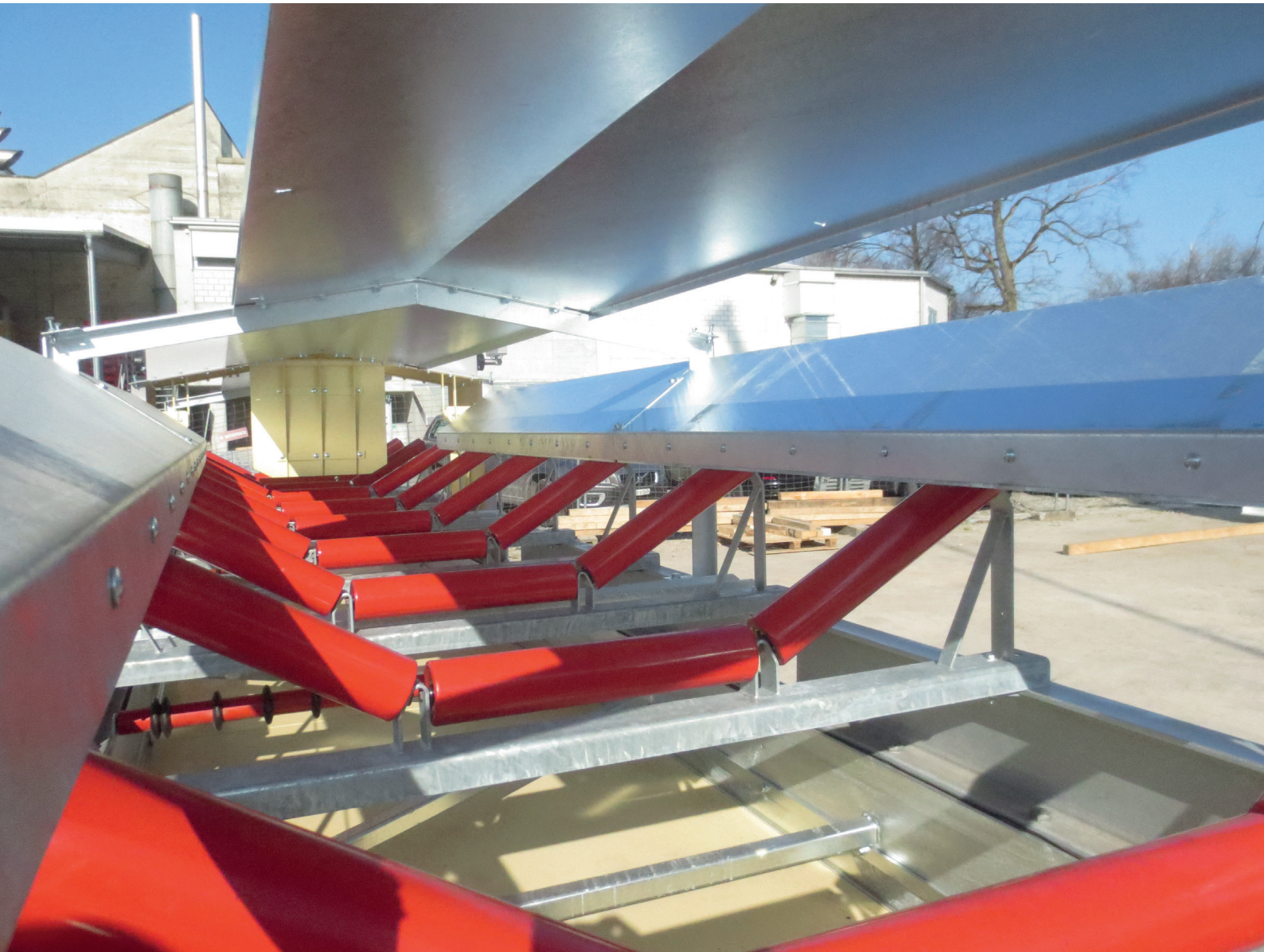
STIFTUNG ZENTRUM FÜR NACHHALTIGE ABFALL- UND RESSOURCENNUTZUNG

FOUNDATION DEVELOPMENT CENTER FOR SUSTAINABLE MANAGEMENT OF RECYCLABLE WASTE AND RESOURCES

Waste and Resource Management

Innovative, Practical, Economic

Annual Report / Activity Report 2014



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Forword by the President

For the fifth time running, we are presenting what we like to call our "Business Report" to our partners, as well as to the wider public. However, how might the activities of a foundation for developing new processing methods and techniques in the field of "urban mining" be described in terms of a "business"? Are we really working on a "business", with a "business case", "SWOT analysis" and "risk management"? Hardly. The terminology of the Swiss Code of Obligations must not prevent us from envisaging our central objective, namely to build ecological progress, or, in the parlance of our times, "added value" for the environment. Rather than an annual economic result, our priority is a holistic result consisting of various findings and implementation steps. This explains why our annual financial statements do not declare a profit or loss, but rather an "Annual Result" in the sense of a "change in the project reserve".

For us, therefore, the – long-term – journey is our destination, and purpose of our work. Our central challenge is that we cannot wait until certainty has emerged. Our essential findings are embodied in the expertise of our ZAR staff. It would thus be tempting to expand the ZAR Foundation into the realm of consulting. However, this would most certainly be regarded as a business activity, which would be contrary to our statutes. We are thus only permitted to establish a supportive cooperation with industrial and commercial entities, as well as engineering and consulting companies. On the one hand, this is to pave the way to the successful implementation of the ZAR Foundation findings for investors in the waste recycling industry. On the other hand, we require a guarantee that our partners are well-versed in the application of our expertise - for the benefit and in the interests of the entire industry.

I would hereby like to express my gratitude to all stakeholders – the ZAR Foundation and KEZO staff, our donors, the Foundation Board and the Technical Advisory Council members, as well as the supporting authorities: Many thanks for your solid support in the form of advice and assistance in addressing the many challenges we face.

Dr. Ueli Büchi
Foundation Board Chairman

1 Dry Bottom Ash Processing Plant

The ambitious goals of attaining the highest possible efficiency of metal recovery, the highest metal quality and availability, as well as dust-free operation of the plant for this major project, once again tied up substantial ZAR team resources in 2014.

Detail engineering

Even though more than 90 % of the detailed engineering was previously completed, the last 10 % proved highly complicated and critical to the achievement of objectives. Particular attention was paid to the continuous flow of bottom ash and the bottom ash constant distribution over the entire width. Countless small details were revised time and again, and repeated testing with bottom ash had to be carried out to investigate new approaches. The team collectively elected the approach for implementation.

The design of the extraction system presented another challenge. The fact that the extraction system was to generate a vacuum in the system without removing dust caused many suppliers a headache, since they were to design airtight systems. The smoke test introduced for acceptance to verify the air-tightness of the system revealed weaknesses, requiring reworking by most suppliers.

Construction

The construction of the ZAV Recycling AG dry bottom ash processing plant made very good progress in 2014. All concrete construction work on the grounds, as well as the steel construction of the container terminal and parts of the steel structure for the process engineering in the triage were completed by the end of the year.

Interior treatment plant

The first stage of the steel structure for the interior treatment plant was completed shortly before year-end. The supplied machinery, equipment and devices were tested prior to installation by the ZAR team, and deficiencies were corrected immediately. Thereafter, the devices were installed on all floors.

2 Product Development

Fine aluminum

Since the commissioning of the fine bottom ash processing line in 2012, aluminum powder with a particle size of 0.2–1.0 mm is being generated. Since this fine aluminum can be melted only with extensive material losses, the recovery of the aluminum powder by smelter was never an economically viable option.

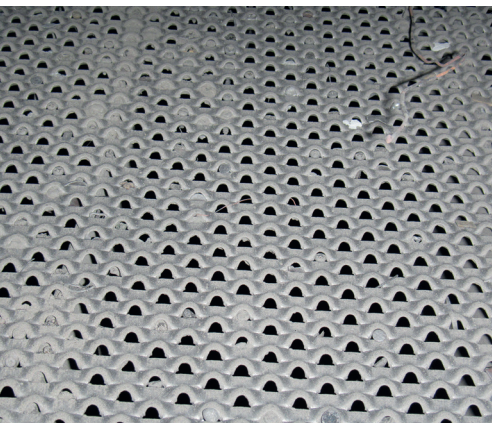
The ZAR product development department repeatedly attempted to supply the high quality powder to a direct application. The aluminum powder was, among other experiments, utilized as an oxidizing additive or for expanded concrete. Despite positive results initially, it was not possible to develop a long-term ecologically and economically viable processing option.

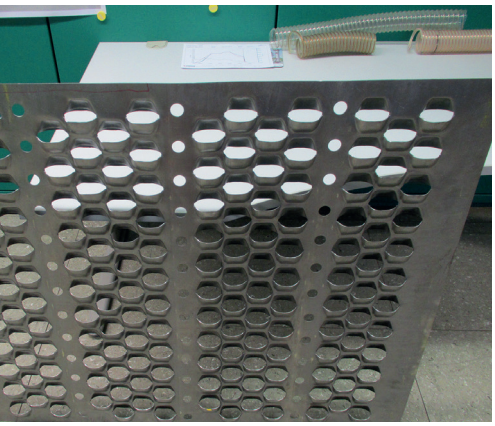
Establishment of new applications

In 2014, we finally succeeded in evaluating a promising application in cooperation with a partner. Following further mechanical cleaning, 85 % of the aluminum powder is directly used for aluminized mining explosive composites, dynamite, as well as exothermic stoking and anti-cavitation powders (cavity-preventing substances). The extensive reactive surface of the aluminum powder, which is due to the thermal recycling process, has highly positive effects on the product.

The 15 % of material losses are mainly due to mineral components (bottom ash), which must be disposed of. In the meantime, however, the ZAR development team has succeeded in optimizing the system further. The proportion of mineral constituents in fine aluminum (0.2–1.0 mm) is now below 10 %, while the high degree of efficiency in the separation of aluminum has remained constant.

3 Deveolpment "ZAR-Double Nose Sieve"





Dry bottom ash is a free-flowing bulk material, which can be fractionated into its smallest components by way of suitable screening at a minimum in energy consumption. This makes fractioning of the bottom ash an important step in the process to guarantee highly efficient metal separation. The fractioning down to the range of 0.1 mm is carried out by way of mechanical sieving. However, the mechanical sieving of waste bottom ash presents plant operators with major challenges. The stable operation of a bottom ash treatment plant with solid processing quality requires the following prerequisites:

No clogging of screens due to build-up of material (bonding material, especially for wet bottom ash)

- No clogging of the screens due to hooking of wires
- Low abrasion and corrosion (no change in fraction size)
- Defined and narrow particle size distribution

An accurate sieve with narrow particle size distribution and long service life are essential for use in the ZAV Recycling AG plant.

The sieve lining development process

The research of a suitable nose sieve for use in ZAV Recycling AG dry bottom ash processing was based on the following product specifications:

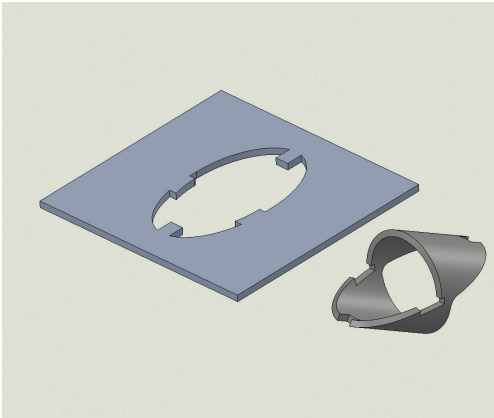
- Arbitrary sheet thickness greater than 3 mm
- Free choice of materials, preferably stainless steel
- Arbitrary, preferably round screen holes
- Maximum free sieve area
- Maximum stiffness of sieve lining

Since none of the nose sieves on the market meet these requirements, the ZAR development team decided to develop its own nose sieve.

The development was shaped by production engineering and economic aspects. The requirements had to be met, while costs were to be kept at a reasonable level. It was thus decided to develop the screen surface so that it can be used both ways, thus doubling its lifespan.

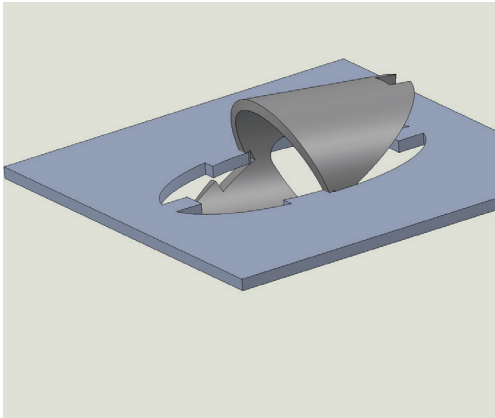
The nose sieve was to be made from two functional parts rather than sheet metal. This permits the desired flexibility in terms of plate thickness, material and hole shape. The functional parts can be precisely joined by way of the special positioning cams. Moreover, the tight fit between the two functional parts absorbs shocks from larger bottom ash lumps.

In the evaluation of joining technology, the common methods of bonding and welding proved unsuitable. The choice fell ultimately to soldering. A corresponding soldering method was developed with the support of an expert, with very promising results. Various prototypes were developed to evaluate the most suitable soldering method.¬

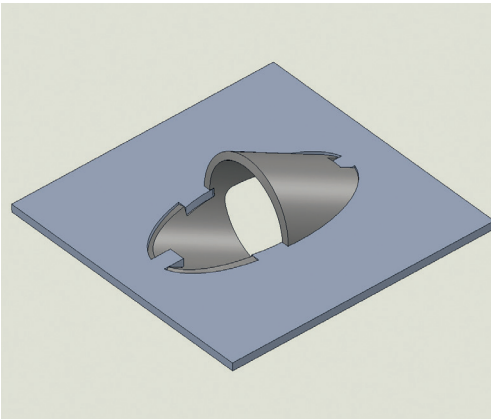


Summary

Following the development of the "ZAR double nose sieve", the ZAR development team now disposes of the technology for manufacturing special nose sieves for dry bottom ash. However, other sieving media of any dimension, sheet thickness and material may be tailored and manufactured for the desired applications. Due to the manufacturing process, the production costs are reasonable. The sieve panels do not necessarily have to be made in large volumes to keep costs down.



The ZAR double nose sieve is highly flexible in terms of its applications. In the next stage, the "bar sizer" technology, which produces an unsatisfactory separating cut, is to be replaced. The aim is to achieve a clean separation cut and eliminate long pieces in the coarse grain range (200–500 mm), which affect processing and jeopardize the equipment.



4 Analytics

Induction field sample divider to determine the mineral content for non-ferrous metals

A quality control system for quick and reliable use in the lab or on the production line was developed to ensure optimum configuration and monitoring of the eddy flow separator.

The newly developed induction field sample divider permits the highly efficient and reliable measurement of the mineral content for non-ferrous metals up to a size of 30 mm.

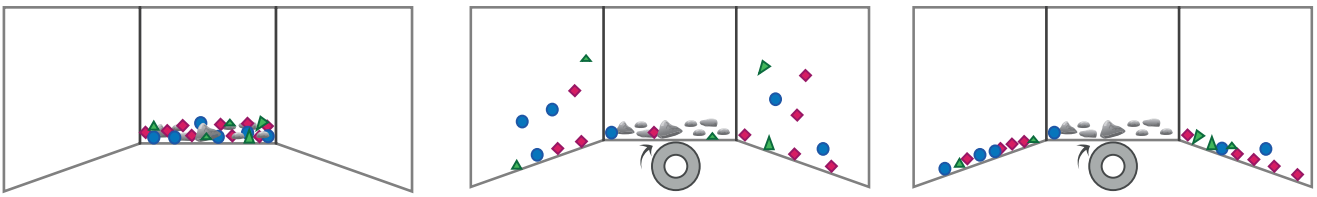
When processing wet bottom ash and very fine bottom ash, the induction field sample divider is absolutely necessary for product monitoring. The induction field sample divider may also be used to determine the proportion of metallic non-ferrous metals in the bottom ash or metallic residual content in the processed bottom ash with sufficient accuracy. This permits specification of the quantity of non-ferrous metals that are deposited at a loss.

Experimental design

The selected approach is based on a rotating magnetic drum that generates an eddy current field, which is similar to the eddy flow separator. In one vessel, the non-ferrous metals are subjected to the influence of an eddy current field on a rotating magnetic drum.

The vessel consists of three open chambers that are closed at the top by a cover. The vessel is made of Plexiglas. The chambers are separated by a barrier of 1–5 mm at the bottom. The material for testing is evenly distributed in the bottom of the central chamber.

During the slow movement of the vessel over the quickly rotating drum magnet, the induction field acts on the individual particles in the vessel. The individual particles are repelled depending on their conductivity, mass and shape. The particles fly over the barrier and accumulate in the left or right half of the vessel, or stay in the middle.

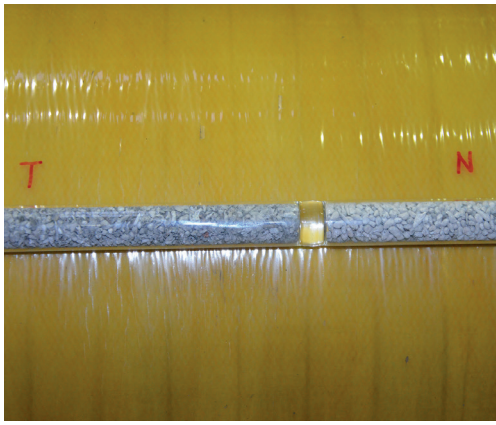


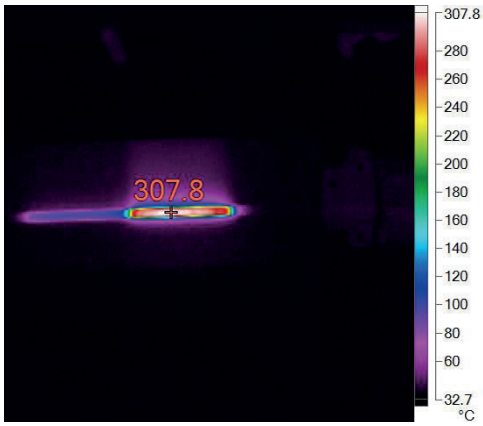
Conductivity measurement for bulk materials

The efficiency of various eddy flow separators is assessed by comparing the conductivity of the bulk material fractions for certain temperatures. Low temperatures in the non-ferrous metals suggest a high degree of efficiency.

Experimental design

The bulk material is stretched across the magnetic drum of an eddy flow separator in a glass tube. Once the magnetic drum rotates, an induction field is generated. Since the bulk material is held in position by the glass tube, the repulsion forces are converted into thermal energy, and the bulk material heats up relative to its conductivity. The measured temperature permits conclusions on the conductivity and repulsion forces exerted by the induction field on the bulk material. The heating of materials is recorded using a thermographic camera.

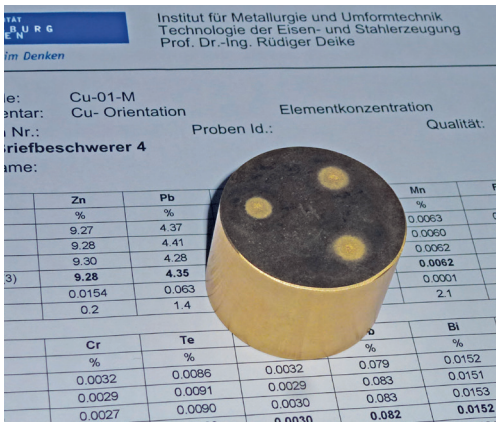




Methods Report

To assure and improve the reliable evaluation of the quality of residues from thermal waste treatment, as well as the reliable determination of the economic and ecological potentials of recyclable materials, ZAR has been working intensively on optimizing the corresponding methods in cooperation with Bachema AG, Schlieren, and with the support of the Canton Zurich.

Following intensive further development of individual methods over the past 5 years, the report “Methods Report”, which was published in March 2014, represents the present state of knowledge regarding practicable methods across the entire spectrum of residual fractions from thermal waste treatment. The publication of this document makes this knowledge available for real-world applications.



5 Mineral Processing

The processing of dry bottom ash permits efficient metal recovery. The chemical composition of prepared, metal-depleted bottom ash was evaluated in 2013. In 2014, the analyzes and tests were intensified. The treated bottom ash has a very low residual metal content. The work and experiments were conducted by ZAR with the objective of testing possible applications in building materials.

Sand substitution for concrete

Treated bottom ash was used as a sand substitute for concrete production in these experiments. Unwashed and washed bottom ash of different lengths was utilized. The application as a sand replacement was not established by these experiments, since a volume increase was noted for all samples. This increase is due to the formation of hydrogen in the reaction of aluminum and zinc, which tends to weaken the concrete.¬¬

Aerated concrete

The findings of the volume increase in the sand replacement testing led the team to investigate whether this property could be used specifically for the production of aerated concrete. For this purpose, aluminum powder was added to the processed bottom ash to examine gas formation. In a second stage, aluminum granules that were separated in the treatment plant were ground to aluminum powder for the application. The results indicated that the high specifications of aerated concrete were not met, since the pores were not formed uniformly.

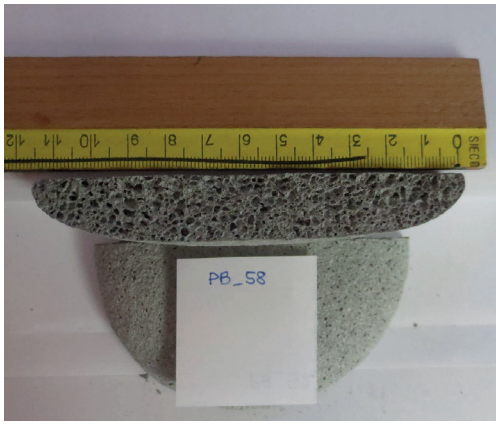
Landfill

Based on the results, the only option is disposal of the processed dry bottom ash. For this purpose, a dry bottom ash compartment was establishment, where the processed dry bottom ash will be deposited from summer / autumn 2015 so as to investigate the deposit behavior. The deposit compartment is equipped to record gas emissions, leachates and the temperature profile of the landfill. The detailed clarification of the monitoring setup is ongoing.

Gas formation potential

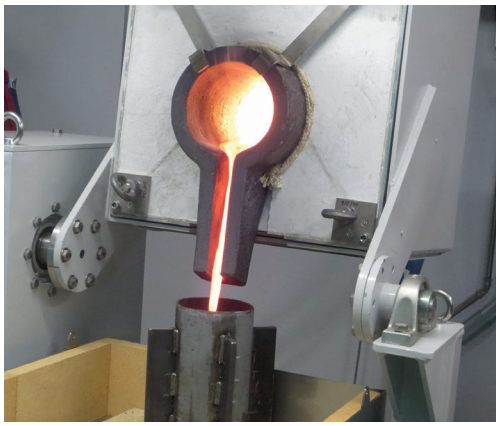
The gas production potential of the bottom ash was investigated in collaboration with the Institut für Umwelt- und Verfahrenstechnik UMTEC (Institute for Environmental and Process Technology).

A detailed examination of the elements responsible for gas formation was conducted. The experiments indicated that the gas measurements must be carried out in an argon atmosphere due to the varying reactions of the individual elements with oxygen. The measurement method can be used to determine the overall gas formation potential of the processed bottom ash.



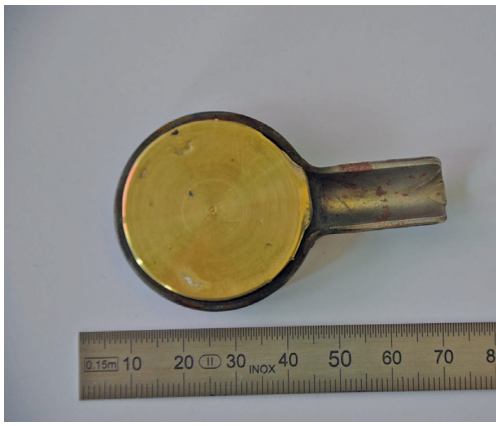
Melting furnace

The quality control of the separated metals is relevant for the operations evaluation of the processing plant, and to determine the composition of the fractions and their market value. Normally, the chemical analysis of the fractions requires a few grams, which do not tend to be representative. The difficulty is in collecting a representative sample. The fractions are packed in big bags of one ton each. The newly designed and constructed sample divider is capable of drawing a sample of 1–50 kg from a big bag.



The furnace installed in 2013 permits the melting of samples up to a weight of 50 kg. The induction melting furnace has several clay-graphite crucibles, which permit melting aluminum, as well as precious non-ferrous metals. In the past year, more than twenty different melting experiments were conducted in collaboration with Stefan Skutan performed.

The experiments had two goals: Maximization of the yield from homogeneous molten metal, and the extraction of representative test specimens with a diameter of 40 mm and a height of 10 mm for analysis. The specimen, also called “lollipop”, are to have a weight of up to 100 g, and are to be used directly to determine the composition.



In further experiments, the homogeneity of the melt and lollipops was examined. The first wet chemical analyzes confirmed the homogeneity of the lollipops. It is thus possible to determine the composition of the fractions, i.e. the 100 gram specimens are representative of the starting material in the big bag. The aim is to analyze the lollipops more quickly in the future, since wet chemical analysis is extremely time consuming. This is to take place with a sparkspectrometer.

6 Wet Chemical Extraction

Phosphorus recovery from sewage sludge ash

Phosphorus is an essential nutrient for humans and nature, which cannot be replaced by any other material. The high-quality, recoverable resources are limited, and the global supply is expected to be depleted in the foreseeable future. The challenge for the future will be the development of a solution for the efficient and sustainable recovery of phosphorus, as well as its implementation on an industrial scale.

Sewage sludge has a lot of potential; the available resources must thus be used as efficiently as possible. Since Swiss sewage sludge contains the same amount of phosphorus as is imported for fertilizers every year, sewage sludge ash would be an optimal resource for phosphorus recovery.

Previous work

In the years 2011–2013, our cooperation with partners was geared towards the preparation of a phosphorus product for direct integration into the fertilizer production chain. However, since these recovered materials represent a new class of products and are inadequately covered by Swiss and European legislation, the marketing of these products is far from certain. This results in economic risks, which have been an obstacle to large-scale implementations hitherto. The substitution of raw phosphate from the mining of primary deposits by a recycled product is the only established and viable option. The sales proceeds, however, amount to a mere 100–120 francs per ton of phosphorus product (30 % P2O5 content), which does not permit profitable recovery operations. Since 2014, the focus has thus been on higher phosphorus product quality, which yields a higher selling price on the one hand, and greater market acceptance on the other.

Work in progress

Calcium phosphates and phosphoric acid are two commercial products representative of such higher-value phosphorus products. The possibility of wet-chemical production of higher quality phosphorus products from sewage sludge ash is currently under investigation in the scope of a feasibility study. In addition to phosphorus recovery, essential prerequisites are the recovery of minerals and the use of iron loads as precipitant substitutes in wastewater treatment plants. The heavy metals separated in the treatment process are supplied to an existing metal recovery process.

Swiss Zinc - central zinc recovery from municipal solid waste incineration (MSWI) plant hydroxide sludge

MSWI filter ashes bear an enormous metal recyclables potential. The high zinc content is of particular interest for recovery. Additionally, the elimination of toxic heavy metals also serves as a positive environmental contribution.

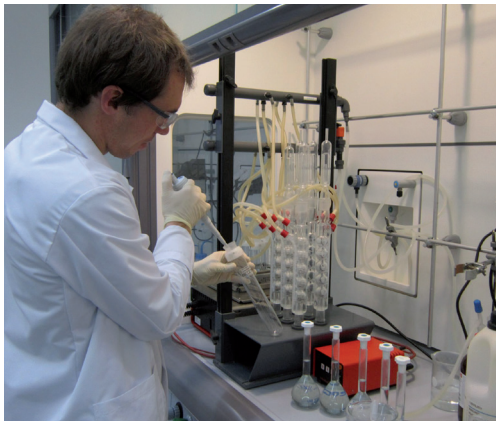
Currently, around 55 % of Swiss filter ashes are washed with the FLUWA process, and metals contained therein are transferred into a zinc-containing hydroxide, which was previously processed as an expensive residue abroad. The increasing processing costs of hydroxide sludge take a toll on the economics of metal recovery from filter ashes, even though the material contains around 20 % zinc. By contrast, comparable conventional ores are already successfully traded as commodities.

The SwissZinc project is to overcome such hurdles, and demonstrate the technical and economic viability of direct recovery in Switzerland.

Process engineering

The supplied hydroxide sludges of different types are classified into three quality classes, and fed by way of a suitable mixture of sulfuric acid leaching. In this context, at least 98 % of the zinc is brought into solution and fed to the subsequent wash water purification and treatment process. The leach residue consists primarily of gypsum and lead sulphate. The latter is separated in a subsequent process for recycling of the gypsum. The lead sulphate and metal concentrate from the caustic cleaning process are sold to a smelter for recovery.¬¬

The purified, zinc-containing solution is purified and enriched further in the scope of solvent extraction. In addition to interfering heavy metals, the halogens chlorine and fluorine are mainly separated at this stage, and the zinc concentration is raised to the desired value. In the subsequent zinc electrolysis process, cathode zinc is produced from high-purity SHG zinc concentrate. The cathode zinc obtained can be sold at market prices.



7 Public

Information Event (October 24)

Around 130 Swiss and international guests accepted the ZAR management invitation to the 3rd Information Event in Solothurn on the 24th of October.

With the expansion of development efforts in the wet-chemical field, and the new close cooperation with the Kehrichtbeseitigungs-AG in Zuchwil / Canton Solothurn, the venue was chosen for a reason. Following an informative and diverse schedule, the participants were offered the opportunity of visiting the zinc recovery facilities at KEBAG AG in Zuchwil.

Visitors

In 2014, we experienced growing interest from Asia. The European plant operators working in the dry bottom ash area are especially interested in the detailed engineering of the treatment plant. In addition to environmental issues, economic questions were increasingly at the fore. We are anxiously awaiting first results and experiences from the large-scale plant.

Publications

METHODS REPORT Sampling, sample preparation and analysis of solid residues from waste incineration and their purification products; Authors: Stefan Skutan and Rolf Gloor, supported by Dr. Leo Morf, March 2014

DEVELOPMENT REPORT Development of a test method to determine the mineral content in the non-ferrous fraction of bottom ash. Development of a process for assessing the electrical conductivity of bulk materials (non-ferrous metals). Implementation: Peter Schellenberg, Daniel Böni, Author: Daniel Böni, October 2014

INVESTIGATIVE REPORT Leachphos – process optimization by means of ion exchange, Implementation: Dr. Stefan Schlumberger, Author: Dr. Stefan Schlumberger, February 2015

DEVELOPMENT REPORT Development of the ZAR double nose screen for fractionating bottom ash flows Implementation: Peter Schellenberg, René Weber, Daniel Böni, Author: Daniel Böni, May 2015

Milestones

2005 Initial trials with dry bottom ash extraction at KEZO on kiln line 2

2006 Long-term testing with dry bottom ash extraction on kiln line 2 with pestle de-bottom asher and screening machine

2007 Conversion of kiln line 2 for dry bottom ash extraction

2008 Study by GEO Partner AG on bottom ash-monitoring at KVA Thurgau

Commissioning of fine bottom ash sorting plant

2009 Conversion of dry bottom ash extraction at kiln line 2

2010 Establishment of the Foundation "ZAR - Centre for sustainable management of recyclable waste and resources"

Commissioning of the dry bottom ash extraction at KEZO kiln line 3

Commissioning of the non-ferrous metals treatment

The brand Thermo-Re® is registered and protected

2011 Optimization of the eddy flow separator specifications for fine bottom ash treatment

Optimization of screening for continuous operation

Completion of product development

2012 Commissioning of the fine bottom ash treatment plant

Commissioning of non-ferrous metal treatment plant (0.2–1.0 mm)

Utilization of the new high-performance separator by SGM Gantry SpA (1.0–5.0 mm)

Evaluation and description of the non-ferrous analysis method

Completion of basic engineering for the large-scale treatment plant at ZAV Recycling AG

2013 Determining the "State of the art Technology in bottom ash processing"

Commencement of detailed engineering for the large-scale processing plant at ZAV Recycling AG

Start of development of 3rd generation eddy current separator for fractions of 0.1–8.0 mm with SGM Gantry SpA

Wet-chemical processing: Agreement with KEBAG Kehrichtbeseitungs-AG, Zuchwil for competence building in wet-chemical engineering.

2014

March

Publication of the Methods Report

Current state of knowledge regarding practicable methods for sampling, sample preparation and analysis for the full range of residual fractions from the thermal treatment of waste.

May

Publication of two Development Reports

Development of an induction field sample divider to determine the mineral content of non-ferrous metals up to a size of 30 mm, and the proportion of metallic non-ferrous metals in the bottom ash.

Development of a process for assessing the electrical conductivity of bulk materials (non-ferrous metals).

August

Finalization of detailed engineering for the dry bottom ash processing plant

Optimization of individual process stages for material flow, continuous operation, emissions, maintenance, energy consumption, etc.

Intensive exchange with potential suppliers, development, testing and optimization of prototypes.

October

3. ZAR Information Event in Solothurn

Informative presentations on the activities and developments at ZAR, and subsequent visit to the zinc recovery plant at KEBAG AG.

November

Fine aluminum

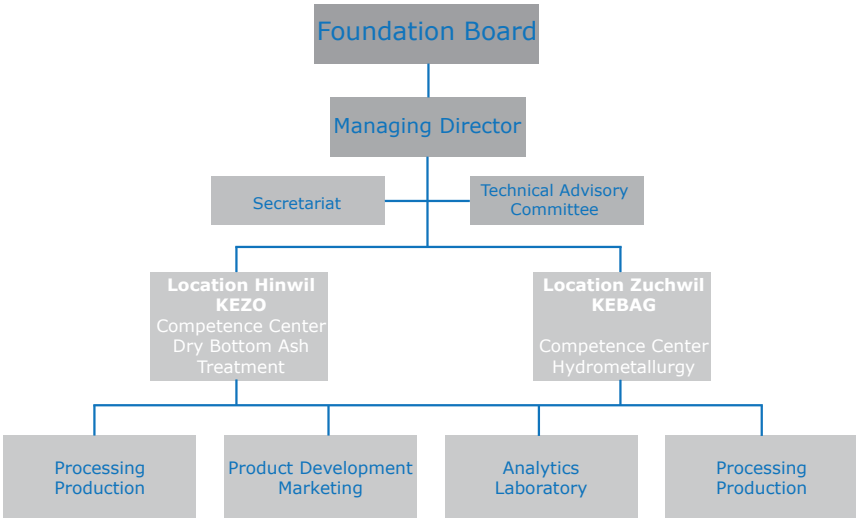
Evaluation of a promising application. The Al powder is used for formulations of aluminized mining explosives and dynamites, as well as exothermic heating substances and anti-cavity powders (cavity-preventing substances).

December

Development start “ZAR double-nose sieve”

Since no product meeting the high specifications for mechanical sieving of dry bottom ash could be identified on the market, the component was produced by way of proprietary development..

Organization



Foundation Board (as of 12/31/2014)

Presidency

Dr. Büchi, Ueli, Chairman of the Administrative Board KEZO

Vice Presidency

Dr. Fahrni, Hans-Peter, Senior Consultant

Board Member

Adam, Franz
Department head of waste management & operations, AWEL, Canton ZH

Buttet, Yannick
Member of the national council, president of VBSA

Christen, Daniel
Managing director of SARS Swiss Automobile Recycling Foundation

Dr. Hediger, Robert
Managing director of Fair Recycling Foundation

Kalunder, Werner
Director of HOLINGER AG, Western Switzerland

Juchli, Markus
KEBAG AG , Director

Martin, Johannes J. E.
Managing director of MARTIN GmbH

Süsstrunk, René
Hitachi Zosen INOVA AG, flue gas treatment system

Technical Advisory Committee

Dr. Morf, Leo (presidency)
Department for Waste Management & Operations, Canton Zurich

Prof. Dr. Brunner, Paul
TU Wien, Institute for Water Quality,
Resource Management and Waste Management, Vienna

Prof. Dr. Hellweg, Stefanie
ETH Zurich, Institute for Environmental Engineering, Zurich

Dr. Johnson, Annette
Eawag, Water Resources and Potable Water, Dübendorf

Dr.-Ing. Koralewska, Rolf
MARTIN GmbH, München

Dr. Kündig, Rainer
Schwiss Geotechnical Commission

Dr. Liechti, Jürg
Neosys AG, Gerlafingen

Sigg, Alfred
Hitachi Zosen INOVA AG, Zurich

Streuli, Adrian
Jura-Cement-AG, Wildegg

Dr. Zeltner, Christoph
Stahl Gerlafingen AG, Gerlafingen

ZAR Team

Location KEZO, Hinwil

Böni, Daniel	Managing Director
Di Lorenzo, Fabian	Project Manager – Metallic raw materials
Dr. Ardia, Paola	Project Manager – Mineralic raw materials
Miràs, Albino	Process development and production
Schellenberg, Peter	Process development and production
Bruno, Francesca	Secretariat

Location KEBAG, Zuchwil

Dr. Schlumberger, Stefan	Head of Competence Center Hydrometallurgy
Klink, Waldemar	Project Manager Hydrometallurgy

Foundation

Excerpt from the foundation charter

Art. 2 PURPOSE

The Foundation aims to promote a sustainable chemicals policy in the scope of treatment and recovery of waste. It promotes the further technological development and supports appropriate development activities that are carried out in close proximity to the waste heating plant of the administrative association Kehrichtverwertung Zürcher Oberland KEZO in Hinwil / ZH, or its legal successors. The Foundation may also support the exploitation of any knowledge generated.

Wider Swiss sponsorship and collaboration with stakeholders are to ensure that the findings are incorporated in system development and plant construction, both in Switzerland and abroad.

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

Any change to the purpose of the Foundation in accordance with Art. 86a ZBG [Civil Code] remains reserved. The Foundation must not pursue commercial purposes, and is not profit-oriented.

Founders

AWEL
Zurich Cantonal Agency of Waste, Water, Energy and Air

VBSA
Association of Swiss Operators of Waste Material Processing Plants

KEZO
Waste Processing Association of Zürich Oberland, hinwil

Donors 2014

In alphabetical order

Acr–Azienda cantonale di rifuiti	Giubiasco
AFATEK A/S	Kopenhagen (DK)
BACHEMA AG	Schlieren
BSH Umweltservice AG	Sursee
Deponie Leigrueb AG	Lufingen
ERZ Entsorgung + Recycling Zürich	Zürich
EWB Energie Wasser Bern	Bern
Hitachi Zosen INOVA AG	Zürich
KEBAG AG	Zuchwil
KEZO Kehrichtverwertung Zürcher Oberland	Hinwil
KVA Linth	Niederurnen
LIMECO	Dietikon
Magaldi Industrie s.r.l.	Salerno (I)
MARTIN AG für Umwelt- und Energietechnik	Wettingen
Pöyry Schweiz AG	Zürich
Renergia Zentralschweiz AG	Perlen
SAIDEF	Fribourg
SATOM AG	Monthey
SITA Deutschland GmbH	Mannheim (D)
STAG AG	Maienfeld
Stadtwerk Winterthur, Kehrichtverwertungsanlage	Winterthur
SARS Stiftung Autorecycling Schweiz	Bern
TBF + Partner AG	Zürich
Toggenburger Unternehmungen	Winterthur
Trumag Aufbereitungsstechnik AG	Frutigen
Verband KVA Thurgau	Weinfelden
WIEDAG AG	Oetwil a.S.
Zweckverband für Abfallverwertung Bezirk Horgen	Horgen

Financial Reports

Income Statement

	Statement 2014 in CHF	Budget 2014 in CHF	Statement 2013 in CHF
Income			
Donors	999 692	1 045 000	875 901
Other income	237 769	245 000	–
Interes	1 289	0	1 332
TOTAL INCOME	**1 238 750**	**1 290 000**	**877 233**
Expenses			
Materials	8 168	20 000	24 847
Analyses	108 690	123 500	73 072
Third party services	371 772	280 000	79 689
Salaries	703 049	780 908	465 348
Social security	163 127	183 200	106 834
Trainings	1 032	2 000	565
Rents	65 000	0	0
Maintenance/Optimization	59 135	75 000	28 827
Administration costs	2 343	4 000	7 970
IT	2 806	1 000	1 909
Advertising costs	1 524	5 000	0
Costs of representation	19 084	15 000	1 928
Foundation board expenses	948	2 500	1 922
Technical advisory board expenses	626	2 500	1 294
ZAR operational expenses	15 540	5 000	4 884
Bank expenses	0	0	16
Miscellaneous	0	10 000	0
TOTAL EXPENSES	**1 522 845**	**1 509 608**	**799 105**
RESULT	**-284 094**	**-219 608**	**78 128**

Balance Sheet

	31.12.2014 in CHF	31.12.2013 in CHF
Assets		
Current Assets		
Raiffeisen Uster	1 073 973	1 164 412
Debtors	193 481	0
Input taxes on debtors	14 962	45 102
Withholding taxes on deptors	451	333
Properties		
iCAP 7600 ICP-OES Duo (Analyzer)	87 790	0
TOTAL ASSETS	**1 370 659**	**1 209 847**
Passive		
Creditor	405 104	22 038
Sales taxes on creditor	0	0
KEZO	604 269	545 892
Sales taxes	0	0
Transitory liablities	67 161	63 699
Foundation capital	100 000	100 000
Foundation capital	478 218	400 090
TOTAL LIABILITY	**1 654 752**	**1 131 719**
ANNUAL RESULT (change project reserve)	**-284 094**	**78 128**

All amounts are rounded

External Auditors
PricewaterhouseCoopers AG | Neumarkt 4 | Bornhausstrasse 26 | CH-9001 St. Gallen

Activities 2015

ZAR Projects

4 **THERMORECYCLING**
RESH
Mixed Plastic – Electronic waste
Contaminated substrates

5 **PRODUCT DEVELOPMENT AND MARKETING**
Aluminum (0.2–1.0 mm)
NF precious metals / rare metals (0.1–0.7 mm)

8 **COARSE BOTTOM ASH**
Construction and start-up

9 **CENTRAL BOTTOM ASH TREATMENT PLANT**
Logistics
Unloading at the treatment plant
Optimizing of the plant
State of the art bottom ash treatment

10 **ANALYTICS**
Evaluation Analytics (diefferences between metals and oxide)
Melting trials for non-ferrous metals
Melting/Qualitty Control precious non-ferrous metals
Melting trials Al granulate

11 **STATE OF THE ART**
Evaluation of the state of the art
Specification of the state of the art

21 **MINERAL FRACTION IN THE BOTTOM ASH**
Characterization of entire bottom ash of ZAV Recycling AG
Further use of recycled bottom ash

22 **LANDFILL**
Gas formation and Al oxidation
Project planning “Landfill compartment bottom ash”
Pretrials technics/analytics
Landfill trial “Landfill compartment bottom ash”

30 **WET CHEMICAL BOTTON ASH TREATMENT**
Basic trials with different fractions
Fractioning / Enrichment
Trials with samples from bottom ash processing plant

30 **PHOSPHOROUS MINING**
Further metal reduction in phosphorous product
Recycling options for mineralic raw material
Increase of product added value for phosphor

30 **SWISSZINK – CENTRAL HYDROXIDE SLUDGE TREATMENT**
Feasibility study
Evaluation locationsand ownership

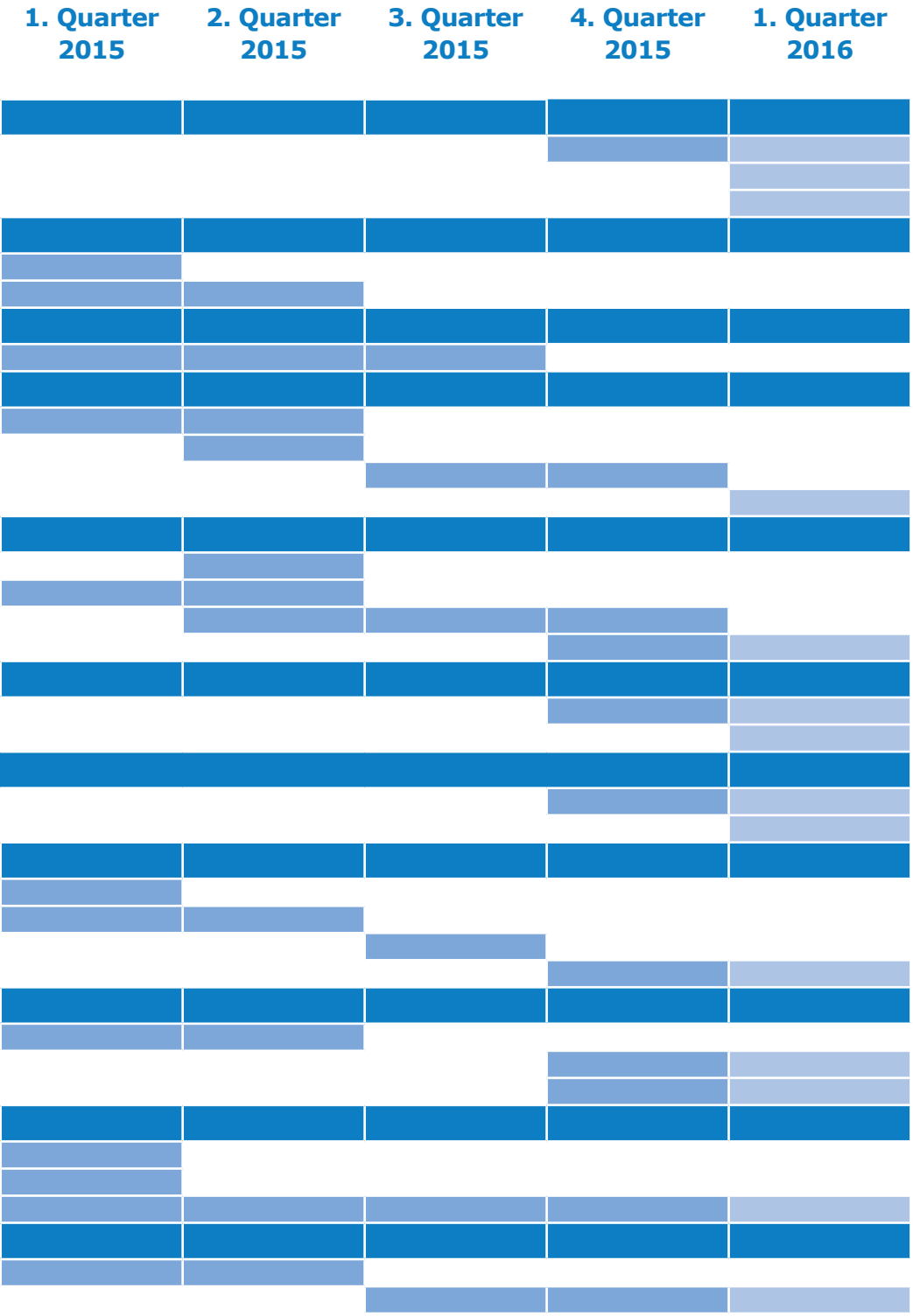

1. Quarter 2015
2. Quarter 2015
3. Quarter 2015
4. Quarter 2015
1. Quarter 2016

Image Subtitles

Title image	Conveyor Belt (Trumag AG, Frutigen)
4	Container station for steel construction Triage concrete structure Eddy current separator for the treatment plant
5	Untreated fine aluminum fraction Treated fine aluminum fraction
6	Conventional nose sieves
7	CAD drawing ZAR double nose sieve Functional parts, connection cams and connection technology
8	Induction field sample divider to determine the mineral content in non-ferrous metals in operations Schematic view of the separation process
9	Glass tube for determining the conductivity of non-ferrous metals Thermography image of specimen
11	Aerated concrete Melting furnace “Lollipop” (specimen)
13	Separation of KVA hydroxide sludge for metal analysis Laboratory zinc electrolysis for process optimization Zinc production on a laboratory scale
14	Nationalrat Yannick Buttet, VBSA President Cover of the Methods Report
15	Screen lining of the “ZAR double nose sieve”

Imprint

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