

# » Annual and responsibility report 2017



**Terrafame**

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# The year 2017



## Mining total

**35,1 Mt**



## Nickel production

**20 864 t**



## Zinc production

**47 205 t**



## Net sales

**220,0 M€**



**EBITDA**

**13,6 M€**



**Lost-time injury frequency**

**3,5**

# The year 2017

## CEO's review

# Terrafame continued its ramp-up and stabilisation of operations

2017 was in line with Terrafame's expectations. We continued the ramp-up and stabilisation of our operations. In nickel production, we exceeded the previous year's production as early as mid-2017, and our net sales more than doubled in a year.

During the year, we continued the mining and processing of ore at the target level. We mined, crushed and agglomerated 17.5 million tonnes of ore as a feed to our bioleaching process.

At the start of our operations in autumn 2015, bioleaching had dwindled in the primary and secondary leaching areas. In May 2017, we completed the stacking of the entire primary area with new ore. During the year we continued to block 3 in the secondary leaching area. This work enhances the leaching yield of metals.

Our metals production plant more than doubled volumes of nickel and zinc compared with the previous year. At the same time, we achieved the mine's annual production records in our main products: nickel, 20,864 tonnes and zinc, 47,205 tonnes. Towards the end of the year, we also made the first customer deliveries of copper.

## Demand for metals remained robust

The global demand for our main products, nickel and zinc, continued at a good level in the market in 2017. In the same period, the combined stock levels of the metal exchanges in London and Shanghai decreased, contributing to a favourable price development.

The development of the global market price of nickel was slow during the first half of the year, but the price clearly increased in the second half. In the fourth quarter, the average price was USD 11,583 per tonne, which was 7.2% higher than the average price in the fourth quarter of the previous year (Q4 2016: 10,810). Due to the weakening of the US dollar, the price of nickel in euros in the fourth quarter of 2017 was almost at the level of the previous year (Q4 2017: 9,838 and Q4 2016: 10,019).

The global market price of zinc reduced slightly in the third quarter, but otherwise the price developed progressively. In the fourth quarter, the average price was USD 3,235 per tonne, which was as much as 28.5% higher than the average price in the fourth quarter of the previous year (Q4 2016: 2,517). The price of zinc in euros in the fourth quarter of 2017 was 17.8% higher than in the fourth quarter of the previous year (Q4 2017: 2,748 and Q4 2016: 2,333).

## Private funding for ramp-up and further processing

During the year, we acquired private funding for finalising the ramp-up as well as for investing in further processing of our main product. Basically, we have assessed two alternative routes for processing our nickel-cobalt sulphide: the production of metallic nickel-ferro alloy suitable for stainless steel, and the production of nickel and cobalt chemicals suitable for the manufacturing of batteries used in electric vehicles.

In February, we announced a financing arrangement of EUR 250 million for the finalisation of the ramp-up and, in November, in connection with a USD 200 million financing package, we announced that we are planning the production of battery grade nickel and cobalt chemicals.

## New steps forward in occupational safety

I am particularly happy about the fact that, in just over two years, we have succeeded in a transformation of our safety culture. At the end of the year, our lost-time injury frequency rate (LTIFR), i.e. the number of lost-time injuries per one million person-hours worked, was 3.5, which is clearly better than our target of below 5.0 and the LTIFR of the previous year, 8.4. We also reached a new record – 131 days – without lost-time injuries.

In addition to avoiding injuries, we have invested in occupational hygiene with very good results. We continuously focus on the use of protective equipment and utilise biomonitoring based on precise analytics for the monitoring of exposure to metals. The biomonitoring results of our personnel have been very good.

## Solid water situation

At the end of 2016, we had already reduced the amount of water stored at the site close to the target level. At the start of 2017, we received an environmental permit for our new centralised water treatment plant and commissioned the plant. Thanks to the good water situation already in the first quarter, we were able to suspend the discharge of water from the site for about seven weeks. Spring melt water or autumn rains did not result in specific measures.

Of the annual sulphate discharge quota of 16,300 tonnes, about one third was left unused, and our total sulphate load decreased compared with 2016.

## Full-year EBITDA positive

In the light of economic figures, 2017 was a good year at Terrafame. We continued to improve our profitability with persistence.

Our net sales more than doubled to EUR 220.0 million. Our EBITDA was EUR 13.6 million positive, which is a good sign that we are progressing towards a profitable business as planned. At the same time, our operating loss reduced to EUR -6.2 million. We also made significant investments worth EUR 92.1 million in the expansion of the bioleaching area, a third hydrogen sulphide production line and additional mining equipment, as well as for sustaining capex. Based on these figures and achievements, we are committed to continued efforts in 2018.

I would like to warmly thank our customers, business partners and owners, as well as our personnel, who have persistently continued to develop our operations. I greatly appreciate the feedback that our neighbours and other local stakeholders have provided concerning our operations. Thank you also to the numerous visiting groups who have travelled to Sotkamo in Finland to become acquainted with our operations and to engage in face-to-face discussions with our company representatives.

**Joni Lukkaroinen**

CEO

Terrafame Ltd

# The year 2017

## Chairman's review

# Terrafame is ready to take the next developmental steps

During 2017, Terrafame succeeded in reaching its key targets and took major steps forward again. We achieved production records in nickel and zinc, our lost-time injury frequency rate continued to clearly decrease, and our full-year EBITDA was positive. Also, our environmental situation is stable. I would like to thank everyone at Terrafame for these achievements.

Financing arrangements and new ownership were milestones over the last year. In early 2017, we announced a EUR 250 million financing package to ensure finalisation of the ramp-up of our operations. With this package, the Galena Fund, part of the Trafigura Group – which specialises in international commodities trade and logistics – as well as the Finnish financial group Sampo, became owners of the company in addition to the Terrafame Group, owned by the Finnish State. As a result of the arrangement, our Board of Directors was strengthened by two new members who have international metals industry and trade expertise. In this connection, the Terrafame Group's representative also became a member of the Board.

In November, we announced that we are planning production of nickel and cobalt chemicals, which are used in battery manufacturing for electric vehicles. We also published a new USD 200 million financing package concluded with the Trafigura Group and Sampo for designing and constructing a battery chemicals plant.

Along with the ownership and financing arrangements implemented during the year, the Terrafame Group's stake in Terrafame will decrease to 71.2%. The Trafigura Group's stake will increase to 28.7% and Sampo's holding is 0.1%.

Private funding for finalising the ramp-up of operations was a very important milestone for Terrafame's operations, and also for the

Finnish mining industry in general, as well as for the economy and employment in the Kainuu region. Terrafame has a major impact on the vitality of Kainuu, also bearing in mind the positive effects that indirectly extend to the whole of Finland.

The plan for investing in chemicals used in manufacturing batteries for electric vehicles, which will have a very important role in future road traffic, also demonstrates Terrafame's commitment as a key international player in the manufacturing chain of electric vehicles. The plan also represents a significant initiative in the development of the Finnish battery industry. It is to the benefit of all Finns that Finland's natural resources are used so that the highest possible amount of added value remains in Finland.

I have confidence in 2018 for Terrafame. The financing arrangements and new investment plans, together with metals production records, are strong evidence of the exciting future opportunities in Terrafame.

**Lauri Ratia**

Chairman of the Board  
Terrafame Ltd

# Business activity

## Extracting innovation

**Terrafame continued to develop its operations under the previously identified strategic themes. In some of these themes, the key targets were already met during 2017. The further processing of the main product, nickel-cobalt, was designated as a new theme.**

### Strategic themes

#### Leaching yield

**Terrafame's objective is to improve the leaching yield of metals in both primary and secondary bioleaching.**

In 2017, developments were made in the quality of ore to be utilised, uniformity of the recovery and the technical performance of bioleaching. Bioleaching capacity was increased by taking into production the entire primary leaching area and by expanding the secondary leaching area.

#### Metals production efficiency

**In terms of metals production efficiency, Terrafame's objective is to recover the metals leached in the process solution as accurately and cost-efficiently as possible.**

Yields at the metals production plant were improved and production records were achieved in nickel-cobalt and zinc. With increasing production volumes and improved chemical efficiency, the cost-effectiveness of the metals production plant and the entire company improved significantly.

Also, the first copper deliveries took place at the end of the year and preparations were made to study the recovery of uranium and rare earth elements on a laboratory scale.

#### Further processing

**Terrafame's objective is to further process its main product, nickel-cobalt, thereby increasing the added value of the product.**

Two further processing options were studied in 2017: the production

of metallic nickel suitable for stainless steel and the production of chemicals utilised in the batteries of electric vehicles. Starting from the end of the year, the focus was put on technical and economic analysis and planning of the battery chemicals plant.

## **Uptime**

**At Terrafame, seamless cooperation between production and maintenance personnel aims to improve the availability of production lines. This creates a basis for cost-effective operations.**

In 2017, the planning of operations and maintenance tasks, as well as joint field rounds, were further enhanced. Targets were reached in the availability of mining, ore processing and reclaiming machinery and lines.

The expertise of operators was strengthened to enable them to participate in maintenance tasks and be better equipped to identify the needs for preventive maintenance. Thus, focus was increasingly transferred from repairs to preventive maintenance, which will bring savings and efficiency to operations.

## **Ore processing**

**Ore is crushed and agglomerated to make it suitable for bioleaching. Ore processing in accordance with high quality criteria ensures an optimal bioleaching yield.**

In 2017, ore mining and processing continued at a full-capacity level already achieved at an earlier stage. Operational cost-efficiency was further improved and ore uniformity and agglomerate quality were optimised.

Ore processing has reached the level of the strategic objectives and the development of operations will continue as a part of day-to-day work.

## **Procurement**

**Uninterrupted and cost-efficient production is the primary objective when procuring raw materials and services. In addition, the commitment of Terrafame's partners to long-term cooperation will bring benefits to the development of operations on both sides.**

In 2017, Terrafame achieved stable operations also in its procurement. Several new extensive partnership agreements were concluded during the year. Internal processes were developed so that procurement and technical experts now plan purchases together. Furthermore, the use of electronic tools in procurement

was expanded, which will further streamline operations.

The major development goals originally set for procurement operations have been reached over the past two years and the work will continue as part of normal operations.

**Terrafame's strategic themes.**

## Business activity

# Another record year in metals production

**In 2017, Terrafame achieved annual all-time records in nickel and zinc production as well as several monthly and quarterly records. Altogether 20,864 tonnes of nickel and 47,205 tonnes of zinc were produced. Towards the end of the year, the first copper deliveries were also made.**

The 2017 volumes of mining remained at the target level already reached in mid-2016. Ore containing 46,200 tonnes of nickel and 91,827 tonnes of zinc was mined and stacked to primary leaching. In late 2017 and early 2018, the southern end of the open pit was emptied of water, which in the future will offer better opportunities for extracting homogeneous ore and further improving cost-efficiency.

The mining equipment purchases made during the year correspond better to mining volumes. Another heavy wheel loader was introduced, and in transport, dumper trucks 11 and 12 were introduced in addition to the previous ten dumper trucks. The transport distance of waste rock was reduced significantly when a separate waste rock area was introduced closer to the pit. This will lower the internal transport costs of the mining site.

Cost-efficiency was improved in ore processing by developing magnetic removal of metal parts from the crushing circuit. Agglomeration of crushed ore was improved by more detailed quality control. This will also lay the ground for successful bioleaching.

A fourth surface miner was introduced to enhance operations in ore reclaiming in the primary leaching area. The utilisation rate of the conveyor line for transferring ore from the primary area to the secondary area was also significantly increased with new technical solutions.

## **Improvement in the cost-efficiency of the metals production**

The primary leaching area was taken in full production use in May, when it was fully stacked with completely new ore. In the secondary leaching area, ore stacking progressed in the spring to block 3. During the year, aeration of primary leaching was also developed, which has a considerable impact on microbial activity and mineral oxidation, and thereby on the bioleaching recovery rate. On the whole, the leaching of metals at the heaps continued as expected.

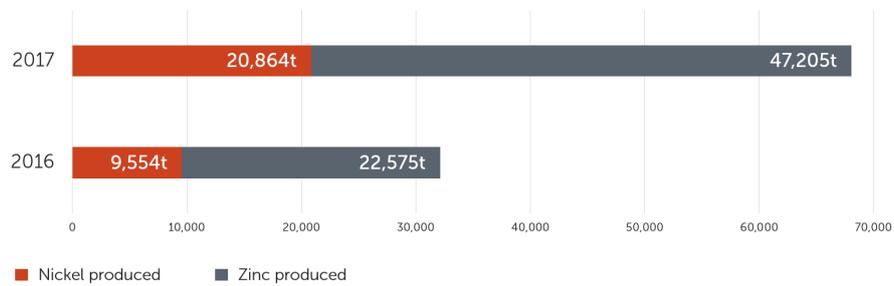
During the year, cost-efficiency of Terrafame improved significantly, particularly with the growth in production at the metals production plant. The plant continued to use two production lines, which started during the previous year. The feeding of the process solution from bioleaching to the plant was developed so that metals could be recovered more efficiently than previously. A third pressure filter for zinc was also commissioned, which will enable a further increase in the production capacity of zinc. Additionally, feed equipment for sulphur dioxide was installed for the recovery of copper, and the first customer deliveries of copper were made towards the end of the year.

Altogether, Terrafame produced a record-breaking 20,864 tonnes of nickel and 47,205 tonnes of zinc during the year. Several quarterly and monthly production records were achieved in addition to the annual production records. A third hydrogen sulphide production line was also under construction at the industrial site which, once finished, will support increasing production and process reliability at the metals production plant.

## **Battery chemicals production planning started**

The main product of Terrafame is nickel-cobalt sulphide precipitate. Its further processing possibilities have been under study at the company since the start of operations. During the year, two development alternatives were assessed, and in this work the production organisation also made its own contribution. The production possibilities of nickel and cobalt sulphates, used in the

batteries of electric vehicles, were examined in addition to the production of metallic nickel-ferro alloy, suitable as a raw material feed for stainless steel.



**Annual production records were achieved in both nickel and zinc.**

## Business activity

# Net sales totalled EUR 220 million

**In business relationships, 2017 was a year of significant development. Net sales more than doubled from the previous year. Procurement was enhanced by longer and more comprehensive partner agreements.**

Terrafame began building a strong customer base as early as 2015, and in 2017 this work was continued by the Trafigura Group, which became Terrafame's new partner in February. Terrafame was thus able to utilise Trafigura's extensive market knowledge.

In accordance with the agreement between the companies, most of the production of nickel-cobalt sulphide and zinc sulphide in 2017 was delivered to end customers through Trafigura's resale network.

## Significant growth in sales volumes

The sales volumes of Terrafame's metal sulphide products grew from quarter to quarter in 2017, following the growth in production volumes. Compared to the previous year, net sales more than doubled. The company's profitability also improved throughout the year in accordance with the targets.

The global market prices of metals developed positively on the whole. The price of zinc continued to increase in 2017, and the development in the price of nickel was positive in the second half of the year. The combined stock levels of London Metal Exchange and Shanghai Futures Exchange dropped globally in both nickel and zinc during the year. However, the value of the US dollar, commonly used in the global trade of metals, weakened against the euro.

## Closer to end customers and consumers

Since the start of its operations, Terrafame has conducted research into the further processing options of the nickel-cobalt sulphide product. By processing nickel-cobalt sulphide more than today, the value and revenue of the product would increase.

One of the options studied during the year was the possibility of processing nickel precipitate into nickel oxide by roasting, which would be suitable as a raw material for stainless steel, globally. The production of battery chemicals used in electric vehicles was identified as an even more interesting option. In November, Terrafame announced that it was preparing an investment in a battery chemical plant.

In commercial operations, the design of further processing required, for example, arrangements for plant-scale test runs, as well as the identification of sales opportunities for new kinds of products. In addition to end customer segments, the monitoring of consumer markets was strengthened at Terrafame, especially based on studies concerning the growing popularity of electric vehicles.

Terrafame filed a licence application for uranium recovery with the Finnish Government at the end of October. The applications for sales-related licences with the European Atomic Energy Community (Euratom) and the Ministry for Foreign Affairs of Finland will become relevant later.

## Partners were engaged in joint development work

The transition from the ramp-up phase towards stabilised industrial activity was also visible in procurement. New, extensive contracts were concluded during the year to organise, for example, industrial cleaning, waste management, storage and production supplies. The cooperation with import and export ports was developed to streamline logistics and increase the security of supply.

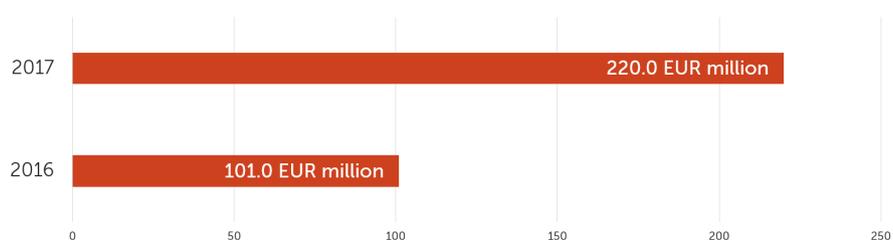
Terrafame wants to engage the companies selected as partners in the continuous improvement of operations and the support of business growth. This means that partner companies will be audited regularly and concrete development targets will be set for cooperation.

## Electronic tools enhance procurement

The utilisation of electronic tools as part of the procurement process was expanded during 2017. Companies striving to become partners can now register in Terrafame’s electronic procurement system by entering basic information on their operations, which is used as a basis for assessing the possibility of them succeeding in the cooperation.

Also, the submission of requests for offer and the reception of offers was initiated in early summer from electronically pre-registered partners, based on their competencies. Additionally, the first online auction was held in the summer. Electronic tools can correspondingly be utilised, for example, in the sale of waste fractions.

On the whole, electronic tools enhance operations, both at Terrafame and in its partner companies. Duplicate and repetitive work can be reduced when basic company information as well as the requests for offer and the submitted offers can be found in the same format in the same location. Good ground work and systematic information management clearly emerge as important factors, and time is freed up for cooperation development.



**Terrafame grew into an even more significant export company in 2017. Net sales increased to EUR 220 million.**

## Business activity

### Production and equipment – key areas for capital expenditure

**In 2017, investments were made in bioleaching, metals production plant operations, as well as mining and ore reclaiming equipment. Also, the construction of a new emergency shelter got well under way. Capital expenditure during the year totalled EUR 92.1 million.**

Terrafame has substantial expertise in metals bioleaching conducted in two stages. In the first stage, ore is leached in the primary leaching area for about 18 months. Subsequently, the ore is reclaimed and transferred to secondary leaching area. Block 3 base structures were finalised in the secondary leaching area in the spring of 2017, and the main area of block 4 base structures were finished by the end of the year. Furthermore, a joint pumping station for the process solution was built for the blocks 3 and 4. Thanks to these investments, the secondary leaching area was doubled in comparison to the past.

Mining includes also mining of waste rock. Terrafame has long been able to utilise waste rock as a building material for production areas. Towards the end of the year, in accordance with the environmental permit, transfer of waste rock to a separate block 1 in the waste rock area commenced. An investment was also made to increase the gypsum pond volume.

Total capital expenditure on the earthwork construction over the year amounted to approximately EUR 38 million.

### Third hydrogen sulphide production line almost complete

Terrafame utilises hydrogen sulphide in the extraction of metals from the process solution. Originally, two hydrogen sulphide plants built in 2008–2009 have been in use in the metals production. Design of the third hydrogen sulphide plant started in autumn 2016, and construction work was initiated in early summer 2017.

The new hydrogen sulphide plant will make it possible to increase the capacity of the metals production plant, and will simultaneously improve the operational reliability. The third plant, equal in annual capacity to the previous plants, is due to be commissioned in early summer 2018.

In 2017, close to EUR 9 million was invested in construction work for the new hydrogen sulphide production line.

## **New equipment at the mine and in ore reclaiming**

Close to EUR 10 million was invested in mining and ore reclaiming equipment. Thus, another wheel loader was acquired, as well as dumper trucks 11 and 12 for transporting material from the open pit. In the primary leaching area, one more surface miner was introduced for ore reclaiming. From primary leaching, the reclaimed ore is conveyed to the secondary leaching area for second-stage bioleaching.

## **Production of copper and zinc was developed at the metals production plant**

In the summer, plant-scale trial operations in the recovery of copper were started at Terrafame, and the first customer deliveries of copper oxide were made in late 2017. Sulphur dioxide is used in the precipitation of copper at the metals production plant so close to EUR one million was invested in the storing and feed equipment for sulphur dioxide.

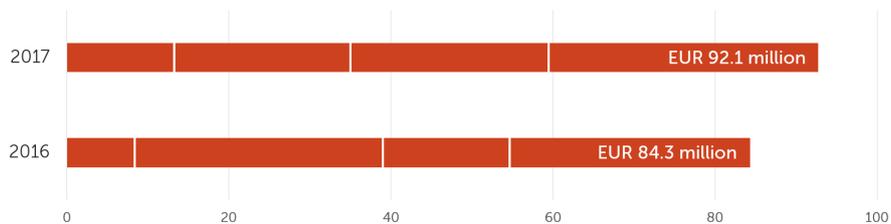
Also the filtering capacity of zinc was increased with a capital expenditure of close to EUR one million in a third pressure filter.

## **Construction work on new emergency shelter started**

In the autumn, construction work of a new emergency shelter was started next to the main gate. During the remainder of the year, the foundations were finished, and building of the frame commenced. Once finished, the building will offer also new training facilities and social premises. In 2017, approximately EUR 0.8 million was invested

in the building.

Terrafame also constructed a domestic water pipeline from the local water cooperative's water supply network to the industrial site. This amounted to an investment of around EUR 0.3 million. A domestic water supply from the network was introduced in January 2018.



**Capital expenditure in 2017 amounted to EUR 92.1 million.**

## Business activity

### Research work supports the efficient utilisation of ore

**In research and development work, the focus was on production ramp-up and stabilisation. At the same time, studies were conducted into how metals from ore can increasingly be utilized. At the same time, exploring possibilities for further processing nickel-cobalt were continued.**

Terrafame continued the development of bioleaching technology based on natural microbial activity in the ore. The company has unique expertise in the bioleaching of ores that contain pyrrhotite and know-how is further enhanced through a global collaboration network.

The ore material plays a major role for the leaching yield. During the year, ore and mineral models were utilised for developing the consistency of the feed used for bioleaching. In future, the modelling information will be utilised in operating the bioleaching process.

### Increasingly efficient work in bioleaching and recovery

Bioleaching was studied on a laboratory and production scale, both with Terrafame's own resources and with the help of partners. In the column leaching pilot, primary leaching was simulated and the bioleaching phenomena, such as microbial activity, were addressed. Furthermore, samples were drawn from the primary and secondary leaching areas through rotary drilling for specific laboratory examinations. Based on analysis results, a high volume of information was obtained for the development of bioleaching technology.

At the metals production plant, production-scale trial commenced in the summer to improve the precipitation properties of copper,

and the first customer deliveries of copper were made during the year. Several different ways of enhancing the precipitations were also tested at the plant, with the aim of further improving the efficiency of nickel, cobalt and zinc recovery.

## Targeting further processing of nickel-cobalt

The further processing of the current main product, nickel-cobalt sulphide, has been under examination at Terrafame since the start of the company's operations. As part of this work, the pyrometallurgical alternative had already been identified as feasible, but the hydrometallurgical alternative turned out to be even more interesting.

In the pyrometallurgical alternative, the added value of the product would be increased in the roasting-smelting process, rendering the current nickel sulphide product a metallic nickel-ferro alloy suitable for stainless steel production. Plant-scale trial runs with partners were also successfully completed during the year.

In the hydrometallurgical alternative, nickel-cobalt sulphide would be further processed into chemicals used in the batteries of electric vehicles. During the year, the feasibility studies of battery chemicals production were continued.

In 2017, the company decided to focus on planning the production of battery grade chemicals.

## The extraction process offers new opportunities for metals recovery

There is a nearly completed, solvent extraction technology-based uranium recovery plant at Terrafame's industrial site. On top of uranium recovery, this plant could possibly be utilised in the recovery of rare earth elements (REE) from the main process solution. Based on this, a pilot-scale study was prepared, which received a permit from the Radiation and Nuclear Safety Authority in December.

The target of this study is to obtain information for the extraction process optimisation well before the possible commissioning of the

plant. Additionally the plan is to identify recovery possibilities for rare earth elements.

## **Environmental R&D focus on landscaping**

Terrafame managed to leave one third of its annual sulphate quota unused in 2017. In sulphate control, the smooth operation of the production process is of utmost importance, as well as the ability to precipitate sulphate to the bioleaching heaps. In 2017, the nano-filtering technique was tested for sulphate control in addition to the reverse osmosis technique currently in use.

Landscaping studies have been conducted at the secondary leaching area and at the gypsum ponds. In these studies, the aim is to identify environmentally-safe ways of shutting down areas of mining operations, as well as utilising local sealing materials for cover structures, where possible.

In the secondary leaching area, safe cover structures and landscaping have been studied and monitored for several years, and the work continues. The first phase of the studies at the gypsum pond area, which started with a trial operations permit in 2016, was finalised in autumn 2017. Further research plans will be specified based on the results obtained thus far.

Research activities into waste rock, not classified as ore, commenced in autumn 2017. The aim is to collect data for the development and inspection of base structures in waste rock areas and to investigate the possibilities of utilising the small concentrations of valuable substances in waste rock.

## **EU funding for further development of sulphate management**

In 2017, Terrafame Group Ltd continued the implementation of the final stages of the Ariel project, focused on the development of water treatment technology, the construction of a longer-term research portfolio, and the monitoring and support of a number of Terrafame Ltd's projects. The key results of Ariel were published at a water seminar organised by the University of Oulu in January 2018.

The project resulted in three conceptual options for further development of sulphate management at Terrafame's mine. The solutions are based on 1) optimising the current process, 2) sulphate recycling, and 3) sulphate recovery as a new saleable product.

In 2017, Terrafame Group Ltd also acquired new research funding from the European Commission to develop the technologies conceptualised in Ariel into production scale.

# Business activity

## Metals are crucial in modern society

**The benefits of metals include good recyclability. But recycling alone is not enough to meet the needs of modern society. The use of metals is enhanced by the electrification of traffic, as well as the production and storage solutions offered by renewable energy sources, for example.**

Currently, Terrafame produces nickel, cobalt, zinc and copper, which are used for stainless steel, in corrosion protection as well as in batteries and in electronics, for example. In metals production, the company utilises energy-efficient bioleaching technology, which also allows for lower production greenhouse gas emissions than the traditional foam-smelter technology. Furthermore, Terrafame's goal is to enhance the utilisation of the ore from mining.

### Nickel

Nickel is one of the most used metals in the world, and has excellent recyclability. Nearly two thirds of nickel is used in the production of steel and manufacture of metal alloys. Nickel is combined with other metals, as it enhances durability and rust prevention.

Together with cobalt, nickel is a significant material in batteries for electric vehicles. According to estimates, by 2030 about one quarter of new cars globally could be electric or hybrid vehicles.

### Zinc

Zinc is one of the most used metals, and it has high recyclability. Together with nickel, zinc is very popular in the rust protection of steel. Furthermore, it is utilised in batteries, radiators, paints and in the manufacture of rubber.

Zinc is also beneficial for agriculture. Zinc in fertiliser enhances crop yield, and the nutritional values of the crop are improved.

## Cobalt

The European Union has defined cobalt as one of critical raw materials. According to the definition, critical raw materials cannot usually be replaced by other materials, they play an important economic role and there are risks related to their availability. Cobalt has also been defined as a hi-tech metal suitable for low-emission energy solutions.

Just over half of global cobalt production is currently utilised in the production of battery chemicals, and the growing popularity of electric vehicles also indicates growth in the demand for cobalt.

## Copper

Copper is also one the most used metals in the world. It has excellent electrical conductivity, which is why it is particularly used in electrical cables, electricity production and electronics. Copper is suitable for various metal alloys, for example, in the manufacture of brass and bronze. Additionally, it is utilised in construction and in coins.

## Uranium

Uranium is used for energy production in nuclear power plants. Together with renewable energy sources such as wind and solar energy, the use of uranium in energy production supports efforts to curtail greenhouse gas emissions and climate change.

# Responsibility

## Chief sustainability officer's review

# Production ramp-up progressed safely

**In 2017, we continued systematic work to develop our safety culture, and the results showed further improvement. Terrafame's management system was certified, and we extended the work by auditing our partners. At the end of August, we filed a new environmental permit application with the authority, covering all our operations.**

The development of an occupational safety culture requires long-term work. We started this work at Terrafame at the very beginning of operations in autumn 2015, and clear signs of improvement in our safety culture were already visible during 2016. In 2017, we continued to refine our safety practices and placed even greater emphasis on preventive safety work. I am particularly happy about the fact that our progress during this period has been even more rapid than anticipated.

In 2017, Terrafame's personnel experienced 4 lost-time injuries, making the lost-time injury frequency rate (LTIFR) 3.5 injuries per one million person-hours worked (2016: 8.4). The LTIFR was set at under 5.0, so the target was clearly achieved. Furthermore, the LTIFR of Terrafame's partner companies operating at the site decreased to 11.7 (2016: 19.4).

The significant reduction in both Terrafame's and its partner companies' LTIFR demonstrates that the safety work has produced results. During the year, there were no serious injuries related to tools, machinery or equipment. The longest lost-time injury was caused by slipping.

## Management system was certified and partner companies were audited

The building of Terrafame's management system had already reached the external audit phase by the end of the previous year and, in February 2017, the company received certificates on quality, environmental, and occupational health and safety management. The certification of the management system proves that our personnel are working systematically throughout the organisation.

In 2017, the focus of maintenance and development of the management system was on audits. We conducted several audits of our contractual partners during the year focusing on safety and operating culture. Furthermore, we organised three contractor meetings over the year, during which the practices of our partner companies operating at the site were reviewed, and safety at the site was jointly developed.

At the end of the year, we initiated the self-assessments related to the Finnish Towards Sustainable Mining Standard. Our goal is to conclude the self-assessments in 2018 and to start developing our operations based on the results of the self-assessments.

## Water management became part of normal operations

At the start of Terrafame's operations, the water storage pools at the site were full, and the most significant environmental risks were associated with water management. During 2016, we managed to reduce water levels in the water storage pools considerably, which also meant a reduction in risk levels.

During 2017, the volume of stored water was brought down to the target level of 1–3 million cubic metres and, during the course of the year, water management has become part of our site's normal operations. Naturally, we continue to monitor the volume of stored water closely and, at the same time, maintain preparedness for exceptional weather conditions.

During 2017, a total of 5.3 million cubic metres of purified water was released from Terrafame's site. The sulphate load was 10,468 tonnes, which was clearly below the volume specified in the environmental

permit. The metal concentrations of purified water were also clearly below environmental permit limit values, apart from a few individual exceptions.

## **A new environmental permit application was submitted in August**

The Supreme Administrative Court (SAC) issued its decision on Terrafame's environmental permits on 9 May 2017. It requires Terrafame to file for a new environmental permit for its entire operations with Northern Finland Regional State Administrative Agency (RSAA) by the end of August 2017.

A new permit process was already required in the decision issued by Vaasa Administrative Court in April 2016. For this reason, we had initiated two Environmental Impact Assessments, or EIA procedures, as early as autumn 2016. The EIA report on water management was submitted to the Kainuu Centre for Economic Development, Transport and the Environment (ELY Centre) acting as supervisory authority in April, and the EIA report on the continuation and further development of mining operations was submitted in August 2017. The ELY Centre issued its statement on the EIA report on water management in July, and the statement on the EIA report on the continuation and further development of mining operations in December 2017. The statements by the contact authority form part of our environmental permit application.

We filed the environmental permit application covering all operations with the RSAA within the time limit prescribed by the SAC, at the end of August 2017. The environmental permit decision is expected in the first half of 2019, and our current permits will be valid until the new environmental permit is enforceable.

**Veli-Matti Hilla**  
Chief Sustainability Officer  
Terrafame Ltd

# Responsibility

## New environmental permit filed on schedule

**Major work in permit process issues was the preparation of an environmental permit application covering all of Terrafame's operations. As background work to this, Environmental Impact Assessment (EIA) procedures for water management and mining operations were also finalised. In addition, Terrafame filed a licence application for uranium recovery with the Government.**

The Supreme Administrative Court (SAC) issued rulings on all Terrafame's key permit decisions in May 2017. These included the environmental and water management permit that covers all mining operations (including uranium recovery, RSAA decision No. 36/2014/1), an environmental permit for water emissions along the old discharge routes (RSAA decision No. 52/2013/1) and an environmental permit for the Nuasjärvi discharge pipe (RSAA decision No. 43/2015/1).

The SAC upheld the ruling issued by the Vaasa Administrative Court (VAC) in April 2016, according to which Terrafame should apply for a new environmental permit covering all operations by 31 August 2017.

## The new permit process was prepared using two EIA procedures

Terrafame had already launched two EIA (Environmental Impact Assessment) procedures in the autumn of 2016. The EIA report on water management was submitted in April 2017 to the Kainuu Centre for Economic Development, Transport and the Environment (ELY Centre) acting as coordinating authority, and the EIA report on the continuation and further development of mining operations was submitted in August 2017.

The ELY Centre issued its statement on the EIA report on water management in July, and the statement on the EIA report on the mining operations in December 2017.

## The environmental permit application covering all operations was submitted in August

The environmental permit application covering all operations was filed within the time limit prescribed by the SAC, i.e. at the end of August 2017.

The application filed in August is seeking a new environmental and water management permit for Terrafame's multi-metal mine and metals recovery processes, including all auxiliary processes. The application covers current operations and incorporates new leaching, waste rock and waste areas to be constructed, as well as a partial increase in production capacity in respect of mining volumes and metals production.

The permit application proposed that the sulphate quota for the treated water discharge pipe should be 20,000 tonnes per year (currently 15,000 t/y). Thus, Terrafame wants to ensure safe water management in its area, even during years of heavy rainfall. During years of normal rainfall, the company's sulphate emissions are under half of the quota applied for, as demonstrated by load statistics for 2017. The permit limit proposals for metals follow the current permits.

The environmental permit decision is expected in the first half of 2019. Terrafame's current environmental permits, confirmed by the SAC, will remain in force until the new environmental permit is enforceable and final.

## Progress in other permit issues

In addition to the environmental permit process concerning all operations, Terrafame also had separate permit issues pending with the Northern Finland Regional State Administrative Agency (RSAA). In January 2017, the RSAA granted an environmental permit for the new centralised water treatment plant, and in September, an environmental permit for the construction of a separate waste rock area. The RSAA also issued a permit decision on the final disposal of deposits from water treatment incurred in the past and located in various parts of the site. Following the decision, the goetubes including water treatment precipitate can be disposed of in their location by using an impermeable structure for the cover. This

decision was a partial refusal, so the final disposal of the deposits requires further planning and a new permit process.

Terrafame also has an environmental permit application pending with the RSAA for a third hydrogen sulphide plant, as well as compensation cases related to the existing permit decisions. Decisions on these are expected during 2018.

Terrafame filed an application for uranium recovery with the Finnish Government at the end of October. There is an almost complete uranium recovery plant at the company's industrial site with a valid environmental permit and a chemicals permit granted by the Finnish Safety and Chemicals Agency (Tukes). Uranium recovery is also included in the new environmental permit application covering all operations.

# Responsibility

## Safety at the industrial site on an increasingly high level

**Substantial efforts were made in occupational safety and hygiene and excellent results were achieved during the year. Terrafame's industrial fire brigade started as a contract fire brigade for Kainuu Regional Rescue Authority enhancing the level of emergency services also in the community.**

2017 was successful in terms of occupational safety. Terrafame's own lost-time injury frequency rate (LTIFR), i.e. the number of lost-time injuries per one million person-hours worked, fell to 3.5 from 8.4 in the previous year, which was better than the target, set at under 5.0. The LTIFR of partner companies operating at the site was 11.7.

During the year, Terrafame's employees suffered 4 lost-time injuries and 22 minor zero injuries, which did not result in sickness absence. Lost-time injuries resulted in a total of 54 days of sickness absence, or 13.5 working days per injury. The average was increased by one slip due to icy conditions, which caused a sickness absence of 41 days. The remaining lost-time injuries resulted in absences of 1–4 days.

The most common injuries were hand and finger contusions resulting from installation work, lower limb injuries caused by slipping, as well as minor eye injuries caused by debris.

## A wide range of tools to support occupational safety

The rapid decline in the injury frequency rate in 2016–2017 has been achieved by increasing the awareness of occupational safety. This has meant the analysis of accidents, deviations and near misses, and implementation of the measures that were subsequently agreed.

Safety sessions are also held for employees, with prepared materials

aimed at preventing injuries. Actual injuries are used to draw up “lessons learned” materials, which are also distributed to other companies operating at the site. The number of materials grew from two to 20 during the year.

205 department-led safety rounds were conducted during 2017. The safety round procedure was modified towards the end of the year by combining the separate management and department safety rounds. Representatives of management participate in one of the departments’ safety rounds every week. Management participated in 78 safety rounds during the year.



Safety training



Observation and non-conformity reports



Safety rounds



Accident and near-miss review meetings

## Increase in amount of safety training

The externally organised safety management training for supervisors, started in 2016, was continued in 2017. Terrafame organises compulsory safety training for both its own personnel and partners, comprising safety info and an occupational safety card, emergency first aid and hot work licence training. Presentation of the plant fire brigade and instruction in the use of fire extinguishers, as well as chemical safety training at the site, form part of Terrafame’s safety induction. Additionally, training in chemicals is organised, among other things.

During 2017, Terrafame’s own personnel received a total of 7,013 hours of safety training, i.e. 1.27 training days per employee. Partners’ personnel received 2,970 hours of safety training and the number of partners’ employees who received training was 2,335.

## Growing emphasis on occupational hygiene

Terrafame's occupational health care is organised in accordance with the occupational health action plan, and pre-recruitment and follow-up medical examinations are performed on all personnel. Occupational health care also conducts work place visits, and the Finnish Institute of Occupational Health provides occupational hygiene measurements in various process stages annually. Furthermore, occupational health care carries out biomonitoring, in which the employees' exposure to metals is monitored regularly. The emphasis of biomonitoring is on nickel, but other metals are also examined through sampling. Based on the results of the past year, the exposure level of Terrafame's personnel does not differ from the typical level of the Finnish population. On the basis of the summary data on the monitoring and measurement of employees' health, work-related occupational diseases have not been observed at Terrafame, either.

It is a requirement of Terrafame that its partners operating at the site organise occupational health care and, to a large extent, biomonitoring. During 2017, guidance and control of occupational hygiene provided to partners was increased further.

## In process safety, the year went well

The root causes of the fire in a hydrogen sulphide reactor in December 2016 were analysed, and changes were made to the reactors. Experience from the fire influenced the technical solutions for the new hydrogen sulphide reactor under construction, as well as the selection of fire prevention solutions.

During 2017, an electronic change management tool critical to process safety was implemented at Terrafame. The tool is used in process and equipment changes, and it helps identify occupational safety, environmental and process risks, as well as the statutory obligations related to them as early as during the preliminary design phase.

## Developmental leaps in fire and rescue capabilities

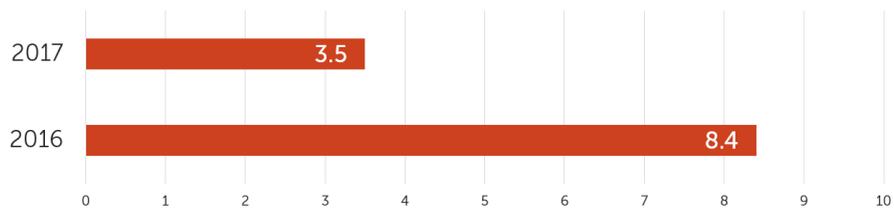
Since the beginning of the year, Terrafame's industrial fire brigade has served as a contract fire brigade for Kainuu Regional Rescue Authority. This arrangement has contributed to the rise in the level of emergency services in the sparsely populated area around the industrial site. The industrial fire brigade serves as a unit under Regional Rescue Authority, within an approximately 10-kilometre radius of the site.

In the summer, together with Regional Rescue Authority, Terrafame's industrial fire brigade organised a rescue drill at the mining site. The topic was the evacuation of an injured person from a large mining vehicle. In the autumn, Regional Rescue Authority and Terrafame's industrial fire brigade held smoke diving drills.

During 2017, Terrafame also updated the safety report in accordance with the Seveso III Directive, which deals with significant major accident hazards and their impact areas. The report was also used as a basis for preparing safety communications for the neighbouring area.

## Terrafame continued to represent European nickel producers

In product safety, the update of REACH documents for nickel and zinc sulphides continued with the industry's international organisations. For the purposes of product development, Terrafame filed for test product authorisations with the European Chemicals Agency (ECHA), the most important being the test product authorisation for copper sulphide. Additionally, Terrafame attended the regular meetings held by the Nickel Institute, and still acts as lead registrant for nickel sulphide for the ECHA.



**Lost-time injury frequency (LTIFR) meaning the number of injuries per million person-hours worked in 2017 and 2016.**

# Responsibility

## Load on waterbodies clearly below permit quota

**Environmental monitoring of the mine continued in accordance with the approved, extensive monitoring programme. The amount of stored water was brought to the target level, and the load on waterbodies released into the environment decreased compared to the previous year.**

During 2017, the amount of water stored at Terrafame's site was brought down to the target level of 1–3 million cubic metres, and the storage of water no longer posed a major risk. The amount of purified water released from the site totalled approximately 5.3 million cubic metres, which is approximately 4.3 million cubic metres less than in the previous year.

All the water discharged from the site was released north into the Oulujoki watercourse area. Thus, no water was discharged into the Vuoksi watercourse area. Most of the water was released via a discharge pipe into Lake Nuasjärvi. In May, around 0.4 million cubic metres of water was also released via Latosuo into the north-bound discharge route.

As in previous years, the substance concentrations of water discharged into water bodies were low and clearly below permit levels, apart from individual exceptions. A clear deviation occurred in water treatment when the aluminium content of discharge water increased in late autumn. The aluminium permit level was exceeded in October and November due to disruption at the central water treatment plant. The plant's operating parameters were modified, and the aluminium content returned to its normal level for the remainder of the year.



**Amount of water stored at the site, 1 September 2015–31 December 2017.**

**Average concentrations of purified water released from Terrafame’s site in 2016 and 2017.**

In 2017, according to confirmed analysis results, the sulphate load resulting from purified water released from the site was 10,468 tonnes, which was about one third less than the maximum amount permissible by the environmental permit. Particularly positive is the fact that the total sulphate load decreased by more than 7,000 tonnes from the previous year.

The most exceptional situation in water management occurred in August in the separate waste rock area (KL2) under construction east of the open pit. In a disruption caused by human error, metallic water flowed into the Pirttipuro route for about 24 hours, resulting in an extra nickel load of about 100 kilogrammes. The metallic water was directed into the purification process as soon as the situation had been registered. Additional water samples were drawn from Pirttipuro and Talvijoki and, based on them, environmental impact was limited to a short period.

**Loading on water bodies**

## resulting from the operations

### Discharge pipe

Loading 2017	Discharged (m <sup>3</sup> )	Copper (kg)	Manganese (kg)	Nickel (kg)	Zinc (kg)	Sulphate (t)	Sodium (t)
January	329,855	0.3	422.9	20.4	25.2	1,043.1	151.0
February	325,261	0.5	348.6	17.7	21.1	803.0	116.7
March	192,927	0.2	216.0	8.8	10.1	496.3	104.7
April	49,661	0.1	46.6	1.1	2.2	194.9	61.1
May	519,091	0.5	419.4	19.3	18.4	1,226.0	413.6
June	708,005	0.8	223.1	17.0	19.5	1,098.1	254.2
July	692,779	0.8	94.7	11.5	11.9	1,002.6	201.6
August	220,350	0.2	49.8	7.5	14.3	411.3	91.2
September	546,058	0.5	115.3	12.1	21.9	1,026.3	181.4
October	703,730	0.7	113.0	11.2	16.9	1,407.0	230.8
November	112,316	0.1	160.2	1.7	2.0	237.0	48.1
December	523,573	0.9	773.7	13.0	18.0	992.7	176.0
<b>Total</b>	<b>4,923,605</b>	<b>5.7</b>	<b>2 983.4</b>	<b>141.3</b>	<b>181.5</b>	<b>9,974.5</b>	<b>2,030.2</b>

### Permit limit (43/ 2015/1)

100.0    20,000.0    350.0    525.0    15,000.0    4,000.0

Between 15 March – 5 May the discharge pipe was used only as much as was necessary to keep the pipe free of ice.

Water was not discharged from the mine area between 6 – 13 August.

### Old discharge routes

Loading 2017	Discharged (m <sup>3</sup> )	Copper (kg)	Manganese (kg)	Nickel (kg)	Zinc (kg)	Sulphate (t)	Sodium (t)
<b>South</b>	0	0	0	0	0	0	0
<b>North (8–30 May)</b>	355,772	0.4	249.4	18.3	26.9	493.2	119.4
<b>Total</b>	<b>355,772</b>	<b>0.4</b>	<b>249.4</b>	<b>18.3</b>	<b>26.9</b>	<b>493.2</b>	<b>119.4</b>

<b>Permit limit (52/2013/1)</b>							
	150.0	2,600.0	250.0	300.0	1,300.0	650.0	
<b>Total</b>							
<b>Loading 2017</b>	<b>Discharged (m<sup>3</sup>)</b>	<b>Copper (kg)</b>	<b>Manganese (kg)</b>	<b>Nickel (kg)</b>	<b>Zinc (kg)</b>	<b>Sulphate (t)</b>	<b>Sodium (t)</b>
<b>Discharge pipe and old routes</b>	<b>5,279,377</b>	<b>6.1</b>	<b>3,232.8</b>	<b>159.6</b>	<b>208.4</b>	<b>10,467.7</b>	<b>2,149.6</b>

## The condition of the lakes below the site in line with expectations

The impact of purified water was visible during 2017 in Lake Nuasjärvi mainly as increased electrical conductivity and concentrations of sulphate, manganese and sodium in the basins closest to the discharge pipe. The lake's seasonal overturns extended to the entire mass of water during both the spring and autumn overturns, and discharge water did not prevent normal operation of the lake.

In the small watercourse areas of the old discharge routes on both the Oulujoki and Vuoksi side, the situation remained either unchanged or improved slightly. Lake Salminen and Lake Kalliojärvi in the Oulujoki watercourse area route have continued to be stratified. The sulphate concentration in Lake Kolmisoppi and Lake Jormasjärvi is gradually decreasing, thanks to the decrease in the sulphate load on old routes. During 2017, Terrafame released no water into the Vuoksi watercourse area. Thus, a reduction in sulphate concentration continued to be visible in the water route. Lake Kivijärvi, part of the Vuoksi watercourse area, has stratified basins as a result of operations from years ago, but in some of the shallower basins, water circulation has occurred.

## Impact on groundwater under close scrutiny

Terrafame has an extensive groundwater monitoring programme,

the goal of which is to gain information on the surface level and quality of groundwater. There are 24 rock groundwater pipes and eight earth groundwater pipes pertaining to the monitoring programme in the mining concession area.

Furthermore, the monitoring programme has eight domestic water wells in the vicinity of the mining concession area. In addition, the quality of groundwater is observed through one domestic water well and through two wells in connection to water intake plant in the Nuasjärvi impact area.

In February 2017, Terrafame submitted a report to the supervisory authority on the groundwater in the primary leaching area and the neighbouring area of the Kortelampi dam, as well as the measures to minimise environmental impact. According to the report, there are observable changes in the quality of groundwater resulting from industrial activity in the areas examined. Groundwater impact was monitored more rigorously during the year under review and improvements were made to the protective structures of the leaching solution collection system in the primary leaching area.

## **Dust impact slightly less than in the previous year**

Mining operations and ore crushing always cause a certain amount of dust impact. This is monitored by measuring the amount of particles emitted into the atmosphere, and by fallout surveillance, which is used to monitor the amount and quality of solids deposited from the atmosphere onto the production area and its vicinity. The metals production plant also produces air emissions, which are monitored by measuring the concentrations of metal, hydrogen sulphide and sulphur dioxide in air emissions.

Efforts were made to reduce dust impact by, for example, watering roads in the production areas. According to surveillance results from 2017, the dust impact of operations was at its highest at the mining site, whereas dust fallout outside the mining site was clearly lower, and slightly less in 2017 than in the previous year.

The permit limits of air emissions were tightened during 2017. Hydrogen sulphide measurements at the metals production plant fell below the environmental permit limit value. The particulate concentration in ore fine crushing, as well as the particulate and sulphur dioxide concentrations of heat production, were exceeded once during the year. Ore production replicate measurements were, however, below the limit value of 5 milligrammes per cubic metre ( $\text{mg}/\text{m}^3$ ).

# Responsibility

## Organisational development – the theme for the year

**Terrafame continued to develop its operations and organisation. Strong emphasis was placed on supervisory work, vocational skills, as well as occupational and environmental safety. After a rapid growth phase, personnel resources were also adapted to better match the stabilising industrial operation phase.**

At the end of 2017, Terrafame had 650 employees (2016: 645). During the year, a total of 165 employees were recruited, over half of whom were temporary summer employees. Thus, the headcount was at its highest during the summer months, when the company offered summer jobs to 90 interns.

As a result of the cooperation negotiations in September–October, the organisation was renewed and streamlined. 37 employees were laid off for production and financial reasons, as well as restructuring of operations. As part of transition assistance, the laid-off employees were offered relocation support and occupational health care services.

628 employees held permanent positions. Temporary positions were replacements of various absences and tasks related to development projects. The exit turnover of permanent employees fell to 6.2% (2016: 8.1%).

At the end of the year, as in the previous year, about 84% of Terrafame's employees lived in municipalities in Kainuu region, mainly in Kajaani and Sotkamo. The proportion of male and female personnel remained at the previous level. 91% of employees were men and 9% were women.

Terrafame also offered work to labour force provided by some 70 business partners at the industrial site. At the end of the year, the partner companies employed 696 people on a regular basis. Of these, an estimated 60% were from Kainuu.

## Diversification of personnel development

Terrafame invested heavily in supervisor training and the professional development of its personnel. In addition to on-the-job learning and short day courses, long-term training was launched in chemical engineering, electrical automation maintenance and leadership. Nearly 60 persons started on these qualification training courses, which will also continue in 2018. The Frontliner programme, designed to develop supervisory work, was continued and complemented by new content.

In the autumn, an 18-month operations development programme tailored to the company's needs was launched, involving 60 employees from various functions. The programme aims to develop leadership, planning and the common procedures of the production and maintenance organisations. The goal is to ensure cost-effective and high-quality operations.

Weekly safety training was organised for all personnel. Training organised in the workplace amounted to an average of 2.5 days per employee. The focus of training was on occupational and environmental safety. Safety induction, as well as chemical, protective equipment and first aid training, were also organised for everyone working at the site.

Leadership training amounted to an average of 3.6 days per supervisor. Additionally, employees took part in supported voluntary qualification studies.

## Wide range of occupational health services in use

Terrafame offers highly varied tasks. For this reason, efforts are also made to look after the working capacity and well-being of personnel in numerous ways. A wide range of occupational health services are utilised in this work.

Terrafame's industrial site has an occupational healthcare service point comprising occupational nurses and doctors. We continue to monitor working capacity and identify risks of exposure systematically with optimal results.

In 2017, employee sick leave accounted for an average of 5.5% of

theoretical regular working hours, which corresponds to the average level in the mining industry. However, sick leaves started to decrease in the autumn.

Early support and replacement work models were actively applied. During the year, almost 100 working capacity discussions were conducted, via both occupational health care and between supervisors and their employees.

## Development of HR information system launched

The last time Terrafame conducted an employee survey was in 2016. Based on the survey, more than 100 development measures were recorded, driven forward throughout different parts of the organisation. The survey was renewed in February 2018.

Towards the end of the year, an HR information system project was launched, which will be finalised in early 2018. The system will improve the control and reporting of human resource data and processes.

## The remuneration system was complemented by a production bonus

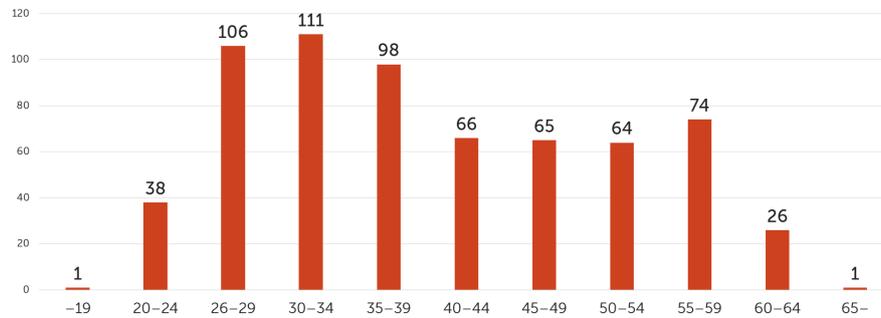
In 2017, Terrafame paid all employees a safety bonus for accident-free periods. The remuneration system was complemented by a production bonus based on monthly goal setting.

Additionally, employees were rewarded for a job well done and for initiatives that improved operations and safety.



**The number of Terrafame’s employees in 2017 remained at the**

same level as the previous year.



**Terrafame's personnel structure is balanced. The average age of employees is around 40 years.**

**Approximately half of the employees worked 12-hour shifts, with four days at work followed by six days off.**

# Responsibility

## Local focus on stakeholder activities

**Interest groups in the Kainuu region, such as employees, local inhabitants and representatives of adjacent municipalities, were emphasised in Terrafame's stakeholder relationships in 2017. The company's industrial site in Tuhkakylä, Sotkamo received a total of almost 4,000 visitors, who became acquainted with the exceptional production process and engaged in topical discussions with company representatives.**

About 1,300 people regularly work at Terrafame's industrial site, when both Terrafame's and its business partners' personnel are taken into account. In personnel relationships, shared work targets and practices continued to be in focus, as well as the development of occupational safety.

Well-functioning business relationships are also an important factor to the success of Terrafame's ramp-up and the stabilisation of operations. Over a couple of years, the company has become a sought-after business partner that appreciates long-term business relationships and wants to support its partners in growing with it.

Terrafame's ownership was expanded in 2017. Galena funds, part of the Trafigura Group – which operates in the raw materials industry – and the financial group Sampo, became owners of the company, in addition to the Terrafame Group, which represents the Finnish State. Cooperation with the Trafigura Group also intensified in commercial relationships.

## Close neighbours and entrepreneurs were met at different events

During 2017, Terrafame had two Environmental Impact Assessment (EIA) procedures pending. Local inhabitants, as well as representatives of tourism companies and various organisations, among others, were invited to the procedures' monitoring groups.

The purpose of the monitoring groups is to promote information flow and exchange among Terrafame, authorities and stakeholders. The participants can submit opinions concerning the preparation of EIA materials and reports that support the procedure.

As part of the EIA procedure, Terrafame participated in the public events organised by the Kainuu Centre for Economic Development, Transport and the Environment (ELY Centre), which were held in Kajaani and Sotkamo. Dozens of people attended. Additionally, the company participated as a speaker and panellist in a public event on uranium recovery organised by the Ministry of Economic Affairs and Employment, held in Sotkamo in November.

In March, Terrafame arranged an ice fishing competition in conjunction with the local village association and fishing club. Many local participants came to enjoy the beautiful winter's day on the ice of Lake Nuasjärvi.

In November, Terrafame held open discussion events for neighbours who live or spend freetime time near the mining concession. At these events, close neighbours could discuss topics of particular interest to them with company experts. The invitation also reached people who had not previously visited Terrafame.

## Topical communication with various sectors of society

Terrafame's mining concession is primarily located in Sotkamo municipality, but it also extends to Kajaani. In 2017, elected representatives of both Sotkamo and Kajaani visited the company on two occasions to acquaint themselves with its operations. Of the neighbouring municipalities, the new Municipal Executive of Sonkajärvi also visited Terrafame.

In addition to representatives of adjacent municipalities, several pupil and student groups from primary schools to universities visited Terrafame. Several Members of Parliament, as well as national associations, such as Mining Technicians and Finnish Transport and Logistics SKAL, among others, also became acquainted with Terrafame's operations. Terrafame also had virtually daily contact with the national and foreign press, and numerous news items and several reports were published about the company throughout the year. Representatives of several other companies also visited the industrial site in connection with planning meetings and business negotiations, for example.

Typically, visitors were informed about the progress of the

production ramp-up, the continuous improvements in occupational and environmental safety, as well as forthcoming projects, such as the plans for uranium recovery and the further processing options for a nickel-cobalt product. Furthermore, safety procedures at the industrial site were presented and a guided tour was given. Some of the visitors acquainted themselves more closely with mining operations or ore loading equipment, for example.

Our stakeholders	What Terrafame can offer
<b>Current and potential employees</b>	High-level occupational health and safety and taking care of working capacity Opportunities to develop one's skills Long-term business
<b>Customers</b>	Stabilised production and high-quality products Continuous development of operations and products Reliable operator
<b>Service providers and material suppliers</b>	Systematic development of partnerships Effective tools for service supply Sought-after, reliable business partner
<b>Shareholders and financiers</b>	Stabilisation and development of production Improvement of profitability High-level occupational and environmental safety
<b>Local inhabitants and citizens</b>	Continuous improvement of environmental safety Employment and positive impact on economic activity Open communication and answering questions
<b>Associations and networks</b>	Stabilised operations Constructive interaction
<b>Political decision-makers</b>	Substantial impact on area economy

	Sustainable mining operations Transparent communication
<b>Municipal and central government</b>	Careful documentation of projects Compliance with permit conditions and efficient reporting Topical communication
<b>Educational and research institutes</b>	Presentation of operations Jobs and traineeships
<b>Media and analysts</b>	Up-to-date, transparent communication Proactive communication

# Responsibility

## Terrafame has a significant impact on the Kainuu and Finnish economy

**A report on Terrafame's economic impact on the area was published in 2016. The report reviewed the company's direct economic impact and the multiplier effects of production and consumption in Kainuu and elsewhere in Finland.**

The consulting company Ramboll Finland carried out a survey of Terrafame's impact on the regional economy in autumn 2016. The conclusion was that Terrafame's multi-metal mine and metals production plant are highly important to the vitality of the Kainuu region in Finland. In addition, the impacts on employment and economy extend widely to other parts of Finland and to various industries.

The report evaluated the annual impact of Terrafame's activities during 2019–2023 with the assumption that the company will be operating at full capacity in accordance with its strategy. The effects were compared to a situation in which Terrafame's mine and metals production plant did not exist.

The estimate did not include the possible battery chemicals plant investment, which would produce extensive economic and employment impact. The company secured financing for the battery chemicals plant investment in 2017. The report also did not include the commissioning of the uranium recovery plant, which would contribute to the area's economy, employment and competence development.

## Significant increase in the total output of Kainuu and Finland

According to the report, the total production value (total output) of

Terrafame's mine and metals production plant, together with the relevant multiplier effects, will rise to around EUR 1.1 billion per year.

Together with the multiplier effects, the impact on the total output of Kainuu will amount to approximately EUR 600 million per year. Compared to the 2013 figures, this is approximately 16.7% of the total output of the Kainuu region. Regarding the total output of other parts of Finland, Terrafame's impact was estimated to be approximately EUR 510 million.

The multiplier effects of production are estimated to be EUR 77 million in Kainuu and EUR 415 million elsewhere in Finland. The multiplier effects of consumption are estimated to be EUR 43 million in Kainuu and approximately 93 million elsewhere in Finland.

## **Nearly 11 per cent of Kainuu's gross domestic product**

The Terrafame mine and metals production plant have a major impact on the GDP of Kainuu and Finland as a whole. According to the report, Terrafame's impact on Finland's GDP will amount to approximately EUR 430 million. Of this, EUR 225 million will be generated in Kainuu, which is equal to 10.9% of Kainuu's GDP compared to the 2013 level. Approximately EUR 210 million will be generated elsewhere in Finland. In total, compared with the 2015 level, this corresponds to 0.2% of Finland's GDP.

## **Employment impact of about 4,300 person-years**

The employment effects of Terrafame's operation are substantial both for Kainuu and the entire country. According to the report, in a production situation that is in line with the company's strategy, and with the multiplier effects included, Terrafame's mine and metal production plant will employ approximately 1,500 people in Kainuu. Elsewhere in Finland, including the entire supply chain, the employment effects will amount to approximately 2,800 person-years. Consequently, operations in accordance with Terrafame's strategy will create employment amounting to more than 4,300 person-years in total.

## Almost EUR 140 million in various tax revenues

The report states that operations in accordance with Terrafame's strategy will generate, on an annual basis, a total of nearly EUR 140 million in tax revenue from real estate tax, corporate tax, local income tax, value-added tax, product tax and tax linked to production.

In Kainuu, the amount of annual local taxes will be approximately EUR 11 million. Elsewhere in Finland, local taxes will amount to around EUR 16 million. As for value-added tax, the total amount will be around EUR 91 million. With their multiplier effects, product and production-related taxes will amount to approximately EUR 11 million in Kainuu. Elsewhere in Finland, product and production-related taxes will amount to approximately EUR 8 million.

## Kainuu's exports more than tripled

The default applied in the report is the year 2016 situation, where 75% of nickel and 100% of zinc produced by Terrafame are exported. Based on the autumn 2016 price forecasts, the annual value of Terrafame's exports is estimated to be approximately EUR 380 million. This would result in Kainuu's overseas exports increasing to approximately EUR 475 million. If mining operations continue in accordance with the autumn 2016 plans, Kainuu's exports will increase by approximately 230%.

In addition, if mining operations continue in accordance with the company's strategy, the annual value of exports from Kainuu to elsewhere in Finland will be approximately EUR 90 million. This consists of the sale of nickel, copper and cobalt for further domestic processing.

According to the report, each euro of Terrafame exports would generate EUR 2.88 of the total output in Finland, and each euro of Terrafame imports would generate EUR 7.62 of exports.

# Responsibility

## Terrafame's commitment to accountability also extends to tax matters

**Terrafame Group is publishing information on its tax status in 2017. The reports are based on the guidance on tax reporting issued on 1 October 2014 by the Government Ownership Steering Department of the Prime Minister's Office.**

Terrafame Group Ltd is a special assignment company owned by the Finnish state and is subject to ownership steering by the Ministry of Economic Affairs and Employment. At the end of the financial year, Terrafame Group included Terrafame Group Ltd and Terrafame Ltd, in which the parent company has a 77.3% stake.

Terrafame Ltd was entered into the Trade Register on 5 June 2015 under the name Terrafame Mining Ltd. The company's name was changed to Terrafame Ltd in August 2015. Terrafame commenced its actual operations on 15 August 2015 after having acquired the business of Talvivaara Sotkamo Ltd's bankruptcy estate and the related inventories and fixed assets. The financial period from 1 January–31 December 2017 is the company's third financial period and the second full year of operation.

This report includes information about the management of tax matters within the Group and an itemisation of taxes paid to Finland. Terrafame Group only operates in Finland and does not, therefore, pay taxes in other countries.

Terrafame Group has an important social duty and a regional role to play especially in the Kainuu region. The ramp-up of the mine and metals production plant has required extensive recruitment. The number of Terrafame Ltd's employees increased from 645 persons at the end of 2016 to 650 persons at the end of 2017.

In addition to its own employees, 696 people through around 70 subcontractor companies worked full-time at the site at the end of 2017. On 31 December 2017, Terrafame Group Ltd employed five people directly.

## Strategy and principles for the management of tax matters

Terrafame Ltd is focused on environmentally sustainable, safe and financially profitable operation. The business is based on three cornerstones: safety, efficiency and commitment.

Both Terrafame Ltd and Terrafame Group Ltd also act responsibly from the perspective of corporate governance. The companies and their management as well as personnel are committed to observing all applicable laws and regulations in their work. The company is also committed to implementing corporate social responsibility in accordance with the state ownership policy. As an unlisted company, Terrafame Ltd also observes, as applicable, the Finnish Corporate Governance Code (2015) for listed companies issued by the Securities Market Association.

Terrafame companies fulfil their obligations to pay and report taxes in a timely manner, and their objective is to resolve any significant tax issues in advance in cooperation with the tax authorities. The Terrafame companies strive to minimise tax-related uncertainties and to respond promptly to any regulatory changes. The companies ensure the professional competence of personnel who deal with tax issues and, if necessary, use the best possible external expertise to supplement their personnel's know-how.

## Organisation and management of tax matters

The division of responsibilities in tax matters complies with Finnish company legislation. The most important tax-related matters are dealt with by the boards of directors of the companies.

The CEO of Terrafame Group Ltd and the CEO of Terrafame Ltd are responsible for the organisation of tax matters together with the CFO of Terrafame Ltd. In 2017, the Group engaged external experts in the management of tax matters and focused on active cooperation with the tax administration of Finland.

The operations of Terrafame companies are guided by principles that emphasise responsibility. The companies do not plan their operations with the aim of gaining tax benefits, and they have no operations abroad. The companies strive to investigate the tax consequences of crucial business decisions in advance and operate

in an economically justified manner, provided that their practices are acceptable from the perspective of taxation.

## Reporting principles

The report is based on financial statements and accounting documents drawn up in accordance with the Finnish Accounting Act (1336/1997 of 30 December 1997). The reported taxes are based on account-specific and voucher-specific accounting. Taxes are reported in thousands of euros.

The report excludes mandatory insurance premiums that are included in salary costs. These insurance premiums, which are directly related to salaries, are dealt with as direct salary costs due to the nature of these kinds of insurance. The Terrafame companies do not report small amounts of value-added tax included in foreign travel and training costs.

## Itemisation of taxes paid by Terrafame Ltd and Terrafame Group Ltd

Due to the ramp-up stage of the operations, the company has not yet accumulated taxable earnings. However, a considerable amount of tax expenses have accumulated due to the energy and fuel taxes related to the operations. In addition, the companies have paid taxes related to the acquisition and ownership of assets, as normal.

<b>Key figures 2017</b>	<b>Terrafame Group Ltd</b>	<b>Terrafame Ltd</b>	<b>Terrafame companies total</b>
Net sales, EUR 1,000	458	220,024	220,024
Earnings before tax, EUR 1,000	-3,017	-9,601	-15,005
Average number of personnel during the financial year	5	694	699

<b>Key figures 2016</b>	<b>Terrafame Group Ltd.</b>	<b>Terrafame Ltd.</b>	<b>Terrafame companies total</b>
Net sales, EUR 1,000	207	101,042	101,042
Earnings before tax, EUR, 1,000	-2,451	-124,912	-127,152
Average number of personnel during the financial year	3	626	629

The table below presents the tax categories per company – first for 2017 and then for 2016, which is the year of comparison.

## 2017

EUR 1,000	<b>Terrafame Group Ltd</b>	<b>Terrafame Ltd</b>	<b>Terrafame companies total</b>
<b>Taxes paid</b>			
<b>Direct taxes paid</b>	<b>8</b>	<b>1,146</b>	<b>1,154</b>
Income taxes, operating at loss	0	0	0
Asset transfer taxes	0	4	4
Property tax	0	545	545
Employer's social security contributions	5	354	359
Parafiscal charges	3	243	246
<b>Indirect taxes paid</b>	<b>1</b>	<b>5,654</b>	<b>5,655</b>
Electricity taxes, net	0	1,282	1,282
Electricity taxes	0	2,742	2,742
Electricity taxes, return	0	-1,460	-1,460
Insurance premium tax	1	331	332
Fuel taxes, net	0	4,019	4,019
Fuel taxes	0	4,653	4,653
Fuel taxes, return	0	-634	-634
Waste tax	0	22	22
<b>Taxes collected and accounted for</b>	<b>-38</b>	<b>-22,557</b>	<b>-22,595</b>
Tax withheld in advance	183	7,156	7,339
Value-added tax, net	-221	-29,713	-29,934

Value added tax, sales	110	47,398	47 508
Value-added, purchases	-331	-15,757	-15,786
<b>Total</b>	<b>-29</b>	<b>-15,757</b>	<b>-15,786</b>
Ratio of tax payments to net sales	-6,32%	-7,16%	-7,17%

## 2016

EUR 1,000	Terrafame Group Ltd	Terrafame Ltd	Terrafame companies total
<b>Taxes paid</b>			
<b>Direct taxes paid</b>	<b>10</b>	<b>1,419</b>	<b>1,429</b>
Income taxes, operating at a loss	0	0	0
Asset transfer taxes	0	212	212
Property tax	0	487	487
Employer's social security contributions	7	545	552
Parafiscal charges	3	175	178
<b>Indirect taxes paid</b>	<b>1</b>	<b>6,611</b>	<b>6,612</b>
Electricity taxes, net	0	2,906	2,906
Electricity taxes	0	3,273	3,273
Electricity taxes, return	0	-367	-367
Insurance premium tax	1	390	391
Fuel taxes, net	0	3,267	3,267
Fuel taxes	0	3,463	3,463
Fuel taxes, return	0	-197	-197
Waste tax	0	48	48
<b>Taxes collected and accounted for</b>	<b>-210</b>	<b>-51,892</b>	<b>-52,102</b>
Tax withheld in advance	158	6,170	6,328
Value-added tax, net	-368	-58,062	-58,430
Value-added tax, sales	61	10,570	10,631
Value-added,	-419	-68,632	-69,061

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purchases

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<b>Total</b>	<b>-199</b>	<b>-43,862</b>	<b>-44,061</b>
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Ratio of tax payments to net sales

-96.14%	-43.41%	43.61%
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On 31 December 2017, the Terrafame companies had unrecognised deferred tax assets of approximately EUR 36.3 million, which consisted of an estimated loss for the financial year 2017 (EUR 1.1 million), the confirmed loss for the financial year 2016 (EUR 20.4 million) and the confirmed loss for the financial year 2015 (EUR 16.9 million).

# Responsibility

## Key sustainability figures

<b>FINANCIAL</b>	<b>2016</b>	<b>2017</b>
Nickel production (t)	<b>9,554</b>	<b>20,864</b>
Zinc production (t)	<b>22,575</b>	<b>47,205</b>
Net sales (1,000€)	<b>101,042</b>	<b>220,024</b>
Operating profit/loss (1,000€)	<b>-134,533</b>	<b>-6,219</b>
Return on investment (%)	<b>-74,7</b>	<b>1,6</b>
Income tax expense (1,000€)	<b>0</b>	<b>0</b>
Environmental investments (M€)	<b>37.2</b>	<b>52.6</b>
Environmental operating costs (M€)	<b>38.8</b>	<b>31.6</b>
Provisions for environmental restoration (M€)	<b>162.1</b>	<b>159.4</b>
Collaterals for environmental restoration* (M€)	<b>41.3</b>	<b>113.9</b>
Sponsoring (€)	<b>36,000</b>	<b>35,790</b>
Salaries and remunerations (1,000€) (incl. statutory add-ons and ext. fees)	<b>34,954</b>	<b>38,286</b>
<b>ENVIRONMENT</b>		
Ore (Mt)	<b>14.2</b>	<b>17.5</b>
Waste rock (Mt)	<b>18.4</b>	<b>17.6</b>
<b>Process chemicals total (1,000t)</b>	<b>475.0</b>	<b>578.6</b>
Limestone CaCO <sub>3</sub> (1,000t)	<b>112.1</b>	<b>126.4</b>
Sulphuric acid H <sub>2</sub> SO <sub>4</sub> , 93 % (1,000t)	<b>150.2</b>	<b>141.1</b>
Caustic soda NaOH 50 % (1,000t)	<b>47.9</b>	<b>98.6</b>
Burnt lime CaO (1,000t)	<b>110.8</b>	<b>129.8</b>
Sulphur (1,000t)	<b>22.2</b>	<b>46.2</b>
Chalk (1,000t)	<b>6.3</b>	<b>0.5</b>

Explosives (1,000t)	<b>11</b>	<b>13.8</b>
Hydrogen peroxide, 50% (1,000t)	<b>3.7</b>	<b>6.0</b>
Sulphur dioxide (1,000t)		<b>0.6</b>
Other (1,000t)	<b>10.8</b>	<b>15.7</b>
<b>Total energy use (TJ)</b>	<b>1,757.8</b>	<b>2,140.7</b>
Electricity (TJ)	<b>1,133.9</b>	<b>1,379.3</b>
Light fuel oil (TJ)	<b>494.7</b>	<b>629.9</b>
Heavy fuel oil (TJ)	<b>129.2</b>	<b>137.4</b>
<b>Total water use (Mm<sup>3</sup>)</b>	<b>3.4</b>	<b>4.6</b>
Lake Kolmisoppi (Mm <sup>3</sup> )	<b>0.9</b>	<b>1.8</b>
Household water (Mm <sup>3</sup> )	<b>0.02</b>	<b>0.02</b>
Recycled water (Mm <sup>3</sup> )	<b>2.6</b>	<b>2.7</b>
Total recycled water (%)	<b>71.0</b>	<b>58.4</b>
<b>Volume of water directed to surface waters (Mm<sup>3</sup>)</b>	<b>9.6</b>	<b>5.3</b>
Nickel loading (kg/a)	<b>295.7</b>	<b>159.6</b>
Zinc loading (kg/a)	<b>396.4</b>	<b>208.4</b>
Copper loading (kg/a)	<b>16.1</b>	<b>6.1</b>
Manganese loading (t/a)	<b>4.1</b>	<b>3.2</b>
Sulphate loading (t/a)	<b>17,547</b>	<b>10,468</b>
Sodium loading (t/a)	<b>3,703</b>	<b>2,150</b>
<b>Non-hazardous waste (t)</b>	<b>2,778</b>	<b>3,299</b>
<b>Hazardous waste (t)</b>	<b>275</b>	<b>208</b>
<b>Waste utilised as materials or energy (%)</b>	<b>77.0</b>	<b>90.0</b>
<b>Process waste (1 000 t)</b>	<b>18,952</b>	<b>18,137</b>
Gypsum (1 000 t)	<b>522.6</b>	<b>370.6</b>
Precipitate from preneutralization (1 000 t)	<b>37.3</b>	<b>134.2</b>
Waste rock (1 000 t)	<b>18,392</b>	<b>17,632</b>
<b>Utilisation of process waste (%)</b>	<b>97</b>	<b>80</b>
<b>Carbon dioxide (CO<sub>2</sub>) emissions (tCO<sub>2</sub>e)</b>	<b>283,167</b>	<b>333,695</b>
Direct CO <sub>2</sub> emissions, Scope 1 (tCO <sub>2</sub> e)	<b>110,651</b>	<b>127,594</b>

Indirect CO <sub>2</sub> emissions from purchased electricity generation, Scope 2 (tCO <sub>2</sub> e)	<b>85,593</b>	<b>104,211</b>
Other indirect CO <sub>2</sub> emissions, Scope 3 (tCO <sub>2</sub> e)	<b>86,923</b>	<b>101,889</b>
<b>Sources of CO<sub>2</sub> emissions</b>		
Limestone (%)	<b>21</b>	<b>20</b>
Electricity (%)	<b>30</b>	<b>31</b>
Light fuel oil (%)	<b>14</b>	<b>15</b>
Propane (%)	<b>0</b>	<b>0</b>
Burnt lime (%)	<b>31</b>	<b>31</b>
Heavy fuel oil (%)	<b>3</b>	<b>3</b>
Chalk (%)	<b>1</b>	<b>0</b>
New land used during the year (ha)	<b>100</b>	<b>153</b>
Number of operating areas with a closing plan (%)	<b>100</b>	<b>100</b>
Neighbours' environmental observations (no.)	<b>19</b>	<b>35</b>
<b>PERSONNEL</b>		
Number of personnel at end of period (no.)	<b>645</b>	<b>650</b>
Average age of personnel (years)	<b>40.3</b>	<b>40.5</b>
Permanent employees (%)	<b>97.5</b>	<b>97.0</b>
Female employees (%)	<b>9.6</b>	<b>8.4</b>
Employees from Kainuu (%)	<b>84.0</b>	<b>84.0</b>
Training days (days/person)	<b>2</b>	<b>3</b>
Employee turnover (persons)	<b>48</b>	<b>40</b>
Ratio of basic salary women to men	<b>1:1</b>	<b>1:1</b>
<b>OCCUPATIONAL HEALTH AND SAFETY</b>		
Number of lost-time injuries, LTI (no.)	<b>9</b>	<b>4</b>
Lost-time injury frequency, LTIFR (no./million hours worked)	<b>8.4</b>	<b>3.5</b>
Number of accidents, TRI (no.)	<b>52</b>	<b>31</b>
Accident frequency, TRIFR (no./million hours worked)	<b>47.6</b>	<b>27.2</b>
Seriousness of injuries (days/LTI)	<b>6.7</b>	<b>13.5</b>

Occupational diseases (person)	<b>0</b>	<b>0</b>
Accidental deaths at work (person)	<b>0</b>	<b>0</b>
Sickness absences (days/person)	<b>14.0</b>	<b>14.0</b>
Sickness absences (%)	<b>5.3</b>	<b>5.5</b>

\* Excluding collaterals for starting operations despite appeal.

LTI = accidents leading to more than one day's absence, does not include accidents during commuting (Lost Time Injury)

LTIFR = accidents leading to more than one day's absence per million hours worked, does not include accidents during commuting (Lost Time Injury Frequency)

TRI = number of accidents (Total Recordable Injury)

TRIF = number of accidents per million hours worked (Total Recordable Injury Frequency)

# Management

## Terrafame's Corporate Governance principles

The administration and decision-making of Terrafame Ltd ("Terrafame" or "company") are guided by the Articles of Association, the Limited Liability Companies Act and other legislation in force, as well as the Government Resolution on State Ownership Policy of 13 May 2016. As an unlisted company, Terrafame complied in 2017, as applicable, with the Corporate Governance Code for listed companies approved by the Finnish Securities Market Association (2015). The Code is available at [www.cgfinland.fi](http://www.cgfinland.fi) (change to English).

The deviations from the Corporate Governance Code are related to the General Meeting (recommendations 1–4), composition of the Board of Directors regarding representation of both genders (8), diversity of the Board of Directors (9), self-evaluation of the operations of the Board of Directors (13), Rules of Procedure of the Board's committees (14), as well as the specification of executives' duties (21). In addition, the company deviates partially from the Corporate Governance Code's reporting requirements.

The deviations from the Governance Code recommendations are because Terrafame's operations in 2017 were still in the ramp-up phase and the company's securities have not been publicly traded.

This Corporate Governance Statement of 2017 is issued separately from the Report of the Board of Directors.

The General Meeting of Shareholders, the Board of Directors and the CEO are responsible for Terrafame's administration and operations. A shareholder agreement on the use of proprietary rights and decision-making in the company, the terms of which correspond to predominant market practice, has been concluded between the company's shareholders.

## General Meeting

At the General Meeting, the shareholders confirm the company's financial statements and decide on the distribution of profits, the election of Board members and the auditor, as well as their bonuses.

The General Meeting also elects the Chairman of the Board and a possible Vice Chairman.

## Board of Directors

### Duties and responsibility

In accordance with the Limited Liability Companies Act, Terrafame's Board of Directors is responsible for the company's governance and the appropriate organisation of its operations. The Board of Directors must also ensure that the company's accounting and financial management are appropriately supervised. The Board of Directors promotes the interests of the company and its shareholders. One of the Board's main duties is to make significant decisions relating to the company's operating principles, strategy, investments, organisation and finance.

According to the Articles of Association, the Board of Terrafame shall have between three and seven members. The members are elected at the Annual General Meeting for a term ending at the close of the next Annual General Meeting.

### Preparation of the composition of the Board

The major shareholders of the company submit their proposals for the composition of the Board in accordance with the shareholder agreement. Thus, Terrafame Group Ltd has the right to nominate candidates for up to five Board positions and the Galena funds have the right to nominate candidates for up to two Board positions.

### Key content of the Board's Rules of Procedure

The Board of Directors has confirmed Rules of Procedure for itself, the key content of which is described below, and which define the duties of the Board, its Chairman and the committees. The Rules of Procedure include the following issues: composition of the Board of Directors, election of Board members, responsibilities of the members and the Chairman, meetings and decision-making of the Board, disqualification of members, committees, self-assessment of operations, as well as remuneration of the members.

The Board's responsibilities include:

- preparing the annual operating plan, business plan and budget
- approving financial reports, financial statements and the report for the financial period
- approving the organisational structure and remuneration system

- appointing and dismissing the Chief Executive Officer
- appointing the Executive Team
- deciding on the terms and conditions of employment and remuneration of the Chief Executive Officer and key personnel
- appointing committee members and confirming the committees' Rules of Procedure
- directing and supervising the executive management
- supervising the company's operations with respect to compliance with laws and regulations
- approving long-term objectives and strategies
- approving the company's values, principles and practices concerning the control and risk management system
- convening the General Meeting

The Board of Directors has a quorum when more than half of its members participate in a meeting, either present or via telephone or video conference. In current and urgent matters, the Board may also make unanimous written decisions by email. The Board seeks to achieve consensus in its decision-making on all occasions. If this cannot be sensibly achieved, the decisions of the Board shall be made in accordance with the provisions of the Limited Liability Companies Act. According to the Act, the decisions of the Board require a simple majority. In the event of a tie, the Chairman shall cast the deciding vote. With regards to disqualification of Board members, the provisions of the Limited Liability Companies Act shall be observed.

The Board of Directors convenes around ten times per year in accordance with an agreed schedule. If necessary, the Board will hold additional meetings.

### **Board Steering Group and Committees**

In autumn 2017, Terrafame's Board of Directors decided to set up a Steering Group to support and monitor the progress of the further processing project, which comprised the Board members Lauri Ratia (Chairman), Tuomo Mäkelä and Emmanuel Henry. The purpose of the Steering Group is to monitor the progress of the project on a regular basis, every two weeks or more frequently, if necessary, and to support and guide the preparation of the project on key issues. Separate Rules of Procedure have not been confirmed for the Steering Group, and no independent decision-making or representation powers have been assigned to it in the company. The Steering Group reports regularly to the Board.

Terrafame's Board had no functioning committees in the 2017 financial period. The activities and duties of the Board's Environmental and Occupational Safety Committee and the Steering Group for the Mine's Ramp-up Phase, operating in the financial periods before 2017, were incorporated into the Board's regular operations.

The Board of Directors, at its discretion, may establish an Audit Committee and a joint Organisational Structure and Remuneration Committee, and elect chairmen for these committees. The Board did not set up such committees in 2017, and the Board was responsible for the duties of these committees.

## Operational management

### Chief Executive Officer

The CEO is responsible for the day-to-day management of the company in accordance with the guidelines and regulations given by the Board of Directors (general authority). The CEO is responsible for ensuring the legal compliance of accounting practices and the reliable organisation of asset management.

The CEO of Terrafame is responsible for the operational management of the business in accordance with the strategic plans, budgets, action plans, guidelines and regulations approved by the Board. The CEO presents operational issues to the Board and is responsible for the implementation of decisions made by the Board.

### Executive Team

Terrafame's Executive Team manages the attainment of the company's operational and financial objectives. The Executive Team reports to Terrafame's CEO and convenes on a regular basis every other week.

### Committees

The shareholder agreement concerning the company provides for establishing three committees:

- The tasks of the Commercial Committee include the evaluation, monitoring and planning of commercially relevant issues of the company, as well as the acquisition of information related to them.
- The tasks of the Technical Committee include the evaluation, monitoring and planning of topical issues related to the company's production, operations of the mine and metals production plant and

development projects, as well as the acquisition of information related to them.

– The tasks of the Finance Committee include the evaluation and monitoring of the company's finance position and the planning and preparation of initiatives to improve the position, as well as the acquisition of information related to them.

– The members of the Committees are appointed in accordance with the shareholder agreement. The Committees operate in accordance with separate Rules of Procedure confirmed by the Board. No independent decision-making or representation powers have been assigned to the Committees. They report to the Board.

## Control systems

The Board of Directors is responsible for the arrangement of internal control, risk management and internal auditing. Terrafame's Board has confirmed the company's principles concerning internal control and risk management.

### Internal control

The aim of Terrafame's internal control is to ensure that the company's operations are efficient and results will be achieved, business risks are adequately and appropriately managed and the information produced is reliable. The internal control system is also used to monitor compliance with the company's policies and guidelines.

### Risk management

Terrafame assesses risks and opportunities as part of business planning and decision-making processes. In order to limit unnecessary and excessive risk-taking, risks related to the company's operating environment, operational activities, environment, and financial position are assessed regularly when planning and managing business operations. The Board of Directors regularly reviews the risk information collected by the operational management.

### Main features of the internal control and risk management systems related to the financial reporting process

Terrafame seeks to ensure that the company's financial reporting complies with the requirements in force in such a way that the company's financial statements provide a true and fair view of the company's activities and financial position. The system for

monitoring compliance with the requirements is based on the reporting process constructed during the mine's ramp-up phase, on the company's values and on its corporate culture, emphasising honest and transparent activities. In 2017, financial reporting was further developed as the company's operations became more established.

### **Auditing**

The task of the statutory external audit is to verify that the financial statements and report of the Board of Directors provide accurate and adequate information on the company's result and financial position. In addition, auditing includes an audit of the company's accounting and administration.

The auditor has issued a statutory auditor's report to the shareholders of Terrafame in connection with the company's financial statements and has reported on his findings to the company's Board of Directors.

According to the Articles of Association, the auditor of Terrafame shall be an audit firm authorised by the Finnish Patent and Registration Office. The auditor's term of office expires at the close of the next Annual General Meeting following the auditor's election.

### **Related party governance**

Terrafame's parent company, Terrafame Group Ltd, has confirmed Terrafame Group's policy for organising related party governance and dealing with related party transactions at the company. According to the policy, the company's financial administration maintains a register of the organisations and natural persons belonging to related parties. According to the related party policy, the Board's exclusive competence includes all significant transactions involving a natural person or organisation belonging to the company's related parties. Decisions on transactions with related parties comply with the provisions of the Finnish Limited Liability Companies Act (624/2006). The company reports on related party transactions in the Report for the Financial Period.

## Governance in 2017

### General Meeting

In 2017, the Annual General Meeting was held on 7 April. Additionally, two Extraordinary General Meetings were held in 2017.

### Board of Directors

As of 14 August 2015, Terrafame's Board of Directors comprises Lauri Ratia (Chairman), Esa Lager and Tuomo Mäkelä. In February 2017, Matti Hietanen (Vice Chairman), Jesus Fernandez and Emmanuel Henry were appointed to the Board.

Terrafame's Board has assessed the independency of its members. Of the members, Ratia, Lager and Mäkelä all are independent of the company and its shareholders. Hietanen is the CEO of the parent company, Terrafame Group Ltd. Fernandez and Henry are employed by the Trafigura Group, which incorporates Terrafame's minority shareholders, the Galena funds.

Terrafame Group Ltd held 77.3% of Terrafame Ltd's shares at the end of the 2017 financial period. Minority shareholders were Galena Private Equity Resources Investment 2 L.P. and Galena Private Equity Resources Investment 3 L.P. funds, with a holding totalling 22.6%, as well as Sampo plc, with a 0.1% holding. The Board members or the entities over which they exercise control held no shares or share-based rights in Terrafame.

In 2017, the Board of Terrafame convened twelve times, including one telephone conference. Additionally, the Board has made written decisions on current matters by email. The average attendance of the Board members in meetings was 97.1%.

In 2017, the Board's work continued to focus on the controlled ramp-up of the mine according to plan, building on the premise of ensuring occupational and environmental safety and the company's core values of safety, efficiency and commitment.

### Steering Group

The meetings of Terrafame Ltd's Steering Group were combined with the meetings of Terrafame's Board of Directors. The Steering Group comprised Terrafame Ltd's Board members and Terrafame Group Ltd's Chairman of the Board, Janne Känkänen. In 2017, the Steering Group's activities in practice meant that Janne Känkänen

had speech and attendance rights at Terrafame's Board meetings. Känkänen attended eight Terrafame Board meetings in 2017.

### **Executive Team**

In 2017, Terrafame's Executive Team comprised Joni Lukkaroinen (Chief Executive Officer), Harri Natunen (Chief Technology Officer), Reijo Uusitalo (Chief Mining Officer), Antti Arpalahti (Chief Production Officer), Janne Palosaari (Chief Commercial Officer), Veli-Matti Hilla (Chief Sustainability Officer), Matti Rautiainen (Chief Maintenance Officer), Ville Sirviö (Chief Financial Officer), Petri Parjanen (Chief HR Officer) and Katri Kauppila (Chief Communications Officer).

The Executive Team members or the entities over which they exercise control held no shares or share-based rights in Terrafame at the end of the 2017 financial period.

### **Committees**

The Commercial Committee comprised Joni Lukkaroinen (Chairman), Janne Palosaari, Jawad Benkhadra and Gonzalo De Olazaval, and it convened three times during 2017.

The Technical Committee comprised Harri Natunen (Chairman), Antti Arpalahti and Jean Joubet, and it convened three times during 2017.

The composition of the Finance Committee has not yet been established, and it did not convene during 2017.

### **Auditing**

Terrafame's auditor is the Authorised Public Accountants KPMG, with Antti Kääriäinen, APA, as principal auditor.

The auditor's fee and possible expenses are reimbursed according to an invoice approved by the company. In 2017, the fees paid to the auditor were EUR 79,702 (2016: EUR 83,646). Additionally, the fees paid in 2017 for services not related to the audit were EUR 15,499 (2016: EUR 38,172).

# Management

## Terrafame's salary and remuneration report

In its remuneration, Terrafame Ltd ("Terrafame" or "the company") abides by the guidelines and principles of the Government Resolution on State Ownership Policy of 13 May 2016. The management of Terrafame Ltd consists of a Board of Directors and an Executive Team.

The Annual General Meeting of Terrafame Ltd decides annually on the remuneration payable to Board members. The Board of Directors decides on the remuneration payable to the Executive Team. In 2017, Terrafame Ltd did not use the services of any external advisors for preparations related to remuneration.

### Remuneration payable to the Board of Directors and other benefits

Remuneration payable to the Board and its Committee members are paid in cash. Board members have no share incentive plans or share-based compensation plans. They are also excluded from the company's other remuneration or pension plans.

As of 14 August 2015, the Chairman's fee has been EUR 72,000 per year and the meeting fee is EUR 600 per meeting. Since the same date, fees payable to other Board members have been EUR 36,000 per year and the meeting fee has been EUR 600.

In 2017, the company did not pay annual or meeting fees or reimburse costs for those members of the Board of Directors who have ties to shareholders in the Company.

Board members were paid a total of EUR 165,000 in monthly and meeting fees in 2017. Fees were paid as follows:

Member	Attendance of Board meetings	Monthly fees in 2017, EUR	Meeting fees in 2017, EUR	Total remuneration in 2017, EUR
Lauri Ratia	12/12	72,000	7,200	<b>79,200</b>
Esa Lager	11/12	36,000	6,600	<b>42,600</b>
Tuomo Mäkelä	12/12	36,000	7,200	<b>43,200</b>
Matti Hietanen	11/11	0	0	<b>0</b>
Emmanuel Henry	11/11	0	0	<b>0</b>
Jesus Fernandez	10/11	0	0	<b>0</b>
<b>Total</b>		<b>144,000</b>	<b>21,000</b>	<b>165,000</b>

## Consultation fees for related parties

At the beginning of the period, Terrafame Group Ltd, the parent company of Terrafame Ltd, purchased consultation services from a company owned by parties related to Lauri Ratia, the Chairman of the Board of Directors of Terrafame Ltd. The consultation services purchased concerned Terrafame's ownership and financing arrangements in particular.

During 2017, on the basis of a consultation agreement, EUR 50,000 in fees were paid to a firm owned by parties related to Lauri Ratia. The expert services were priced at current value. No consultation services were purchased from companies owned by other members of the Board of Directors or their related parties in 2017.

## Salary, remuneration and other benefits of the Executive Team

### Details on the CEO's terms of employment

Joni Lukkaroinen served as the CEO of Terrafame Ltd in 2017. The retirement age of the CEO is 63, and the pension is determined in accordance with the Employees' Pensions Act (TyEL). No supplementary pension arrangements have been made for the CEO.

The CEO's period of notice is six months. If the CEO is given notice

by the employer, he shall be paid the equivalent of six months' salary in addition to his salary paid during the severance period. No other compensation is payable in relation to the termination of the CEO's employment contract.

### **Remuneration of the CEO and other members of the Executive Team**

Salaries paid to the CEO and other Executive Team members in 2017 were based on fixed monthly salaries. Aside from telephone and internet service benefits, the Executive Team members had no fringe benefits, or any defined contribution or other additional pension insurance plan, during 2017.

Salaries and remunerations paid to Terrafame Ltd's Executive Team in 2017 amounted to EUR 1,537,152. Of this, the CEO was paid EUR 341,045.

In 2017, Terrafame operated a performance-based bonus scheme for members of the Executive Team and other key personnel. The bonus scheme, and the related principles and performance indicators, are determined by the Board of Directors of Terrafame Ltd, which also monitors the fulfilment of the targets on whose basis bonuses are awarded. The production and financial performance of Terrafame, and the company's safety-related goals, serve as indicators for the bonus scheme. In addition, an individual target has been set for each person belonging to the bonus scheme. The targets for the bonus scheme are set so that their achievement supports the long-term development and success of the company in a fundamental manner.

The maximum performance bonus for the CEO is equivalent to 40 percent of his annual salary. The maximum performance bonus for members of the Executive Team is equivalent to three months' salary. For other personnel covered by the performance bonus scheme, the maximum performance bonus is equivalent to two months' salary.

During the spring 2018, members of the Executive Team were paid a total of EUR 134,985 in performance bonuses for 2017, which is equivalent to 9.3 percent of their salaries for 2017. Of this sum, the CEO was paid EUR 42,165, which is equivalent to 13.6 percent of the CEO's salary.

Terrafame has no incentive schemes for its Executive Team or other key employees, aside from its performance-based bonus scheme.

## Remuneration of other personnel

Salaries and remunerations paid to personnel in 2017 totalled EUR 30.5 million. Salary payment complied with the terms and conditions of the collective agreements of each personnel group.

All personnel have been covered by the safety bonus plan since November 2015. The safety bonus is paid if no lost time injuries occur in the following functions: 1) mining and materials handling, 2) bioleaching and metals production plant, and 3) maintenance and office. Safety bonuses of EUR 732,533 were paid in 2017.

A production bonus scheme was introduced for all personnel in July 2017. The bonus is paid on a monthly basis if the production targets for ore and nickel are met. Production bonuses of EUR 86,850 were paid in 2017.

# Management

## Board of directors 31 Dec 2017



## Lauri Ratia

Chairman of the Board 2015–  
Born 1946, Master of Science (M.S.) Eng., Industrial Counsellor  
Professional Board Member

### Other current positions of trust

Member of the Board, NHP Yhtymä Oy 2015–  
Member of the Advisory Board, CV Group 2015–  
Member of the Industrial Advisory Board, Armada Mezzanine Capital Oy  
2010–  
Member of the Finnish Advisory Board, Ratos Abp 2008–

### Previous key positions of trust

Member of the Board, Meyer Turku Oy 2014–2015  
Member of the Board, STX Finland Oy 2013–2014  
Chairman of the Board, Paroc Group Oy Ab 2010–2015  
Member of the Board, YIT Plc 2009–2011  
Chairman of the Board, VR-Yhtymä Oy 2008–2011  
Member of the Board, Inspecta Group Oy 2007–2015  
Member of the Board, LSR Group OJSC 2007–2009  
Chairman of the Board, Sponda Plc 2007–2013  
Chairman of the Board, Medisize Oy 2006–2011  
Chairman of the Board, Nordic Morning Plc / Edita Plc 2005–2013  
Vice Chairman of the Board, Kemira Grow How Plc 2004–2007  
Vice Chairman of the Board, Stala Group Oy 2003–2004  
Chairman, Confederation of Finnish Construction Industries RT (CFCI)  
2003–2004  
Chairman of the Board, Tecnomen Plc 2001–2009  
Member of the Board, Olvi Plc 1999–2010  
Member of the Board, TT / Confederation of Finnish Industries (EK)  
1998–2004

### Primary work experience

CRH Plc, Senior Advisor, Russia, 2007–2008  
Scancem International ANS, Deputy Executive Director of the Cement  
Industry, 1996–1997  
Lohja Rudus Oy Ab, CEO, 1994–2007  
Euroc Abp, Head of the Concrete and Aggregate Division, 1994–1996  
Kone Plc, Regional Director of the Crane Division, 1993–1994  
Euroventures Nordica Ab, Partner 1990–1993  
Nokia Plc, different management positions in the U.S. and Finland  
1978–1990  
Various positions in the forestry and engineering industry 1970–1978



## **Esa Lager**

Member of the Board 2015–

Born 1959

Master of Laws, Master of Science (Economics)

Professional Board Member

### **Other current key positions of trust**

Member of the Board 2017–, Stockmann plc

Member of the Board 2014–, SATO Plc

Chairman of the Board 2015–, Suomen Teollisuussijoitus Oy

Member of the Board, Alma Media Plc, 2014–

Member of the Board 2011–, Vice Chairman of the Board 2014–, Ilkka-Yhtymä Plc

### **Previous key positions of trust**

Member of the Board 2002–2018, Vice Chairman of the Board

2002–2016, Chairman of the Board 2016–2017, Olvi Plc

Member of the Board 2014–2016, Fennovoima Oy

Vice Chairman of the Board and Member of the Board 2014–2015,

Chairman of the Board 2015–2016, SATO Plc

Member of the Board 2014–2015, Suomen Teollisuussijoitus Oy

Member of the Board 1996–2000, 2003–2008, Vice Chairman of the Board 2010–2011 Okmetic Plc

### **Primary work experience**

Deputy CEO, Outokumpu Group 2011–2013

CFO, Outokumpu Group 2005–2013

Director, Financing and Administration, Outokumpu Group 2001–2004

Director, Financing, Outokumpu Group 1995–2000

Vice President, Outokumpu Group 1991–1994

Various specialist and managerial positions, Kansallis-Osake-Pankki, 1984–1990



## Tuomo Mäkelä

Member of the Board 2015–  
Born 1950  
Master of Science, Geologist  
CEO and Senior Advisor, Mining, Escanor Oy

### Current positions of trust

Member of the Board, Ferrovan Oy 2017–

### Previous key positions of trust

Chairman of the Board, Saga Mining Oy 2008–2018  
Chairman of the Board, Outokumpu Metals Off-Take Oy 2011–2016  
Member of the Board, Viscaria AB 2009–2016  
Member of the Board, Talvivaara Sotkamo Oy 2008–2014  
Member of the Board, Scandinavian Minerals Oy 2008  
Member of the Board, Northland Resources S.A. 2007–2013  
Member of the Board, Endomines AB 2006–2011  
Chairman of the Board, OAO Kola Mining 2002–2006  
Chairman of the Board, OAO Kivijarvi 2002–2003  
Member of the Board, Cia. Minera Zaldívar 1996–1999  
Representative for the Confederation of Finnish Industries, Mining Board 2009–2011  
Senior Mining Advisor, Suomen Teollisuussijoitus Oy 2004–2014

### Primary work experience

Expert and management positions, Outokumpu Group 1975–2/2016  
(incl. CEO, Outokumpu Mining Oy 2002–2015)



## Matti Hietanen

Member of the Board 2017–

Born 1977

Master of Laws trained on the bench, Master of Science (Economics)

### Other current positions of trust

Vice Chairman of the Board, VTT Technical Research Centre of Finland Ltd 2015–

### Previous key positions of trust

Chairman of the Board, Terrafame Ltd. 6/2015–8/2015

Chairman of the Board, Terrafame Group Ltd. 2/2015–8/2015

Member of the Board, Sports Tracking Technologies Oy 2012–2014

### Primary work experience

CEO of Terrafame Group Ltd 2015–

Ministerial Counsellor, Ministry of Employment and the Economy 2013–2015

Various positions, Ministry of Education and Culture 2005–2013

Chief Inspector, Ministry of Agriculture and Forestry 2004–2005

Lawyer, Evli Pankki Ltd.j 2003



## Emmanuel Henry

Member of the Board 2017–

Born 1973

M. A. Sc., Geostatistics

Co-Head of Mining Group and General Manager of Technical Services, Trafigura Group Pte Ltd 2013–

### Other current positions of trust

Represents Trafigura at various Technical Committees and Company Boards in Europe, Africa, Asia and the Americas

### Primary work experience

Expert and management positions, SQM 2011–2013, AMEC 2003–2011,

LKAB 1999–2003



## **Jesus Fernandez**

Member of the Board 2017–

Born 1976

M. Sc., Finance and investment

Head of Mergers and Acquisitions, Trafigura Group Pte Ltd 2004–

### **Other current positions of trust**

Non-Executive Director, Nyrstar NV, 2016–

Non-Executive Director, Atalaya Mining Plc, 2015–

Non-Executive Director, Mawson West Ltd., 2015–

### **Primary work experience**

International Power Plc

# Management

## Management team 31 Dec 2017



### **Joni Lukkaroinen**

Born 1965, M.Sc. (Tech.)

CEO

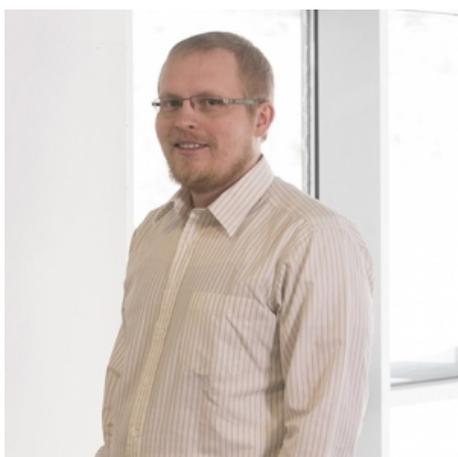
**Primary work experience:**

Managing Director, Extron Engineering Oy

CEO of the chemical industry (Kronochem) of Kronospan

Senior Vice President, Metsäliitto Osuuskunta Finforest, Timber and Upgrades division

Senior Vice President, Dynea Panelboard Nordic



### **Antti Arpalahti**

Born 1983, M.Sc. (Tech.)

Chief Production Officer

**Primary work experience:**

Head of Department, bioleaching process, Terrafame Ltd.

Head of Department, bioleaching process, Talvivaara LLC



## **Katri Kauppila**

Born 1965, M. Sc. (Soc.)

Chief Communication Officer

### **Primary work experience:**

Different titles at business unit and Metsä Board levels  
Marketing Manager, Metsäliitto Cooperative



## **Veli-Matti Hilla**

Born 1971, M.Sc.

Chief Sustainability Officer

### **Primary work experience:**

Environmental Manager and EHSQ department head, Talvivaara Mining Company Plc

Manager positions, Ramboll Finland Oy

Project Manager, Consulting Engineers Paavo Ristola Ltd



## Harri Natunen

Born 1955, M.Sc. (Tech.)

Technology Officer

Deputy to the CEO

### **Current positions of trust:**

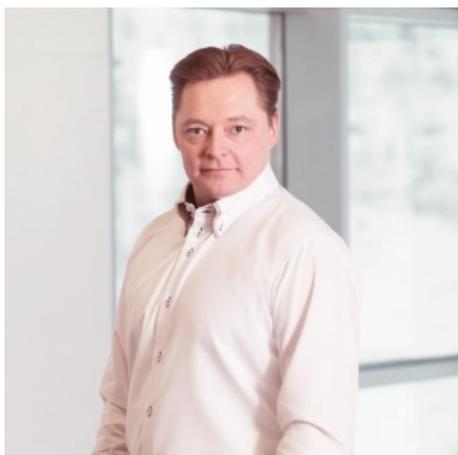
Member of the Board, Voimaosakeyhtiö SF 2013

### **Primary work experience:**

Executive positions, Talvivaara Mining Company Plc

Director, zinc operations, Boliden

Executive positions, Outokumpu Oyj



## Janne Palosaari

Born 1976, M.Sc (Tech.)

Chief Commercial Officer

### **Primary work experience:**

Manager and director positions, Rautaruukki Plc

Commercial positions, Boliden Commercial AB



## **Petri Parjanen**

Born 1969, M.Sc. (Psychology)

Chief HR Officer

### **Primary work experience:**

Chief HR Officer, UPM Kymmene Wood Ltd, UPM Plywood Business Area

HR management positions, Outokumpu/Boliden Harjavalta Ltd.

HR management and development positions from 1990's



## **Matti Rautiainen**

Born 1963, Technician

Chief Maintenance Officer

### **Primary work experience:**

Several manager positions, incl. department head of maintenance, Talvivaara Sotkamo Ltd and the bankruptcy estate of Talvivaara Sotkamo Ltd

Manager positions, UPM-Kymmene Plc (21 years)



## **Ville Sirviö**

Born 1982, M.Sc. (Econ.)

Chief Financial Officer

### **Primary work experience:**

Financial Manager, Mondo Minerals B.V.

Financial Manager, Talvivaara Mining Company Plc



## **Reijo Uusitalo**

Born 1955, M.Sc. (Tech.)

Chief Mining Officer

**Primary work experience:**

Manager and director positions, Outokumpu Plc and other mining companies

# Financial statements

## Terrafame Ltd's report for the financial period 1 January–31 December 2017

Terrafame Ltd (hereafter also referred to as "Terrafame") is a Finnish multi-metal company that produces nickel, zinc and cobalt as well as copper since the end of 2017 at its mine and metals production plant located in Sotkamo. The company's goal is to conduct environmentally sustainable, safe and profitable operations.

Terrafame started actual operations on 15 August 2015. The financial period from 1 January–31 December 2017 is the company's third financial period and the second full year of operation.

### Significant events during the financial period

#### Summary

- Production ramp-up proceeded as planned: nickel production increased by 118% to 20,864 tonnes (2016: 9,554 tonnes) and zinc production increased by 109% to 47,205 tonnes (2016: 22,575 tonnes)
- Net sales EUR 220 million (2016: EUR 101 million)
- EBITDA EUR 13.6 million (2016: EUR -120.6 million)
- Operating profit EUR -6.2 million (2016: EUR -134.5 million)
- Lost-time injury frequency rate, or the number of lost-time injuries per one million person-hours worked, 3.5 (2016: 8.4).
- Two significant financing arrangements: financing arrangement of February totalling EUR 250 million and financing arrangement of November totalling USD 200 million. The purpose of the latter arrangement is to enable planning and investment in the production of battery grade chemicals.

## Market developments

Global demand for Terrafame's main products, nickel and zinc, continued at a good level in the market in 2017. The stock levels of the London Metal Exchange (LME) and the Shanghai Futures Exchange (SHFE) decreased, contributing to a favourable price development. During the year, the combined nickel stock levels at the LME and the SHFE decreased by almost 60,000 tonnes, equalling 12 weeks' demand at the end of the year (2016: 24 weeks). Zinc stock levels decreased by 331,000 tonnes, equalling 3.8 weeks' demand at the end of the year (2016: 5.2 weeks). Demand was primarily supported by the use of nickel in stainless steel production and the use of zinc in galvanisation.

The global market price for nickel in US dollars rose markedly in the second half of the year. The average price in 2017 was USD 10,411 (2016: 9,609) per tonne. In the fourth quarter, the average price was USD 11,583 per tonne, which was 7.2% higher than the average price in the fourth quarter of the previous year (Q4 2016: 10,810). Due to the weakening of the US dollar, the price of nickel in euros decreased by 1.8% (Q4 2017: 9,838 and Q4 2016: 10,019).

In the global market price of zinc there was a slight reduction in the third quarter, but otherwise the price developed progressively. The average price in 2017 was USD 2,896 (2016: 2,095) per tonne. In the fourth quarter, the average price was USD 3,235 per tonne, which was 28.5% higher than the average price in the fourth quarter of the previous year (Q4 2016: 2,517). The price of zinc in euros in the fourth quarter of 2017 was 17.8% higher than in the fourth quarter of the previous year (Q4 2017: 2,748 and Q4 2016: 2,333).

## Production

Terrafame's production ramp-up continued in 2017 and, towards the end of the year, it was possible to proceed to the stabilisation of production after the fastest ramp-up phase. At the same time, focus was increasingly shifted to improving the cost-effectiveness of operations.

In terms of mining volumes, the target level had already been reached in summer 2016. The aggregate mining volume in 2017 was 35.1 million tonnes. Terrafame has long utilised waste rock as a building material for production areas. Towards the end of the year, the transfer of waste rock into a separate waste rock area was started, which will reduce transportation costs.

The primary leaching area, i.e. the first-phase bioleaching area, was fully commissioned in May, when it was stacked with completely

new ore. In the secondary leaching area, i.e. the second-phase bioleaching area, ore stacking progressed to section 3 in the spring, which was virtually fully commissioned by the end of the year. Overall, the bioleaching recovery rate from the primary and secondary areas was almost up to expectations.

The production volumes of Terrafame's main products more than doubled compared with the previous year. A record-breaking 20,864 tonnes of nickel and 47,205 tonnes of zinc were produced during the year. Towards the end of the year, the first customer deliveries of copper were also made.

### Sales and business procurement

In accordance with the sales contracts concluded with Trafigura Ventures V B.V., most of the 2017 production was delivered to end customers through Trafigura's sales network. During the year, sales volumes increased following production, and net sales more than doubled to EUR 220.0 million.

The ramp-up phase and moving towards the stabilisation of operations were also visible in procurement. During the year, the use of electronic procurement tools was expanded, and new, extensive contracts were concluded related to production supplies, storage, industrial cleaning and waste management. Additionally, the audits of partner companies were enhanced, and cooperation with ports was developed further.

### Financial review and key figures

Terrafame's net sales in 2017 totalled EUR 220.0 million (2016: EUR 101.0million). The nickel content of nickel-cobalt product customer deliveries was 20,287 (2016: 9,544) tonnes. The zinc content of zinc product customer deliveries was 46,828 (2016: 25,707) tonnes.

EBITDA was EUR 13.6 million (2016: EUR -120.6 million), and loss for the financial year was EUR -9.6 million (2016: EUR -124.9 million).

(EUR 1,000)	<b>2017</b>	<b>2016</b>
Net sales	220,024	101,042
EBITDA	13,622	-120,551
EBITDA %	6.2%	-119.3%
Operating loss	-6,219	-134,533
Operating loss %	-2.8%	-133.1%
Profit/loss for the financial	-9,601	-124,912

year		
Equity ratio %	47.8%	44.6%
Balance sheet	618,511	370,656
Personnel, average	694	626
Wages and salaries	30,992	27,934

In 2017, capital expenditure totalled EUR 92.7 million (2016: EUR 84.3 million). Key areas of capital expenditure were the construction of foundations for secondary leaching area sections 3 and 4, and for the waste rock area, a third production line for hydrogen sulphide, as well as the addition to mining and ore reclaiming equipment of a one wheel loader, three dumper trucks and one ore surface miner. Also, the construction of a new emergency shelter got well under way.

Terrafame's year-end inventories totalled EUR 168.6 million (2016: EUR 76.2 million). The value of work in progress on 31 December 2017 was EUR 138.0 million (2016: EUR 50.1 million), and the value of raw material and spare part inventories was EUR 22.8 million (2016: EUR 25.5 million), including an inventory provision for slow-moving items of approximately EUR 5.7 million (2016: EUR 6.0 million). The value of the finished goods inventory was EUR 7.8 million (2016: EUR 0.6 million).

Trade receivables on 31 December 2017 totalled EUR 24.7 million (2016: EUR 15.8 million). Other receivables on 31 December 2017 totalled EUR 2.9 million (2016: EUR 8.4 million). Prepaid expenses and accrued income totalled EUR 19.0 million (2016: EUR 2.8 million), the most significant item of which was derivative receivables, amounting to approximately EUR 11.7 million, due to hedging activities initiated during 2017. At the end of 2017, cash and cash equivalents totalled EUR 106.4 million (2016: EUR 44.7 million). Shareholders' equity on 31 December 2017 was EUR 295.6 million (2016: EUR 165.1 million).

In the financial period 2017, cash flow from operating activities was EUR -81.0 million (2016: EUR -176.8 million), of which change in net working capital comprised EUR -88.8 million (2016: EUR -55.3 million). Cash flow from investment activities was EUR -92.1 million (2016: EUR -74.0 million).

## Currency and commodity hedge transactions

In the financial period 2017, cash flow hedging against dollar and metal price fluctuations was initiated in line with the company's hedging policy. The policy was updated in 2017. The company also began to use hedge accounting.

## Financing arrangements

### Financing arrangement concluded in February 2017

Terrafame Group Ltd and Terrafame Ltd, together with Trafigura Ventures V B.V. and Galena Private Equity Resources Investment 2 L.P. fund – both part of the Trafigura Group – executed and announced an agreement concerning Terrafame's ownership and financing arrangements on 10 February 2017. The financing arrangement totalled EUR 250 million, thus covering the anticipated funding required for the completion of Terrafame's ramp-up. In the arrangement, the value of Terrafame Ltd before equity financing is EUR 381.8 million, which corresponds with the capitalisation of Terrafame Ltd by Terrafame Group Ltd before the arrangement.

As a result of the arrangement, Galena Fund held approximately 15.5% of the shares of Terrafame Ltd against an equity investment of EUR 75 million. Terrafame Group Ltd made an additional equity investment of EUR 25 million in Terrafame Ltd. As a result of the arrangement, Terrafame Group Ltd held 84.2% of Terrafame shares. Terrafame Group Ltd also committed EUR 50 million stand-by facility for an equity investment in Terrafame Ltd, which is valid until the end of 2018. The above-mentioned financing was not drawn during the financial period 2017.

As part of the arrangement, Trafigura granted a loan of EUR 75 million to Terrafame Ltd, and Sampo Plc a loan of EUR 25 million under the same conditions as Trafigura. The loans entitle the Trafigura Group and Sampo to subscribe to Terrafame shares in an amount that corresponds to the loan principal and the interest on the loan. The option is valid for five years. Loan arrangement fees of 1.5% were paid in Terrafame Ltd shares.

It was also agreed in the arrangement that Trafigura will purchase all the nickel cobalt sulphide that Terrafame Ltd produces, as well as 80% of zinc sulphide for the next seven years.

### **Financing arrangement concluded in November 2017**

In addition to the above arrangement, on 10 November 2017 the parties agreed on a financing package amounting to USD 200 million, the purpose of which is to enable further add value to Terrafame's nickel-cobalt sulphide by investing in the production of battery grade chemicals. In the first phase of this financing arrangement, the Galena Private Equity Resources Investment 3 L.P. fund made an equity investment of USD 50 million in Terrafame. The fund also committed USD 50 million of equity investment, which is applicable for the financing of the battery chemical plant. As part of the package, Trafigura is committed to a USD 75 million, and Sampo Plc to a USD 25 million loan arrangement in connection with the investment. Terrafame Group Ltd did not participate in the arrangement as financier, apart from continuing its earlier EUR 50 million stand-by equity investment commitment until the end of 2021. After the finalisation of the financing arrangement, the shareholding of Terrafame Group Ltd in Terrafame Ltd will be approximately 71%.

Equity investments have been made at the same Terrafame share price as in the financing arrangement realised in February 2017. Equity investments also provide Galena with an option to subscribe to Terrafame shares in the amount of USD 100 million.

The repayment period of the loans is 5.5 years. The loan arrangement fee of 1.5% will be paid in Terrafame shares. The loans entitle the Trafigura Group and Sampo to subscribe to Terrafame shares in an amount that corresponds to the loan principal and the interest on the loan.

As part of the financing package, Trafigura and Terrafame Ltd continued their zinc sulphide streaming agreement and agreed on new commercial arrangements concerning future battery chemicals, i.e. nickel and cobalt sulphate products. In accordance with the continued agreement, Trafigura would purchase 80% of the zinc sulphide produced by Terrafame until the end of 2027. According to the agreement on new nickel and cobalt products, Trafigura would become an exclusive agent to market the nickel and cobalt products until the end of 2027. The commercial terms of the arrangement are in line with practices applied in international metal markets. The purchase agreement on nickel and cobalt sulphides will remain in force.

As a result of the financing arrangement, the company's invested unrestricted equity fund increased by EUR 144.6 million during the financial period 2017. At the end of the financial period, the invested unrestricted equity fund totalled EUR 524.4 million. The number of

shares increased by 901,423 shares and stood at 3,281,498 shares at the end of the financial period.

## **Estimate of major risks and uncertainty factors affecting operations**

In accordance with good corporate governance on risk management, Terrafame Ltd complies with the risk management policy approved by the Board of Directors. Efforts are made to identify risks, their impact on company business and operations is assessed, and risk management measures are planned as required. Key business risks were assessed in 2017.

The company's operations are affected by various generic risks of the mining industry, including the risks of the impact of environmental permits and other permits on company expenses. Key business risks include fluctuations in exchange rates and the price of nickel and zinc, the counterparty risk associated with customers and other business partners, as well as risks related to the prices of major raw materials and energy.

Occupational, process safety and environmental risk management at Terrafame are based on earlier risk assessments done. Hazard risk assessments were updated 2017 to reflect Terrafame's current operations, practices and requirements.

Operational risks have continued to decrease during 2017. Key issues include the systematic update of piping and instrumentation diagrams, markings on process equipment, and the process change management model.

## **Research and development**

In research and development, special focus was placed on bioleaching development. This work was conducted with own resources and together with partners, both on a laboratory and a production scale at the bioleaching heaps. Based on research results, significant amount of new information was obtained for further development of bioleaching technology.

Technical developments were made at the metals production plant to improve the cost-efficiency and yield of metals recovery. In the summer, plant-scale trial operations commenced to improve the

precipitation properties of copper and, by the end of the year, copper precipitate was commercialized. Chemicals consumption at the plant was minimised and availability improved through new technical solutions.

In June, Terrafame filed a permit application for laboratory scale testing of the extraction process with the Radiation and Nuclear Safety Authority. The aim of the study is to extract rare earth elements in addition to uranium. The study received an operational permit in December.

During 2017, two different options were examined that would be applicable to the further processing of Terrafame's nickel-cobalt product. In the roasting-smelting option, nickel sulphide would be refined into a metallic form suitable for stainless steel production. In the battery chemical option, nickel-cobalt sulphide would be refined into sulphate products suitable for batteries for electric vehicles. From the end of the year, particular focus was placed on studying the feasibility of a battery chemicals plant.

## Safety

The development of occupational safety continued in 2017 with good results. The range of measures continued to comprise training courses, safety rounds, observation and non-conformity notices, as well as accident and near-miss review meetings. The operations of Terrafame and its partner companies that operate regularly in the industrial area were audited to improve safety. Terrafame's personnel were also rewarded for good results with a safety bonus.

Terrafame's lost-time injury frequency rate, i.e. the number of lost-time injuries per one million working-hours, fell to 3.5 from 8.4 in the previous year. This was a better result than the target for the year, set at under 5.0. The company's employees suffered 4 lost-time injuries, the most significant of which was caused by a slippage in the yard due to icy conditions.

Occupational safety continued to be in focus through workplace visits, occupational hygiene measurements and employee biomonitoring. According to the results, the exposure level of Terrafame's personnel does not differ from the typical level of the Finnish population, and no cases of occupational disease have been reported in the company. During 2017, guidance and control of occupational hygiene provided to partner companies that regularly operate at the site was increased, and they were expected to organise biomonitoring.

In terms of process safety, the year went well. The root causes of the fire in a hydrogen sulphide generator in December 2016 were analysed in early 2017, and preventive measures were taken. During the year, the safety report on the extensive use and storage of chemicals was updated. This was used as a basis for preparing communications on safety issues for the neighbouring area. Terrafame's industrial fire brigade and Kainuu Rescue Services extended their cooperation at the start of the year. According to the agreement, Terrafame's fire brigade and its equipment can be utilised even outside the industrial area for various rescue missions, and inter-organisational rescue exercises will be further enhanced.

## Environment

Environmental safety at Terrafame's industrial site continued at a good level in 2017. Environmental monitoring of operations continued in accordance with the extensive monitoring programme approved by the supervisory authority.

The target level of 1–3 million cubic metres of stored water was achieved, and spring melt water and autumn rains were managed without difficulty. The substance concentrations of purified water discharged from the site were clearly below permit levels, apart from individual exceptions. One third of the company's annual sulphate quota was unused, and the sulphate load fell by over 7,000 tonnes compared with the previous year. Overall, the load on surrounding water bodies resulting from Terrafame's operations was reduced from 2016. Purified discharge water was released to the northern routes only, mainly through the Lake Nuasjärvi discharge pipe. The spring and autumn natural overturns of Lake Nuasjärvi proceeded normally.

Towards the end of the summer, a disruption occurred in the waste rock construction area, where rainwater and runoff failed to be directed to water purification due to human error. Hence, unpurified metal containing water flowed outside the mining site. This caused an additional nickel load of around 100 kilogrammes. The aluminium content of discharge water in water treatment increased in late autumn, but the discharge of water was suspended, and the aluminium content was returned to its ordinary level by adjusting the operating parameters of the centralised water treatment plant.

The impact of operations on groundwater was monitored in line with an extensive monitoring programme, and still no impact from mining operations was observed in adjacent domestic water wells. In early 2017, Terrafame submitted a report to the supervisory authority

on the groundwater impact in the industrial site's primary leaching area and the neighbouring area of the Kortelampi dam, as well as the measures to prevent the impacts from spreading.

The dust impact of mining operations was reduced from the previous year, thanks to road watering, and other measures. Permit levels for air emissions were tightened in 2017, and the operations fulfilled the requirements, apart from one-time overruns in the particulate and sulphur dioxide concentrations in ore fine crushing and heating installations.

## Permit processes

The most extensive of the permit processes in 2017 related to the environmental permit application covering Terrafame's entire operations, which the Supreme Administrative Court (SAC) had required when deciding on the currently valid environmental permit. Terrafame filed a new permit application with the Northern Finland Regional State Administrative Agency (RSAA) within the time limit set by the SAC. In order to prepare for the application, the company had already initiated two Environmental Impact Assessment (EIA) procedures in 2016. These EIA processes, related to water management of the site as well as mining operations, were completed during 2017. Terrafame's current environmental and water management permits will remain in force until the new environmental permit covering all operations is final.

In September 2017, the RSAA issued two environmental permit decisions for Terrafame's operations. The RSAA granted permission for the use of waste rock area KL2, sectors 1–4. In its decision on water treatment deposits, it ruled that the so-called geo tubes, with deposits, could be finally disposed of in the area south of the open pit. The final disposal of earlier deposits requires further planning and a new permit process.

In January 2017, the RSAA granted Terrafame an environmental permit for the use of the new centralised water treatment plant. At the end of the year, Terrafame also had an environmental permit application pending with the RSAA for a third hydrogen sulphide plant, as well as compensation cases related to the existing permit decisions.

Terrafame filed a permit application for uranium recovery with the Government in October 2017, and in December, the Radiation and Nuclear Safety Authority granted the company an operational permit for the study of the extraction process used in uranium recovery.

## Personnel

About 1,300 people were regularly employed at Terrafame's industrial site during 2017. At the end of the year, Terrafame had 650 employees, and the balance of the people was employed with contractors. The headcount was at its highest during the summer months, when the company offered summer jobs to 90 persons.

Throughout the year, personnel were offered various development opportunities. Special emphasis was placed on vocational skills and supervisory work, as well as safety training. The operations development programme was also continued in 2017, aiming to enhance cooperation between the production and maintenance departments.

In the autumn, cooperation negotiations between the company and personnel were conducted at Terrafame to adjust personnel resources to the needs of the final stage of the ramp-up. As a result of the negotiations, 37 employees were laid off for production and financial reasons, as well as restructuring of operations.

## Related party transactions

The Board of Directors of the parent company, Terrafame Group Ltd, has confirmed the group's related party policy. The major related party organisations of Terrafame Ltd include Terrafame Group Ltd, the state of Finland, Galena Private Equity Resources Investment 2 L.P. and Galena Private Equity Resources Investment 3 L.P. funds, as well as Trafigura Ventures V B.V. The related parties also include members of Boards, CEOs and management team members of group companies, persons responsible for Terrafame Ltd's commercial agreements, immediate family members of persons referred to here, as well as entities over which they or their immediate family members have control.

During the financial period 2017, the company had a EUR 68 million counter-guarantee granted by the Finnish state for arranging collateral in accordance with environmental permits, and a EUR 17 million third-party pledge provided by Terrafame Group Ltd for the same arrangement. Legal and other administrative services were bought from the parent company.

The sales of nickel cobalt sulphide and zinc sulphide to Trafigura Ventures V B.V. company amounted to EUR 158.8 million during the financial period.

The financing arrangements realised with the related-party companies Terrafame Group Ltd, Trafigura Ventures V B.V. and Galena funds are presented in the "Financing arrangements" section of the annual report.

All business transactions between Terrafame Ltd and its related parties were at arms-length basis.

## Shares and shareholders

Terrafame Ltd has one series of shares. At the end of 2017, the company had 3,281,498 shares, EUR 2.0 million in share capital, and EUR 295.6 million in shareholders' equity. Terrafame Ltd is a subsidiary of Terrafame Group Ltd, which owns 77.3% of the company. Minority shareholders are Galena Private Equity Resources Investment 2 L.P. and Galena Private Equity Resources Investment 3 L.P. funds, both part of the Trafigura Group, with a holding totalling 22.6%, as well as Sampo Plc, with a 0.1% holding.

## Governance

The General Meeting of Shareholders, the Board of Directors and the CEO are responsible for Terrafame Ltd's administration and operations. As an unlisted company, Terrafame follows, as applicable, the Finnish Corporate Governance Code for listed companies issued by the Securities Market Association. The company will publish a corporate governance statement as part of its Annual Report for 2017.

Terrafame's Board of Directors was expanded as a result of the ownership arrangements made during the year under review. Lauri Ratia continued to act as Chairman of the Board. Esa Lager and Tuomo Mäkelä continued as previously appointed members of the Board, and Emmanuel Henry and Jesus Fernandez were appointed as new members in February 2017, together with Matti Hietanen, who also acts as Vice Chairman of the Board. Joni Lukkaroinen continued as CEO.

Terrafame Ltd's auditor is the Authorised Public Accountants KPMG Oy Ab, with Antti Kääriäinen, APA, as principal auditor.

## Significant events after the end of the financial period

Terrafame's financial period ended on 31 December 2017. In January 2018, the southern end of the Kuusilampi open pit was emptied of water, making the whole pit available for mining operations. This will provide more future options for the planning of mining and thus improve the cost-effectiveness of mining.

## Estimate of future developments

Terrafame will continue ramping up its production and improving its profitability. During the first half of 2018, the permit process for a battery chemicals plant will be initiated, and preparations will be made for an investment decision for the plant. In addition, the company will study the recovery of rare earth metals and uranium on a laboratory scale.

The target for Terrafame's personnel's lost-time injury frequency rate, i.e. the number of lost-time injuries per one million working hours, is set at under 2.5 for 2018. The occupational safety of the employees of the partner companies that operate in the mining and industrial site will be developed further using the same criteria and means as the occupational safety of Terrafame's own personnel.

According to the JORC code-compliant mineral resource and ore reserve estimate updated in July 2016, the mine's mineral resources allow for mining operations and the production of metals and related downstream products for several decades. Only Measured and Indicated Mineral Resources were used in the calculation of Ore Reserves. The techno-economic parameters were drawn from the mine's historical data, Terrafame's mining plans and specified cost parameters. The Measured, Indicated and Inferred Mineral Resources amount to 1,458 million tonnes.

## Board of Directors' proposal for the disposal of the result

Terrafame Ltd's result for the financial period 2017 shows a loss of EUR -9,601,100.61. On 31 December 2017, Terrafame Ltd's distributable equity totalled EUR 293,643,414.33. The Board proposes that the loss be transferred to the retained earnings/loss account and that no dividend be paid.

# Financial statements

## Balance sheet

<b>ASSETS</b> <b>(EUR 1,000)</b>	<b>Note</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
<b>Non-current assets</b>			
Intangible assets	2.1	<b>1,674</b>	1,593
Tangible assets	2.2	<b>294,028</b>	221,269
<b>Non-current assets</b>		<b>295,702</b>	<b>222,862</b>
<b>Current assets</b>			
Inventories	2.3	<b>168,622</b>	76,235
Long-term receivables			
Deferred tax assets	2.4	<b>1,125</b>	0
Short-term receivables			
Amounts owed by group companies	2.5	<b>32</b>	0
Trade receivables		<b>24,660</b>	15,765
Other receivables		<b>2,931</b>	8,345
Prepayments and accrued income	2.6	<b>19,046</b>	2,746
Cash and cash equivalents		<b>106,392</b>	44,704
<b>Current assets</b>		<b>322,809</b>	<b>147,794</b>
<b>Assets total</b>		<b>618,511</b>	<b>370,656</b>
<b>EQUITY AND LIABILITIES</b> <b>(EUR 1,000)</b>			
	<b>Note</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
	<b>2.7</b>		

<b>Equity</b>			
Subscribed capital		<b>2,000</b>	2,000
Other reserves			
Invested unrestricted equity		<b>524,406</b>	379,800
Fair value reserve	2.8	<b>-4,501</b>	0
Retained earning (loss)		<b>-216,660</b>	-91,748
Loss of the financial year		<b>-9,601</b>	-124,912
<b>Equity</b>		<b>295,643</b>	<b>165,140</b>
<b>Provisions</b>	<b>2.9</b>	<b>159,412</b>	<b>162,078</b>
<b>Long-term liabilities</b>			
Loans from credit institutions	2.10	<b>201</b>	0
Loans from credit institutions	2.11	<b>88,781</b>	0
<b>Long-term liabilities</b>		<b>88,982</b>	<b>0</b>
<b>Short-term liabilities</b>			
Amounts owed to group companies	2.12	<b>128</b>	89
Loans from credit institutions	2.13	<b>130</b>	1 288
Trade payables		<b>43 789</b>	32 682
Other liabilities		<b>1 103</b>	1 026
Accruals and deferred income	2.14	<b>29 324</b>	8 355
<b>Short-term liabilities</b>		<b>74 474</b>	<b>43 439</b>
<b>Liabilities total</b>		<b>163 456</b>	<b>43 439</b>
<b>Equity and liabilities total</b>		<b>618 511</b>	<b>370 656</b>

# Financial statements

## Terrafame Ltd income statement

(EUR 1,000)	Note	1 Jan–31 Dec 2017	1 Jan–31 Dec 2016
<b>Net sales</b>	3.1	<b>220,024</b>	101,042
Cost of goods sold	3.2, 3.3, 3.4	<b>-203,054</b>	-215,787
<b>Gross profit</b>		<b>16,970</b>	-114,745
Sales and marketing expenses	3.3, 3.4	<b>-619</b>	-477
Administrative expenses	3.3, 3.4, 3.5	<b>-16,636</b>	-15,423
Other operating income		<b>357</b>	858
Other operating expenses		<b>-6,291</b>	-4,747
<b>Operating profit/loss</b>		<b>-6,219</b>	<b>-134,533</b>
Financial income and expenses	3.7, 3.8		
Interest income and other financial income		<b>12,260</b>	10,188
Interest and other finance expenses		<b>-15,642</b>	-567
<b>Financial income and expenses</b>		<b>-3,383</b>	<b>9,621</b>
<b>Loss before tax</b>		<b>-9,601</b>	<b>-124,912</b>
<b>Loss for the financial year</b>		<b>-9,601</b>	<b>-124,912</b>

# Financial statements

## Cash flow statement

(EUR 1,000)	1 Jan–31 Dec 2017	1 Jan–31 Dec 2016
<b>Cash flow from operating activities:</b>		
Result for the financial period	<b>-9,601</b>	-124,912
Adjustments:		
Depreciation and amortization	<b>19,841</b>	13,982
Unrealised foreign exchange gains and losses	<b>-2,338</b>	0
Other income and expenses, non-cash items	<b>-2,666</b>	-10,456
Financial income and expenses	<b>3,539</b>	122
Other adjustments	<b>2,588</b>	-82
Cash flow before change in net working capital	<b>11,362</b>	-121,347
Change in net working capital:		
Change in trade and other receivables; increase (-)/decrease (+)	<b>-8,452</b>	-16,439
Change in inventories; increase (-)/decrease (+)	<b>-92,387</b>	-52,967
Change in trade payables and other liabilities; increase (-)/decrease (+)	<b>12,064</b>	14,068
Cash flow before financial items and income tax	<b>-77,412</b>	-176,685
Interest paid and other financial expenses	<b>-4,579</b>	-142
Interest received, operational	<b>1,040</b>	20
<b>Cash flow from operating activities (A)</b>	<b>-80,951</b>	<b>-176,807</b>
<b>Cash flow from investing activities:</b>		
Investments in tangible and intangible assets	<b>-92,147</b>	-74,249
Proceeds from sale of tangible and intangible	<b>18</b>	230

assets		
<b>Cash flow from investing activities (B)</b>	<b>-92,129</b>	<b>-74,019</b>
<b>Cash flow from financing activities:</b>		
Paid increase in equity	<b>144,606</b>	281,800
Proceeds from long-term borrowings	<b>100,000</b>	0
Repayment of short-term borrowings	<b>-957</b>	-2,247
<b>Cash flow from financing activities (C)</b>	<b>243,650</b>	<b>279,553</b>
<b>Impact of exchange rate changes on the amount of foreign currency cash</b>	<b>-8,881</b>	<b>0</b>
<b>Change in cash and cash equivalents (A + B + C); increase (+)/decrease (-)</b>	<b>70,569</b>	<b>28,728</b>
Cash and cash equivalents at the beginning of the period	<b>44,704</b>	15,976
<b>Cash and cash equivalents at the end of the period</b>	<b>106,392</b>	<b>44,704</b>

# Financial statements

## Accounting principles

Terrafame Ltd is domiciled in Sotkamo, Finland. The company is part of the Terrafame Group, whose parent company, Terrafame Group Ltd, is domiciled in Helsinki, Finland. Copies of the consolidated financial statements are available at Terrafame Group Ltd's office and can be viewed on the company's website at [www.terrafame.com](http://www.terrafame.com).

## Basis of preparation

The company has prepared its financial statements in accordance with Finnish accounting legislation and Finnish Accounting Standards (FAS). The financial statement information is reported in tables and related texts in thousands of euros and in the report of the Board of Directors in millions of euros to one decimal place. The comparative figures reported in brackets are figures for the financial period 2016. All the presented figures have been rounded according to general rounding rules, so the sum of the individual figures may be different from the sum presented. Key figures have been calculated using exact values. Comparative information has been adjusted where necessary to correspond with the information of the year under review.

## Operational continuity (going concern)

The financial statements on 31 December 2017 were prepared on a going concern basis. Thanks to the financing implemented in 2017, the finalisation of the ramp-up has been secured and business can continue for the foreseeable future.

An ownership and financing arrangement was carried out at Terrafame Ltd in February 2017. The arrangement amounted to EUR 250 million in total. In November 2017, a financing arrangement totalling USD 200 million was carried out, concerning investment in a battery chemical plant. Part of the funding from November is available for the financing needs of the final stages of the ramp-up. As a result of the financing arrangements, Terrafame Ltd has the funding necessary to complete the ramp-up of production and to

achieve positive cash flow. The investment commitment of EUR 50 million granted by the parent company in the February financing round is unused. Of the November arrangement, the company has withdrawn USD 50 million, after which USD 150 million is unused.

## Translation of items denominated in foreign currencies

Transactions in foreign currencies are entered in euros at the rates prevailing at the transaction date or average rates provided by central banks. Foreign currency-denominated receivables and liabilities have been translated into euros using the rates prevailing at the balance sheet date. Foreign exchange gains and losses related to business operations are included in the corresponding items of net sales, operating expenses or financial income and expenses.

## Revenue recognition

Revenue is recognised from a sale when evidence of an arrangement exists, the title has been transferred to the customer, the price is determinable and collection of the sales price is reasonably assured. Revenue is recognised net of sales-related foreign exchange gains and losses and any applicable sales taxes. Most sales are priced in US dollars. The time of revenue recognition is determined on the basis of the terms of delivery used.

A large proportion of the company's production is sold under long-term contracts, but sales revenue is only recognised on individual sales when persuasive evidence exists that all of the following criteria have been met:

- all material risks and rewards of ownership have been transferred to the buyer;
- there is no continuing managerial involvement to the degree usually associated with ownership or effective control over goods sold;
- the amount of revenue can be reliably determined;
- the costs incurred or to be incurred in respect of the sale can be reliably determined; and
- the flow of future economic benefits to the seller is probable.

Upon delivery, a preliminary invoice is drawn based on preliminary analysis and measurement results and the market prices at the time of delivery. Preliminary invoices are entered as sales. The final analysis and measurement results are normally obtained within a few months. Any preliminary invoices are adjusted based on the final analysis and measurement results. Furthermore, the prices of delivered metals are adjusted to correspond to the market prices of the agreed pricing period.

With regard to preliminary invoices for which final analysis and measurement results have not yet been obtained, the sales prices and euro-denominated valuations are adjusted so as to correspond to the average market prices of the month of the financial statements and the exchange rates at the date of closure of the accounts. With regard to these deliveries, the company also considers the need to make write-downs due to the changes in analysis and measurement results. Such write-downs were not made in the financial statements of 31 December 2017. The fixed-price metal hedges for metal tonnes sold have been taken into account in the valuation of sales.

## Pension obligations

The company has pension schemes in accordance with local conditions and practices. These are arranged with an external insurance company. Pension costs are entered as expenses in the year in which they occur.

## Borrowing costs

Borrowing costs are recognised as expenses in the period during which they are incurred.

## Deferred tax assets and liabilities

Deferred tax assets and liabilities are calculated on temporary differences between the book value and taxable value, using the tax rates enacted by the balance sheet date. Deferred tax assets arising from taxable losses carried forward are recognised up to the amount for which there is likely to be taxable income in the future, and against which the temporary difference can be used. Deferred tax assets with respect to the fair values of derivative contracts have been recognised in the balance sheet of 31 December 2017.

## Tangible assets

Tangible assets have been recognised in the balance sheet at cost, less planned depreciation. Non-current tangible assets include, among other things, buildings, infrastructure, machinery and equipment used in mining operations, laboratory equipment, vehicles, roads, power lines and structures for environmental protection. Acquisition cost includes expenditure that is directly attributable to the acquisition, construction or production of the item.

Non-current assets bought from the bankruptcy estate of Talvivaara Sotkamo Ltd on 15 August 2015 have been amortised in accordance with the original depreciation plan by applying the normal planned depreciation periods, with the exception that a write-down of approximately EUR 76 million was made on the acquired tangible assets: the net expenditure of acquired tangible assets as at 15 August 2015 was approximately EUR 202.6 million, on which a write-down of EUR 76 million was made, and the acquired tangible assets were entered in the company's balance sheet in the amount of EUR 126.6 million.

Spare parts with a useful life of more than one year have been recognised in non-current assets in the 2017 financial statements. In the financial statements of 31 December 2016, they were recognised in inventories. Spare parts recognised in non-current assets had a total value of EUR 6.4 million in the balance sheet of 31 December 2017.

Where parts of an item of tangible assets have different useful lives, they are accounted for as separate items.

Construction in progress and land are not depreciated. Depreciation on other assets is calculated using the straight-line method to allocate their cost over their estimated useful lives, as follows:

Roads	<b>25 years</b>
Buildings and structures	<b>10–40 years</b>
Leaching heap foundations	<b>10–15 years</b>
Machinery and equipment	<b>4–25 years</b>
Furniture, fixtures and fittings	<b>5–10 years</b>
Vehicles	<b>5–10 years</b>

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Fixed asset spare parts	<b>3 years</b>
Structures for environmental protection	<b>25 years</b>

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Net expenditures are reassessed in connection with each financial statement. The reassessment is based on the company's estimates of ore reserves, mineral resources, production capacity and other relevant factors.

Gains and losses on disposals are determined by comparing the proceeds with the book value and are recognised within other operating income or expenses, respectively, in the income statement.

## Intangible assets

### Other intangible assets

Other intangible assets are recognised in the balance sheet at cost, less planned depreciation. Other intangible assets mainly comprise IT applications and geodata supporting the company's business operations, which are amortised over 3–5 years.

### Research and development expenditure

Research expenditure is recognised as an expense as incurred. The company has not capitalised development expenditure during the financial period 2017 or earlier.

### Inventories

The company classifies its inventories into three groups: raw materials and consumables, work in progress, and finished products.

Raw materials and consumables are valued at the average acquisition cost of the goods in stock. A so-called write-down on slow-moving items is made on the slow-moving goods in the raw materials and consumables inventory. If an item has been in stock for more than a year, a write-down of 25% is made. The write-down increases 25% annually, so the value of an item that has been in storage more than four years is zero.

Work in progress and finished products (metal content for sale) are presented in the balance sheet as valued at actual production costs but up to the net realisable value of the products on the balance sheet date. Net realisable value refers to the estimated selling price

in the ordinary course of business, less the production costs necessary to complete the sales.

The acquisition cost of work in progress and finished products (production cost) includes the fixed and variable costs of production and maintenance that supports production, as well as depreciation on these functions, based on the realised production costs in the production process. The acquisition cost excludes borrowing costs.

Finished products include nickel cobalt sulphide, zinc sulphide and copper sulphide. Work in progress includes metals in the ore in primary and secondary heaps, as well as metals in the leaching process or metal precipitation and filtration process that can be processed for sale as a finished product.

The amount of metal contained in work in progress is measured by calculating the metal tonnes added to and removed from the production process. The recoverable quantities of nickel, zinc, copper and cobalt included in work in progress are determined based on the estimated ore concentrations based on geological studies, the estimated recovery percentages of metals in the bio heap leaching process and the recovery percentages of the metals recovery plant.

Ore concentrations, the amount of metals in the production process and the metals recovery percentage are reviewed monthly.

The company's finished products on 31 December 2017 were valued in accordance with the net realisation principle, as the acquisition cost of finished products calculated on a cost basis was higher than the net realisable value. Work in progress was valued for the first time in the company's financial statements for 2017 on a cost basis, as it was lower than the net realisable value. The value of work in progress on a cost basis was EUR 138.0 million on 31 December 2017.

The value of work in progress determined according to the principle of net realisation value includes discretionary factors related to, for example, the measurement of metal volume in work in progress, metals recovery percentages, production costs necessary to complete sales and sales prices.

## Derivatives and hedge accounting

### Derivatives

The derivatives used by the company were acquired for hedging purposes, and hedge accounting has been applied to them. Any unrealised change in the value of derivatives that are considered effective hedges are recognised, in accordance with Section 5:2a of the Finnish Accounting Act, at fair value in the balance sheet's fair value reserve as per the valuation report for the last day of the reporting period. The fair values of derivatives are based on valuations of external counterparties, which have been verified by the company.

The realised earnings effects of changes in the value of effective hedging instruments that are covered by hedge accounting are presented uniformly with the hedged item. In case of any ineffective hedging, changes in the fair value of hedging instruments are recognised in profit or loss.

### Hedge accounting

The company applies hedge accounting in accordance with Section 5:2a of the Finnish Accounting Act to all hedging instruments it holds. At the beginning of the hedging arrangement, the relationship between each hedging instrument and the hedged asset, as well as the risk management objectives, are documented by hedging instrument type. The effectiveness of the hedging relationship is assessed at the beginning of the hedging and in connection with each quarterly accounts.

### Cash flow hedging

The company's hedging activities are entirely focused on cash flow hedging. Changes in the fair values of derivatives acquired for the purpose of hedging forecasted cash flows are recognised in the fair value reserve under equity. Changes in fair value are recognised in profit or loss for the same periods in which hedged cash flows affect the result.

### Provisions

Provisions are recognised when the company has a present legal or constructive obligation as a result of past events, and when it is probable that an outflow of resources will be required to settle the obligation and a reliable estimate of the amount of the obligation

can be made.

A provision is made for mine closure costs and legal claims on the following conditions: the obligation relates to a closed or prior financial period, its materialisation is deemed certain or likely upon preparation of financial statements, the corresponding income is neither certain nor likely, the obligation is based on law or commitment to third parties, and the obligation can be identified but its precise amount or time of realisation is not known.

### **Rehabilitation provision for mine closure and environmental clean-up costs**

A rehabilitation provision for mine closure costs is made with respect to the estimated future costs of closure and restoration, and for environmental restoration and rehabilitation to the condition required by the environmental permits granted for mining operations.

Prevention of the threat of environmental pollution entails environmental and landscaping obligations. After mining operations have ceased, any machinery and equipment, chemicals, fuels and waste involving the risk of environmental pollution must be removed from the site. This will be carried out as part of normal mining operations. In addition, open pits must be restored to the condition required by public safety.

The majority of the estimated restoration costs arises from the closure of waste rock dumps and primary and secondary leaching areas, the treatment and clean-up of primary and secondary leaching solution channels, the construction, covering and landscaping of gypsum ponds, the clean-up of waters and precipitates caused by the gypsum pond leak of 2012, the treatment of rock drainage, the fencing of open pits and the ex post supervision of the mining site.

The mine closure plan is based on the covering of areas with water- and oxygen-impermeable material, and long-term aftercare. It is assumed that environmental monitoring of the mine will continue for 30 years after closure of the mine.

Restoration costs have been estimated in accordance with the cost level at the date of closure of the accounts.

The bioleaching method used by Terrafame is of such a nature that the process cannot be stopped abruptly at the end of operations. In order to ensure environmental safety, bioleaching must be continued until most of the metals have been recovered at the

metals recovery plant. Also, the safe management of solution circulation requires a phased ending. Mining and ore crushing will be terminated after the closure decision.

The shutdown of bioleaching and metals recovery production processes is expected to last approximately three to four years. During the first two years, primary phase leaching will be terminated, and primary leaching ore will be transferred to the secondary heap in accordance with permit requirements. In the first two years, the metals recovery plant will normally be operated on hydrogen sulphide precipitation, and the resulting metals will be sold. During this time, detailed closure plans will be drawn up, and regulatory processes required for closure will be initiated.

After the third year, bioleaching will still be operational in secondary leaching, and when the metal concentrations of the solution decrease, the metals production plant will transfer to sodium hydrogen sulphide precipitation, which will continue to produce small amounts of product for sale. This phase is estimated to last from one to two years, after which the bioleaching and the operations of the metals production plant will be discontinued, and the dilute solutions formed will be treated either at the central water treatment plant or by any other suitable purification method.

The environmental provision for the closure of the mine of EUR 159.4 million has been set to cover the closure costs for thirty years from the date the actual closure measures commence. The environmental provision covers, for example, closure of waste areas, necessary soil rehabilitation measures, solution and water management, and environmental monitoring. It is estimated that the central water treatment plant will be used for around 10 years, after which lighter purification methods will be adopted. The company assesses the amount of the environmental provision annually. The assumption is that a decision on the closure of mining operations would have been made at the balance sheet date.

## Notes to the balance sheet

## 2.1 Intangible assets

(EUR 1,000)	Intangible rights	Other capitalized long-term expenditure	Investments in progress	Total
<b>Carrying amount at 31 Dec 2016</b>	<b>1,586</b>	<b>8</b>		<b>1,593</b>
Gross carrying amount at 1 Jan 2017	1,837	19	0	1,856
Increase	32	0	338	369
Capitalisation for per year	0	125		125
Gross carrying amount at 31 Dec 2017	1,868	144	338	2,350
Accumulated amortisation and impairment losses at 1 Jan 2017	251	11	0	262
Amorsation for the year	380	33	0	413
Accumulated amortisation and impairment losses at 31 Dec 2017	631	44	0	676
<b>Carrying amount at 31 Dec 2017</b>	<b>1,237</b>	<b>100</b>	<b>338</b>	<b>1,674</b>

Investments in progress in intangible assets are presented as a separate column in the intangible asset group as of 2017.

## 2.2 Tangible assets

(EUR 1,000)	Land	Buildings	Machinery and equipment	Other tangible assets	Construction in progress	Total
<hr/>						

<b>Carrying amount at 31 Dec 2016</b>	<b>145</b>	<b>49,356</b>	<b>68,048</b>	<b>51,564</b>	<b>52,155</b>	<b>221,269</b>
Gross carrying amount at 1 Jan 2017	145	53,479	78,096	54,836	52,155	238,710
Increase	125	35	7,908	0	84,165	92,233
Capilisation for the year	0	14,194	29,828	46,349		90,370
Transfers					-90,370	-90,370
Decrease	0	0	-114	0	0	-114
Gross carrying amount at 31 Dec 2017	270	67,708	115,717	101,184	45,950	330,829
Accumulated amortisation and impairment losses at 1 Jan 2017	0	4,122	10,047	3,271	0	17,441
Decrease	0	0	0	0	0	0
Amortisation for the year	0	3,765	11,757	3,905	0	19,428
Depreciation for reductions	0	0	-68	0	0	-68
Accumulated amortisation and impairment losses at 31 Dec 2017	0	7,888	21,737	7,176	0	36,801
<b>Carrying amount at 31 Dec 2017</b>	<b>270</b>	<b>59,820</b>	<b>93,980</b>	<b>94,008</b>	<b>45,950</b>	<b>294,028</b>

## 2.3 Inventories

<b>(EUR 1,000)</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
Raw materials and consumables	<b>22,759</b>	25,497
Work in progress	<b>138,026</b>	50,120
Finished goods	<b>7,837</b>	618
<b>Total</b>	<b>168,622</b>	<b>76,235</b>

The value of raw materials and consumables on 31 December 2017 includes a provision of EUR 5,681 thousand for slow-moving inventory, which reduces the value of inventory. The corresponding provision on 31 December 2016 was EUR 6,024 thousand.

## 2.4 Deferred tax assets

<b>(EUR 1,000)</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
Deferred tax assets	<b>1,125</b>	0

According to estimates, the company has approximately EUR 181.4 million of confirmed and to-be-confirmed losses, and approximately EUR 12.6 million of deferred depreciation. The company has recognised deferred tax assets for derivatives in the balance sheet.

## 2.5 Amounts owed by Group companies

<b>(EUR 1,000)</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
Trade receivables		
Terrafame Group Ltd	<b>32</b>	0
<b>Total</b>	<b>32</b>	<b>0</b>

## 2.6 Prepayments and accrued income

(EUR 1,000)	31 Dec 2017	31 Dec 2016
Other prepayments and accrued income	7,306	2,746
Derivative receivables	11,740	0
<b>Total</b>	<b>19,046</b>	<b>2,746</b>

## 2.7 Equity

(EUR 1,000)	31 Dec 2017	31 Dec 2016
Subscribed capital at the beginning of the period	2,000	2,000
<b>Subscribed capital at the end of the period</b>	<b>2,000</b>	<b>2,000</b>
Fair value reserve at the beginning of the period	0	0
Increase	90,911	0
Decrease	95,413	0
<b>Fair value reserve at the end of the period</b>	<b>-4,501</b>	<b>0</b>
Invested unrestricted equity at the beginning of the period	379,800	98,000
Investment in invested unrestricted equity	144,606	281,800
Invested unrestricted equity at the end of the period	524,406	379,800
Retained earnings at the beginning of the period	-216,660	-91,748
<b>Retained earnings at the end of the period</b>	<b>-216,660</b>	<b>-91,748</b>
<b>Loss for the period</b>	<b>-9,601</b>	<b>-124,912</b>
<b>Retained earnings</b>	<b>-226,261</b>	<b>-216,660</b>

<b>Total equity</b>	<b>295,643</b>	<b>165,140</b>
<b>Restricted equity at the end of the period</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
Subscribed capital	<b>2,000</b>	2,000
Fair value reserve	<b>-4,501</b>	0
<b>Distributable equity at the end of the period</b>	<b>-2,501</b>	<b>2,000</b>

### Distributable equity at the end of the period

<b>(EUR 1,000)</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
Retained earnings	<b>-216,660</b>	-91,748
Loss for the period	<b>-9,601</b>	-124,912
Fair value reserve	<b>-4,501</b>	0
Invested unrestricted equity	<b>524,406</b>	379,800
<b>At the end of the period</b>	<b>293,643</b>	<b>163,140</b>

The fair value reserve comprises the market value of derivatives covered by hedge accounting.

## 2.8 Notes to hedging derivatives

	1.1-31.12.2017			1.1.-31.12.2016			2017	2016
	Positive fair value	Negative fair value	Fair net value	Positive fair value	Negative fair value	Fair net value	Notional amount	Notional amount
Currency and interest rate derivatives								
Foreign exchange forwards	118	0	118	0	0	0	19,000	0
Currency options	448	0	448	0	0	0	7,500	0
Metal							Tonnes	Tonnes

derivatives								
Nickel forward contracts	0	993	-993	0	0	0	2,850	0
Nickel options, sold	2,183	2,550	-367	0	0	0	1,200	0
			0				0	
			0				0	
Nickel forward contracts	0	555	-555	0	0	0	8,000	0
Zinc options, sold	8,991	13,269	-4,278	0	0	0	38,400	0
<b>Derivatives total</b>	<b>11,740</b>	<b>17,366</b>	<b>-5,627</b>	<b>0</b>	<b>0</b>	<b>0</b>		
<b>Short-term derivatives</b>	<b>11,740</b>	<b>17,366</b>	<b>-5,627</b>	<b>0</b>	<b>0</b>	<b>0</b>		

**(EUR 1,000)**
**31 Dec 2017**
**31 Dec 2016**
**Derivative assets**

Balance assets, gross amount	<b>11,740</b>	0
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**Derivative liabilities**

Balance liabilities	<b>17,366</b>	0
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The fair value calculation of hedges is based on market rates and quotations on the balance sheet date in accordance with the hedging portfolio. Counterparties for derivative transactions have been approved in accordance with the company's hedging policy. Intercompany receivables and liabilities are connected on a transaction level with each counterparty and accounted for on a daily level by transaction.

The importance of financial instruments to the company's financial position on 31 December 2017 is not significant when considered in relation to the scope of the company's business. Of greatest significance are zinc and nickel option structures, the maximum risk of which was EUR 6.7 million on the balance sheet date. If realised, it would weaken the company's reported net sales and cash flow in the financial period 2018. The company has not made longer-term hedges where the maximum risk was not limited.

## 2.9 Obligatory provisions

<b>Long-term (EUR 1,000)</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
<b>Rehabilitation provision</b>		
At the beginning of the period	<b>162,078</b>	162,078
Increase	<b>0</b>	0
Decrease	<b>2,666</b>	0
At the end of the period	<b>159,412</b>	162,078
<b>Long-term total</b>	<b>159,412</b>	<b>162,078</b>
<b>Estimated cost of rehabilitation provision</b>		
Rehabilitation of primary and secondary heaps and gypsum pond area	<b>128,729</b>	145,195
Repairing of gypsum pond leak damage 2012	<b>20,100</b>	10,300
Rehabilitation and fencing of the open pit area	<b>2,583</b>	2,583
Environmental monitoring of the mining area after finishing rehabilitation	<b>8,000</b>	4,000
<b>Estimated rehabilitation costs total</b>	<b>159,412</b>	<b>162,078</b>

## 2.10 Long-term loans from credit institutions

<b>(EUR 1,000)</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
<b>Installment credit</b>		
At the beginning of the period	<b>0</b>	1,288
Increase	<b>271</b>	0
Decrease	<b>-70</b>	-1,288
At the end of the period	<b>201</b>	<b>0</b>
<b>Total</b>	<b>201</b>	<b>0</b>

## 2.11 Long-term loans from credit institutions

<b>(EUR 1,000)</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
At the beginning of the period	<b>0</b>	0
Increase	<b>100,000</b>	0
Decrease	<b>0</b>	0
Valuation	<b>-11,219</b>	0
At the end of the period	<b>88,781</b>	<b>0</b>

<b>Options and other rights (pcs)</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
Batch 1 Maximum number of shares to be issued	<b>566,712</b>	0
Batch 2 Maximum number of shares to be issued	<b>244,265</b>	0
At the end of the period	<b>810,977</b>	<b>0</b>

Subscription period for the first batch is 10th Feb 2017–31st Dec 2022 and second batch 9th Nov 2017–31st Dec 2023. Option rights can be transferred to permitted transferee. Option rights are not allowed to be directly or indirectly pledged. The option rights may be exercised in one instalment. Agreed subscription price with option rights is 10 % higher than subscription price at the time the arrangement is implemented.

## 2.12 Specifications of Group liabilities

<b>(EUR 1,000)</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
<b>Short term liabilities to group companies</b>		
Trade payables		
Terrafame Group Ltd	<b>128</b>	89
<b>Total</b>	<b>128</b>	<b>89</b>

## 2.13 Short-term loans from financial institutions

(EUR 1,000)	31 Dec 2017	31 Dec 2016
<b>Installment credit</b>		
At the beginning of the period	<b>1,288</b>	2,247
Increase	<b>210</b>	1,288
Decrease	<b>-1,367</b>	-2,247
At the end of the period	<b>130</b>	<b>1,288</b>
<b>Short-term loans from financial institutions</b>	<b>130</b>	<b>1,288</b>

## 2.14 Current liabilities/Accruals and deferred income

(EUR 1,000)	31 Dec 2017	31 Dec 2016
Salaries, fees and other personnel expenses	8,291	6,281
Other accrued liabilities and deferred income	3,667	2,074
Derivative liabilities	17,366	0
<b>Total</b>	<b>29,324</b>	<b>8,355</b>

# Notes to the income statement

## 3.1 Net sales

(EUR 1,000)	1 Jan–31 Dec 2017	1 Jan–31 Dec 2016
<b>Industry distribution</b>		
Metals	220,024	101,042
<b>Total</b>	<b>220,024</b>	<b>101,042</b>
<b>Geographical distribution</b>		
Europe	185,526	44,217
Asia	30,778	49,854
United States	-248	6,396
Australia	2,969	575
<b>Total</b>	<b>220,024</b>	<b>101,042</b>

## 3.2 Materials and services included in cost of goods sold

(EUR 1,000)	1 Jan–31 Dec 2017	1 Jan–31 Dec 2016
<b>Raw materials and consumables</b>		
Purchases during the financial year	-125,001	-102,863
Change in stocks	-2,739	7,237
	-127,740	-95 627
External services	-66,451	-67,256
<b>Total</b>	<b>-194,191</b>	<b>-162,883</b>

### Change in inventory, included in cost of goods sold

(EUR 1,000)	1 Jan–31 Dec 2017	1 Jan–31 Dec 2016
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Chance in inventory

Change in Work in progress	87,906	49,639
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### 3.3 Personnel expenses

<b>(EUR 1,000)</b>	<b>1 Jan–31 Dec 2017</b>	<b>1 Jan–31 Dec 2016</b>
Wages and salaries	<b>-30,992</b>	-27,934
Pensions expenses	<b>-5,807</b>	-5,234
Other personnel expenses	<b>-1,488</b>	-1,785
<b>Total</b>	<b>-38,286</b>	<b>-34,954</b>

**Wages and fees for Members of Board of Directors**

**-165**                      **-163**

	<b>1 Jan–31 Dec 2017</b>	<b>1 Jan–31 Dec 2016</b>
<b>Average number of company personnel</b>		
Salaries and senior salaried	<b>218</b>	166
Blue-collar	<b>476</b>	460
<b>Total</b>	<b>694</b>	<b>626</b>

### 3.4 Depreciation, amortisation and impairment charges

<b>(EUR 1,000)</b>	<b>1 Jan–31 Dec 2017</b>	<b>1 Jan–31 Dec 2016</b>
Intangible assets	<b>-380</b>	-236
Other capitalised long-term expenditure	<b>-33</b>	-9
	<b>-413</b>	-244

Tangible assets

Buildings	<b>-3,765</b>	-3,177
Machinery and equipment depreciation	<b>-11,757</b>	-8,074
Other tangible assets depreciation	<b>-3,905</b>	-2,487
	<b>-19,428</b>	-13,737
<b>Total</b>	<b>-19,841</b>	<b>-13,982</b>

### 3.5 Administrative expenses

<b>(EUR 1,000)</b>	<b>1 Jan–31 Dec 2017</b>	<b>1 Jan–31 Dec 2016</b>
Wages and fees	<b>-3,088</b>	-3,558
Contributions	<b>-657</b>	-1,172
Depreciation and amortisation	<b>-183</b>	-167
External services	<b>-5,686</b>	-5,262
Insurances	<b>-1,800</b>	-2,646
Administration, other	<b>-3,668</b>	-1,061
Finance and IT, other	<b>-461</b>	-514
EHSQ, other	<b>-398</b>	-358
HR, other	<b>-153</b>	-665
Communications, other	<b>-81</b>	-89
Other	<b>-460</b>	68
<b>Total</b>	<b>-16,636</b>	<b>-15,423</b>

### 3.6 Auditors' fees

<b>(EUR 1,000)</b>	<b>1 Jan–31 Dec 2017</b>	<b>1 Jan–31 Dec 2016</b>
Audit	<b>-80</b>	-84
Tax consultancy	<b>-1</b>	-4

Other services	-14	-34
<b>Total</b>	<b>-95</b>	<b>-122</b>

## 3.7 Finance income

(EUR 1,000)	1 Jan–31 Dec 2017	1 Jan–31 Dec 2016
Other interest and finance income	12,260	10,188
<b>Total</b>	<b>12,260</b>	<b>10,188</b>
Other interest and finance income include exchange change rate profit	11,439	0

Of finance income, EUR 11,219 thousand derives from unrealised finance income related to the valuation of foreign currency loans at the exchange rate of the balance sheet date.

## 3.8 Finance expenses

(EUR 1,000)	1 Jan–31 Dec 2017	1 Jan–31 Dec 2016
Other interest and finance expenses	-15,642	-567
<b>Total</b>	<b>-15,642</b>	<b>-567</b>
<b>Finance expenses to others include exchange rate losses</b>	<b>-8,918</b>	<b>-425</b>

Finance expenses include EUR 5,124 thousand of interest expenses and EUR 8,880 thousand of unrealised exchange rate losses.

# Financial statements

## Key financial figures of Terrafame Ltd

<b>(EUR 1,000)</b>	<b>2017</b>	<b>2016</b>
Net sales	<b>220 024</b>	101,042
EBITDA	<b>13 622</b>	-120,551
EBITDA %	<b>6.2%</b>	-119.3%
Operating loss	<b>-6,219</b>	-134,533
Operating loss %	<b>-2.8%</b>	-133.1%
Profit/loss for the financial year	<b>-9,601</b>	-124,912
Equity ratio %	<b>47.8%</b>	44.6%
Balance sheet	<b>618,511</b>	370,656
Personnel, average	<b>694</b>	626
Wages and salaries	<b>30,992</b>	27,934

**Equity  
ratio %**

**100 x Equity**

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Balance sheet - received prepayments

# Financial statements

## Notes to commitments

<b>Contingent and off-balance sheet liabilities (EUR 1,000)</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
<b>Amounts payable on rental and leasing agreements</b>		
No later than 1 year	<b>1,140</b>	138
Later than 1 year and no later than 5 years	<b>368</b>	15
<b>Total</b>	<b>1,508</b>	<b>153</b>
<b>Other liabilities</b>		
<b>Contractual liabilities transferred in connection with a business acquisition</b>		
No later than 1 year	<b>0</b>	3,144
Later than 1 year and no later than 5 years	<b>0</b>	1,156
<b>Total</b>	<b>0</b>	<b>4,301</b>
<b>Fixed assets serving as collateral for installment credit</b>		
	<b>287</b>	2,605
<b>Installment credit</b>		
No later than 1 year	<b>130</b>	1,288
Later than 1 year and no later than 5 years	<b>201</b>	0
<b>Total</b>	<b>331</b>	<b>1,288</b>
<b>Bank deposit</b>	<b>1,650</b>	<b>200</b>

<b>Securities complying with environmental and mining</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
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**permits  
(EUR 1,000)**

Beneficiary	Type of security	Amount of security	Amount of security
		total	total
Kainuu ELY Centre*; securities in accordance with permit condition 101	Credit insurance		31,940
	Bank guarantee	<b>0</b>	2,450
Kainuu ELY Centre; securities in accordance with permit condition 117	Credit insurance		0
	Bank guarantee	<b>22,000</b> <b>85,000</b>	0
Kainuu ELY Centre; securities in accordance with permit condition 10	Bank guarantee	<b>0</b>	1,750
Kainuu ELY Centre; securities in accordance with permit condition 13	Bank guarantee	<b>6,929</b>	0
Regional State Administrative Agency for Northern Finland, security in accordance with permit condition 99	Bank guarantee	<b>1,500</b>	1,500
Security in accordance with permit decision no. 52/2013/1	Bank guarantee	<b>0</b>	1,250
Security in accordance with permit decision no. 52/2013/1	Bank guarantee	<b>1,500</b>	1,500
Security in accordance with permit decision no. 43/2014/2	Bank guarantee	<b>6</b>	6
Security in accordance with permit decision no. 43/2015/1	Bank guarantee	<b>0</b>	260
Security in accordance with permit decision no. 43/2015/1	Bank guarantee	<b>100</b>	100
Security in accordance with permit decision no. 3/2017/1	Bank guarantee	<b>50</b>	0
Security in accordance with permit decision no. 76/2017/1	Bank guarantee	<b>100</b>	0
Decision of the Finnish Safety	Bank	<b>100</b>	100

and Chemicals Agency Tukes, 30 June 2014, KaivNro: 2819	guarantee		
Decision of the Finnish Safety and Chemicals Agency Tukes, 30 June 2014, KaivNro: 2819	Bank guarantee	<b>35</b>	35
Decision of the Finnish Safety and Chemicals Agency Tukes, 30 June 2014, KaivNro: 2819	Bank guarantee	<b>50</b>	50
<b>Total</b>		<b>117,370</b>	<b>40,941</b>
Other securities	Bank guarantee	<b>830</b>	623
<b>Real estate investments'</b>			
<b>VAT refund liability</b>		<b>7,376</b>	<b>10,497</b>
<b>Company mortgages</b>		<b>160,000</b>	<b>0</b>

\*Kainuu Centre of Economic Development, Transport and the Environment

# Related party transactions

## Related party transactions

The key related party entities of Terrafame Ltd include Terrafame Group Ltd, the state of Finland, Galena Private Equity Resources Investment 2 L.P. and Galena Private Equity Resources Investment 3 L.P. funds, as well as Trafigura Ventures V B.V. The related parties also include members of Boards, CEOs and management team members of group companies, persons responsible for Terrafame Ltd's commercial agreements, immediate family members of persons referred to here, as well as entities over which they or their immediate family members have control. Further, entities in which the Government of Finland exercises either control or significant influence are considered related parties of Terrafame. Terrafame has applied an exemption pursuant to which it only reports significant transactions with Government-related companies.

Financing arrangements between the company and Trafigura Ventures V B.V., Galena Private Equity Resources Investment 2 L.P. and Galena Private Equity Resources Investment 3 L.P. funds, and Terrafame Group Ltd, as well as commercial agreements between the company and Trafigura ventures V B.V., have been described in the Report of the Board of Directors. In addition, the counter-guarantees related to environmental collateral by the state of Finland and the parent company have been described in the report.

All business transactions between Terrafame Ltd and its related parties were market-conform.

### Business transactions with related parties

(EUR 1,000)	31 Dec 2017	31 Dec 2016
<b>Goods and services sold</b>		
Other related party ventures	<b>212,887</b>	0
<b>Ventures total</b>	<b>212,887</b>	<b>0</b>

<b>Total</b>	<b>212,887</b>	<b>0</b>
<hr/>		
<b>(EUR 1,000)</b>	<b>31 Dec 2017</b>	<b>31 Dec 2016</b>
<hr/>		
<b>Goods and services purchased</b>		
Other related party ventures	<b>18,701</b>	<b>0</b>
<b>Ventures total</b>	<b>18,701</b>	<b>0</b>
<b>Total</b>	<b>18,701</b>	<b>0</b>

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# Financial statements

## Board of Directors' proposal for the measures to be taken owing to the loss for the financial period

Terrafame Ltd's result for the financial period shows a loss of EUR -9,601,100.61. The Board of Directors proposes to the Annual General Meeting that no dividend be distributed, and that the loss be retained in shareholders' equity.

In Sotkamo,

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Lauri Ratia  
Chairman of the Board

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Matti Hietanen

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Esa Lager

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Tuomo Mäkelä

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Jesus Fernandez

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Emmanuel Henry

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Joni Lukkaroinen  
CEO

### **Auditor's confirmation**

A report on the audit has been issued today.

In Sotkamo,

KPMG Oy Ab  
Authorised Public Accountants

Antti Kääriäinen  
APA

**Terrafame Oy**

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88120 Tuhkakylä  
Puh. 020 7130 800

**Terrafame Group Oy**

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