. 3: "Sand bed" for determining the flight distance of the standard particle

Optimized material feed to the non-ferrous separators implemented

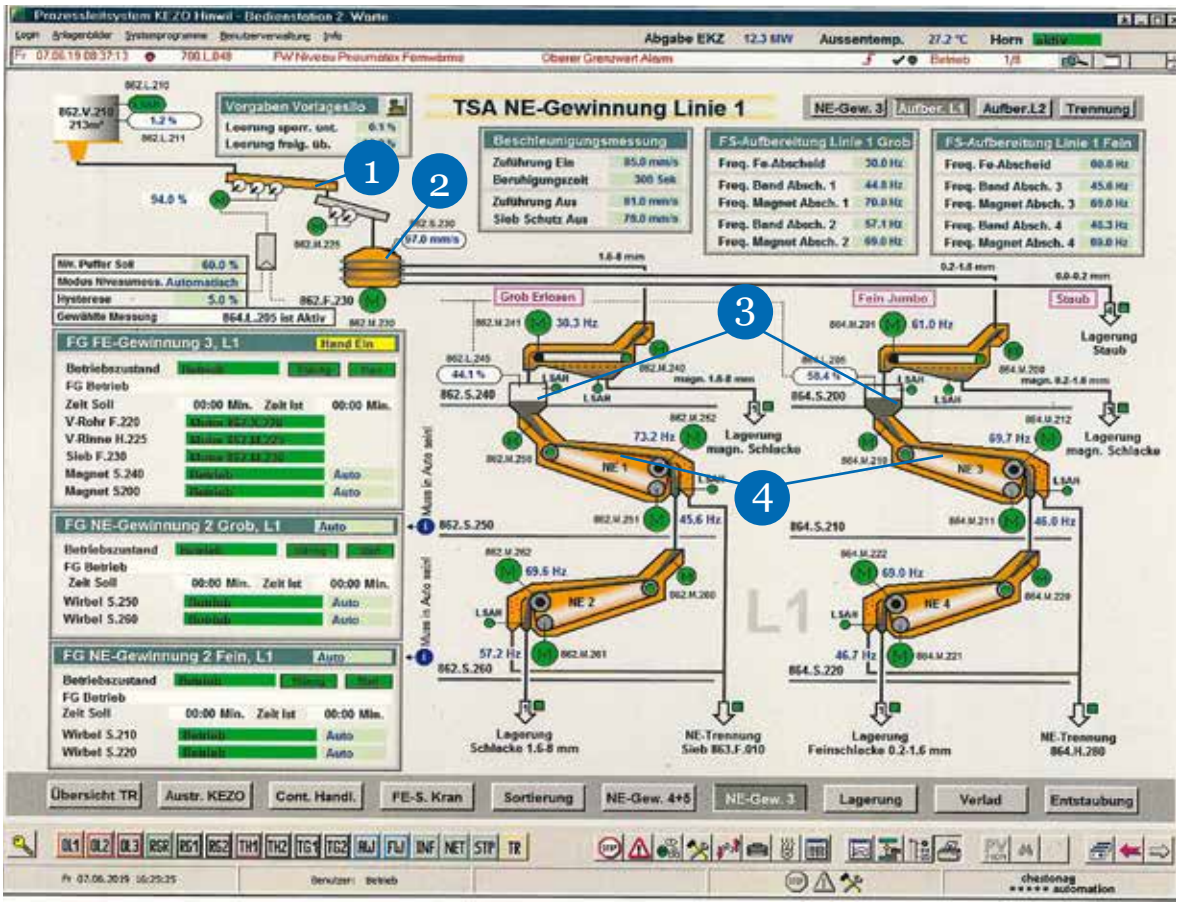
Operating experience

With the installation of buffer silos (3) for constant feeding of the non-ferrous separators of the fractions 0.3–2.0 mm and 2.0–15 mm, the expectations, i.e. better screening, slightly increased efficiency, better adjustment possibilities, slightly increased throughput of the plant could be fully met (see Fig. 4). The indirect throughput measurement via the levels of the two buffer silos (3) proved that the variance of the throughput differences between fine (0.3–2.0 mm) and coarse (2.0–15 mm) fraction is considerably greater than previously assumed.

The bottom ash feed (4) to the first eddy current separator is now set to an optimum and constant throughput via the unbalance of the vibration or feed chute of the eddy current separator. The bottom ash feed (1) for screening (2) is now controlled via a control system on the basis of the levels in the buffer silos (3). If the filling level in one of the buffer silos (3) falls below the specified minimum level, the feed chute (4) stops the material feed and waits until the pre-silo (3) is full again (see blue curve in Fig. 4).

DThe red curve (Fig. 5) shows the buffer silo level of the coarse fraction, the blue curve the buffer silo level of the fine fraction and the green curve the change in throughput across both fractions. The graph shows how the throughput rule size

▼ Fig. 4: Process flow diagram of line 1 of ZAV-Recycling AG



changes from the fine fraction to the coarse fraction (time period 4:30–5:30), i.e. the proportion of fine fraction becomes smaller and the vibratory channel of the fine fraction must be stopped again and again. The material feed (1) to the screening machine (2) is controlled in such a way that one of the fractions follows the target level of 60%. On the left half until 04:30 the material feed was controlled on the basis of the fraction 0.3–2 mm. For the fraction 2–15 mm the feeding of the eddy current separator had to be stopped again and again because there was too little material for a constant material feeding.

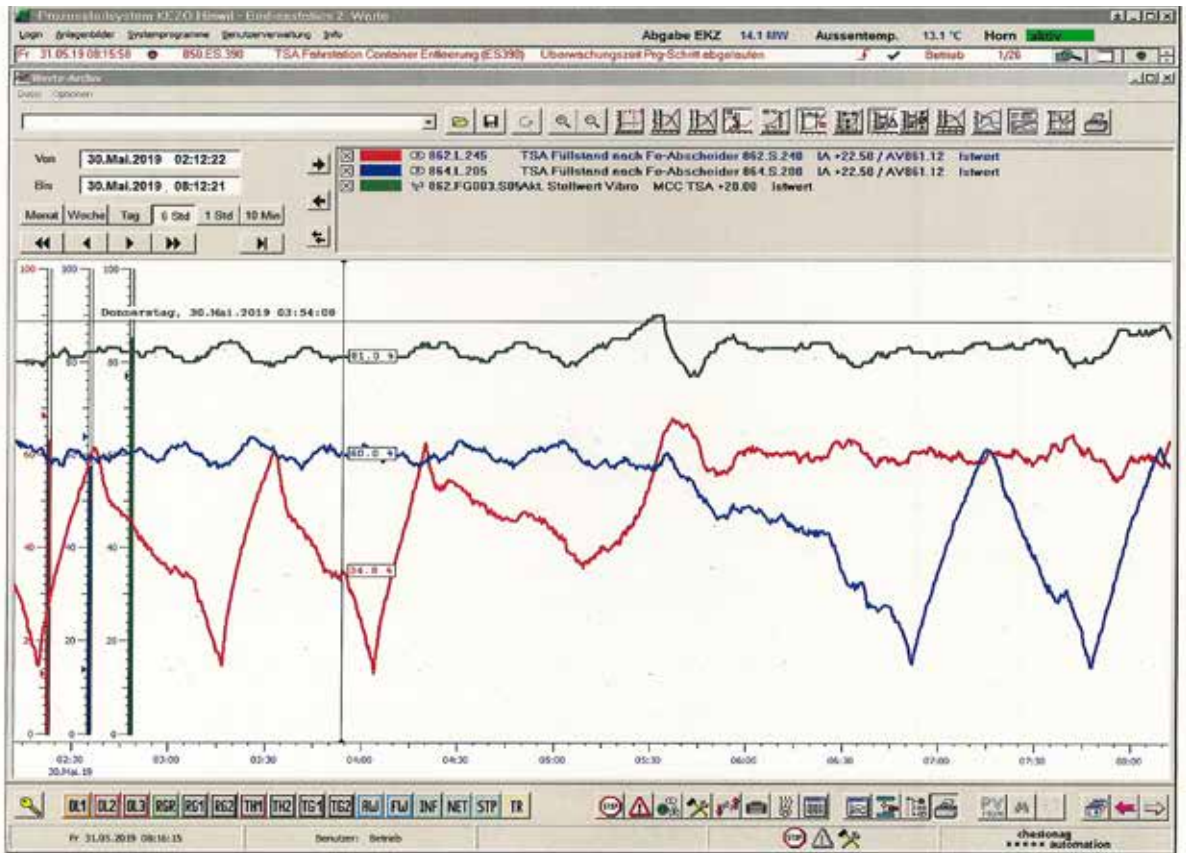
From 5:30 a.m. onwards, the coarse fraction fraction increased again and the material feed was controlled after the coarse fraction.

Erkenntnis

This modification has led to the following concrete improvements:

- Increase in throughput by around 15%.
- Constant operation: Quality controls are now only carried out once a month. Only minimal adjustments of the parameters of the non-ferrous separators result.
- Since the installation of the buffer silos, there have been no more overloads (blockages) of the screens, which massively relieves the maintenance personnel.
- Constant product quality of non-ferrous metals

▼ Fig. 5: Level measurement and throughput change
(■ Buffer silo coarse fraction / ■ Buffersilo fine fraction / ■ Throughput change over both fractions)



Adjustment of particle size

In the period under review, the particle size of the fine fraction was increased from 12 mm to around 15 mm, with the aim of further increasing the value added in the 12 mm to 15 mm range. The screen cuts on the four separating tables also had to be adjusted accordingly in order to achieve good product quality. The existing separation table configuration showed that a further increase in particle size would not be the best solution. The results on the increase in value added through this measure are still pending.

Disc Screen

The implementation of the modification of the disc screens also delivered very pleasing results. By reducing the number of disc shafts from 27 to 6, the number of interventions could be reduced by more than 70% with similar cutting quality, which not only reduces the number of operating hours but also protects the following plant components.

MINERALS

The processing of dry bottom ash at ZAV Recycling AG results in four residual bottom ash fractions, which are currently being deposited at various Zurich landfills. Due to legal regulations in Switzerland, bottom ash can only be landfilled today. Over the past year, the ZAR Foundation has carried out various projects to improve the quality of mineral residual bottom ash. Two different approaches were pursued: low-post-care landfilling and partial recycling of the residual bottom ash as a building material.

Landfill monitoring

Since October 2016, around 40,000 tonnes of bottom ash A (mineral residual bottom ash 0.3–12 mm) have been installed in the dry bottom ash compartment of the Chrüzlen landfill every year. The duration of aftercare at landfills must be limited to a manageable period of time, which is why it is necessary to forecast as precisely as possible the harmful effects of the deposited bottom ash on the environment. The monitoring system installed in cooperation with Meteotest AG since autumn 2018 (see Fig. 6 allows continuous monitoring of the temperature, gas emissions and collected leachate of the compartment. Since September 2017, the leachate has also been regularly sampled and chemically analysed by Bachema AG.

The temperature in the compartment was 85° C near the landfill surface in October 2018, with a continuous decrease to 45° C near the landfill base. In the last six months, a temperature decrease of 15% was observed over the entire height of the landfill. Hydration reactions and the corrosion of particulate residual metals lead to exothermic reactions, which are currently under investigation.

In the center of the compartment, i.e. at one meter above the landfill surface, ammonia concentrations between 2–5 ppm, with short-

Fig. 6: Online monitoring of the dry bottom ash compartment ►

term peaks of 10 ppm, are measured. The MAK value is significantly higher at 20 ppm ammonia, and consequently there are no health concerns about the ammonia concentration in the vicinity of the landfill. Nevertheless, measures are being developed to sustainably reduce ammonia emissions from the mineral residual bottom ash. In cooperation with the University of Bern and UMTEC Rapperswil, tests were therefore carried out to determine the sources of ammonia and the ammonia emission potential of residual bottom ash.

The leachate monitoring shows that the increasing thickness of the bottom ash deposits leads to an increased leachate load (chloride, sulphate, nitrate and boron). In contrast, a decrease in pH, ammonium, nitrite, copper and DOC (Delutet Organic Content) can be observed over time. The comparison with predicted loads from standardized column eluate tests under the same conditions leads to the conclusion that water flows through only approx. 12% of the dry bottom ash compartment (heterogeneity factor). With continuous data collection, it will be possible to predict the development of emissions from deposited dry bottom ash with ever greater precision.

Slag washing trials

In autumn 2018, bottom ash washing trials were carried out at KIBAG RE Bodenrecycling in Regensdorf with a focus on low-maintenance landfilling and the use of mineral residual bottom ash as a building material. In general, very high heavy metal removal was achieved in the washed fractions. The digestion in the scrubber and the resulting grain size reduction uncovered further metals, which could then be separated by the setting machine. Overall, the bottom ash scrubbing shows a significant additional reduction potential for dry bottom ash – especially for TOC, but also for copper, zinc, lead, chromium and nickel. In dry bottom ash, the average TOC content is 0.5%, which is already considerably lower than the Swiss Waste Regulation. Depending on the fraction, the TOC content could still be reduced by the washing process.

This is an advantage with regard to the aftercare of the landfill. This significant reduction can be explained by the fact that a large proportion of particulate TOC was mechanically washed out during the washing tests. The ammonia formation potential of the washed fractions was also significantly lower than the average value of the starting material. Further investigations are currently underway into the recycling of the mineral residual bottom ash.

PHOSPHORUS RECOVERY

In July 2018, the joint piloting of the Phos4life process at Técnicas Reunidas SA in Madrid was successfully completed. Phosphorus could be converted from sewage sludge ash to technically pure phosphoric acid with a yield of over 95%. Solvent extraction as the selected «purification process» of the raw phosphoric acid to technically pure phosphoric acid quality proved to be very efficient. The phosphoric acid obtained in this way is a globally established commercial product whose high purity means that it can be used in a wide range of applications, from fertilizer production to technical applications.

In addition to phosphoric acid, iron is also used as a ferric chloride solution and the heavy metals separated from the sewage sludge ash (SSA) are recycled. The iron (III) chloride solution is used in sewage treatment plants for the renewed phosphorus elimination from the wastewater stream and can therefore be kept in a closed circuit. The mineral content of the KSA can also be recycled thanks to the efficient removal of heavy metals. This makes it possible to make virtually complete use of the «resource CSA» without having to landfill large quantities.

The next step on the way to the large-scale implementation of the Phos4life process is the implementation of a preliminary project at the Emmenspitz (SO) site. The possibility of integrating a plant with an annual KSA capacity of 30,000–40,000 tonnes is to be demonstrated there. Synergies with other processes currently being planned there (SwissZinc) are to be examined and evaluated in terms of economic efficiency. Discussions on the financing of the project have so far been positive, so that the project is expected to start in 2019. The results of the preliminary project are expected in 2020.

SWISSZINC-PROJECT

With the positive conclusion of the SwissZinc preliminary project in April 2018, it was also possible to obtain a commitment from 28 of the 29 future Swiss MWIPs to further support the project. The next decisive step is therefore the preparation of the necessary contracts, the statutes and the project documentation, on the basis of which the respective decision-making bodies of the MWIP are sufficiently well documented to approve the signing of the contracts.

These documents are to be sent out in the first half of 2019 and signed by mid-2020. If MWIPs, which together represent more than 85% of the amount of waste incinerated in 2017, have signed the contracts, the construction project will start at the end of 2020. Should the general assembly of SwissZinc AG approve the construction of the plant after completion of the construction project, it is expected that the plant will be commissioned in 2025.

PUBLIC

Presentations / Events

The ZAR team was represented at events in Hamburg, Berlin and Düsseldorf and presented the latest results from the thermal recycling process to an expert and interested audience.

In 2018, a ZAR event was dispensed with, as the 10th anniversary of the foundation is scheduled for January 2020 and this will then be celebrated adequately within the framework of a special event.

Visitors

Also in the ninth year after the foundation ZAR was founded, the interest in the thermo-recycling process was unbrokenly high. The process is now well known and recognized in Europe. Once again we welcomed a large number of delegations from home and abroad who wanted to get an overview of the operation and the process on site. The trend has continued that more and more delegations from Asia are interested in the process and would like a guided tour of the plant.

Internally, the aim was to support young prospective engineers in their training and to provide an insight into the thermal recycling process. Many Swiss universities have now firmly integrated a tour into their curricula and visit us every year with their students. This gives the prospective engineers the opportunity to get an impression of the latest technology.

In 2018 more than 350 people in 32 groups were guided through the plant by the ZAR team.

Publications (in German only)

Status report "Thermo-Recycling, Efficient recovery of recyclable materials from dry bottom ash"
Februar 2018, Daniel Böni und Dr. Leo Morf

Project Sheet No. 6 - Phosphorus Mining: The Implementation of Phosphorus Mining Requires Cooperation

August 2018, Co-Autor: Dr. Stefan Schlumberger

Fig. 7: Safety vests and helmets for visitors ►


KEZ
ZO
KEZO

Foundation

EXCERPT FROM THE FOUNDATION CERTIFICATE

Art. 2 PURPOSE OF THE FOUNDATION

The purpose of the foundation is to promote a sustainable materials policy for the treatment and recycling of waste. It promotes the further development of state-of-the-art technology and supports the corresponding development activities which are to take place in the immediate vicinity of the waste-to-energy plant of the Zweckverband Kehrichtverwertung Zürcher Oberland KEZO in Hinwil/ZH or its legal successor. The foundation can also support the commercial exploitation of the findings.

With a broad Swiss sponsorship and cooperation with interested parties, it is intended to ensure that the knowledge gained is incorporated into plant development and plant construction in Switzerland or abroad.

The purpose of the foundation can be extended to activities with similar objectives at a later date.

We reserve the right to change the purpose of the foundation in accordance with Art. 86a ZGB (Swiss Civil Code). The foundation does not pursue any commercial purposes and is not profit-oriented.

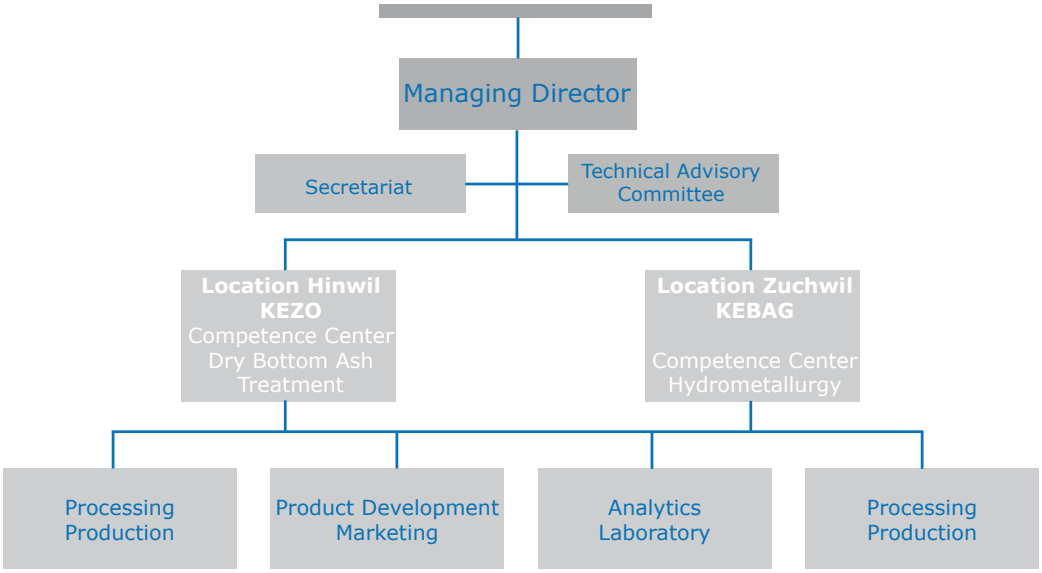
FOUNDERS

Kanton Zürich
Baudirektion, Amt für Abfall, Wasser, Energie und Luft (AWEL)
Department for Waste, Water, Energy and Air of the Canton of Zurich)

VBSA
Verband der Betreiber Schweizerischer Abfallverwertungsanlagen
(Swiss Association of Waste-processing Plants)

KEZO
Zweckverband Kehrichtverwertung Zürcher Oberland, Hinwil
(Association of Waste Disposal for the Zurich Oberland, Hinwil)

ORGANISATION CHART



FOUNDATION BOARD (AS OF 31.12.2018)

President

Adam, Franz, Senior Consultant

Vice president

Dr. Fahrni, Hans-Peter, Senior Consultant

Board Members

Christen, Daniel
Managing Director, Foundation for Auto Recycling Switzerland SARS

Dr. Gablinger, Helen
Hitachi Zosen INOVA AG, Flue gas treatment systems, Head of R&D

Dr. Girod, Bastien
Member of the National Council, President VBSA

Kalunder, Werner
HOLINGER AG, Director for the Suisse romande

Juchli, Markus
KEBAG AG, Director

Martin, Ulrich
MARTIN GmbH, Porprietor

Morgan, Kurt
KIBAG RE AG, Managing Director

TECNICAL ADVISORY COMMITEE

Dr. Morf, Leo (presidency)
Departement of Waste Management & Operations, Canton Zürich
Bolliger, Markus
Jura Cement AG, Wildegg
Prof. emer. Dr. Brunner , Paul H.
–
Prof. Dr. Hellweg, Stefanie
ETH Zürich, Institute or Environmental Engineering, Zurich
Dr. Ing. Koralewska, Ralf
MARTIN GmbH, München
Dr. Kündig, Rainer
Swiss Geotechnical Commission, Zurich (until 31.12. 2018)
Dr. Liechti, Jürg
Neosys AG, Gerlafingen
Müller, Oliver
Hitachi Zosen INOVA AG, Zürich
Dr. Zeltner, Christoph
Stahl Gerlafingen AG, Gerlafingen (until 31.12.2018)

ZAR-TEAM

Location KEZO, Hinwil

Böni, Daniel	Managing Director
Di Lorenzo, Fabian	Project manager – Metallic raw materials
Dr. Weibel, Gisela	Project manager – Mineral raw materials
Böni, Frauke	Secretariat

Location KEBAG, Zuchwil

Dr. Schlumberger, Stefan	Head of Hydrometallurgy Competence Center
Klink, Waldemar	Project Manager – Hydrometallurgy (until 08/2018)
Zappatini, Anna	Project Manager, Laboratory Manager (until 08/2018)

Donors 2018

In alphabetical order

BACHEMA AG	Schlieren
Bau-, Verkehrs- & Energiedirektion Kanton Bern BVE	Bern
Direction générale de l'environnement DGE, Etat de Vaud DGE	Lausanne
ERZ Entsorgung + Recycling Zürich	Zürich
EWB Energie Wasser Bern	Bern
Hitachi Zosen INOVA AG	Zürich
KEBAG AG	Zuchwil
KEZO Kehrichtverwertung Zürcher Oberland	Hinwil
KIBAG RE AG	Rotkreuz
KVA Linthgebiet	Niederurnen
MARTIN AG für Umwelt- und Energietechnik	Wettingen
Pöyry Schweiz, AG	Zürich
Renergia Zentralschweiz AG	Perlen
SAIDEF Fribourg SA	Fribourg
SATOM AG	Monthey
STAG AG	Maienfeld
Trumag Aufbereitungstechnik AG	Frutigen
Verband KVA Thurgau	Weinfelden
WIEDAG AG	Oetwil a.S.
Zweckverband für Abfallverwertung im Bezirk Horgen	Horgen

Financial Report

Income Statement

		2018 in CHF		2017 in CHF
Donations		662 500.00		721 745.00
Other Income		2 275.00		0.00
Subsidies AWEL		620 000.00		420 000.00
Support contributions BAFU		30 900.00		0.00
Service revenues		224 566.69		461 294.95
Income		**1 540 241.69**		**1 603 039.95**
Operating expenses		**640 606.71**		**677 981.65**
Material-costs	534 874.47		558 698.89	
Studies & analysis costs	104 954.03		118 296.78	
Expenses for third-party services	778.21		733.61	
Expenses SwissZinc AG	0.00		252.37	
Expenses KEZO	0.00		0.00	
Expenses ZAV Recycling AG		**841 868.76**		**1 003 082.02**
KEBAG rental expenses	56 056.22		509.31	
Maintenance/Repairs	63 359.77		34 606.01	
Administration & IT-expenses	192 567.33		768 692.94	
Public relations	0.00		73 408.00	
Representation expenses	500 000.00		0.00	
Fee Board of Trustees	0.00		0.00	
Costs Foundation Board	0.00		0.00	
Costs Technical Advisory Board	65 000.00		65 000.00	
Other operating costs	0.00		0.00	
Value added tax from subsidies	9 809.71		3 335.46	
Operating income	2 230.00		1 070.71	
Income from offsetting costs from ZAV RE AG	2 718.98		8 699.46	
Income from offsetting costs from KEZO	5 000.00		5 000.00	
Operating result before depreciation and interest	1 962.10		5 205.09	

		2018 in CHF		2017 in CHF
Depreciation		**23 595.36**		**34 023.52**
Valuation adjustments on Fixed Asset Items	23 595.36		34 023.52	
Earnings before interest and taxes		**34 170.86**		**–112 047.24**
Cost reduction		**0.00**		**50 000.00**
Losses on accounts receivable	0.00		50 000.00	
Financial expenditure		**207.80**		**154.80**
Interest cost	0.00		0.00	
Other financial expenses	207.8		154.80	
Financial income		**0.00**		**0.50**
Interest income	0.00		0.50	
Exchange rate gains (losses)	0.00		0.00	
PROFIT/LOSS FOR THE YEAR		**33 963.06**		**-162 201.54**

Balance Sheet

Assets

	31.12.2018 in CHF	Change	31.12.2017 in CHF	Change
Cash and cash equivalents	**283 573.74**	33.3%	**841 538.93**	76.2%
Raiffeisenbank Uster, current account	283 387.29		841 352.48	
Raiffeisenbank Uster, investment account	186.45		186.45	
Trade accounts receivable	**561 773.48**	66.0%	**147 592.11**	13.4%
Receivables donor contributions	255 000.00		198 800.00	
Receivables subsidies/support contributions	134 250.00		–	
Receivables third parties	71 674.70		2 792.11	
Receivables FTA	150 848.78		–	
Del credere	–50 000.00		–54 000.00	
Other current receivables	**–**	0.0%	**–**	0.0%
Anticipation tax	–		–	
Inventories and unbilled services	**–**	0.0%	**–**	0.0%
Stocks	–		–	
Accrued income and prepaid expenses	**5 200.00**	0.6%	**91 000.00**	8.2%
Prepaid expenses TA	5 200.00		91 000.00	
Current assets	**850 547.22**	100.0%	**1 080 131.04**	97.9%
Financial assets	**–**		**–**	
Fixed installations	–		–	
Movable assets	**–**	0.0%	**23 595.36**	2.1%
iCAP 7600 ICP-OES Duo (analyzes equipment)	87 789.84		87 789.84	
Spectro Blue 138491	60 217.92		60 217.92	
Vibrating disk mill	22 109.83		22 109.83	
Value adjustments of tools and equipment	–170 117.59		–146 522.23	
Fixed assets	**–**	0.0%	**23 595.36**	2.1%
TOTAL ASSETS	**850 547.22**	100.0%	**1 103 726.40**	100.0%

Liabilities

	31.12.2018 in CHF	Change	31.12.2017 in CHF	Change
Trade accounts payable	–	0.0%	**790 883.37**	71.7%
Accounts payable to third parties	–		576 472.72	
Accounts payable KEZO	–		214 410.65	
Short-term interest-bearing liabilities	–	0.0%	**3 762.98**	0.0%
Value added / revenue taxes	–		3 762.98	
Deferred income	**605 589.51**	71.2%	**98 085.40**	8.9%
Accrued expenses and deferred income	105 589.51		98 085.40	
Deferred Projects	500 000.00		–	
Short-term liabilities	**605 589.51**	71.2%	**892 731.75**	80.9%
Endowment capital	100 000.00		100 000.00	
RESERVES				
Project reserves	110 994.65		273 196.19	
Anual Result	33 963.06		–162 201.54	
EQUITY CAPITAL	**210 994.65**	19.1%	**210 994.65**	19.1%
TOTAL Liabilities	**850 547.22**	100.0%	**1 103 726.40**	100.0%

Notes to the financial statements

1. Information on the accounting principles applied in the annual financial statements

These financial statements have been prepared in accordance with the provisions of Swiss law, in particular the articles on commercial accounting and financial reporting under the Swiss Code of Obligations (Arts. 57 to 962).

2. Name, legal form and domicile of the foundation

ZAR, Development center for sustainable management of recyclable waste and resources, Zurich

c/o Building Directorate of the Canton of Zurich, AWEL, Office for Waste, Water, Energy and Air,

Walcheplatz 2, 8001 Zurich

Further address: c/o Zürcher Oberland KEZO, Wildbachstrasse 2, 8340 Hinwil, Switzerland

Auditors: PricewaterhouseCoopers (CH-320.9.045.078-2), in St. Gallen

3. Angaben über Zeichnungsberechtigungen

President and Vice-President with joint signature of two:

Franz Adam, from Oberdorf (SO), in Riedholz, Präsident des Stiftungsrats

Dr. Hans-Peter Fahrni, from Steffisburg, in Vechigen, Vizepräsident des Stiftungsrats

Members of the Board of Trustees with joint signature of two:

none

Members of the Board of Trustees without signing authority:

Daniel Christen, from Kallern, in Port

Werner Kalunder, from Wängi, in Vich

Further persons with joint signature of two:

Daniel Böni, from Amden, in Bülach, Geschäftsführer

Yvonne Wicki, von Ruswil, in Zell ZH

4. Information, breakdown and explanations of balance sheet and income statement items

	31.12.2018	31.12.2107
Property, plant and equipment	170 117.59	170 117.59
Value adjustments	170 117.59	112 498.71

The assets were depreciated at 20% in line with the progress of the project.

5. Net release of hidden reserves

	31.12.2018	31.12.2107
Material net release of hidden reserves	none	none

6. Number of employees, external employee

	31.12.2018	31.12.2107
Number of full-time employees (annual average)	< 10	< 10

7. Shareholdings

None

8. Other information

	31.12.2017	31.12.2016
Off-balance sheet lease liabilities	0.00	0.00
Liabilities to pension funds	0.00	0.00
Total amount of collateral provided for third-party liabilities	0.00	0.00
Total amount used to secure own liabilities	0.00	0.00
Total amount of assets subject to retention of title	0.00	0.00

9. Contingent Liabilities

	31.12.2018	31.12.2107
Guarantees, warranties	0.00	0.00

10. Erläuterungen zu Positionen der Erfolgsrechnung

None

11. Erläuterungen zu ausserordentlichen, einmaligen oder periodenfremden Positionen in der Erfolgsrechnung

After the balance sheet date and until the adoption of the annual financial statements by the Board of Trustees, no significant events occurred that could impair the informative value of the 2018 annual financial statements or that would need to be disclosed here.

Bericht der Revisionsstelle

zur eingeschränkten Revision an den Stiftungsrat der Stiftung Zentrum für nachhaltige Abfall- und Ressorcennutzung

Zürich

Als Revisionsstelle haben wir die Jahresrechnung (Bilanz, Erfolgsrechnung und Anhang) der Stiftung Zentrum für nachhaltige Abfall- und Ressorcennutzung für das am 31. Dezember 2018 abgeschlossene Geschäftsjahr geprüft.

Für die Jahresrechnung ist der Stiftungsrat verantwortlich, während unsere Aufgabe darin besteht, die Jahresrechnung zu prüfen. Wir bestätigen, dass wir die gesetzlichen Anforderungen hinsichtlich Zulassung und Unabhängigkeit erfüllen.

Unsere Revision erfolgte nach dem Schweizer Standard zur eingeschränkten Revision. Danach ist diese Revision so zu planen und durchzuführen, dass wesentliche Fehlaussagen in der Jahresrechnung erkannt werden. Eine eingeschränkte Revision umfasst hauptsächlich Befragungen und analytische Prüfungshandlungen sowie den Umständen angemessene Detailprüfungen der bei der geprüften Stiftung vorhandenen Unterlagen. Dagegen sind Prüfungen der betrieblichen Abläufe und des internen Kontrollsystems sowie Befragungen und weitere Prüfungshandlungen zur Aufdeckung deliktischer Handlungen oder anderer Gesetzesverstösse nicht Bestandteil dieser Revision.

Bei unserer Revision sind wir nicht auf Sachverhalte gestossen, aus denen wir schliessen müssten, dass die Jahresrechnung nicht dem Gesetz und der Stiftungsurkunde sowie den Reglementen entspricht.

PricewaterhouseCoopers AG

Marcel Aeberhard

Stefanie Andermatt

Revisionsexperte
Leitender Revisor

Zürich, 15. April 2019

Beilage:

- Jahresrechnung (Bilanz, Erfolgsrechnung und Anhang)

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