Celebrating our 85th year of Unlocking Mineral Wealth
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It's been 85 years since Mintek was formed. With our rich history and strive for improvement, we are proud to be a global leader in minerals and metallurgical innovation. Mintek boosts an extensive range of products and services, which include world-class Research and Development (R&D) expertise, testwork, and process optimisation for all mineral sectors at local and international level. We have world-class equipment and the best human capital to continue to grow and serve the mining industry.

Your Partner in Unlocking Mineral Wealth
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Three new Cynoprobes were installed in Mauritania, Armenia and the Ivory Coast.

Susan Brill receiving the Top Empowered: Public Service Award at the 17th Annual Oliver Top Empowerment Awards on behalf of Mintek from Mapule Ncanywa, Executive Director of BanSA.
On behalf of the Board of Mintek, I am pleased to present the 2018/19 Annual Integrated Report to our shareholder and other key stakeholders. It has been a year of continued economic upheaval and pressure on the mining industry, with Mintek also continuing to feel the strain on its revenues. Mining in South Africa continues its unexciting performance in 2018, with overall production falling 1.6% according to Stats SA. Globally, the mining and metals industry is recovering from one of its most difficult periods in decades. Market volatility and a downturn in commodity prices have created a new normal where cost cuts, automation and operational efficiency are vitally important. Meanwhile, industry-specific issues related to regulation, geopolitical risk, legal limits on natural resource use, shareholder activism and public scrutiny have created additional challenges.

In South Africa, there are a number of different factors that have put the local mining industry under severe pressure in the past few years, according to the latest findings by mining industry analysts. These factors include the challenges of increasing costs, increasing depth of mining, as well as lower grades, all of which lead to a natural shrinkage of the ore reserves. Although commodity prices play a key role in profitability, there are large and significant fixed-cost elements associated with mining. Production levels, therefore, play a significant role in determining profitability. While the risk environment in South Africa is not too dissimilar from the global environment, factors such as loss of critical skills, challenges of third party infrastructure such as electricity and a vibrant labour union contingent, are arguably unique to South Africa.

The Board and management of Mintek spent an inordinate amount of time engaging on the analysis of these challenges, with an intention to identify areas where Mintek can take advantage of the status quo and be a true global leader in minerals and metallurgical innovation. We held a joint Mintek leadership strategic planning workshop, to review the business landscape within which Mintek operates, to reflect on the organisation’s performance and to re-align the organisation’s focus areas so that Mintek can navigate the turbulent waters while remaining sustainable and above water. We were fortunate to be joined by the Minister of the Department of Mineral Resources, as well as the Department of Science and Technology that continually support Mintek’s scientific research and technology development through specially funded programmes.

The Minister’s visit to the Mintek campus allowed us a rare opportunity of showcasing the great work that is done by the scientists, engineers and technicians to develop novel technologies that are meant to improve mineral production. Subsequent to the end of the reporting period, the Minister was appointed Minister of Energy and Mineral Resources, which presents an exciting opportunity for Mintek’s research programmes where minerals research converge with energy research. The Board looks forward to exploring synergies that can be gained with sister state-owned entities in this regard.

We continue to be proud of how Mintek has performed even in a challenging environment. I trust that the report gives comfort to our other South Africans that Mintek did not only deliver on the targets that were set for the year, but it did so while upholding high standards in conducting business as shown in the Auditor-General’s report.

I am pleased to report that Mintek attained more than eighty percent of its targets, which incrementally builds towards the overall attainment of the goals and mandate. Transformation remains a challenge, particularly for science, engineering and technology (SET) staff. Since the current Board was appointed in 2016, women representation has increased from 38% to 41% over the period as a result of a deliberate strategy to increase the number of women. The end state has not yet been reached, and the Board expects management to work even harder towards the achievement of the target.

I would like to thank the Board for diligently exercising its independence in providing strategic oversight to the organization, and ensuring that the executive management was held accountable. The Auditor-General has, once again, issued an unqualified audit, which is a confirmation of the effectiveness of the governance systems and internal controls that management has put in place. The Board and its Committees, including the independent members of the Audit Committee, exercised the necessary oversight while also giving management the space to manage the organization.

One of the Board’s critical tasks during the course of the year, was to appoint a suitably qualified and experienced Chief Executive Officer, following a period during which the organization was under acting CEOs, Mr David Msiza, who was seconded by the shareholder minister, and Mr Saki Simelane, who is Mintek’s Chief Financial Officer. I would also like to thank both for making themselves available for the difficult task of steering a ship for only a short period of time.

The Board was excited to welcome the new CEO, Dr Molefi Motuku in January 2019. Dr Motuku brings with him a wealth of experience in research, development, innovation, leadership and management in the area of science, technology, innovation, mining & minerals and advanced engineering. His arrival at Mintek was a second coming, as he had served as General Manager: Research and Development between 2005 and 2010, and a Manager for one of the Divisions from 2003 to 2005. Working with the Board and the rest of Mintek’s employees, Dr Motuku spent the first few months of the year conducting a deep diagnosis of the challenges facing the organization, with a view to developing a long term strategy that is based on a firm understanding of the organization, its mandate and the environment within which it is operating. The outcome of this process will place Mintek firmly in the lead towards fostering the establishment and expansion of industries in the field of minerals and products derived therefrom, as prescribed in the founding legislation. It will also ensure that Mintek remains true to its core function as a science council that excels in its field of operation. The country depends on state-owned entities such as Mintek, playing a crucial role in stimulating the economy towards the achievement of national goals of reducing poverty and unemployment.

I would also like to thank the key stakeholders who have contributed to the sustainability of Mintek as outlined in the rest of the report. The organization benefits immensely from the support from other state-owned entities under the Department of Mineral Resources, as well as the Department of Science and Technology that continually support Mintek’s scientific research and technology development through specially funded programmes.

Lastly, I would like to thank our shareholder Minister, Hon Gwede Mantashe, who hit the ground running with establishing the mining sector, setting all key role players on a path towards a common goal. The Board is thankful for the leadership that the Minister provided, while also allowing the Board the space to exercise independence in discharging its fiduciary responsibilities.

We are honoured to have been entrusted with the task of guiding Mintek in the last few years and appreciate the leadership that the Minister has provided.

Chairperson’s Overview
tsa tekodisiso tsa mokgatlo e le hore Mintek e tle e qhele maqhubu e le ho totobatsa tshebetso ya mokgatlo le ho laola botjha dikarolo
boetapele bo rerilweng ka hloko ya Mintek, e le ho lekola botjha mme ebe moetapele wa nnete wa hohle mabapi le diminerale dikarolo tseo Mintek e ka nkang monyetla ya maemo a hona jwale efela e le tsa Afrika Borwa ka ntle ho pelaelo ya letho.

hlwahlwa ya lekgotla la basebetsi jwaloka baemedi ba basebetsi, tsa bohlokwa tsa ditheko tse tsepameng tse amanang le merafo.

ha disiu tsa manya a tshepe. Le hoja theko ya thepa e le ntho ya eketsehang, ho eketseha ha botebo ba merafo, esita le dikgato tse merafo. Dintlha tsena di kenyeletsa diphephetso tse ditheko tse e matla ho indasteri ya lehae ya merafo dilemong tse mmalwa tse ho tswa dinakong tse boima tsa dilemo tse balwang ka

Mona Afrika Botswana ho na le dirinta tse ngatla tsa balinga igakete e matladi ho indasteri ya le ha ya mokgatla e le botlhalo ya mintle, e la gore lopho gakatla ya mokgatla ya le merafo a leleng le lopho gakatla ya merafo.

Difhlo eletsha ya le tse tse tsepameng tse amanang le merafo, lelela ba ga lela ka batala ba merafo. Mokgwa ona molemo wa Mintek, empa hape ho tsoseletsa indasteri ya diphuputso tse thumisang sebakeng sona seo. Disebediswa le ntshetsopele mme di na le boemo ba theknoloji ya bonono esita le baamela. Diphuputso tse ditheko tse ba bokwetsi ka hara pehelo ya Mohlahlobi ka koretso.

Makgabeng ditaba tse igkhetsheng tse amanang le tao, boitelo bo kotsi ba bafetsha le dipolotiki, mendi ya molao mabapi le thebheside le mohlodi ya thabo, bohwahlah wa baorealo esita le tekodisiso ya sethjaba di thele le ho eketse diphephetso tse dingo hape.
WO BUHLAKANI

Womnyango Wezamaminerali, owagcizelela indlela okuphuthuma isimeme. Saba nenhlanhla yokuba kube khona noNgqongqoshe iMintek ikwazi ukudlula kulezi zimo eziyaluzayo kuyilapho ihlala siqondise kahle izindawo inhlangano okumelwe igxile kuzo ukuze isimo sebhizinisi iMintek esebenza kuso, ukuze sicabangisise okuhlela izinto eyayihlanganisa abaholi beMintek, ukuze sibukeze bexoxisana ngokuhlaziywa kwalezi zinselele, ngenhloso IBhodi kanye nabaphathi beMintek bachithe isikhathi esiningi okungathiwa zenzeka lapha eNingizimu Afrika kuphela.


Umsebenzi Wonyaka ka-2019

Ngesi phakathi yaseMintek ezikahle kubakhiqizi, ukuze kuzuze izakhamuzi zakuleli

Mintek’s performance in 2018/19 is a combination of achievements that makes Mintek a proud science council, and a sobering view of the task that lies ahead to revitalise the science outputs in our quest to be a global leader in mineral and metallurgical innovation. Our total revenue grew by 6.6% between 2017/2018 and 2018/19, despite the sustained tough economic conditions. This is a significant achievement, particularly because the increase is a point where Mintek changes the path that has seen commercial income steadily declining from a high of R257 million in 2013 to a mere R171 million in 2018. This year, we are reporting higher commercial income, which is indicative of a positive future outlook. We remain a solid organization with an asset base of about R950 million.

We are mindful that, adjusting for inflation, the growth is so marginal it might not enable the organization to invest in its most critical resource, the employees. In fact, in an attempt to maintain a healthy balance between fair compensation and organizational sustainability, the overall employment costs have been curbed at about 19% for the year, 25% in the past five years, with 50 employees in the pipeline for attaining either a master’s or doctoral level qualification. We have committed to mounting an aggressive human capital development programme that should see this picture improve by a significant margin in the next five years.

A low revenue growth rate might also present major challenges for the investment in research and development infrastructure that we need to make in order to ensure that we remain ahead of the competition. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. We intend to. 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Okufuze weYimintek ngo-2018/19

KuMintek ku-2018/19

Umbiko omushawu KaChief Executive Officer

UMSEBENZI WO BUHLAKANI

Umthetho yokupha ukuthi ukuqhubeka ukuthi ukuqhubeka ukuze ukuqhabeka umsebenzisayo nokusithetha kwizintsha ezinhliziyo ezikhwetha ekubaluleke ezinhliziyo umsebenzisayo umsebenzisayo. Ukuthi ukuphila ukuthi ukuqhubeka umsebenzisayo umsebenzisayo ukuthi ukuqhubeka ukuze ukuqhabeka umsebenzisayo ukuthi ukuphila ukuthi ukuqhubeka umsebenzisayo umsebenzisayo.

Lena yimpumelelo enkulu ezinyeleyile, ikakhulu ngakuzo lokhu kwakwakhe lapho Mintek isingxoxo elapho nokukhuliseleyo izinto ezithotho lokhona ukuthi ukuthuthukisa kwenza kuwo. Sina ukuqhubeka umsebenzisayo umsebenzisayo umsebenzisayo ukuthi ukuqhubeka ukuze ukuqhabeka umsebenzisayo umsebenzisayo...

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Kwakwakhe kule nxamala biqinile, zezizawuleza ezithetha ezinhliziyo umsebenzisayo umsebenzisayo umsebenzisayo. Ekukhuliseni ngenthuthu lapho ukuthi ukuqhubeka ukuthi ukuqhubeka ukuze ukuqhabeka umsebenzisayo umsebenzisayo ukuze ukuqhabeka umsebenzisayo.
Re a hlokomela hore, ha re etso diphithele bako sa infoletheng, leboho, kgatla, nka le monge ya se dumele mokgatlo ho theha ke tsa ke kana toloakgaka e ka tloa e kgomo sa tla etsa ditla go tla hloko hore ho aho. Re re e keletso ya mokgatlo o betere, mme, ho ya ka metso wa ntshetsopele ya diphuputso le theknoloji, ka diphetho Mintek e bile le diphihlello tse ngata tse tsotehang nalaneng yohle tse diphuputa. Re le tse etsa ditla go tla hloko hore ho aho ya aha mokgatlo o betere, mme, ho ya ka metso wa ntshetsopele ya diphuputso le theknoloji.
HIGHLIGHTS: THE YEAR AT A GLANCE

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Digital model of the Minfurn™ 200: The sale of the first commercial Minfurn™ 200 is a major commercial highlight for Mintek.

HIV PoC kits produced by Mintek at the DST/ Mintek Cleanroom.
Our total income increased by 6.6%, from R527 million in 2017/18 to R562 million in 2018/2019, mainly due to an increase in conditional grant funding and the baseline allocation. Due to the subdued economy and a mining industry that continues to be under severe strain, income generated from commercial transactions such as the products and services declined slightly by 1.2%, from R171 million last year to R169 million.

#### Financial Performance

We maintained a healthy income-expenditure ratio, ensuring that we remain sustainable. The increase in total expenditure was kept within inflation, to ensure that we do not negate the gains accruing from income growth. Total expenditure rose by 4.3% from R524 million in 2018 to R556.6 million in this financial year. Employee costs remained practically constant, mainly as a result of the declining headcount as we work towards maintaining a core to support staff ratio that befits a research and technology development entity.

We also made meaningful progress towards attaining a reasonable level of employee costs as a percentage of total operating costs, which is 57% compared to 60% for the prior year.

We are still on the path to reduce the employee costs even further, so that we can be able to reinvest our income in research and development. This should be pursued while also appreciating that Mintek has a contingent of highly specialised unique skills, particularly in science, engineering and technology, that is crucial for sustainability, and needs to be compensated fairly for their contribution to the organization.

Net surplus for the year increased from a restated net deficit of R5.85m in 2018 to a surplus of R5.45m. This is mainly attributable to reclassification adjustments due to the newly adopted Generally Recognised Accounting Practices (GRAP).

Mintek’s cash and cash equivalents increased from R429 million in 2018 to R447m in 2019, keeping liquidity at a conservative level. Net cash inflows from operations amounted to R58m, significantly higher than the R19 million generated in 2018.

Mintek’s long term obligation for post-retirement medical aid to qualifying employees declined from R20m in 2018 to R13m in this financial year.

#### Technical Performance and Scientific Outputs

Significant levels of effort were dedicated to refocusing organizational resources in pursuit of Mintek’s mandate and core business during the year. Despite the lacklustre performance of the mining industry amid subdued commodity prices, Mintek’s overall research, development and technology programme continued to deliver sterling results, in respect of the planned activities for the year.

To mention but a few, the long term investments made in the rare earth element (REE) technology and refining facilities are showing signs of bearing fruit in the immediate future. The ultimate aim is to stimulate a REE sector in South Africa that can stand its own globally, and produce rare earth magnets that are used in a number of emerging applications. We have also developed and patented the PyEarth™ process for the extraction of REE’s from iron-rich rare earth deposits, and are currently running a project that is investigating the application to process a Namibian rare earth ore deposit. It is the closest step towards commercialising the process, and Mintek’s engineers are quite excited about the prospects of full commercialisation, especially its application on secondary industries.

The commercialisation of the point-of-care diagnostics kits that Mintek developed using gold nanoparticles is another source of great pride for the organization. The diagnostics kits are used for the detection of HIV, malaria and TB, and are currently being used in five of the nine provinces.
2.3 People Performance

Mintek’s most critical resource is its 576 employees that ensure that the organization continually strives towards the attainment of goals in pursuit of its mandate. Of the total, 45% are in the science, engineering and technology space, which is the core business of Mintek. It is this group that is jointly responsible for the attainment of Mintek’s scientific outputs outlined above, and continues to place the organization’s technologies, products and services on the global map.

In recognition of their outstanding innovation and research, the organization awarded at least 50 employees across different employment levels, in various categories during the Annual Excellence (Apex) Awards. Six staff members walked away with the Development Award. This award is for the successful demonstration of a process or product which could lead to Technology Transfer, usually the result of a successful pilot plant or prototype demonstration. The best Technical/Procedural Contribution was awarded to two staff members, one below and one at the Advanced Operational (AO) grading level. This category includes the design and building of prototypes. Two teams were awarded for Procedural Innovation which includes an adaptation or discovery which could accelerate, simplify, or improve quality and cost effectiveness to financial advantage either internally at Mintek, or externally. Two promising researchers won the best Young Researcher category which represents the best technical contribution by a researcher below the age of 35. The Technical Innovation category was by far the most popular, with 11 staff members receiving the award. This category is for an adaptation or discovery with novel characteristics, which could ultimately lead to advantageous commercial application.

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Mintek’s Research has achieved international recognition for its contributions. Our mining and minerals industry has been extremely innovative, and many notable advances in extraction, refining, and manufacturing technology that originated in South Africa have impacted on the minerals industry worldwide. Mintek works with industry and other R&D organisations to research, develop, and implement new and improved technologies in the minerals and metallurgical sectors. South Africa has become a world leader in this technological niche, with a successful record of technology export, and Mintek itself has become an international player in the field.

With a total staff of about 620, Mintek employs a highly qualified and motivated workforce with a wide range of skills, including metallurgical, chemical, and electronics engineers, chemists, physicists, and mineralogists. Many of our engineers and scientists are recognised as leaders in their fields of specialisation. Mintek provides world-class R&D expertise, testwork, and process optimisation for the precious and base metals, ferroalloys, and industrial minerals sectors on an international basis. The activities range from initial investigations to process development, and the design, construction, and commissioning of industrial plants. Working closely with clients, and in conjunction with engineering partners, Mintek supplies a flexible package of technology for process development and optimisation.
Mintek’s scope of work is illustrated in the integrated value chain outlined below. The bulk of the work is in the parts of the chain that start with concentration through to refinement and value addition, as indicated below.

### Mintek’s integrated value chain

#### Exploration
- Geochemical sample analysis;
- Mineral/ore characterisation;
- Certified Reference Materials (CRMs); and
- Artisanal and Small-Scale Mining (ASSM).

#### Mining
- In the mining space, Mintek focuses on:
  - ASSM Technology;
  - ASSM training assistance;
  - Mining inputs economic studies; and
  - Urban mining.

#### Concentration
- In the concentration, flotation and physical separation parts of the value chain, Mintek’s work includes:
  - Flowsheet design and optimisation and piloting;
  - Plant audits;
  - Control and optimisation strategies;
  - Bulk sample preparation; and
  - Gravity, magnetic, electrostatic, flotation and mineral density separation.

#### Pyrometallurgy
- With respect to pyrometallurgy, Mintek’s work includes:
  - Pelletisation and briquetting; Preheating and pre-reduction;
  - DC arc process development and piloting;
  - Modelling and simulation;
  - Submerged-arc furnace (SAF) control strategy;
  - Fluidised bed and controller technologies;
  - Refractories performance investigations;
  - High temperature solid state and phase equilibrium investigations; and
  - Ore, slag, matte and alloy characterisation.

#### Hydrometallurgy & Biotechnology
- In hydrometallurgy and biotechnology, Mintek’s work includes:
  - Atmospheric and pressure leaching;
  - Bioleaching (refractory gold and base metals);
  - Solvent extraction and ion exchange;
  - Electrowinning;
  - Process simulation;
  - Reagent development and evaluation;
  - Gold recovery by CIP/RIP;
  - Activated carbon regeneration;
  - Uranium processing expertise UO₂ recovery;
  - Leach circuit control; and
  - Rare Earths Element (REE).

#### Refining & Value Addition
- In the latter part of the value chain, Mintek’s scope includes:
  - Gold refining and value-added products/chemicals; New industrial applications for gold: catalysis, nanotechnology & biomedical;
  - Pyrometallurgical refining of inc (PWG to SHG) and off-grade ferro-alloy fines;
  - Titanium chlorination technology;
  - “Smart” materials and sensors;
  - PGM-based superalloys;
  - Low-nickel stainless alloys;
  - Jewellery fabrication; Gold and platinum jewellery alloys; and
  - Identification of downstream metal-based industries.

#### General
- Mintek also has resident expertise in the following:
  - Engineering, design, manufacturing, installation and commissioning; and
  - Project management services and Regional mineral-based studies.
Mintek operates in an open global environment, servicing a multi-national industry. Customers include state enterprises, conglomerates, junior resource companies, engineering contractors and small-scale enterprises – operating both locally and internationally. In such an environment, the imperatives of remaining competitive and credible in terms of reputation and facilities is widely acknowledged and appreciated. As such, Mintek remains committed to ensuring the long-term financial health performance and credibility of the organisation through the effective management of revenue and on-going compliance to governance structures.

### Geographic Spread of Mintek’s Operation by Type of Metal/Mineral

**Gold**
- Design and optimisation of integrated comminution, flotation and smelting circuits.
- Design and optimisation of base metal recovery and PGM refining circuits.
- Minturn™ equipment for granular activated carbon regeneration.
- Minataur™ all-hydrometallurgical gold refining process.
- New industrial uses for gold - catalysis, biomedicine, and nanotechnology.

**PGMs**
- Iron ore beneficiation.
- DC arc smelting processes for chrome, ilmenite, nickel laterites, magnetite, magnesium metal production, and metal recovery from slags and dusts.
- Materials characterisation (physical, mechanical and corrosion properties), and failure investigations.
- Atomijet™ atomiser for base and precious metals.
- SAVMIN™ process for acid mine drainage purification.

**Ferrous Metals**
- Biobioleaching of copper, nickel, cobalt, zinc and polymetallic concentrates.
- Heap bioleaching of low-grade chalcopyrite-bearing materials.
- Integrated circuit design for metal recovery and purification by leaching/heap leaching, precipitation, ion exchange, and SX/EX.

**Equipment & Technology**
- Minturn™ regeneration furnace for activated carbon in the gold processing, water treatment, and food industries.
- MNATAUR™ gold refining process.
- DC arc furnaces.
- Atomijet™ atomiser for base and precious metals.
- SAVMIN™ process for acid mine drainage purification.

**Base Metals**
- Minturn™ regeneration furnace for activated carbon in the gold processing, water treatment, and food industries.
- MNATAUR™ gold refining process.
- DC arc furnaces.
- Atomijet™ atomiser for base and precious metals.
- SAVMIN™ process for acid mine drainage purification.
- Novel PGM-containing alloys, and powder metallurgical processes.

**Base Metals**
- Physical beneficiation - comminution, flotation, gravity, dense media, electrostatic and magnetic separation, and optical sorting.
- Advanced process control and optimisation strategies for milling, flotation, and leaching circuits, and submerged-arc furnaces.
- Ambient, pressure and heap leaching, solvent extraction, fixed bed and counter-current (NIMCIX) ion exchange, resin-in-pulp, and ADU precipitation.
- Mintek is registered as a uranium testwork facility with South Africa’s National Nuclear Regulator (NRR) and the Department of Mineral Resources.

**Uranium**
- Concentrate cracking and refining flowsheet development and optimisation.

**Economic & Regional Studies**
- Physical beneficiation - comminution, flotation, gravity, and magnetic separation, sensor based sorting.
- Regional commodity-based mineral economic studies.
- Resource based technology strategies.
- Sustainable mineral development studies.

**Industrial Minerals & Diamonds**
- Advanced process control and optimisation strategies for milling, flotation, and leaching circuits, and submerged-arc furnaces.
- Ambient, pressure and heap leaching, solvent extraction, fixed bed and counter-current (NIMCIX) ion exchange, resin-in-pulp, and ADU precipitation.
- Mintek is registered as a uranium testwork facility with South Africa’s National Nuclear Regulator (NRR) and the Department of Mineral Resources.

**Process Control Strategies**
- Ambient, pressure and heap leaching, solvent extraction, fixed bed and counter-current (NIMCIX) ion exchange, resin-in-pulp, and ADU precipitation.
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**Uranium**
- Concentrate cracking and refining flowsheet development and optimisation.

**Economic & Regional Studies**
- Physical beneficiation - comminution, flotation, gravity, and magnetic separation, sensor based sorting.
- Regional commodity-based mineral economic studies.
- Resource based technology strategies.
- Sustainable mineral development studies.
On the left: SAVMIN® acid mine drainage treatment plant in Randfontein
Pictured above: Aerial view of the same SAVMIN® plant in Randfontein.
Mintek’s Cynoprobe online cyanide analyser sold 13 instruments in 2019, bringing the total number of sales to well over 120.
Mintek is a national Science Council that forms part of the National System of Innovation. As such Mintek’s core business is Research, Development and Innovation (RDI). These activities are aimed at industrial impact and consequently it is critical that the outputs of Mintek’s research and development activities translate into commercial and industrial impact for the broader benefit of society. We work with industry, government and other RDI institutions to research, develop, and implement new and improved technologies and processes in the mineral and metallurgical sectors. Our expertise has been shaped by the particular industry needs of the South African minerals sector and has evolved over time to address the unique resource challenges faced.

**Operational Performance**

Mintek is currently executing REE feasibility projects again after a number of years of no activity. Rare Earth Metals are slowly regaining some of their earlier lustre. An interesting REE project had been carried out for an iron exchange clay REE project in Uganda. This gave Mintek the first opportunity for exposure to the recovery of REE from this kind of deposit and the production of a marketing REE sample from a large amount of this material. This work contributed to the expansion of the already considerable REE processing expertise and experience at Mintek.

The year also marked the completion of the bilateral research project with Finnish universities and public entities on the exploitation of phosphogypsum waste. The main outcome of this project is that the recovery of REE can be improved significantly by a hydrothermal conversion and re-crystallisation of the phosphogypsum to release the trapped REE from the matrix. A secondary benefit of this approach is the potential value enhancement of the gypsum since the process results in a gypsum morphology sought by the construction industry. Although this process has been shown to be technically feasible, the economics as well as regulatory requirements on thorium levels in construction material may present very high hurdles for practical application.

A significant development during the work on the REE flow sheet for the SACREF concept had been the establishment of a reagent recycle step during the ore cracking stage. This recycle has reduced the OPEX of this process by 40% and further reduced the OPEX of the pyrometallurgical process. By far the dominant parameter in the economic model is now the throughput of the processing plant.

Mintek has developed and patented the PyEarth™ process for the extraction of REE’s from iron-rich rare earth deposits. Rare earth elements are used in the manufacture of batteries and magnets, which are key components in clean energy technologies such as wind turbines and hybrid/electric car vehicles.

The PyEarth™ process employs direct smelting of iron-rich rare earth ores to selectively recover the iron as pig iron, whilst concentrating the REEs in the slag. The REE rich slag is subsequently leached to extract the REEs, and the pig iron is a saleable by-product used in the manufacturing of steel products. The direct smelting approach is based on fundamental thermodynamic principles of pyrometallurgical processes, whereby the iron oxide (Fe₂O₃, Fe₃O₄ and FeO) in the ore is reduced by carbon into iron metal. REEs are concentrated into the slag as rare earth oxides are not readily reduced to metallic form at iron-making temperatures.

Many nations of the world have been embroiling REE due to its increasing importance in a wide range of cutting edge technologies. In September 2009 China announced plans to limit exports of rare earth elements. This strategy was also successfully demonstrated using Mintek’s REE recovery is possible across the complete flowsheet. The technology was also successfully demonstrated using Mintek’s large-scale pilot smelting facilities.

A project investigating the application of PyEarth™ for processing of a Namibian rare earth ore deposit is currently underway at Mintek, with the aim of commercialising the process. This project together with several other iron rich rare earth deposits in Southern Africa have the potential to provide feed sources to the South African Centralized Refinery (SACREF) development at Mintek for the production of saleable intermediate rare earth element products.

Possible secondary industries that can be developed beyond PyEarth™ and SACREF implementation include the production of pure rare earth metals for local manufacturing of magnets, batteries, and other components; exploration of these opportunities constitutes a new collaborative research area.

**Industry Development**

The main impact of Mintek’s activities occurs in the area of Industry Development. This occurs in two main areas, namely; the development of new industries, and the support and sustaining of existing industries.

**Development of new industries**

**Leading the way in Rare Earth Element Processing**

Mintek’s aim is to develop the rare earth element manufacturing industry in South Africa. To this end the required technology and refining facilities have been developed to support the rare earth element mining sector and to stimulate local refining and manufacturing of rare earth products, and to market South Africa a key player in this high value sector. There is renewed interest in the development of rare earth element production due to increased global demand and supply restrictions from China, who currently dominates the market.

Mintek undertook an analysis to evaluate Southern African rare earth element (REE) resources and the potential to play a role in global supply. Southern Africa has a significant number of REE deposits and feasibility studies on most of these deposits have been conducted. Development of the deposits was put on hold due to low REE prices over the last few years. However, with the tightening of supply from China (and the current trade disputes with the USA), prices have recovered and there is renewed interest in the development of REE deposits in Southern Africa have the potential to be commercially viable due to increased global demand and supply restrictions from China that only has approximately 40% of the world’s REE resources.

At the same time, China has also focused on benefiting its domestic production and also dominates world production of REE-containing components and technologies.

There is forecast tightening of REE supply which has led to renewed activity in REE production and production at operations outside China is forecast to increase significantly to cater for increased demand. The increase in non-Chinese production is expected to reduce China’s stranglehold on REE supply and manufacturing.

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between the pyrometallurgy and advanced material divisions. The capacity to produce saleable rare earth intermediate products locally together with manufacturing of components for renewable energy applications is expected to create new jobs and contribute favourably to the Gross Domestic Product (GDP), positively impacting the role of SADC in the global rare earth markets.

In the recent 2019 State of the Nation (SONA) address, the President emphasised that industry transformation and the creation of jobs in the South African economy are among the foremost and urgent priorities facing the country. Therefore, Mintek in its capacity as a Science Council and one of the organs of state tasked with the implementation of government policy is required to participate in this urgent clarion call. The manufacturing of point of care test kits directly addresses the needs identified in the SONA.

**Sustaining existing industries**

One of Mintek’s key objectives is to have tangible and meaningful impact on existing minerals processing operations by improving recovery (productivity) and efficiency (reducing input costs such as energy, reagents) through implementation of advanced process control solutions and instruments.

**Reviving the ferroalloys industry**

Mintek-developed technology has proved instrumental in the development of the ferroalloys sector in South Africa, e.g. the development of technology to process chromite fines via DC arc smelting. Mintek aims to revive the sector by the transfer of new technology, including the introduction of renewable energy, in the production of ferroalloys. Towards this end funding has been secured, locally and internationally, to develop and implement the solutions.

Mintek has a long history of technology development and transfer in the South African ferroalloys industry, some of which have previously transformed the sustainability of the sector, e.g. the development and transfer of technology to treat chromite fines as well as lump material in the 1980’s and 1990’s. Mintek researchers have been working with a consortium of local and international researchers to pioneer the development of the use of renewable energy in energy efficient metal production. Significant funding has been obtained from local and international sources, including the European Union (via the Horizon 2020 funding programme), to develop the application of solar energy to partially replace electricity in ferroalloy metal production.

Pyrometallurgy is an energy intensive activity, but many metals, including ferroalloys (FeCr and FeMn), can only be produced via pyrometallurgical processing, and consequently their production is very energy intensive. Historically, the energy to produce ferroalloys has been provided by electricity, however with advances in technology it is possible to substitute some of this electrical energy with renewable energy.

In South Africa, the ferroalloys sector has been significantly impacted by the cost of electrical energy, and as a consequence a significant portion of the local ferroalloys smelters have been shut down and the ore is currently exported. As an example, in excess of 30% or the South African ferrochrome smelters are currently mothballed and the ore that was previously smelted is now exported (mainly to China, which has overtaken South Africa as the dominant global ferrochrome producer).

The replacement of a portion of the electrical energy required to produce ferroalloys with renewable energy has the potential to reinvigorate the sector and restart the idle capacity. It is considered much easier to recapacitate and revive the ferroalloys industry by re-balancing the energy mix, than it would be to develop from scratch a whole new mining sector.

Mintek is a major player in the consortium responsible for the PreMaS Project, funded by the Horizon 2020 program of the European Union and industrial partners. The project aims to increase energy flexibility and allows the use of sustainable energy sources and reduces the overall energy consumption and CO₂ emission in Mn-alloy production. This will be done by driving the Mn-alloy production, today done in submerged arc furnaces (SAF), into two separate units as illustrated below. A pretreatment unit will be added before the existing furnace. Within the project various pretreatment technologies using different energy sources like: CO-rich industrial off-gas, bio-critical and solar thermal energy will be developed and demonstrated.

Integration of the novel PreMaS pretreatment technologies with the process currently used by smelters will lead to a better flexibility in terms of raw materials leading to a 20% reduction in the consumption of fossil carbon, more energy efficient production processes giving a potential for a 20% reduction in overall energy consumption and a global reduction of operation costs by at least 10%. The ultimate ambition of PreMaS is to scale the technology up to use in industrial manganese alloy production both in Europe and South Africa.

At Mintek, the goal is to reduce electrical energy consumption by 25% and CO₂ emissions by 15%. Mintek is responsible for two major pilot-scale campaigns which will show-case its technical capability to all European producers of manganese ferroalloys. PreMaS is implemented by a consortium, gathering all producers of Mn-alloys in Western Europe and one from South Africa, innovative technology providers for Mn-processing and use of renewable energy sources as well as research and academia organizations with global expertise in Mn ores processing and use of solar thermal energy. The expertise gathered in the consortium allows to cover the whole value chain as well as different specific needs for the development in PreMaS. Through its multinational collaboration the project will also intensify the co-operation between Africa and the EU in the area of raw materials as outlined in the joint Africa-EU strategy mentioned in the Raw Materials Initiative.

**Sustaining the gold industry**

**An efficient technology for carbon regeneration**

The Mintek developed Minfurn™ is a novel carbon regeneration furnace. It combines the advantages of direct resistive heating in a vertical-tube furnace with those of continuous operation, in a furnace whose capital, operating, and maintenance costs compare favourably with those of conventional rotary kilns. Activated carbon is used for recovering gold in gold mines. The activated carbon is regenerated and reused in the process. Regeneration of activated carbon is carried out commonly in rotary kilns which consume high power and generate carbon fines. Replacing rotary kiln with Minfurn™ will help in reducing the power consumption and reduce the quantity of carbon fines. This eventually will improve the process efficiency and lead to more efficient utilisation of the natural resources by gold mines that play a significant role in the South African economy.
The sale of the first commercial Minfurn™200 is a major commercial highlight for Mintek’s Pyrometallurgy Division. The investment in upscaling the Minfurn™ over the past few years has resulted in the first Minfurn™ installation at a South African gold producer in over two decades. This is a major breakthrough for the product. The Zimbabwean market has shifted and the second Minfurn™ in a year was sold to a producer from this region.

Mintek’s Cynoprobe online cyanide analyser continues to be a top choice for gold producers serious about monitoring their Cyanide levels and protecting the environment

The world’s first online, in–tank, carbon concentration measurement instrument continues making waves

Mintek’s new Carbon Concentration Meter, the C2 Meter continues to enjoy market uptake, with 13 units being sold in 2019. This includes sales to new sites in South Africa, USA, Indonesia, and Laos – with the sale into Laos being the first into that country too. In addition to the new sites, several customers ordered additional C2 Meters to add further measurement points in additional leach tanks. The C2 Meter gives gold leaching plants the ability to continuously measure, monitor, and control the amount of carbon in their leaching tanks. Proper control of the carbon concentration at a local gold producer resulted in a reduction in the amount of gold that was lost to the tailings stream by 50%.

LeachStar Cyanide Addition Controller results in Cyanide cost savings

Mintek successfully commissioned its LeachStar Cyanide Addition Controller at a gold mine in Finland during 2018. It was on trial for a period of 3 months. In order to show the benefit that the LeachStar system is able to provide, the performance of this controller was compared to that of the plant manual control. Time series and histogram plots were used to compare the cyanide addition controller against the performance of the LeachStar cyanide addition control. The results indicated that by controlling cyanide concentration, the plant was able to lower the cyanide consumption of the plant by 29% and reduce the cyanide disposal costs by 39% per year.

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New technology for refractory gold processing

Mintek is well positioned to take advantage of test work opportunities due to its proactive focus on building out its pressure oxidation expertise. The validation of the fundamental dynamic POX (Pressure Oxidation) model has provided Mintek with valuable insights not only for refractory gold applications, but also for novel applications such as in base metals or process residue stabilisation.

The Zimbabwe Minerals Institute is considering building a central gold plant for treating refractory material from junior operators and sought a partner in order to facilitate such a development. Special focus was therefore placed on the marketing of Mintek’s gold processing expertise, especially in the area of treatment of refractory gold deposits.

A highly successful continuous pilot plant run had been completed on the patented gold from carbon fines technology and preparations are currently in progress for a technology transfer initiative. Discussions at the inaugural Mintek-Gold Industry workshop provided valuable pointers for the commercialisation target. It became clear that individual producers are not likely to be interested in incorporating the technology in their current flow sheets, but that a dedicated, centralised facility run by an independent company would be a much more prospective target. Mintek will continue with cooperation discussions with potential operators of such a centralised facility.

Stabilising Controllers Increase Gold Production in Sweden

Mintek successfully commissioned stabilising controllers on the mill feed, mill discharge and flotation circuits at the Mandalay Resources Bjorkdal gold mine in Sweden – the first process control installation for Mintek in this country.

The Model Predictive Controller (MPC) that was installed on the mill discharge section feeding the gravity separation circuit was able to improve the cyanide feed stability by 28%. This has subsequently resulted in an average 1% improvement in recovery of the gravity circuit. With an average production rate of 3,600 tonnes per day at a typical head grade of 1.45 g/t, this recovery improvement amounts to 144 grams of additional gold being produced on a daily basis. Assuming the concentrate is sold at 50% of the average market value of gold (US$ 40.75/g), this equates to US$8,000 additional revenue per month from this section alone. Implementation of the FloatStar Level Stabiliser to mitigate the Knelson separator flushing disturbances on the flotation section of the plant also improved the circuit stability by 37%, which has resulted in a 2.1% recovery improvement for this section too. On average this improvement results in an additional 35g of gold produced daily from the flotation circuit. Using the same assumptions above, this equates to US$21,000 additional revenue per month. Given the cost of the entire control system (mill feed and discharge control, flotation stabilisation and optimisation), this improvement will allow Bjorkdal to realise a return on their investment within only 6 months.

The sale of the first commercial Minfurn™200 is a major commercial highlight for Mintek’s Pyrometallurgy Division. The investment in upscaling the Minfurn™ over the past few years has resulted in the first Minfurn™ installation at a South African gold producer in over two decades. This is a major breakthrough for the product. The Zimbabwean market has shifted and the second Minfurn™ in a year was sold to a producer from this region.

Mintek developed an Embedded Robust Non-linear Model Predictive Control (RNMPC) product, which integrates directly with a Cynoprobe 3 online cyanide analyser for the purpose of providing superior model-based cyanide dosage control. The product uses a cost-effective microcomputer running the Linux operating system to execute the sophisticated RNMPC algorithm that was specifically adapted and streamlined to run on this microcomputer platform. Less than a decade ago, it was not possible to run the same RNMPC technology on a cluster of high-performance computers in real-time. Although online free cyanide analysers are widely available and used in gold leaching operations worldwide, reliable automated free cyanide concentration control is not consistently achieved in many of these operations. Some operations still control cyanide addition manually, whilst most use traditional PID (proportional-integral-derivative) control. Since PID control struggles to cope with the long time-delays between making an adjustment to the dosing rate, and seeing a response in the cyanide concentration measurement (a scenario typical of gold leaching operations) the controllers have to be detuned so they don’t over-react to disturbances, resulting in inferior control. On the other hand, due to its predictive and model-based nature, MPC is able to counter the long time-delays and has been proven to provide superior cyanide concentration control, effectively stabilising free cyanide usage, leading to savings in operational costs and reduced soluble gold losses. The Embedded RNMPC product enables this cutting-edge control technology to be delivered without the need for expensive computer and communication infrastructure. The technology was successfully demonstrated to a client who opted to use Mintek’s MPC controller over the previous instrument being sold in 2019, bringing the total number of sales to well over 120. In this financial year, Sudan and Brazil were added to the comprehensive list of over 30 countries where Cynoprobe has been sold. Cynoprobe has the unique ability to measure both the cyanide in the gold leaching circuit as well as the levels of environmental WAD cyanide in the plant tailings stream in one instrument at high frequency and low cost. In this way the plant can closely monitor and control how much cyanide is added, whilst also ensuring the amount of cyanide leaving the circuit is kept within safe levels.

Mintek’s new Carbon Concentration Meter, the C2 Meter continues to enjoy market uptake, with 35 units being sold in 2019. This includes sales to new sites in South Africa, USA, Indonesia, and Laos – with the sale into Laos being the first into that country too. In addition to the new sites, several customers ordered additional C2 Meters to add further measurement points in additional leach tanks. The C2 Meter gives gold leaching plants the ability to continuously measure, monitor, and control the amount of carbon in their leaching tanks. Proper control of the carbon concentration at a local gold producer resulted in a reduction in the amount of gold that was lost to the tailings stream by 50%.
Better control of DMS circuit improves waste rejection and throughput at local PGM plant

A local client contracted Mintek to develop, install, and commission a yield controller on the Dense Medium Separation (DMS) circuit at a plant on a three month trial basis. This is the first DMS control application for Mintek. The objective of the controller is to control the yield of the material leaving the DMS circuit via the sink belt to a specified target. The Mintek MPC controller was utilised due to its inherent ability to account for slow process dynamics and time delays. For the analysis of the performance of the MPC controller versus the existing Distributed Control System (DCS) controller, a number of operating periods separated by periods of plant stoppages were collated. It was shown that the MPC controller offers vast improvements in the sinie yield stability, with the variability of the sink yields reducing three-fold under MPC control. Furthermore, the average sink yield was reduced by 2.1%, which will correspond to either a direct decrease in the number of tons milled, or an increase in overall plant throughput over the long term. The sink yield tracking performance was vastly improved, with the average integral of absolute error (IAE) of the MPC controller calculated to be six times smaller than that of the existing DCS controller.

Mintek successfully installed a Minstral control system on a furnace for a plant located in India during FY2018. This plant operates five submerged-arc furnaces, and during FY2019 requested Mintek to install and commission the systems on their remaining furnaces. The main challenge encountered was operating all of the systems within the constraints of the plant’s MVA contract demand limit, since previously operators would intervene on all furnaces when the limit was exceeded. Strategies for successfully preventing the systems from actively exceeding the limit and independently reducing load as required were employed successfully and the four new Mintek systems have been successfully commissioned at the plant, completing the deployment of the systems to all five furnaces.

Mintek successfully completed all the required work for the feasibility studies for the Tschiudi heap leach operation. This led to the first Cu cathode produced in Namibia.

The Tschudi copper project in Northern Namibia currently produces copper by heap leaching, solvent extraction and electrowinning. The orebody comprises copper, transition and sulphide zones. The ore is a fine-grained sandstone that dewatered upon exposure to air, to a lesser extent, in the transition zone. Copper occurs predominantly as malachite / azurite and chalcocite. Oxide ore was mined during the initial phase and the plant is currently processing transition material.

Column leach tests (Phases 2 and 3) performed at Mintek on transition and sulphide dills cores yielded copper recoveries of above 80% within 150 days. The tests were conducted under conditions of aeration and inoculation with iron- and sulphur-oxidising microbial cultures. To date, however, it has not been possible to reproduce these results on the commercial heaps, where leach cycles are in excess of 400 days. The commercial heaps are currently operating without forced aeration and inoculation, in order to establish activity from naturally-occurring organisms. In order to investigate the performance of the commercial heap, if they have any inhibitions to microbial activity, additional column tests (Phase 4) were performed at Mintek on ore supplied directly from the crusher plant. The columns were loaded at an average bulk density of 1.62 t/m³ rather than the “as placed” bulk density of 1.9 t/m³, in order to better replicate plant conditions. Moreover, the tests were performed with actual plant raffinate rather than synthetic feed solution. Of particular interest was the need to determine if sufficient air permeability could be achieved in the ore bed, and to determine if the plant solution supports naturally-occurring microorganisms.

Advanced Process Control systems earn zinc producer extra US$188k per month in extra production

Mintek implemented Advanced Process Control (APC) at a mine in India with a purpose to drive efficiency and maximise productivity on their milling and flotation circuits. Two major challenges were experienced during the implementation of the APC, viz. limitations in the cleaning capacity of the zinc cleaners flotation circuit due to different circuit configurations being used, and over frothing due to presence of reagents in the recycled process water. Despite these challenges, the purpose to drive efficiency and maximise productivity has been successfully achieved through implementation of Mintek’s Advanced Process Control system. The overall performance of the system resulted in recovery improvements of 1.2% in Zinc mineral and 0.5% in Lead mineral based on long term data of 3 months. While these improvements may seem like insignificant amounts to some, if one assumes the concentrate is sold at 50% of the average market value for each mineral, at the current plant production rate of 5,520 tonnes per day, an extra revenue of about US$ 185,000 per month is made as a result of the Mintek control system. This translates to a payback period of about 6 weeks for the entire control system.

After over a quarter of a century and 130 installations, Minstral Furnace Control still in demand to provide stability and efficiency to ferroalloy furnaces

Mintek successfully installed a Minstral control system on a furnace for a plant located in India during FY2018. This plant operates five submerged-arc furnaces, and during FY2019 requested Mintek to install and commission the systems on their remaining furnaces. The main challenge encountered was operating all of the systems within the constraints of the plant’s MVA contract demand limit, since previously operators would intervene on all furnaces when the limit was exceeded. Strategies for successfully preventing the systems from actively exceeding the limit and independently reducing load as required were employed successfully and the four new Mintek systems have been successfully commissioned at the plant, completing the deployment of the systems to all five furnaces.

A most popular new technology in fines gravity separation

Interest in fine chrome processing by a Reflux Classifier (RC) appears to be high in industry since several requests for quotation were received during the year. RC is an innovative fine ore (typically <1mm top size) separation device offering advantages in both gravity separation and particle size classification. The device combines a conventional fluidized bed with sets of parallel inclined plates in the overflow stream called lamellae for secondary separation of any misplaced heavy fines. Mintek has a pilot RC-100™ from FLSSmith for independent testing on various fines ore-types.

Mintek attended the launch of the cooperation agreement between FLSSmith, Sibanye Stillwater and Linhleko Projects. The launch was also attended by the Deputy Ministers, Honourable Godfrey Oliphant (DMR) and Honourable Bulelani Magwanishe (the dti). Linhleko projects has been appointed by Sibanye Stillwater to run the FLSSmith reflux classifier plant due to be built at their Waterval plant.

The Zimacas project conducted by Mintek which is looking at the possibility of increasing metal fines recovery using reflux classifiers has been completed. Results evaluated thus far indicate that additional metal can be recovered from the final spiral tailings using the RC.

Operational Performance
**Interventions in the Circular Economy**

Mintek acknowledges the imperative of promoting the circular economy in the interests of sustainable development through resource re-use and recycling and are at the forefront of developing an environmentally-friendly and cost-effective industry sector in South Africa.

**Transforming electronic–waste into a resource**

Research in urban mining is one of the essential components of Mintek’s strategic programme to develop competitive waste management technologies for recycling and treating waste in order to extend mineral resources and reduce the volume of hazardous waste in urban areas.

The programme evaluating and developing technologies for the recycling of e-waste continued during this financial year with focus on the hydrometallurgical recovery of valuable metals from printed circuit boards (PCBs), the recycling of cathode ray tubes using a gas-fed rotary furnace. There is currently interest from various local stakeholders in locally developed technologies and the intention is to pilot the processes within the next two to three years.

The lack of processing options for the recycling of cathode ray tubes (CRTs) in South Africa has resulted in large stockpiles of hazardous waste in urban areas.

The research programme evaluating and developing technologies for the recycling of CRTs continued during this financial year with focus on the hydrometallurgical recovery of valuable metals from printed circuit boards (PCBs), the recycling of cathode ray tubes using a gas-fed rotary furnace. Mintek has developed a technology for the recycling of CRTs that classifies it as hazardous waste, resulting in high disposal costs. The conclusion of the TBRC monitors with no resolution to the problem. The lead content of tubes (CRTs) in South Africa has resulted in large stockpiles of hazardous waste in urban areas.

The lack of processing options for the recycling of cathode ray tubes (CRTs) in South Africa has resulted in large stockpiles of hazardous waste in urban areas.

**Transforming mine impacted water into a resource**

Acid Mine Drainage (AMD) is a significant legacy issue that has developed due to the gold mining activities around Johannesburg. Mintek has developed a solution that addresses the AMD problem by removing the environmental impact of AMD and transforming it into usable water, thereby also addressing the issue of water shortages / scarcity. The solution developed by Mintek has passed industrial testing scale and is ready for full scale implementation to address the AMD problem. The solution has been developed over a long period, using government funding, and includes the SAVMIN™, NIMembrane and Biological Sulphate Reduction technologies.

These treatment technologies, if applied nationally and properly planned and managed, can lead to an integrated water treatment and reuse model closely aligned to many of the NDP priorities. A good example is the treatment and use of the AMD from the Witwatersrand Basin, where an integrated system could focus on the treatment and repurposing of water so that it can be used for human, agricultural and industrial consumption.

South Africa is a water scarce country, rated as one of the 30th driest countries in the world. Worryingly, water demand is predicted to outstrip supply as early as 2025. Mintek believes that substantial volumes of water can be made available through the reuse of treated mine impacted water. Currently, however, large volumes of mining impacted water are produced, often with no end use in mind other than discharge or disposal, when these treated effluents may have further uses in applications which are currently and unnecessarily using high quality water. Although the mining sector in South Africa only uses 3-5% of the water resources, water scarcity increases the pressure on the mining sector to deal with contaminated mine water as the effluent often requires dilution with fresh water to reach legislated limits. In general, the areas affected are water scarce and do not have large enough water bodies to dilute the neutralised effluent sufficiently. This results in salination of the water resources due to the high sulphate content of the discharge.

A novel flowsheet for the recovery of valuable metals from printed circuit boards

Mintek has developed a novel flowsheet for the hydrometallurgical recovery of valuable metals such as gold, silver and copper from printed circuit boards with the aim to provide design parameters for the design of a fit for purpose beneficiation plant. There is currently interest from companies in locally developed technologies and the intention is to pilot the processes within the next two to three years in partnership with a local stakeholder. The ability to profitably recover valuable metals from PCBs in an environmental conscious manner could potentially position South Africa as a global player in the area of e-waste recycling.

Currently around 90% of the PCBs recovered from electronic waste in SA are exported for reprocessing. In doing so, the country loses access to valuable metals. By increasing the reuse rate of PCBs in South Africa, we create more opportunities to recover valuable resources that can feed into downstream manufacturing, and as a result, more opportunities for job creation and enterprise development.

Robust process for treatment of acid mine drainage

Mintek developed the SAVMIN™ technology for the treatment of waste water and as such serves towards the protection of environmental assets and natural resources and sustainability of the mining environment, thus contributing to a better and safer South Africa.

The SAVMIN™ pilot plant at the Sibanye-Stillwater site had been re-commissioned with a noteworthy addition of new thickening technology. These new thickeners had shown promise in similar operational applications and the promising initial data from the pre-start-up test work was confirmed during the subsequent pilot run.

The SAVMIN™ pilot plant had been run at steady state in both the non-recycle and Ai recycle modes. This was largely as a result of the successful implementation of the new settling technology. During the pilot plant run, an extensive simulation programme was also undertaken in order to support the test work on site. Information obtained from these simulations has led to two new process discoveries that resulted in a huge simplification in the process control and operability of the plant. This is expected to make a significant contribution to the robustness of the SAVMIN™ design.

Transforming mine effluents

South Africa has a severe and persistent problem of acid mine drainage discharge from mines post-closure, particularly in the Witwatersrand and eMalahleni areas. The waters are often acidic, containing heavy metals and high concentrations of sulphate. Conventional neutralisation methods currently used do not remove sulphate to allowable limits for discharge. This poses a problem when considering discharge as a means of waste management, usually the most popular choice, as the effluent often requires dilution with fresh water to reach legislated limits. In general, the areas affected are water scarce and do not have large enough water bodies to dilute the neutralised effluent sufficiently. This results in salination of the water resources due to the high sulphate content of the discharge.

A passive bioreduction process for treatment of mine effluents

Mintek successfully piloted a passive biological sulphate reduction process for the removal of sulphates and metals from acid mine drainage (AMD) at a coal mine site near eMalahleni. This plant has been operational between September 2017 and March 2019 and treated around 340 L/d of acid mine water. The results obtained during the laboratory-scale work have been duplicated in this plant and metal precipitation and sulphate reduction efficiencies of over 95% were achieved under these conditions. It has operated through a summer and a winter cycle, with little to no effect noted on the sulphate removal efficiency. These results have been duplicated in this plant and metal precipitation and sulphate reduction efficiencies of over 95% were achieved under these conditions. The plant was also being demonstrated at the same site and currently further optimisation of the polishing step is underway at Mintek’s laboratories. A preliminary benchmarking study was undertaken to estimate the capital and operating costs of an integrated demonstration scale passive waste water treatment plant treating 200 m³/d of AMD.

The impact of technologies that can follow from this work will range from preservation of mining rights by compliance with water use license requirements, to the environmental and social responsibilities of mines and the preservation of water resources impacted by mining activities.
Research in Support of Industrial Development

In the current phase of the programme, the major focus is the commercialisation of R&D towards industry transformation and the creation of jobs in the South African economy. In the Biosensors Research Unit, there is already a technology that has the potential to be utilized in the manufacturing of high-end nanotechnology-inspired products through the beneficiation of gold. Mintek was able to find applications for these products in the development and manufacture of point-of-care (PoC) test kits for the detection of human and animal diseases that plague South Africa and the broader African continent. These diseases include HIV, TB, malaria, rift valley fever (RVF), etc.

Mintek in partnership with the DST constructed an ISO 5 Cleanroom facility for the manufacture of the point-of-care products on a commercialization scale in South Africa. The facility was unveiled in April 2015 and is currently in the process of acquiring the relevant regulatory certifications that are required for manufacturing.

While the above test systems and point-of-care devices have been designed and developed and are almost at a manufacturing stage, there is already a need to develop second generation devices for modern and future society. The Bioiabeis Research Unit has already developed a prototype for a quantitative diagnostic assay using surface-enhanced Raman scattering (SERS) technology, which has already attracted attention for potential use as a narcotic testing device.

HySA/Catalysis Programme

The HySA/Catalysis-Impala project has greatly accelerated the scale-up of the HySA series of fuel cell electrocatalysts to true commercial quantities, with the platinum-based HySA-K40, K50, V40, and GV40 all scaled to the 1 kg/batch level while maintaining performance parity with lab scale materials and industrial benchmarks. The first attempts at scaling the HySA alloy catalysts have also proceeded but catalysts like PdCo-K30 have not yet achieved full parity and the scale up methodology is still under development. With the successful graphitization of some carbon supports, advanced corrosion resistant catalysts like HySA-GV40 are now being commercialised through the HySA/Catalysis spin off company HyPlat. Other catalyt development work has achieved a scalable method to prepare PdRu/C catalysts and it is expected that these will be scaled to 1 kg/batch in the near future. This will give HySA/Catalysis a suite of catalysts suitable for use in direct methanol fuel cells (DMFC) and reformate fuelled fuel cells where the ruthenium offers tolerance to the carbon monoxide contaminants of reformed hydrogen fuels that poison platinum only fuel cell catalysts.

In addition, to the successful demonstration of several of the HySA/Catalysis catalysts in membrane electrode assemblies (MEA) manufactured by HyPlat (Pty) Ltd and tested by their customers, the catalysts will soon be incorporated into several fuel cell demonstration projects that the Department of Science and Technology is currently supporting. This effort will give the programme longer term field trial data on the performance of the catalysts and MEAs and other HySA technologies that will aid in the successful commercialisation of the HySA technologies.

Novel process for production of nickel boron (Ni–B) master alloy

Mintek is developing a new process for the production of nickel-boron (Ni-B) alloys through carbothermic reduction of boron oxide sources. The invention offers a significant opportunity to provide South Africa with the capability to produce such alloys locally. More importantly, from a technological perspective, the process offers an advancement on conventional methods of pelletising Ni-B alloys as it eliminates the use of saw dust/wood chips and charcoal as a reductant and requires less intense furnace operation and produces a more saleable resultant pelletised product.

An industry partner has been involved and demonstration of the process at larger scale is planned, subject to successfully demonstrating viability of upscaling the process.
Food security is a national priority and CMDD, in this regard, is aiming to develop novel compounds against agriculturally related pests and diseases such as African Cassava Mosaic Virus (ACMV). Significant progress has been made on the ACMV Rep protein production and activity assays: although the isolation of pure Rep protein has shown to be difficult, the group has developed methodology to isolate large amounts of pure protein, and developed an activity assay to characterise and test Rep protein against potential inhibitors. Using this assay two natural compounds with inhibitory action against Rep were identified by random screening.

Historically CMDD has endeavoured in the field of drug discovery against HIV-1 as a target. In this front, three additional new families of compounds were designed, synthesised and biologically evaluated. Compounds showing over 50% inhibition at 100 μM were subjected to further chemical modification in order to improve their inhibitory effect, while one additional family of compounds was provisionally protected. These projects have a heavy human capital development component as most of the projects are executed in partnership with universities. As a consequence three doctoral degrees were conferred during the financial period reported.

Sensor Nanotechnology Unit

Mintek has developed a non-enzymatic glucose sensor that uses engineered nanoparticles and screen printed electrodes designed and fabricated in-house, which form the base of the sensors. To this effect, the unit has developed a working prototype for detection of blood glucose levels. However, because of the large number of diabetic patients, many approaches for glucose measurement have focused on enabling continuous and accurate glucose level monitoring. Among them, electrochemical analysis is prominent because it is simple and quantitative. The Unit is currently at a stage to design and commercialise the glucose sensor technology. This technology is also being incorporated into the development of research level devices from simple test strips to wearable devices that is non-invasive and capable of continuous monitoring. The mandate of the Sensor R&D Unit of the DST/Mintek NIC is to develop electrochemical sensors that are easy to use.

NanoMinerals Nanotechnology Unit

Mintek is busy undertaking worthwhile tasks such as developing methods of water purification, producing nanoparticles for biomaging and developing new coatings to prevent corrosion in steel structures. Mintek further beneficiates minerals such as graphite which is then used as a primary source of graphene which has undoubtedly become the wonder material. The development of new methods to produce graphene at an industrial scale could have a significant impact in sectors such as electronics, medicine, aerospace, automotive, energy storage, water desalination, coatings and paints, solar technologies, oil and communications. It is for these reasons that researchers at Mintek are making giant strides in developing new methods to generate graphene with optimum quality. This creates an exciting emerging research field with the potential to help with a variety of global challenges. Mintek also undertakes other NRF and TIA supported research activities with Copperbelt University in Zambia and the University of Antananarivo in Madagascar.

Physical Metallurgy

The Ferrous Materials Development Network (FMDN) of the Advanced Materials Initiative (AMI), a programme funded by the DST, was initiated in 2009 to foster industrial growth and support the metals-related industries in South Africa by undertaking relevant research and development. In this financial year, members of the FMDN actively participated at the Steel R&D workshop facilitated by Arcelor Mittal South Africa (AMSA), various government departments such as the dti, DST and Treasury and other stakeholders. The objective of the workshop was to jointly explore mechanisms to create Public/Private collaborative R&D platforms to support the steel industry in South Africa. In addition, the forum further explored various strategies that can be put in place to drive a steel driven industrialization characterised by local and sustainable supply chains. The project aimed at reducing material losses, controlling the production rate, investigating the effect of particle size and of re-cleaning the concentrate using the pan. The main development was the introduction of a variable speed drive (VSD) to the driven load, not only to improve productivity but also to curb energy losses associated with constant speeds.

Mintek investigated the possible adaptation of satellite imagery, Landsat and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) as process tools for small scale miners in their monitoring and assessment of environmental impacts. This adaptation involved a successful application of these tools in monitoring land cover changes of granite quarries between Rustenburg and Mabengbo Local municipalities. The results of this work confirmed the effectiveness of assessing environmental impacts using remote sensing data and thus can be used to determine and plan for rehabilitation programmes. This also extends to other areas such as agriculture and ownership mines and can be applied for monitoring impacts of other mining activities and those of mine dump material. This tool will be utilised by Mintek in support of the small scale mining sector in their efforts for environmentally-related industry. Beyond South Africa’s shores, the Group has signed a consultancy contract with Scaw Zambia Steel Foundry, one of the clients in the SADC region, for technology intervention towards improving their grinding ball production processes. This technical intervention will definitely lead to medium and long term projects for Mintek from Zambia and other SADC countries.

In terms of short-term interventions to industry, the Physical Metallurgy Group executed about 200 projects in the service to the South African metals-related industries. These types of projects ranged from small projects (~R10 000) usually provided to small and medium-sized clients, and large projects (~R250 000) that are carried out on behalf of big clients such as well-established mining houses and the broader metals-related industry. The small scale mining and minerals beneficiation sector plays a crucial role in the South African economy as it presents miners and communities in rural and peri-urban areas with a solution to poverty alleviation and improved livelihoods. This sector is however characterised by limited resources, primitive mining and processing methods, lack of understanding of legislation, limited business acumen and many other developmental challenges. Mintek provides support through research and development of appropriate technologies for use by small businesses within the sector. Further technical training, business and marketing support is also provided to ensure sustainable development of these small businesses.
sound practices and responsible mining.

The Northern Cape Province hosts gemstone occurrences that are sporadically mined on a small scale by local communities. One of the most common gemstones mined in the province is the tiger’s eye which is hosted in the Banded Iron Formation (BIF) sequence. Mintek was contacted by the local community through Basad Sebele Enterprise, to assess the potential use of the abundance iron formation rocks in jewellery manufacturing. Basad Sebele Enterprise intends to create job opportunities in the rural villages of Bossa and Pennry through the beneficiation of the BIFs into jewellery. A feasibility study was conducted and when cut and polished, the rocks displayed beautiful colours in varying layers that can be used in jewellery manufacturing. The hardness of the samples (6.5-6) is also one of the good characteristics of the rocks and this makes them suitable for jewellery manufacturing.

### Training and Skills Development to Empower Communities and Small Businesses

Mintek embarked on an initiative to identify retrenched/ex-miner workers and then provide them with short training programmes that would assist them to find other opportunities for employment or even to set-up their own small businesses. Collaborations were established with local stakeholders, in the North West Province, with the Dr. Kenneth Kaunda District Municipality and the Economic Development Agency which resulted in 55 retrenched/ex-miner workers being trained.

In Mpumalanga, partnerships were forged with the Mpumalanga Legislature and Small Enterprise Development Agency (SEDA) where 60 learners were trained in Kempton Park and another 30 in Pilgrims Rest. The content of the short courses included: business skills, introduction to small scale mining, minerals beneficiation, legal requirements for starting a new mine, background to the Mining Charter and the African Mining Vision.

A pottery training workshop funded by the National Lotteries Board has been set up in Mangontong (Matlakane) in the Eastern Cape which has an abundance of quality clay deposits. Learners were taught the basics of clay and its properties followed by the manufacturing of ceramic pinch and coil pots and pottery wheel training. The project benefitted 13 previously unemployed community members.

As part of Mintek’s on-going SMME support and incubation programme, 3 pottery manufacturing start-up businesses in Rustenburg, Klerksdorp and Mongolong were assisted. The latter of the projects is funded by the National Lotteries Board. This has resulted in the creation of job opportunities for 20 previously unemployed individuals.

In order to enhance the existing jewellery training programme, Computer Aided Design (CAD) and 3D Printing were introduced. This gave learners an opportunity to use the computer training facilities at Mintek and the 3D printer for improving product design and manufacturing. Learners from Northern Cape were also brought to Mintek to be trained on this aspect.

Training and skills development continued which resulted in 43 learners being trained in programmes including Jewellery (Level 2 & 3), Glass Beads and Pottery Manufacturing. The groups of learners trained were from Johannesburg, Rustenburg, Klerksdorp and Bothe’s H4.

As part of their Local Economic Development (LED) Mining & Enterprise Development Programme the Bojanala Platinum District Municipality funded Mintek’s Small Scale Mining and Beneficiation Division to train 9 active small scale miners in a two week introductory course on small scale mining. This training intervention has improved the knowledge of these miners and will assist them to run their existing mining co-operative more safely and efficiently.

The Mining Qualifications Authority (MQA) awarded Mintek discretionary grant funding for training 90 learners in Small Scale Mining Programmes in the Mpumalanga Province. The duration of the project was six months. Mintek had successfully managed to train 60 of the learners by the end of the financial year. The areas were Bushbuckridge (25) and Ehlanzeni Local Municipalities (25). The training (theoretical and practical) focuses on small scale surface mining, safety, health and environment. Practical training was conducted at an operational small scale mine (quarry) in White River. The training of the remaining learners will be completed in the 2019/20 financial year.

### Collaborations and Science Promotions

Mintek works with industry, government and other R&D institutions to research, develop, and implement new and improved technologies and processes in the mineral and metallurgical sectors. Partnerships and collaborations extend both locally and internationally and each contributes to advancing the transfer of the scientific knowledge and strengthening the global minerals innovation pipeline.

**International**

- Test work on the Horizon 2020 funded project, INTMET, hosted in Fort Walton Beach, Florida. The project focused on on-site “mine-to-metal” hydrometallurgical processing of low-grade, complex, poly-metallic ores to achieve efficient recovery of valuable metals such as Cu, Zn, Pb and Ag. A flow sheet has been developed at Mintek for an integrated biocell-leaching-metal recovery pilot project based on the results obtained during a mini-plant pilot scale programme.

  - **Mintek hosted a Swedish University PhD Student, Lee Fowle on an exchange research programme for corrosion studies on antibacterial titanium alloys for biomedical applications at the Advanced Materials Division (AMD) from 11-20 March 2019. The visit was part of the Advanced Materials Initiative (AMI) – Ferrous Metals Development Network (FMDN) programme led by Mintek. Sponsored by the DST, DST-NRF Centre of Excellence in Strong Materials (CESM), the programme is part of the international collaboration strategy for AMI – FMDN programme with Mintek, the University of the Witwatersrand, Nelson Mandela University and Uppsala University (Sweden). Nonzombuloko Masia, a scientist in AMI and an MSc student at the University of the Witwatersrand is also part of the project focusing on corrosion of titanium alloys for biomedical applications. As part of the collaboration, Ms Masia visited Uppsala University in December 2018 on an exchange research programme to perform an in-vitro evaluation on titanium alloys for her MSc project. Through this R&D collaboration, Mintek will be in a position to access the state-of-the-art materials characterisation facilities at Uppsala University, University of the Witwatersrand and Nelson Mandela University as part of a student exchange programme, with a possibility of joint publications.

- **South Africa and China**

  - Mintek’s Small Scale Mining and Beneficiation Division (AMD) from 11-20 March 2019. The visit was part of the Advanced Materials Initiative (AMI) – Ferrous Metals Development Network (FMDN) programme led by Mintek. Sponsored by the DST, DST-NRF Centre of Excellence in Strong Materials (CESM), the programme is part of the international collaboration strategy for AMI – FMDN programme with Mintek, the University of the Witwatersrand, Nelson Mandela University and Uppsala University (Sweden). Nonzombuloko Masia, a scientist in AMI and an MSc student at the University of the Witwatersrand is also part of the project focusing on corrosion of titanium alloys for biomedical applications. As part of the collaboration, Ms Masia visited Uppsala University in December 2018 on an exchange research programme to perform an in-vitro evaluation on titanium alloys for her MSc project. Through this R&D collaboration, Mintek will be in a position to access the state-of-the-art materials characterisation facilities at Uppsala University, University of the Witwatersrand and Nelson Mandela University as part of a student exchange programme, with a possibility of joint publications.

  - **South Africa and China** launched the Joint Research Centre (JRC) on the Development and Utilisation of Mineral Resources at Mintek on 14 September 2018. The launch was officiated by The South African Director-General of Science and Technology, Dr Phil Mzimela, and the Chinese Vice Minister for Science and Technology, Xu Nanping. The JRC is a China - South Africa collaboration that is a branch of the President of the Republic of South Africa, Cyril Ramaphosa and by the People’s Republic of China’s President Xi Jinping. Mintek is playing a key role in hosting the JRC on behalf of South Africa, with the Beijing General Research Institute of Mining and Metallurgy (BGRIMM) in China. The Centre is expected to facilitate the beneficiation of mineral resources whilst enabling both countries to share the experience and work in synergy to boost their growth.

- **In the Nanotechnology Group, a European Union (EU) Horizon 2020 proposal entitled, NanoformTAX was accepted for funding. The grant is for a consortium that comprises several countries within the EU, the UK, the USA, and South Africa. The R&D covered in this collaboration will include synthesis of nanomaterials for various applications, and this will be backed up by extensive modelling and toxicity evaluation. The grant will support research activities, traveling and hosting of international collaborators.

- **Senior staff members in AMD attended the following strategic international conferences:**

  - The first workshop with the theme: “Non-Classical Behaviors in Biological Functions/Potential for Smart Sensing”, took place on the 12-13 April 2018 at the Virginia Tech Research Centre in Arlington, Virginia, USA. The workshop was jointly organized by the US Airforce Office of Scientific Research (AFOSR), the Johns Hopkins University and the National Institutes of Health (NIH). The second conference was the 2018 AFOSR Biophysics Program Review which took place on the 16-20 April 2018. The third conference, which was hosted by the University of Pretoria, was the 2018 Program Review of Aerospace Materials for Extreme Environments, which took place from the 14–18 May 2018. At all these conferences, senior Mintek staff delivered oral presentations on relevant and aligned research.
• Representatives of the Hydrometallurgy division met with a delegation from Namibia University of Science & Technology (NUST) and discussed potential collaboration on technology development projects as well as potential commercial projects. NUST has interactions with local Namibian commercial operators and believe that Mintek may be a valuable partner for them in these interactions to provide comprehensive solutions to these clients.

• A joint collaborative Zambia/South Africa research project entitled, “Evaluation of safety of copper (Cu), copper oxide (CuO) and zinc oxide (ZnO) nanoparticles using protocenes techniques for eventual application in drug for cancer treatment”, was invited to submit a proposal for the up-scaling of nanomaterials to the National Technology Business Centre of Zambia and Technology Innovation Agency of South Africa. The progress towards commercialization of R&D outputs augurs well with the funding provisions of this Zambia/South Africa collaborative partnership.

• A grant was awarded by Technology Innovation Agency (TIA) of South Africa to support the up-scaling of Smart Copper Based Nanoparticles for drug carriers for the treatment of cancerous tumours. This is a joint collaboration project with Copperbelt University (CBU) in Zambia.

• The 18 delegates at the opening of the 4th Training Programme on Minerals Processing and Beneficiation, from the member states of NAM/S&T and other developing countries.

• Mintek, in collaboration with UNISA, unveiled a state-of-the-art 3D X-ray microscopy system that enables analysts to “see inside” a mineral sample without physically breaking it down. The 3D imaging facility is similar to the CT scan that is used for imaging the human body, and can be used on different materials. It will improve both Mintek’s and UNISA’s analytical work.

• Mintek held a PGM Symposium on 27 June 2018 that was attended by about 100 delegates from industry and academic institutions. Several mineral processing topics were discussed and presentations for Mintek were made by Dr Victor Ross on “Flowtion of PGMs with the Mach Hydrodynamic Cavitation Reactor”, Elzma Ford on “Fine Grinding in a HIG Mill to Reduce Energy Requirement” and Dr Mike Bryan on “Waves on Flowsheets and Technology for Complex PGM Ores”.

• A Mintek inter-group project on water and materials in collaboration with the Shell and South Africa Petroleum Refiners (Pty) Ltd (SAPREF) was finally cemented with a signing of a MoU. Material and water samples and technical information have already been exchanged, including a tour of the refinery premises for the purpose of understanding and prioritizing the needs of SAPREF. The R&D collaboration will include short-term intervention projects of the products and services (P&S) type and long-term research projects that will also include human capital development via the DST-AMI Ferrous Materials Development Network (FMDN) programme.

• Mintek partnered with Difeme Holdings Group (Pty) Ltd to contribute to the development of appropriate process technologies by providing technical services with the objective of advancing sustainable mining and minerals beneficiation in South Africa. This initiative is part of Mintek’s beneficiation strategy, as the Difeme Holdings Group, is a black owned mining startup company with a focus to mine and beneficiate Quartz (SiO2) to a purity standard of higher than 99.99%, which is very rare in the world.

• Diamond experts from around the world gathered at Mintek to discuss technical issues of footprinting and fingerprinting of diamonds. The Kimberley Process Certification Scheme (KPSC) has adopted to regulate the trade of rough diamonds. The Working Group of Diamond Experts comprised experts in the diamond industry who assist the KPSC in their endeavours to end the flow of conflict diamonds particularly on the African continent. In attendance were delegates from South Africa, Republic of Botswana, Namibia, Zimbabwe, Democratic Republic of Congo, United States of America and the European Union. Some of the technical issues discussed at the workshop related to the consideration to use the concept of Laser-Induced Breakdown Spectroscopy as an additional complimentary technique to the process.

• Mintek hosted the 3rd Stakeholder Workshop for the Leading Integrated Research Agenda 2030 in Africa (LIRA 2030) programme-funded project on 08 February, 2019, to discuss a feasibility study into the use of biogas to support potable water treatment systems for township communities in Diepsloot, Johannesburg. The workshop was attended by delegates from the South African Local Government Association (SALGA), City of Johannesburg, University of Johannesburg and Diepsloot Township community representatives. The study is also being conducted for the Chambisi Township in Zambia. The project seeks to find sustainable solutions through collaborative research, to address water challenges encountered in fast growing township communities in South Africa and Zambia.

• Members of the Ferrous Metals Development Network (FMDN) actively participated at the ArcelorMittal and Government R&D meeting in an effort to establish a Public-Private Partnership (PPP) collaborative framework to support the customisation of steel production in South Africa. This is both a localization and supplier development initiative geared towards empowering the small scale producers to be competitive suppliers both to the local and international markets. Mintek’s role is to provide R&D support to these partnerships.

• The second quarter of 2018/19 was a fruitful period for Mintek with a number of critical collaborations and partnerships resulting in tangible successes. The Minister of Mineral Resources, Hon. Gwede Mantashe hosted the Minister of Natural Resources and Environment from Russia, Dmitry Kobytkin at the Platinum Group Metals Conference held at Mintek. A delegation from Saudi Arabia’s Vice-Minister for Mining, Mr Khalid Al Murdasby and Burkinia Faso’s Minister of Mines and Quarries, H.E Oumarou Idriss visited Mintek to discuss potential areas of collaboration to build capacity in these countries’ mining sectors. Their presence followed on the bilateral discussions held with Minister Gwede Mantashe during the 25th Investing in African Mining Indaba held in Cape Town. The ministerial delegation

South Africa

Mintek, in collaboration with UNISA, unveiled a state-of-the-art 3D X-ray microscopy system that enables analysts to “see inside” a mineral sample without physically breaking it down.

From left, Prof Mamba, Executive Dean of CSET at Umla, Naoshio Maso and Mintek Board members Dr Sarah Mohala and Jacob Rakotondravony cutting the ribbon for the new microscopy system.
Human Capital Development

Mintek has for years played a critical and necessary role in the development of all its people. Always realizing that to reap the most benefits from its employees, it needs to invest actively in them. Over the years, bearing testament to this, is increased employee satisfaction, improving retention rate of our researchers, better employee and client engagement and improved organizational communication. These inevitably lead to a greater, positive organizational culture, which creates engaged and happy employees. Mintek also believes that employees who are receiving professional education and development are less likely to seek other employment opportunities.

Mintek researchers enjoy national recognition

Dr Joalet Steenkamp, a Chief Engineer and pyrometallurgy expert at Mintek has recently been appointed as an Adjunct Professor at the University of the Witwatersrand’s School of Chemical & Metallurgical Engineering. Dr Steenkamp will enjoy a three-year visiting appointment starting in February 2019 within the school’s Faculty of Engineering & the Built Environment.

Joalet joined Mintek in 2014 after completing her Ph.D. in Metallurgical Engineering at the University of Pretoria. Prior to that, she had 12 years’ experience in industry (steelmaking, ilmenite roasting and smelting, and manganese ferro-alloy production) – and 3 years’ experience in academia where she taught courses in pyrometallurgy on both undergraduate and postgraduate level. Her main research interests are furnace tapping and production of manganese ferro-alloys. She mainly conducts industrial research for which she was recognised by professional bodies both locally and abroad. Joalet also holds B.Eng., B.Eng.Hons., and M.Eng., degrees in Metallurgical Engineering, all conferred by the University of Pretoria.

She is a Fellow of the Southern African Institute of Mining and Metallurgy, a member of The Minerals, Metals & Materials Society (TMS) and a registered professional engineer (P.Eng.) with the Engineering Council of South Africa (ECSA). The South African National Research Foundation (NRF) rated her in 2017 as an ‘Established Researcher’. In 2018, TMS invited Joalet to serve as the chair of the newly established Industrial Advisory Committee for a period of two years, and as member for three years.

On 12 November 2019 Mr Joseph Moema, Head of Physical Metallurgy at Mintek was elected as Secretary for the South African Association of Shipbuilders and Repairers (SAASR). The objective of being members of this association (which also includes Dr Jones Papo, Manager of Mintek’s Advanced Materials Division) from a strategic point of view is to find areas of research and development, identify collaborative partners in the shipbuilding industry and develop advanced materials/ coatings for corrosion mitigation and control. This is in alignment with the government policy - Operation Phakisa: Oceans Economy, that was launched in 2014. Their focus is to play a significant role to the Department of Transport plans e.g. to maintain and refurbish existing marine facilities being degraded by corrosion. Being a secretary of the association will enable Mintek to be at an advantage or have preview to key information about the shipbuilding industry.

Mr Joseph Moema, Master of Technology in Physical Metallurgy, currently pursuing his PhD studies at University of Pretoria.

Joalet joined Mintek in 2014 after completing her Ph.D. in Metallurgical Engineering at the University of Pretoria. Prior to that, she had 12 years’ experience in industry (steelmaking, ilmenite roasting and smelting, and manganese ferro-alloy production) – and 3 years’ experience in academia where she taught courses in pyrometallurgy on both undergraduate and postgraduate level. Her main research interests are furnace tapping and production of manganese ferro-alloys. She mainly conducts industrial research for which she was recognised by professional bodies both locally and abroad. Joalet also holds B.Eng., B.Eng.Hons., and M.Eng., degrees in Metallurgical Engineering, all conferred by the University of Pretoria.

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Dr Phumlani Tetyana is part of the cohort of Mintek Research Scientists who are involved in the development of rapid diagnostic devices for the detection of human and animal diseases. Phumlani first joined Mintek in April 2010 as an intern, after completing an honours degree in Biochemistry and Microbiology. He then obtained an MSc degree in Physiology (Cum Laude), through the University of Pretoria in 2015. He went on to obtain a PhD in Chemistry through the University of the Witwatersrand in July 2018. His research focused on the synthesis of various nanomaterials and functionalization with biological molecules for subsequent use in the development of rapid diagnostic tests. Phumlani has co-authored several publications and has disclosed a patent and several discoveries.

Dr William Shipman joined Mintek as an Engineer-in-Training in 2015 after obtaining his M.Eng in Electrical and Electronic Engineering at the University of Johannesburg funded by a Mintek bursary. He immediately continued his studies with a further Mintek bursary, graduating with a D.Eng in Electrical and Electronic Engineering from the University of Pretoria. Dr Shipman is working on machine learning applications in process control for metallurgical processes.

Dr Sanele Nyembe obtained his PhD in Chemistry through the University of the Witwatersrand in December 2018 with the research title: “Group III-V Nanostructures Application in Gas Sensing”. Sanele is part of the team in the Mintek Nanotechnology Innovation Group. He joined Mintek in 2012 and has also obtained an MSc in Metallurgical Engineering.

A bright future on the horizon as we harness the skills and talents of our workforce

Mintek sustains its efforts in building the next crop of PhDs. Mintek gives financial support and allows a flexible study schedule for its staff to enrol for both undergraduate and postgraduate studies. Financial support is prioritised for staff that continue with further studies in areas that align with Mintek’s mandate and mission as a Science Council.

• Tshiamo Legoaile, benefited from the Mintek Pipeline programme. She joined Mintek in 2012, as a scientist-in-training, after completing a BSc (Hons) in Geology with the University of the Free State. In June 2018 she obtained a Master of Science (Cum Laude) through UFS for her research on an environmentally conscious manner of scavenging gold from old mine tailings using phyto-hyperaccumulators. Legoaile was awarded the Matlantla Seaman award for the best student in Environmental Management by the University. In June 2017 in front of a packed audience Legoaile made South Africa proud by winning both the audience and the judges’ vote at the FameLab International competition which took place at the Cheltenham Science Festival, in the UK. She is the first South African contestant to win the international title.

• Refilwe Moleletsi who joined Mintek in 2012 also completed her MSc in 2018 through the University of the Witwatersrand. Her research work on sustainable development in the small-scale mining sector encouraged her to pursue her studies in Environmental Management focusing on assessing environmental impacts in the mining sector using Remote Sensing and Geographic Information System.

• Sydney Mantsho, obtained a Master of Engineering (Extractive Metallurgy) from the University of Witwatersrand in July 2018. Sydney first joined Mintek as an Engineer-in-Training in 2007, after completing a BSc in Chemical Engineering from the University of the Witwatersrand.

• Veronica Morudo completed an MSc Engineering in Metallurgy through the University of the Witwatersrand in December 2018. She is part of a team working on corrosion and wear tests through the Advanced Metals Initiative (AMI-FMDN) Metal Dusting Programme.

• Carla Da Corte completed an MSc Engineering in March 2019 with distinction through the University of the Witwatersrand. Her research topic focused on improving the separation efficiency of hematite from slimes through selective flocculation.

• Joseph Moema obtained his MSc (Applied Science) Metallurgy at the University of Pretoria in 2019. His research project was titled: “The Role of Retained Austenite on the Performance of High Chromium White Cast Iron and Carbidic Austempered Nodular Iron (CANI) for Grinding Ball Applications”.

Cultivating the next generation of scientific leaders

Dr Asimenye Kapito joined Mintek in 1999, as a student bursar, and completed a Bachelor’s of Science in Engineering in Materials Engineering in 2003 at the University of Cape Town. After obtaining her MSc in Engineering Materials and Metallurgical Engineering from the University of the Witwatersrand, she started work as an Engineer-in-Training in 2005. She continued her studies with a further Mintek bursary, graduating with a PhD in Engineering from the University of Pretoria in April 2019, entitled: ‘The Design of a Carbide-Free Alloy Composition and Heat Treatment Process for Forged Rail Wheel Application in South Africa’. Asimenye has worked at Mintek as an Engineer-in-Training (2006-2007), Engineer (2007-2012) and Senior Engineer (2012 to date) in the Physical Metallurgy Group of the Advanced Materials Division. She is part of the research and consulting team and lead researcher on the AMI-FMDN programme.

Dr Sanele Nyembe obtained his PhD in Chemistry through the University of the Witwatersrand in December 2018. Sydney first joined Mintek as an Engineer-in-Training in 2007, after completing a BSc in Chemical Engineering from the University of the Witwatersrand.
As a science council, Mintek plays a critical role within the South African landscape in respect of research, innovation, service delivery, development and growth.

The determination of Mintek’s remuneration strategy and policy is among the duties of the Human Resource Committee (HRC).
### 5.1 Corporate Governance Report

Being a global leader in its field also means that Mintek’s business practice has to be world class. As such, Mintek endeavours to ensure that business processes, systems and controls are governance compliant while ensuring efficiency in business. As a science council, Mintek plays a critical role within the South African landscape in respect of research, innovation, service delivery, development and growth.

### 5.2 Governance Framework

There are a few legislation frameworks that Mintek operates within, they are:

- The Mineral Technology Act No. 30 of 1989;
- The Public Finance Management Act (PFMA), which also governs Mintek and finance management related matters per specie as a Schedule 3B Company;
- The King IV Report which aims at promoting best practice in corporate governance across organisations and applies to public entities and public enterprises that fall under the PFMA; and
- The Governance Protocol which provides guidance to Mintek and finance management related matters per specie as a Schedule 3B Company.

The Governance Protocol which provides guidance to Mintek and finance management related matters per specie as a Schedule 3B Company.

The governance structure depicted below, reflects the inter-related relationships, factors, and other influences upon the political-economic sphere. While the Protocol applies to Mintek, it does not seek to supersede the King Code, but rather amplify the requirements. According to The Protocol, Boards constitute a fundamental base of corporate governance, and as such, Mintek must be headed and controlled by an effective and efficient Board appointed in terms of the Mineral Technology Act.

The governance structure depicted below, reflects the inter-related relationships, factors, and other influences upon the institution. Governance structure is often used interchangeably with governance framework as they both refer to the structure of the governance of the organisation.

#### Mintek Governance Structure

<table>
<thead>
<tr>
<th>SHAREHOLDERS AND STAKEHOLDERS</th>
<th>BOARD OF DIRECTORS</th>
<th>EXECUTIVE MANAGEMENT</th>
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#### EXECUTIVE MANAGEMENT

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<tr>
<th>ICT Steering Committee</th>
<th>Risk Steering Committee (RSC)</th>
<th>Skills Development Committee</th>
<th>Diversity Forum</th>
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<tbody>
<tr>
<td>Authorises and directs development of the strategic and operational plans for ICT resources; ensures that ICT resources strategic and operational plans align with the organisation’s directions; and reviews and approves business cases to ensure that ICT resources are optimised.</td>
<td>Identifies the key strategic risks that would prevent achievement of Mintek’s objectives; assigns ownership of specific identifiable risks; evaluates the significance of each risk; assesses Mintek’s risk appetite; identifies suitable responses and mitigating actions to each risk; ensures that the internal control system helps manage the risks; and regularly reviews the RM Policy and the Risk Implementation Plan.</td>
<td>Evaluates the skills development needs of the employees and the organisation and continually evaluates the implementation of identified needs. Develops and implements external and internal skills development strategies. Monitors the progress of the skills development of the organisation. Monitors the implementation of the Workplace Skills Planning.</td>
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#### DIVERSAL MANAGEMENT / OPERATIONAL

Core technical divisions supported by service divisions and operational & project committees and forums.
The role of the Board is to organise and direct the affairs of Mintek and its subsidiaries in a manner that seeks to maximise the value of Mintek for the benefit of its shareholders as a whole, while complying with relevant regulatory requirements, the Mintek Act, and relevant corporate governance standards. The Board has overall responsibility for reviewing Mintek’s strategic plans and performance objectives, financials, operations, funding and investment proposals and legislative and corporate governance in terms of the Mintek Act, the Public Finance Management Act and other relevant requirements of reports on Corporate Governance matters for South Africa.

In essence, the Board plays a fundamental role in corporate stewardship and performance.

The Board currently comprises the Chairperson, the Deputy Chairperson, the Chief Executive Officer as Ex-officio and eight Non-Executive Directors. The Mineral Technology Act prescribes the minimum and maximum number of Board members. There are also two Independent Non-Executive Directors, appointed by the Board, who serve only on the Audit and Risk Committee (ARC). The broad range of skills and experience Board members bring to Mintek are set out further below.

The ultimate control as to the composition of the Board rests with the Minister of the DMR, who can appoint and dismiss a Board member. The current Board has been appointed effective 01 June 2016 and their three year term will end only on 31 August 2019, after being extended by three months.

The members of the Mintek Board and Committees and their roles are listed below.
Non-Executive Directors

Mr Maroale Jacob Rachidi
PTC; MDP; CCP
Value add to the Board
Corporate governance, administration and ICT governance and programming

Mr Rantsadi Andries Moatshe
Masters in Environmental Management
Value add to the Board
Corporate governance, administration and mine rehabilitation

Mr Dumisani Dlamini
MCom; PGD in Bus Mngt; BTech; BCom; N Dip Accounting; Prof Accountant SA; Chartered Director SA
Value add to the Board
Experience in finance and auditing fields

Dr Sarah Mohlala
PhD Chemistry; MSc; BSc Hon
Value add to the Board
Chemistry, strategy and business analysis/intelligence

Ms Khetiwe McClain
BA in Fine Arts
Value add to the Board
Corporate governance, administration and mine rehabilitation

Dr Siyabonga Simayi
PhD in Ops Mngt; MBA; BTech; N Dip; Pr Tech Eng
Value add to the Board
Metallurgy, operations, mining and environmental geology

5.4 Board, Committees and their Functions

The Board is supported by a number of committees to which it has delegated certain powers. These committees are the Audit and Risk Committee (ARC), the Human Resources Committee (HRC) and the Technical Committee (TC). Each of the three committees has its own Terms of Reference (ToR) and or Charter and their roles are summarised further below.

Members of the Board are appointed based on their business acumen, experience and knowledge, as well as other relevant skills. The Board is accountable to the Minister of Mineral Resources and as a result a shareholder performance agreement (the Compact) has been concluded between the Board and the Executive Authority. The Compact entails strategic objectives to be achieved and forms the basis for quarterly performance reporting to the Executive Authority on these objectives. Mintek has a Board secretariat that is responsible for ensuring Board support to enhance maximum Board functioning.

The Board meets at least four times a year. As warranted by particular circumstances, ad hoc meetings are also convened to deliberate on urgent, substantive matters. The Board reserves at least one day per year to discuss the strategic long-term plan of the organisation and its subsidiaries. Board meetings, with the exception of certain in-camera sessions, are attended by all members of executive management. Furthermore, selected members of executive management and senior management participate in certain committee meetings.

Non-Executive Directors
GOVERNANCE

Board approved Charters and/or ToRs

The Audit and Risk Committee (ARC)

The ARC is established to assist the Board in discharging its duties relating to:

**COMMITTEE OBJECTIVES**

- Effectiveness and efficiency of operations;
- Safeguarding of the company’s tangible and intangible assets (including information);
- Compliance with applicable laws, regulations and supervisory requirements;
- Supporting business sustainability under normal as well as adverse operating conditions;
- Reliability of reporting;
- Behaving responsibly towards all stakeholders;
- The operation of adequate systems and control processes; and
- The preparation of accurate financial reporting and statements in compliance with all applicable legal requirements and accounting standards.

**HIGHLIGHTS OF ACTIVITIES FOR THE YEAR**

- Approved the revised ARC & internal audit charters for 2018, the internal audit strategic plan for 2018/20 to 2021/22 and the Shareholder Agreement sections dealing with the group financials the group financials and risk management;
- Approved the Mintek Group Management and Group Audit Reports for 2018;
- Approved the Mintek audit strategy for 2019/20;
- Interrogated the ICT steering committee activities, internal audit quarterly reports, tip-offs and theft and fraud quarterly reports;
- Approved the Internal Audit Methodology;
- Discussed and monitored risk steering committee activities;
- Approved the audited financial statements and the financial performance scorecard for 2018;
- Approved the Mintek Act – Legislative Review;
- Approved the Mintek Quality Assurance and Improvement Programme;
- Through consultation and agreement with the AGSA, approved the Mintek group management and audit reports for 2018;
- Approved and recommended for Board approval, the Remuneration, SAT Standard Operating Procedure for Board member remuneration.

The Human Resources Committee (HRC)

The HRC is established to assist the Board, amongst others, in:

**COMMITTEE OBJECTIVES**

- Reviewing and determining human resource-related policies, including conditions of employment, reward, remuneration and retention policies;
- Reviewing aspects of the shareholder’s compact that relate to human resource development, and reviewing performance against targets; and
- Consideration of the annual review of remuneration packages.

**HIGHLIGHTS OF ACTIVITIES FOR THE YEAR**

- Approved the following revised policies:
  - o Bursary policy
  - o HR Scorecard for 2018/19;
  - Mintek Act – Legislative Review;
- Approved the 2017/18 annual salary increases and incentive bonuses for qualifying staff.
- Tracked Mintek’s CSI activities.
- Revised the HRC Charter.
- Tracked reports on employee relations, staff appointments and terminations, employee wellness, employment equity and human capital development.

The Technical Committee (TC)

The TC is established to assist the Board in discharging its duties relating to:

**COMMITTEE OBJECTIVES**

- Assists the Board in discharging its duties relating to the legal mandate of Mintek regarding its core business.
- Provides a forum for discussing technical issues for consideration by the board in informing strategy development and implementation in Mintek.
- Actively utilizes the expertise, project proposals and financing thereof, looking into various co-operatives and related strategies and the positive expansion of Mintek business within the said mandate.

**HIGHLIGHTS OF ACTIVITIES FOR THE YEAR**

- Approved the planned international visits for 2018/20.
- Approved the technical sections of the 2019 Shareholder Agreement.
- The Performance Scorecard 2017/18 relating to operational achievements.
- Monitored the visits of Mintek Executives to CEOs of mining companies, in an effort to better sell Mintek’s technologies and establish collaborative partnerships.
- Reviewed, MTEF projects, Science Vote projects, corporate SHEQ activities and safety statistics.
- Approved the Mintek Act – Legislative Review.

As seen above, the work of the Board and Committees ensured that Mintek’s operations were conducted with due regard to the expectations and needs of all its stakeholders, the safety and health of employees and the communities that Mintek serve, and the development of effective systems which ensure proper access to and dissemination of credible and auditable information.

Both the Board and Committee meetings are held in an environment of intellectual honesty of purpose, truthfulness and mutual respect. These meetings require reporting of the highest standard by management and vigorous and constructive challenge and debate among all members.

### Board and Committee Meeting Attendance

<table>
<thead>
<tr>
<th>Name of Board and/or Committee Member</th>
<th>Scheduled</th>
<th>Board</th>
<th>ARC</th>
<th>HRC</th>
<th>TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr Namane Dickson Masemola (Board Chair)</td>
<td>3/4</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Mr Marcal Rachidi (Board Deputy Chair)</td>
<td>4/4</td>
<td>4/4</td>
<td>4/4</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Mr David Msiza (Ex-officio &amp; Acting CEO)*</td>
<td>2/2</td>
<td>2/2</td>
<td>2/2</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Mr Sakhile Simelane (Ex-officio &amp; Acting CEO)**</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td></td>
</tr>
<tr>
<td>Dr Molefi Motuku (Ex-officio &amp; CEO)***</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td></td>
</tr>
<tr>
<td>Mr Dumisani Dlamini</td>
<td>3/4</td>
<td>4/4</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Mr Dlam du Toit</td>
<td>3/4</td>
<td>n/a</td>
<td>n/a</td>
<td>2/3</td>
<td></td>
</tr>
<tr>
<td>Ms Khetiwe McClain</td>
<td>4/4</td>
<td>n/a</td>
<td>3/4</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Mr Rantsadi Moatshe</td>
<td>4/4</td>
<td>n/a</td>
<td>3/4</td>
<td>3/3</td>
<td></td>
</tr>
<tr>
<td>Dr Sarah Mohlala</td>
<td>4/4</td>
<td>n/a</td>
<td>n/a</td>
<td>3/3</td>
<td></td>
</tr>
<tr>
<td>Ms Samke Ngwenya</td>
<td>4/4</td>
<td>3/4</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Mr Pahnani Mhomboro</td>
<td>4/4</td>
<td>4/4</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Dr Sibonong Simayi</td>
<td>3/4</td>
<td>n/a</td>
<td>n/a</td>
<td>3/3*</td>
<td></td>
</tr>
<tr>
<td>Ms Tumi Hongwane</td>
<td>n/a</td>
<td>4/4</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Mr Mpolo Moalusi</td>
<td>n/a</td>
<td>2/4</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
</tbody>
</table>

* Acting CEO from 14 September 2017 to 31 July 2018
** Acting CEO from 01 August 2018 to 31 December 2018
*** CEO from 1 January 2019
Board performance and evaluation

An annual assessment is conducted on the effectiveness of the Board, Committees and the Company Secretary. For the 2018/19 financial year the Institute of Directors in Southern Africa NPC (“IoDSA”) has been appointed as an external independent service provider to conduct the annual Mintek Board Evaluation.

The Board self-appraisal entailed a review of areas such as Board composition, Board culture, Roles and Responsibilities, Board Committees and Board Role Players. The Board Committees self-appraisal entailed a review of Committee Composition, Roles and Responsibilities, Interaction with Management, and Committee Meetings. The Company Secretary Peer appraisal was premised on the provisions of best practice standards and expectations of the specific role and/or conduct of the Company Secretary. This in essence was a peer review of an individual’s performance and is not an independent assessment of that individual’s performance nor an independence assessment.

The results and report on the evaluation will be made available towards the end of the first semester.

Statement by the Board

The Board hereby considers Mintek’s annual financial statements to be a fair representation of its financial position at year-end in terms of the South African Standards of Generally Recognised Accounting Practice (GRAP) and as required by the Public Finance Management Act.

The Executive Management Team comprises the Chief Executive and five general managers responsible for corporate services, finance, business development, technology development and research and development. The main responsibilities of the Chief Executive include: executive leadership, formulation and implementation of Group strategy as agreed by the Board; approval and monitoring of business plans, organizational structure; business development; and stakeholder relations.

The Executive team prepares and guides the development of Mintek’s processes and business operations as well as the common functions. The team handles, in particular, Mintek’s strategy, budget, major procurements and projects, as well as major policies of administration. The executive management team consists of:

As of 1 January 2019, Dr Molefi Motuku took over the helm as Chief Executive Officer of Mintek. He re-joins Mintek with a strong track record of over 20 years in research and development, technology innovation, leadership and management. Prior to this appointment, he served as Group Executive for Research and Development at the Council for Scientific and Industrial Research (CSIR).

He held roles of CEO at the National Metrology Institute of South Africa (NIMISA) and acting CEO for CSIR. He was the General Manager for Research and Development at Mintek from 2005 to 2010 and a Manager in the Physical Division, (now renamed Advanced Materials Division) and a Director of Fort Hare Institute of Technology.

Dr Molefi Motuku
Chief Executive Officer
PhD and MSc degrees in Materials Engineering, BSc in Mechanical Engineering, BSc Physics.
Research and Development, Corporate Governance, General Management, Strategic Planning.

Mr Sakhi Simelane
General Manager: Finance
MBA, BCom Hons (Auditing), BCom Finance, Auditing and General Management.

Ms Gugulethu Nyanda
General Manager: Corporate Services
MBA, BA Hons, BPaed, Dip, HRM Corporate Governance, Human Resources Management, Strategic Planning, Communications, Integrity & Compliance Management.

Dr Makhapa Makhafola
General Manager: Research and Development
PhD (Analytical Chemistry), MSc, PGD in Project Management, BSc Honors Analytical Chemistry, Advanced Materials, Quality Assurance, General Management.

Mr Alan McKenzie
General Manager: Technology
MSc, BSc Honors Analytical Services, Pyrometallurgy, Minerals Processing, General Management.
Performance Against Mintek’s Sustainability Focus Areas
Investing in Mintek’s people
Safety, Health and Wellbeing of Mintek’s People
Protecting the Environment
Corporate Social Responsibility
SUSTAINABLE DEVELOPMENT

The Annual Women Recognition Awards is one of the empowerment efforts that Mintek utilises to realise the voluntary stretch target of 46% female representation at Mintek.

From Left Moshili Ramolelepo, Jatson Ilu, Joshua Trace and Uzile Mkhumbusi, 1st Place winners of the 2018 Minquiz™ Nationals.
For a global leader in its field, it is vital for Mintek to adopt a business practice of sustainable development. Mintek has therefore tailored its activities, to not only meet the needs of its stakeholders, but also ensuring that its practises enhance, protect and sustain human and natural resources for the future. The activities vary from upskilling the workforce to raising awareness and funds for just causes.

**Sustainable Development**

**Performance Against Mintek’s Sustainability Focus Areas**

Table 6a: The table below lists Mintek’s sustainability-related focus areas and summarises its progress in addressing these areas.

**Investing in Mintek’s people**

<table>
<thead>
<tr>
<th>How Mintek performed in 2018/19 FY</th>
<th>What Mintek is committed to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocated 44 full-time (57% UG and 43% PG) and 101 part-time bursaries (38% Master’s and 11% doctoral) towards feeding its bursary pipeline and for the recruitment and retention of critical skills.</td>
<td>Increase efforts to produce, retain and attract staff with PhD and MSc degrees, as is befitting a research institution.</td>
</tr>
<tr>
<td>Exceeded target of 5% for percentage staff with PhD’s, Mintek currently has 7%.</td>
<td>Continue with the good progress made towards achieving employment equity, and in particular, increase the female component at Mintek.</td>
</tr>
<tr>
<td>14% staff with Masters degrees exceeds the target of 10%.</td>
<td>Continue rolling out more empowerment strategies for women and people with disabilities.</td>
</tr>
<tr>
<td>Mintek reached its target by hosting 60 Work-Integrated Learning, Studentships and Internship Programmes.</td>
<td>Continue efforts to build a values-driven high-performance culture across all of the operations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How Mintek performed in 2018/19 FY</th>
<th>What Mintek is committed to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trained 9 learners on the artisan learnership programme and exceeded the target of six by 50%.</td>
<td>Increase innovative activities centred on graduate mentoring and training of mentors.</td>
</tr>
<tr>
<td>Mintek currently has an overall 92% of designated group representation (towards achievement of EE targets). This exceeds the target of 90%.</td>
<td>Further develop the capability and increase the ability of Mintek to attract a broad spectrum of young graduate scientists and/or engineers that are skilled and ready for the 4th industrial revolution.</td>
</tr>
<tr>
<td>As in last year, achieved the target of 3% for employees with disabilities.</td>
<td>Continue to enhance the organization’s comprehensive occupational and primary health management and wellness programmes.</td>
</tr>
<tr>
<td>Achieved 9% staff turnover rate against a target of 9%.</td>
<td></td>
</tr>
<tr>
<td>Target achieved for hosting five wellness interventions for the year.</td>
<td></td>
</tr>
<tr>
<td>Spent 2.1% of payroll on training and development interventions for its employees.</td>
<td></td>
</tr>
<tr>
<td>Against a target of an average of 6 years of Mintek experience for its researchers, Mintek was able to achieve an average of 9 years, well above the target.</td>
<td></td>
</tr>
<tr>
<td>Average age of researchers at Mintek at 39 years against a target rate of 33.</td>
<td></td>
</tr>
<tr>
<td>Labour turnover for overall staff and professionals is relatively high at 11% and 13% against a target of 9% and 10% respectively.</td>
<td></td>
</tr>
</tbody>
</table>
Mintek’s response to environmental challenges

**How Mintek performed in 2018/19 FY**

- A total of 14.5 tonnes of waste comprising cardboard, paper, plastic and other were recycled, compared to 2.5 tonnes the previous year.
- A total rebate of R60 925 was received for recycled scrap metal, cardboard, paper, plastic and other compared to the previous year of R20 526. This represents an increase of 197%.
- Approximately 29 tonnes of scrap metal was recycled, compared to approximately 24 tonnes the previous year, up by 21%.
- Total carbon emissions measured for the year amounted to 12 392.61 tCO2e, down by 2.5% on the previous year result of 11 982.18 tCO2e.
- Total water consumption has increased from 46,153 kilolitres last year to 46,524 kilolitres this reporting period, an increase of nearly 1%.

**What Mintek is committed to**

- Continue with investments and increased investigations to reduce atmospheric emissions.
- To intensify efforts to save water through the reticulation project.
- Mintek should fast-track the current project pertaining to the recycling of effluent plant water for reuse.
- Investigate the harvesting of rainwater on Mintek premises for use in operations.
- Enforcing the movement of water saving awareness e.g. display all water consumptions (similarly to the electricity consumptions) via the display panels in the Block 9 foyer and roll out in other public areas on the campus.
- The required electronic meters are being bought to record the most important consumption points.
- Continue to document all water losses across the campus including evaporation and seepage.

The quality of Mintek’s work

**How Mintek performed in 2018/19 FY**

- Mintek produced an average external customer satisfaction frequency rate of 89%, against a target of 80%. The slight drop from last year’s 93% is as a result of customer complaints on Mintek’s order and payment processes. These are being addressed by Finance and Supply Chain Management.
- All technical divisions reached their 80% target for project information chart (PIC) submission success. PIC is a measure of the quality of the initial information on environmental aspects and compliance with Mintek codes and policies. PIC submission success rate ranged between 90% and 100%, with all but 1 out of 9 divisions scoring 95% or higher.
- In terms of IP creation and transfer, Mintek filed 3 patents, registered 16 discoveries (IPR_PFDR Act). Both are below the annual targets and the loss of skilled personnel during the year was a major contributor for the below target performance.
- Mintek produced 59 technical articles in credible publications (2 up on last year’s achievement and 64% higher than the target of 36).
- Mintek participated in 109 conference presentations and posters. This is 51% higher than the target of 72.

**What Mintek is committed to**

- To continue with value-adding process improvements, process performance and management programmes with regards to quality of Mintek’s research and technology development work.
- To increase training interventions and ensure that more employees are educated on ISO9001 changes.
- To continually work on improving external and internal customer satisfaction rates.
- To continue to send young scientists and engineers to participate at relevant conferences all over the world. More focus will be placed on opportunities for young, black female scientists and engineers.
Employment statistics

For the review period ended 31 March 2019, the total permanent employee head count at Mintek was 576. This comprised 336 males and 240 females. The single biggest block of the head count is the skilled technical, academically qualified, junior management and supervisor occupational level that accounted for 53% of the total staff complement, followed by the semi-skilled occupational level at 20% that included our operators and technical staff responsible for operating the wide range of technical plant and equipment of Mintek. This profile is in line with the nature of the work of Mintek.

Mintek has a total of 85 professionals, specialists, and middle management-level employees, which represents 15% of the total workforce. At senior and top management levels Mintek has 15 senior managers (2.6% of the total) and 5 top managers, forming less than a percent of the total.

Table 6b: Mintek’s Employment Statistics

<table>
<thead>
<tr>
<th>OCCUPATIONAL LEVELS</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>C</td>
</tr>
<tr>
<td>Top Management</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Senior Management</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Professionals, Specialists and mid-management</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>Skilled technical, academically-qualified, junior management and supervisors</td>
<td>99</td>
<td>6</td>
</tr>
<tr>
<td>Semi-skilled</td>
<td>84</td>
<td>5</td>
</tr>
<tr>
<td>Unskilled</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Total Permanent</td>
<td>259</td>
<td>15</td>
</tr>
<tr>
<td>%</td>
<td>45%</td>
<td>2%</td>
</tr>
<tr>
<td>Gender%</td>
<td>58%</td>
<td>42%</td>
</tr>
</tbody>
</table>

*Non South African

Female representation at Mintek remains a key focus of the recruitment and gender transformation efforts. Impact of these efforts is evident in improving female representation which has reached the 42% mark in the period under review. While this is a commendable milestone, Mintek remains committed to pursue the voluntary stretch target of 46%, which is higher than the female component in the Gauteng economically active profile of the population.

Through women empowerment efforts such as the Annual Women Recognition Awards that is driven through the Diversity Forum, Mintek is well positioned to realise the stretch target. The efforts to encourage women in science and technology and, the attendant progress, are laudable as Mintek has come a base of 33% five years ago.

Mintek has a total of 17 (3%) staff that are classified as disabled. This is on par with the target of 3% for the year. The majority (59%) of these employees are categorised as skilled technical, academically-qualified, junior management and supervisors.

Pipeline development programmes

Effectively identifying and developing the next wave of scientists and engineers is crucial to Mintek’s ability to develop a healthy talent pipeline that supports succession and ensures business continuity. As mentioned above, Mintek has a healthy bursary programme that serves to maintain the desired flow of suitably qualified graduates over the long term. Furthermore, the Graduate Development Programme (GDP) and coaching and mentoring programmes provide a more structured approach to nurturing and advancing the skills and capabilities of both new graduates and existing employees in Mintek. The GDP emphasises on-the-job technical training supplemented with formal supervisory and management training. While the coaching and mentoring programme will promote a culture of continuous learning and growth within Mintek.

During the year under review Mintek awarded 44 full time bursaries. Some highlights include:
- Increased number of female bursars to 69% of the 44 bursaries awarded;
- 81% of the awarded bursaries are from the previously disadvantaged groups;
- 25 undergraduates and 19 postgraduate students benefitted from the bursary scheme.

A critical success factor of Mintek’s GDP is the regular assessments of the competency levels and progress monitoring of the graduate trainees at the different stages of their rotation amongst various Mintek divisions. Graduates are rated on the Mintek performance management system based on input that includes records of attendance and participation in training programmes. During the year the GDP was revamped to include rotation through the various strategic, support and service divisions to allow for an appreciation to be developed for the greater Mintek and to understand how these units operate. It is envisaged that this new rotation that includes exposure to support functions’ graduates will gain deeper understanding and appreciation for the Mintek business.

Mintek collaborates with the NRF, the DST, as well as the MQA to provide integrated learning opportunities at Mintek. The purpose of these internships is to provide young people with an opportunity to learn, gain work experience and/or improve their skills. Young people emerging from these internship are equipped not only be competitive and employable in the job market, but to also make a difference early in their employment. The NRF and DST programmes attracted 9 students. However the bulk of the 60 internship students currently at Mintek come from the collaboration with MQA. Thirty (30) MQA students are involved in the Work Integrated Learning (WIL) internship and thirteen (13) are involved in the Higher Education and Training programme.

The annual DST and NFP Internship Programme, known as the Professional Development Programme (PDP) currently has 9 students. The DST and the NRF have designed a professional development programme for Masters and Doctoral graduates to develop their research competencies in a real world environment outside of university at institutions such as Mintek, and other science councils as well as other research bodies. During the last quarter of the year there were seven candidates on this programme (three Pre-PhD and four Post-Doctoral).

DST/NFP Internship is a twelve month programme geared towards providing work experience opportunities for unemployed graduates. At the end of the year, there were two interns on the programme.

Both the PDP and the WIL programmes are examples of the success that can be attained of state entities who collaborate for the benefit of the country, and the beneficiaries of the programmes that would otherwise not obtain enriching experiential learning opportunities. Programme participants not only obtain an opportunity for practical learning experience, they also stand to be the first people to be considered for employment, should entry level positions become vacant. Equally, Mintek has an opportunity to identify high potential students who could be suitable for future absorption into the business ranks. During the second semester, the WILs were required to present their work as part of their programme close-off. Through these presentations, we were able to ascertain the positive impact that Mintek had on the students, as they came in with no technical experience at the beginning of the programme and are now exiting the programme with a wealth of technical knowledge.

Artisan learnership programme

The Artisan Learnership Programme is a unique initiative that is both an employee development and a pipeline development programme. Historically it has been observed that focus has been solely on growing internal candidates, but Mintek has since extended to include external participants. The motivation for extending the reach of the programme was primarily to recruit females into a field that has previously been dominated by males. Mintek has partnered with the MQA to deliver the programme. During the year under review, the programme enrolled nine learner-artisans, four internal learners and five external learners. All five of the external learners are female. Four of the five female artisan learners have successfully completed their programme, while one exited the programme due to maternity leave.
Awards and Recognitions

At this year’s Annual Excellence Awards, fifty employees across all divisions and levels received recognition for work excellence in various categories. The award recipients included:

**Awards: Annual Excellence Awards**

**Best Technical/Procedural Contribution below Grade A0**

Staff in the new categories of Best Technical / Procedural Contribution below Grade A0, included Vincent Nyai, (pictured here) for process development for production of glass ceramic composites from fly ash and waste glass. Runners-up in the category were Joseph Mashishi for flowsheet development and Tebogo Gopane for maintenance and development of pressure leaching facilities. Vincent Nyai, Senior Operator in Pyrometallurgy Division was announced winner in the Best Technical/Procedural Contribution category.

**Best Technical / Procedural Contribution at Grade AO**

In the Best Technical / Procedural Contribution at Grade AO category, for staff members, Driaan Bezuidenhout received an award for the design and built of Disposifurn™, a prototype muffle furnace for short term use.

**Best Young Researcher**

Dr Sanele Nyembe and Jakolien Strauss were joint winners in the Best Young Researcher category.

**Development**

Winners in the Development Category were Dr William Shipman, Dr Loutjie Coetzee, and Dominic Jordan for the development of an integrated cyanide analyser and dosage model predictive controller.

**Development**

Morthusi Marumo, John Neale, Richard Mavhunga and Kerri Du Preez (not included in the picture) also won in the Development category for the Biological Sulphate Reduction Pilot Plant.

**Technical Innovation**

The Technical Innovation category award went to a team from Biotechnology, Petrus Basson, Stefan Robertson, Nontobeko Nxumalo and Mpumelelo Nhlapo for developing a process which enhanced cobalt heap leaching from Copper/Cobalt Ores.

**Technical Innovation**

A team in the Nanotechnology Innovation Center (NIC), Dr Lucky Sikhwivhilu, Dr Sanele Nyembe, Dr Gebhu Ndlovu and Dr Morgan Shumbula (not included in the picture) also won in the Technical Innovation category for manufacturing a Carbon Monoxide Gas Sensor device based on Novel Semiconductor Nanowires.

**Technical Innovation**

A team led by Kabwika Bisaka, Ituleleleng Thobadi and Xolisa Goso and others took an award in the same category for developing of IMPRIL, an improved ilmenite smelting process.

**Procedural Innovation**

In the Procedural Innovation category, The MinPASS committee won for establishing the association at Mintek and volunteering their time, in order to play a significant role in improving the organisational culture.

**Procedural Innovation**

A team from Engineering and Maintenance Services (EMS) also won in the Procedural Innovation category for successfully developing and testing EasyComm, a wireless communication system that enables simple and reliable exchange of information between field instruments and a SCADA room.

**Recognitions**

Dr Alain Mwamba of Precious Metals Development Network (PMDN) was nominated by the South African National Accreditation Systems (SANAS) as a powder metallurgy specialist to assist them with the assessments of the CSIR Light Metals Laboratory.
Research is critical to what Mintek does and critical to the ongoing success of the institution. It is, by its very nature, an exploration of new ideas and new processes. Consequently, it may generate risks, which arise as a result of those processes, or by virtue of the way in which research is organised, conducted and managed.

Mintek’s Safety, Health, Environment and Quality (SHEQ) committee is a management committee that oversees the policies relating to safety, health, environment and quality and their implementation across Mintek. The SHEQ committee reviews operational performance, anticipates potential issues and provides support in setting direction for improvements. A functional safety, health, environment and quality unit provides a coordinated and effective specialist advisory support to the SHEQ committee.

Mintek has been certified by accredited independent external auditors to meet the requirements of safety and health (OHSAS 18001), environmental management (ISO 14001), and quality (ISO 9001). The following SHEQ scores were achieved at the end of the financial year, and can also be seen in the following graphs:

- The Lost Time Injury Frequency Rate (LTIFR) started at 0 on 01 April 2018 and ended on 0 on 31 March 2019 against a target of 1.0.
- There were no health incidents during the year, ending the Health Incident Frequency Rate (HIFR) on 0 and well below the target of 1.0.
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Mintek has been certified by accredited independent external auditors to meet the requirements of safety and health (OHSAS 18001), environmental management (ISO 14001), and quality (ISO 9001).
The meetings also review policy, objectives, targets and procedures of our SHEQ system, as well as customer satisfaction frequency rates, both internal and external. Some of the critical safety statistics are captured above and elsewhere in the report.

An analysis of the audit conducted within Information and Communications revealed gaps in risk assessments and details of risk control measures, planning in terms of achieving objectives and targets and document control.

Wellness and occupational health

Mintek’s employee wellness programme is a comprehensive programme that includes occupational and primary health management provided under the auspices of the Occupational Health Clinic, as well as the Employee Assistance Programme (EAP).

Provision of occupational health services at an organization means carrying out activities in the workplace with the aim of protecting and promoting workers’ safety, health and well-being, as well as improving working conditions and the working environment. These services are provided by Mintek’s occupational health team comprising a medical doctor, occupational health nursing staff, administrative staff and staff responsible for employee assistance programmes, including counselling for all facets of life.

The Mintek team closely monitors and reports to the Human Resources Committee on the following aspects of occupational health care:

- Medical surveillance programme (including entrance, periodic, exit and executive medicals);
- Medical surveillance testing (including audiometry, spirometry and biological monitoring);
- Injuries on duty (IOD); and
- Non-Occupational health (primary healthcare, wellness screenings, etc.).

An analysis of the audit conducted within Information and Communications revealed gaps in risk assessments and details of risk control measures, planning in terms of achieving objectives and targets and document control.

Non–occupational health programmes

Wellness and incentive programmes can be used to drive and reinforce healthy behaviours, bringing benefits to the employer, the employee, and to the community. Mintek recognizes the benefits of investing in the wellness of their employees, and that the wellness benefits it offers are appreciated by employees, positively impact their health and well-being and create long-term value for the organization.

Throughout the year the Occupational Health Clinic provided primary health care services (PHC), chest X-Ray services, an HIV Management programme and monitored canteen hygiene, and sent monthly food samples for external testing for all forms of bacterial analysis, including Listeriosis Monocytogenes. The results of these samples throughout the year indicated that the canteen is satisfactory and that food was safe for consumption.

The majority (>60%) of Mintek’s non occupational health care services is ascribed to PHC consultations, followed by Dr’s consultations (>10%), family planning services, chronic follow ups and occupational health follow ups. During the year, 300 employees underwent chest X-rays. Of these, 17 employees (5%) were identified to have some abnormalities of which 4 were referred further for TB screening. However, the results showed that there was no evidence of a recurring or new infection. The HIV Management programme provides support and treatment to employees who are affected by HIV. At the end of the year, Mintek had 25 employees (an almost even gender split) registered under the programme. Participants are provided with nutrition boosters as well as treatment to maintain a relatively healthier immune system. The nutrition boosters comprised booster packs, vitamins, meal boxes and Bactrim tabs. Approximately R45 000 was spent towards procuring these nutrition boosters.

Wellness interventions

Mintek’s wellness interventions varied from quarter to quarter and were based on demand. In general, interventions included pre-retirement planning workshops, staff counselling, blood donation drives, wellness screening days, breast light screening and events such as the Candlelight Memorial and an HIV/AIDS day.

At the end of this financial year, Mintek had 2 blood donation drives where a total of 29 employees successfully donated blood. This is in sharp contrast to the 60 employees who donated blood at 4 donation drives during the previous year. Some employees that were keen on donating blood, failed the standard screening tests and were counselled by the SANBS nursing staff. Mintek realizes that there is a need to develop communication strategies to reduce fear and to motivate donation of blood. In addition, there is a need to develop a philosophy of care based on humanization to increase recruitment of voluntary and habitual blood donors, and these will be considered by the organisation going forward.

Wellness screening events were conducted from 21-25 May 2018 and again from 10-11 September 2018. Health screening tests included blood pressure, cholesterol, glucose and body mass index. More than 200 employees benefited from the various activities on offer, which also included first-aid competitions, cancer screening, HIV management programmes, tuberculosis awareness campaigns and healthy lifestyle challenge competitions.

External provider conducting free eye tests for Mintek employees during Wellness Week in May 2018.
Deficient in the text

Mintek continues to integrate its sustainable development agenda, and associated programmes and standards fully in all activities and all functions as an essential element of management. Like most businesses, Mintek produces its fair share of waste. From excess packaging to uneaten food, this waste extracts a huge environmental toll through increased deforestation, greater use of energy and filling up landfills. By using recycled products, Mintek puts in a concerted effort to reduce its environmental impact.

Management of waste

One of the most important reasons for proper waste management at an organization is to protect the environment and for the health and safety of employees and the population in general. Certain types of waste can be hazardous and can pollute the environment. Bad waste management practices can also cause land and air pollution which can result in serious medical conditions in both humans and animals. Therefore, Mintek strongly believes that implementing good waste management practices not only helps to protect the environment but can be beneficial to its business. Some of the benefits for Mintek includes:

- Enhancing of business reputation
- Cost savings
- Resource recovery
- Workplace safety

Recycling is the process of converting waste materials into new materials and objects. It can prevent the waste of potentially useful materials and reduce the consumption of fresh raw materials, thereby reducing energy usage, air pollution (from incineration), and water pollution (from landfilling) and makes the environment more attractive.

A recyclable product is turned back into a raw form that can be used to create a new and different product. Not only are natural resources limited, but recycling efforts can significantly reduce additional waste that will not only harm the planet today, but future generations as well.

Mintek's recyclable volumes of metal, plastic, paper and cardboard during the past financial year are depicted in the graph at the bottom of the page on the left.

At the end of the financial year, Mintek has managed to recycle a total of 14,122 kg of waste. The recyclable waste comprises paper, glass, cans and plastic. Cardboard represents most of the recyclable waste and makes up 35% (4,960 kg) of the total recyclable waste. This is followed by newspapers (33%), paper (23%), plastic bottles (8%) and cans at just over 1%. Most waste is recycled towards the end of the year when year-end functions take place and employees usually clean laboratories and work space in preparation for the start of the new year. Service providers also increase their operational activities during this time and notably have zero activities during the first month of the year.

A total of 28,880 kg of scrap metal has been disposed of during the financial year. This exceeds the previous financial year’s total by 11 tonnes. Most metal is scrapped in the first semester with the peak in June, when 10,180 kg (35%) was disposed of, followed by April, with 5,960 kg (21%).

An analysis of the full recycle report for the financial year, as
Mintek’s water footprint

South Africa is a water-scarce country. As pressure on water resources escalate, companies assess the ways in which their daily activities impact on water resources. Organisations facing risks related to failure to manage freshwater consumption may damage their image in the public interface, threaten regulatory control measures put in place, increase financial risks associated with pollution and insufficient freshwater availability for business operations. Mintek conserves water to develop technologies, processes and other services. Freshwater is utilised as a basic input for daily operations. Test works at Mintek consume water and release effluents that are treated prior to being discharged into the main sewer. It is within this context that Mintek is interested in calculating the water footprint of its operations.

Mintek’s water footprint (WF) is defined as the total volume of freshwater that is used directly and indirectly to produce the products and services expressed as the volume of freshwater used per year. The purpose of water footprint is two-fold: to build a fair account of our direct and indirect water usage and to understand the company’s impacts on the natural environment. The ultimate goal is to effectively manage water consumption, reduce pollution, and identify risks and opportunities to improve water consumption. The reporting period for Mintek’s water footprint is from 1 January 2018 to 31 December 2018.

The total blue water footprint, which includes direct consumption, is measured at 46 524 kilolitres per annum (kL/a) for the above mentioned period. Approximately 2% of the Blue Water Footprint (BWF) used on site to water lawns is sourced from dedicated boreholes and 98% is sourced from Rand Water Board (RWB). The BWF reported in 2018 is approximately 1% higher than the consumption reported in 2017; nearly 50% less than the total BWF reported in 2014, the baseline year. More than 90% of the total BWF used is associated with services that Mintek provides and the rest has been associated with the domestic usage across the campus. The facilities that consume considerable amounts of water include the Jumbo bay & store, crushing and drying areas, west yard and gardens followed by Block 9000 and the single west yard and gardens.

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Table 6c: Mintek’s Total Water Footprint

<table>
<thead>
<tr>
<th>Mintek Operational WF (kL/a)</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue**</td>
<td>93 586</td>
<td>66 431</td>
<td>55 820</td>
<td>46 153</td>
<td>46 524</td>
</tr>
<tr>
<td>Green*</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Grey***</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>93 586</td>
<td>66 431</td>
<td>55 820</td>
<td>46 153</td>
<td>46 524</td>
</tr>
</tbody>
</table>

* Refers to the consumption of rain water stored as moisture in the unsaturated zone of soil.
** Refers to water consumed from surface water sources, including municipal supplies.
*** Refers to water pollution and is defined as the volume of freshwater required to assimilate the load of pollutants based on ambient quality standards.

approximately 33 142.32kL/a. More than 90% of the outflows are from the effluent discharge of the facilities at Mintek. The overall amount outflows released for the period starting from 1 January 2018 to 31 December 2018 is approximately 33 142.32kL/a. More than 90% of the outflows are from the effluent discharge of the facilities at Mintek. The overall amount outflows released for the period starting from 1 January 2018 to 31 December 2018 is approximately 33 142.32kL/a. More than 90% of the outflows are from the effluent discharge of the facilities at Mintek.

A key to a sustainable future for Mintek’s production system lies in understanding and utilising resources (water and energy) more efficiently. In the five years since the release of the first water footprint study, several advances have been made in the organisation to standardise water reporting. This process often poses challenges for other companies in the early stages, especially when attempting to examine the entire corporate production chain. This study addressed these gaps by clearly defining terms and system boundary choices in a way that could be easily emulated by other companies in a similar economic sector. In terms of the formulation of response strategies, this WF has identified key areas of concern and therefore, has put in recommended actions to improve the water management and achieve more savings in potable water consumption.

• Consider setting measurable targets for water use and savings as well as the environmental footprint. This will help the organisation identify unsustainable water uses, both in terms of water quantity and quality.

The reporting period for Mintek’s water footprint is from 1 January 2018 to 31 December 2018. There has been a significant reduction of both potable water and effluent discharges from 2014 to date, owing to the implementation of water management strategies. The consumption has significantly decreased again from 93 586kL/a in 2014 to 46 524kL/a in 2018 which translates to almost 50% to date. The WF of external companies providing services to Mintek was not part of this study. The volumes of outflows estimated consist of effluent discharges and water losses through evaporation and seepages for selected facilities at Mintek. The overall amount outflows released for the period starting from 1 January 2018 to 31 December 2018 is approximately 33 142.32kL/a. More than 90% of the outflows are from the effluent discharge of the facilities at Mintek. The overall amount outflows released for the period starting from 1 January 2018 to 31 December 2018 is approximately 33 142.32kL/a. More than 90% of the outflows are from the effluent discharge of the facilities at Mintek.

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Corporate Social Responsibility

Mintek’s carbon footprint

This report details the calculation of the 2018 carbon footprint for Mintek. It quantifies and reports the greenhouse gas (GHG) emissions based on data recorded at an organisational level, in accordance with ISO 14064, GHG Protocol and the 2006 IPCC Guidelines. The carbon footprint was calculated for the 2018 calendar year (1 January 2018 – 31 December 2018). In accordance with international GHG protocol and the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines, all GHG emissions are reported as tonne and Gigagram of CO₂ equivalent. This year’s carbon footprint again consolidated the GHG emissions by the control approach; this included only activities, Mintek also generated incidental activities below the control of the greenhouse gas emission reporting must be taken foremost that the majority of Mintek’s emissions are far below the regulated reporting thresholds. Mintek generated activity data for the year 2018 under IPCC Codes 2A1, 2C1 and 2C5 as seven minor campaigns involving iron ore, coker, rare-earth, wax, silicon and CRT Glass were conducted. Four of these activities resulted in reportable emissions. In addition to these activities, Mintek also generated incidental activities below the reporting thresholds under IPCC codes 1A4a, 1A5a, 2C7, 2D2 and 4D2. Mintek’s total greenhouse gas emissions for 2018, according to the NEM: AQA reporting format are summarised in the table on the right.

Reporting of emissions was more comprehensive this year as it covered a wider range of Scope 1 emissions sources than previous reports done in accordance with the 2006 IPCC Guidelines Initiative. Data collections from Mintek were also more complete than previous years, but there is still room for improvement for Scope 1 data collection and reporting, specifically for Mintek’s R&D operations. The objective of this report is to provide Mintek with an annual update of the carbon footprint and greenhouse gas emissions resulting from its daily operations and development activities. Mintek first calculated the carbon footprint of the emissions from its operations in 2011. Since that first report, six internal reports and executive briefing notes have been prepared on the Mintek carbon footprint and greenhouse gas emissions as well as on the anticipated tax implications of legislation published in 2017.

This report presents the carbon footprint and greenhouse gas emissions of Mintek for the reporting year 2018. The format of this report follows the one introduced in 2017, and seeks to align Mintek’s reporting with the nationally legislated standard whilst maintaining continuity with previous years’ reports. This is a hybrid report that records Mintek’s emissions in both the former carbon footprint (GHG) standard (Section A) and the IPCC aligned with the National Environmental Management: Air Quality Act (NEM: AQA) standard, (Section B).

Using the former GHG reporting protocol for carbon footprint reporting, Mintek’s total emissions for 2018 calendar year were 12 292.61 tCO₂e, as compared to the baseline carbon footprint conducted in 2011 and using the GHG protocol reporting format, the past financial year has seen a decrease of 67% in calculated emissions though increased slightly from the 2011 962.18 tCO₂e reported for the 2017 financial year. In terms of the NEM: AQA reporting regulations, it must be noted foremost that the majority of Mintek’s emissions are far below the regulated reporting thresholds. Mintek generated activity data for the year 2018 under IPCC Codes 2A1, 2C1 and 2C5 as seven minor campaigns involving iron ore, coker, rare-earth, wax, silicon and CRT Glass were conducted. Four of these activities resulted in reportable emissions. In addition to these activities, Mintek also generated incidental activities below the reporting thresholds under IPCC codes 1A4a, 1A5a, 2C7, 2D2 and 4D2. Mintek’s total greenhouse gas emissions for 2018, according to the NEM: AQA reporting format are summarised in the table on the right.

<table>
<thead>
<tr>
<th>GREENHOUSE GAS</th>
<th>MINTEK EMISSIONS (Gg CO₂ eq) reportable</th>
<th>MINTEK EMISSIONS (Gg CO₂ eq) non-reportable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide (CO₂)</td>
<td>0.0068</td>
<td>0.064</td>
</tr>
<tr>
<td>Nitrous Oxide (N₂O)</td>
<td>0.00019</td>
<td>0.000158</td>
</tr>
<tr>
<td>TOTAL (Gg CO₂ eq)</td>
<td>0.007</td>
<td>0.064</td>
</tr>
</tbody>
</table>

The greenhouse gas emission for Mintek according to the NEM: AQA standard is very low but still triggers a certain activity class for which the threshold for mandatory reporting is 0, so Mintek is obliged to register in accordance with the regulations, Besides regulatory compliance, Mintek will have to spend time and energy developing internal mechanisms to upgrade its SOPs and quality standards to develop, maintain and improve this reporting in future. The implementation of the Carbon Tax announced by the National Treasury in June 2019, along with the existing NEM: AQA regulations have formed a mandatory requirement for Mintek to report its greenhouse gas emissions whilst at the same time continuously invest in GHG emission reduction projects. This report concludes with a look at the impact that the tax will have on Mintek’s revenue. The Department of Environmental Affairs has confirmed that, although Mintek already reports its emissions under the terms of its Atmospheric Emissions Licence on the National Atmospheric Emissions Inventory System (NAEIS) system and reporting under the NEM: AQA regulation is not integrated yet, so reporting on the regulations must be done on paper until further notice. The regulations also require that the quality control of the greenhouse gas emission reporting must be taken up and reflected in the corporate quality policy. This matter will be explored by Mintek and a policy and methodology referring the relevant regulations will be developed.

Through Corporate Social Investment (CSI), Mintek is committed to promote the organisational values of teamwork and building a common sense of purpose amongst all employees. The organisation view this as a means of mobilising employees which enables it to perform good corporate citizenship, through a corporate programme that largely focuses on education and training initiatives within the mineral processing and metallurgy fields.

Our CSI embraces projects and activities that are external to the normal business activities of Mintek and not directly for purposes of increasing profit. Mintek’s projects have a strong developmental approach and utilise company resources, primarily through the time and efforts of its employees to benefit and uplift communities and are not primarily driven as marketing initiatives.

Minerals Education Trust Fund

Mintek supports the Minerals Education Trust Fund, which was founded by the Chamber of Mines so that the industry could consolidate its support towards education, teaching and research. The fund supports institutions of higher learning, attract, retain and develop undergraduate teaching staff; create academic centres of excellence, and foster collaboration.

| Table 6d: Summary of Mintek reportable and non-reportable emissions per gas in Gg CO₂ eq |

<table>
<thead>
<tr>
<th>GREENHOUSE GAS</th>
<th>MINTEK EMISSIONS (Gg CO₂ eq) reportable</th>
<th>MINTEK EMISSIONS (Gg CO₂ eq) non-reportable</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>TOTAL (Gg CO₂ eq)</td>
<td>0.007</td>
<td>0.064</td>
</tr>
</tbody>
</table>
HIV/AIDS Campaign

As part of raising awareness in HIV/AIDS, Mintek observed the 30th anniversary of the AIDS Day commemorations. The theme for the 2018 observance of World AIDS Day was “Know your status”. Mintek’s wellness team held a short ceremony for staff and the purpose was to observe the day in support of those living with HIV/AIDS, encourage employees to pledge to stop the spread of HIV; remember those that have passed on due to HIV/AIDS related diseases; and to support those affected by HIV/AIDS.

Mo–Shave Celebration for Men

The Mintek men celebrated the Mintek, Men’s Day event which coincided with the Movember, (Mo–Shave) known as No Shave November. The event involved the growing of moustaches during the month of November to raise awareness of men’s health issues, such as prostate cancer, testicular cancer, and men’s suicide. As a build up to the Men's Day event, men took part in the “Movember-no shave month”, which raised over R3 000 through the Mo Mintek, an online portal for men’s health awareness.

A leading coach at the Leaders in Transformation Institute spoke on mental health, masculinity and the prevalence of male suicide. The event culminated in the establishment of the Mintek gentlemen’s club, code of conduct and team building activities. Donations received from Mintek and other institutions will help the Movember Foundation fund groundbreaking work in prostate cancer, testicular cancer, mental health and suicide prevention.

Minquiz™

Mintek continues to inspire and foster young talent to sharpen their skills in mathematics and science through the annual Minquiz™ mathematics and science competition for grade 12 learners. The national Minquiz™ held at Mintek was won by a group of learners representing the Gauteng Province. The learners work very hard as teams to achieve excellence in Maths and Science. The winning team was represented by Motshabi Ramolegopa of Mondeor High, Uzize Mkhumbuzi of Dr BW Vilakazi Secondary School, Liu Ireton of Parktown Boys High and Joshua Trace of Greenside High School.

Cansa Shavathon

Shavathon is one of Mintek’s long standing fundraising events. The campaign is run in a competitive spirit of charity amongst employees, which encourages the culture of giving for a good cause. Despite the hard economic climate, and a relatively low participation of staff at this year’s Shavathon, Mintek employees have maintained their support for the Cancer Association of South Africa (Cansa) fundraising for cancer by raising R20 460 during the Shavathon held in March 2019. As part of the cancer awareness, the campaign featured a solidarity wall, where staff could share stories of how cancer touched their lives. The funds raised are donated to the Cancer Association of South Africa.

Mandela Day

In honour of Mandela Month, Mintek held a furniture restoration campaign and a blanket drive for communities in need. Staff dedicated 67 minutes of their time for Madiba by refurbishing office furniture comprising chairs, desks and tables. The wooden furniture was varnished, and donated to Cosmo City Secondary School. Mintek staff also collected clothes and blankets as part of the Mandela Day initiative. The preloved clothes and blankets were donated to the Salvation Army.
Mintek has a well-developed risk management system and adopts a zero tolerance approach to fraud.
7.1 Risk Management

7.2 The Risk Management Process

The Board, assisted by the ARC and the Risk Management Committee (RMC), is responsible for the governance of risk by ensuring that management maintains a sound system of risk management and internal controls to safeguard Mintek’s assets.

Mintek recognises that proactive risk management is both a critical element of sound corporate governance and a crucial enabler in realising opportunities. Mintek has a well-developed management system that includes safety, health, environment and quality (SHEQ).

The Board, with assistance from the ARC and the Risk Management Committee (RMC), is responsible for the governance of risk by ensuring that management maintains a sound system of risk management and internal controls to safeguard Mintek’s assets, and determines the extent and nature of the significant risks which the Board is willing to take in achieving Mintek’s strategic objectives.

The Risk Management Committee (RMC) is a management committee that continually reviews the risk management process, internal controls, and significant risks facing the organisation and reports to ARC. The ARC provides the ARC with a risk assessment report at appropriately scheduled intervals. The ARC ensures that management has implemented a process for risk management, including an annual risk management plan to identify, manage and report on the risks that might prevent Mintek from achieving its strategic objectives. In particular the Audit and Risk Committee:

- reviews and recommends amendments to the risk management policy;
- ensures appropriate review of identified risks, together with the assessment of probability and impact;
- ensures appropriate review of risk action plans for identified risks;
- reviews significant transactions that are not a normal part of Mintek’s business; and
- reviews and monitors related party transactions and assess their propriety.

Meetings are held on a quarterly basis or as required. Mintek utilises the services of insurance brokers on an annual basis to analyse and assess the risks associated with its assets, which are insured, together with public liability and professional indemnity, for the risk assessed.

In order to assess the adequacy and success of our approach to risk management, a number of critical success factors have been identified, amongst others, senior management support, own and lead on risk management; risk management policies are clearly communicated to all staff; organisational culture supports well thought through risk taking and innovation; and management of risk is closely linked to achievement of objectives.

A strategic approach to risk management depends on identifying risks against key organisational objectives. Operating within this framework helps ensure a consistent approach across the organisation and enables a clear structure to be established.

A strategic approach to risk management is closely linked to organisational objectives. Operating within this framework helps ensure a consistent approach across the organisation and enables a clear structure to be established.

The assessment process is designed to be as objective and quantitative as possible, but still contains a degree of judgement. Some risks will be connected to, or dependent upon, other risks. It is important to understand the relationships between risks so that they can be effectively prioritised.

The monitoring and review process tracks the current status of the risk profile, detects changes in the risk context and ensures that the responses and controls are adequate.
Since the beginning of the 2019 financial year the Risk Committee considered the different ways that Mintek could respond to these risks, and the responses were recorded in the Risk Implementation Plan.

The options for responses include:

- avoiding the risk by not starting the activity that creates exposure to the risk;
- mitigating the risk through improvements to the control environment (risk treatment may include methods, procedures, applications, management systems, and the use of appropriate resources that reduce the probability or possible severity of the risk);
- transferring the risk exposure, usually to a third party better able to manage the risk, e.g. through insurance or outsourcing;
- exploiting the risk, where the risk exposure represents a potential missed or poorly-realised opportunity;
- terminating the activity that gives rise to the intolerable risk; and
- integrating some or all of the risk responses outlined above.

Since the beginning of the 2019 financial year the Risk Implementation Plan has been subjected to a significant review. This review process is continuing and the next phase is to ensure that Mintek’s risk profile is aligned and benchmarked against similar organisations. In addition, the principles of total combined risk assurance are being assessed to optimise Mintek’s approach to risk identification and management.

### 7.3 Mitigating the Organisation’s Top Risks

#### Table 7A: A general overview of each risk, the key risk reduction measures and the associated risk mitigation.

<table>
<thead>
<tr>
<th>RISK DETAILS</th>
<th>KEY RISK REDUCTION MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>DESCRIPTION:</td>
<td>Loss of commercial revenue.</td>
</tr>
<tr>
<td>CATEGORY:</td>
<td>Strategic Risk</td>
</tr>
<tr>
<td>MANAGEMENT RESPONSE:</td>
<td>Mitigate</td>
</tr>
<tr>
<td>• Ensure top quality control of all products and services.</td>
<td></td>
</tr>
<tr>
<td>• Timely delivery of all products and services.</td>
<td></td>
</tr>
<tr>
<td>• Ensure competitive pricing.</td>
<td></td>
</tr>
<tr>
<td>• Good maintenance backup and/or after sale customer care.</td>
<td></td>
</tr>
<tr>
<td>• Maximize alternative revenue streams.</td>
<td></td>
</tr>
<tr>
<td>• Ensuring adequate marketing e.g. visits by executive management to various company CEOs, technology showcases, exhibition stands at identified conferences/events, place greater emphasis on Western African events in future.</td>
<td></td>
</tr>
<tr>
<td>• Improving productivity without compromising quality.</td>
<td></td>
</tr>
</tbody>
</table>

#### RISK DETAILS

<table>
<thead>
<tr>
<th>KEY RISK REDUCTION MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
<tr>
<td>CATEGORY:</td>
</tr>
<tr>
<td>MANAGEMENT RESPONSE:</td>
</tr>
<tr>
<td>• Procedures for storing, maintaining and handling of flammable and explosive substances.</td>
</tr>
<tr>
<td>• Three yearly fire risk assessments performed.</td>
</tr>
<tr>
<td>• Regular training of staff.</td>
</tr>
<tr>
<td>• Monitoring of interlocks and emergency shutdown devices, evacuation procedures and airline breathing system.</td>
</tr>
<tr>
<td>• Safety related inspections conducted.</td>
</tr>
<tr>
<td>• Totally enclosed chlorine plant.</td>
</tr>
<tr>
<td>• Emergency response and evacuation procedures (including site evacuation) are in place.</td>
</tr>
<tr>
<td>• Firefighting equipment is serviced once a year and checked once a month.</td>
</tr>
</tbody>
</table>

| 3  | Failure to attract and retain skilled personnel. |
| CATEGORY: | Strategic Risk |
| MANAGEMENT RESPONSE: | Mitigate |
| • Constant monitoring of best practice strategies for attraction and retention of skilled personnel. |
| • Annual performance appraisals conducted on all employees to identify necessary skills for accelerated development. |
| • Coaching and mentoring program. |
| • Succession planning. |
| • Benchmark salary scales against industry and comparable entities. |
| • Continuous benchmarking and market analysis to inform internal strategies. |

| 4  | Changing Government policies and priorities. |
| CATEGORY: | Strategic Risk |
| MANAGEMENT RESPONSE: | Mitigate |
| • Continuous monitoring of opportunities for funding. |
| • Increased visibility of Mintek at National Treasury and DMR specifically focusing on funding issues. |
| • Continuous monitoring of departmental strategic plans and other notifications. |
| • Participation in departmental task teams and strategy sessions to remain abreast of policy changes and emerging priorities. |

| 5  | Surge in operational costs. |
| CATEGORY: | Strategic Risk |
| MANAGEMENT RESPONSE: | Mitigate |
| • Comply with accurate and realistic budgeting and implementation thereof to prevent/minimize loss of profitability. |
| • Designed ability to pass through increased costs to customers via change in rates/tariffs. |
| • Pro-active management accounting and variance/trend analysis thereon. |
| • Regular reviews of pricing policy for Mintek’s products and services undertaken. |
| • Implementation of bi-annual review of workforce planning. |
| • Adequate business process analysis. |
| • Monitor procurement/local content, assembly and fabrication. |
Due to lower commercial revenue in 2019 when compared to 2018, Mintek has intensified its efforts to ensure that marketing opportunities are maximised locally and in the SADC region. Some pilot plant projects have been secured for the current financial year and these will be executed in the coming months. However, Mintek envisages the constrained environment to continue, particularly in South Africa given the depressed state of the economy.

In order to minimise reputational damage due to operational incidents that may cause injuries, destruction of building and equipment and the loss of licenses to operate scheduled processes, Mintek will continue to focus on its ongoing SHEQ monitoring systems, inspections and being legally compliant with all facilities and systems. Addressing the skills flight and retention of skilled personnel, an enhanced human capital development programme will be rolled out in the next few months.

Labour costs remain the most significant factor in Mintek’s operating costs and therefore the workforce planning is reviewed twice per year. Where possible local content / production/ manufacturing will be key in the supply chain when purchasing items. For all divisional business plans going forward, attention will be given to matters of viability and sustainability, while capital and operational expenditure will be closely monitored.

### Internal audit

Mintek’s Internal Audit (IA) is an in-house function in terms of 51(b)(ii) of the PFMA Act No. 1 of 1999 as amended. IA is governed in terms of the Standards for the Professional Practice of Internal Auditing (SPIPA) as prescribed by the Institute of Internal Auditors. The Head of Internal Audit reports directly to the CEO administratively and to the ARC functionally.

The IA function is an independent, impartial and consulting activity designed to add value and improve Mintek’s operations. It helps Mintek accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of governance, risk management and control processes. The ARC approves the charter, audit plan and budget of internal audit to ensure it operates independently. The IA function has direct access to the ARC and regular meetings are held with the chairperson of the ARC. Comprehensive reports on internal audit findings are presented to the executive committee and the ARC quarterly. Follow-up audits are conducted in areas where major internal control weaknesses are found.

### Internal control

Mintek maintains internal controls and systems, designed to provide reasonable assurance regarding the integrity and reliability of its financial statements, to safeguard, verify and maintain the accountability of assets, and to comply with applicable laws and regulations. The directors are ultimately responsible for the company’s system of internal control, designed to identify, evaluate, manage and provide reasonable assurance against material misstatement and loss. The effectiveness of these controls is monitored by the internal auditors, who report to the ARC frequently. The ARC requested management to review and evaluate Mintek’s existing internal controls to further identify areas that can continually be improved upon. The Board considered reports on controls from internal audit, the external auditor and the compliance and risk management units.

For the period 1 April 2018 to 31 March 2019, nothing came to the attention of internal audit to suggest any issues. Thus, internal audit is of the opinion that, overall, the internal controls including financial controls of Mintek are adequate and effective.

### Fraud prevention

Mintek takes fraud very seriously. Mintek is committed to a high standard of ethical conduct and adopts a zero tolerance approach to fraud. Mintek has adopted a fraud prevention plan that incorporates principles contained in the Public Sector Anti-Corruption Act and defined within the ROSA Vulnerability Analysis and the Protection of Personal and Privacy Information Act (Act 4 of 2000). Mintek has also implemented whistle-blowing and reporting procedures that support reporting to the ARC.

### Attendance at Corporate Risk Steering Committee Meetings

<table>
<thead>
<tr>
<th>NAME</th>
<th>CATEGORY</th>
<th>POSSIBLE NO. OF MEETINGS</th>
<th>ATTENDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>D Powell (Chair)*</td>
<td>GM: Business Development</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>A McKenzie (Acting Chair)</td>
<td>GM: Technology</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>D Msiza**</td>
<td>Acting CEO</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>M Makhafola</td>
<td>GM: Research &amp; Development</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>S Simelane***</td>
<td>GM: Finance (Acting CEO)</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>G Nyanda</td>
<td>GM: Corporate Services</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>N Mthalane</td>
<td>Head: Internal Audit</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>H Pretorius</td>
<td>Manager: Finance</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>H Marobane</td>
<td>Manager: Human Resources</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>H Venter</td>
<td>Head: ICT</td>
<td>4</td>
<td>4</td>
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<tr>
<td>M Ginindza</td>
<td>Head: SHEQ</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>B Hewu</td>
<td>Manager: EMS</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>G Ndebele</td>
<td>Head: Campus Support (Security)</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

* D Powell – Resigned - 31 July 2018. A McKenzie, Acting chair as of August 2018
** D Msiza – Acting CEO - Term ended 31 July 2018
*** S Simelane – Acting CEO – 1 Aug 2018 – 31 Dec 2018
Code of Conduct and Business Ethics

Mintek’s Code of Conduct and Business Ethics (the Code) serves to ensure a consistent and fair approach to ethics and management of conduct by advising employees on the required standard of conduct and behaviour in the workplace. This Code clarifies Mintek’s expectations of its employees’ conduct and behaviour at all times in line with Mintek policies and procedures. The Code’s guiding principles include:

- Conduct of Mintek’s business with honesty and integrity by all employees and contractors.
- Display of acceptable and/or satisfactory behaviour of employees at all times.
- Voluntary compliance with all applicable laws and good business ethics practices.
- Fair dealings for mutual benefit in Mintek’s relationships with customers, partners, contractors, suppliers and other stakeholders.
- Commitment of employees to adhere to the principles in this Code.

Mintek Executive Management is responsible for ensuring that this Code is enforced and adhered to by all employees and will investigate in the appropriate manner any breach of the Code irrespective of the seniority of the offenders. It is therefore obligatory for employees to report all actual or suspected contraventions of any section of this Code of Conduct to their immediate Superiors.

Operational performance

Mintek reports to the DMR and is also accountable to the DST and some other government departments for its technology-related R&D activities. Various key performance indicators (KPIs), encompassing financial, organisational, innovation and learning, human resources and transformation perspectives, provide Mintek with a basis for evaluating its activities in the identified key performance areas. Each KPI is supported by a set of identified measures, that provides a more specific and consistent base from which to assess progress.

Mintek’s Management Committee convenes on a monthly basis where business plans, financial results and policy updates are presented. The budget for the current year is usually reviewed in September by executive management in order to keep track of and ensure overall sound financial management.

Going concern

The Mintek Board reviewed the Entity’s financial budgets for the period 01 April 2019 to 31 March 2020 and is satisfied that adequate resources exist to continue business for the foreseeable future.

Remuneration Practice

Mintek’s remuneration strategy and practice is informed by a rigorous analysis of remuneration trends in the environment. Despite the tough competition created by mining industry remuneration practices, Mintek continues to strive to maintain a fair, robust and appropriate remuneration and rewards practice for our employees, which is augmented by other interventions that are aimed at improving staff motivation and retention.

The determination of Mintek’s remuneration strategy and policy is among the duties of the Human Resources Committee. The committee ensures that remuneration policy framework supports the strategic aims of our business and enables the recruitment, motivation and retention of employees at all levels, while complying with all relevant regulatory and legal requirements.

Remuneration Policy

Mintek’s Remuneration Policy applies to all Mintek employees appointed on a permanent, contract and casual basis. The policy shall provide the basis on which to determine an appropriate rate of pay for each job in Mintek; a rate of pay that is fair, consistently applied across all jobs, and that is competitive with market trends.

This policy applies in line with Section 10(1)(b) of the 1989 Mineral Technology Act which requires the Board to determine conditions of employment including the payment of remuneration, allowances, subsidies and other benefits in accordance with a system approved by the Minister. This function has been further delegated by the Board to the GM Corporate Services in line with delegation of authority.

There were no changes to the Remuneration Policy during the period under review. The policy objectives remain that of implementing a fair and just rewards and benefits scheme that does not discriminate on race, gender, creed or in any other form of discrimination. It also advances the principles of fairness and equity in pay by promoting internal parity.

The quest to contain Mintek’s salary bill also continued during the year under review. While we ensure that Mintek employees are fairly rewarded, we also ensure that there is a healthy balance between revenue and total employee costs. As a consequence, the remuneration mix that has been adopted included a performance-based, once-off bonus that does not have a long-term impact on the size of the salary bill. The growth rate of the salary bill is kept within the inflation target range.

Other financial benefits

The basket of other employee benefits is a deliberate strategy adopted by Mintek to mitigate the risk associated with our inability to compete with industry, in term of salary packages. The intention is to improve the quality of work life for the employees of Mintek, while also improving organisational performance. This basket includes a generous study package comprising a comprehensive bursary scheme that includes transfer payments to academic institutions, purchasing of study materials and books as well as leave provision for attending classes, preparation for exams and consultation with supervisors for Masters’ and Doctoral students.

The members of the HRC for the year under review were:

Mr MJ Rachidi  (Chairperson: HRC and Non-executive Deputy Board Chairperson)
Mr RA Mootshe  (Non-executive Board member)
Mr P Mthombi  (Non-executive Board member)
Ms K McClain  (Non-executive Board member)
Mr David Msiza  (Acting CEO and Ex-officio) – 1 Sep to 31 Jul 2018
Mr Sakhi Simelane  (Acting CEO and Ex-officio) – 1 Aug to 31 Dec 2018
Dr Molefi Motuku  (CEO and Ex-officio) – Commenced 1 Jan 2019
Ms G Nyanda  (Executive member - GM: Corporate Services)

Ms G Nyanda  (Executive member - GM: Corporate Services)
GENERAL INFORMATION

Country of Incorporation & Domicile  South Africa

Mindev Directors (As at 31 March 2019)  Namane Dixon Masemola  Chairperson
Dr Molefi Motuku  CEO
Dumisani Dlamini  
Khatiewe McClain  
Phahlane Mphomma  
Andries Moatshe  
Samke Ngeenya  
Morolele Rachi  
Dr Siyabonga Simayi  
Dr Sarah Mohlala

Country of incorporation and domicile  South Africa

Mindev Directors  MA Mngomezulu  
SA Simelane  
RL Paul  
M Mphomma  
GL Rapoo

Registered Office  200 Malibongwe Drive  
Randburg 2194  
South Africa

Business Address  200 Malibongwe Drive  
Randburg 2194  
South Africa

Postal Address  Private Bag X3015  
Randburg 2125  
South Africa

Holding company  Mintek (100% owned) incorporated in South Africa

Auditors  Auditor-General  
South Africa

FINANCIAL PERFORMANCE

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1.1 First Time Adoption of Generally Recognised Accounting Practice (GRAP)

Mintek changed its reporting framework from SA Generally Accepted Accounting Principles (GAAP) to Generally Recognised Accounting Practices (GRAP) as per requirements of Directive 12 issued by the Accounting Standards Board (ASB). The major impact of the change in the reporting standards from Mintek’s perspective was with regards to the recognition of grant funding received towards capital expenditure which was previously set off against the cost of grant funded assets which resulted in no impact against the Statement of Financial Performance due to there been no depreciation charges for these assets.

The GRAP requirements are in contrast to the previous application process with the grant funding now being recognised in full as revenue in the year it is received and the effected assets been depreciated as per Mintek fixed asset policies. The capital grant funding received has been retrospectively recognised as revenue resulting in an increase in accumulated surplus which the impact of is reduced due the additional depreciation charges. The comparative figures have been restated as these changes were applied retrospectively.

1.2 Revenue

The 2018/2019 financial year presented another testing operational environment for Mintek as tougher conditions facing the mining industry persisted. Revenue increased by 7% from R491m in 2017/2018 to R525m in 2018/2019. Revenue mainly consists of State Grant, MTEF, commercial income and other income. The revenue mix remained the same over the two years and the State Grant was the majority contributor to total revenue, 39% [38% -2017/2018]. MTEF’s contribution declined to 22%, products and services increased from 21% in 2017/2018 to 23% in 2018/2019. Contract research remained flat at 9% over the two years. Other income which consists of interest and rental contributed 1% to total revenue.

1.3 Operating Costs

Operating expenditure rose by 5% from R533m in 2017/2018 to R557m in 2018/2019. The 5% increase is in line with the Consumer Price Index (CPI). Although employee related costs continue to be a significant component of operating expenditure, these costs as a percentage of total expenditure declined from 60% in 2017/2018 to 57% in 2018/2019. This is mainly attributable to a decline in the staff complement. Other operating expenditure declined by 1% to 81%. A foreign exchange gain that was largely due to a weaker Rand had a positive impact on other operating expenditure. Prior year depreciation was restated as a result of a GRAP adjustment. The impact of the restatement resulted in an increase from R17m to R42m.

1.4 Net surplus

Mintek’s net surplus increased to R5.45m (FY2017/2018: Restated Net deficit: R6.85m). The net surplus was positively impacted by reclassification adjustments that were due to the first time adoption of Generally Recognised Accounting Practice (GRAP). The decline in net surplus in recent years has also been due to low commercial income compared to state grant. The net surplus realised is also due to cost savings initiatives that resulted in decreased operating costs.

1.5 Mintek’s Financial Position

Mintek’s balance sheet continues to be strong as cash and cash equivalents increased from R429m to R447m. Mintek holds short term fixed deposits with various reputable financial institutions. These funds are partly earmarked for financing Mintek liabilities and other capital expenditure. The returns earned on these funds are in line with the repurchase interest rate. Interest received from these investments decreased from R30m in 2017/2018 to R28m in 2018/2019.

2. Working Capital Management

Cash locked up in working capital is a continuous focus area for Mintek. The current ratio declined slightly to 1:9.1 in 2018/2019. The ratio indicates that Mintek’s short term obligations were adequately covered by current assets at reporting date.

2.1 Trade Receivables

Trade Receivables increased by 10% to R277m. Mintek’s credit policy aims to achieve an optimum balance between maximising revenue and lowering bad debts. Strict adherence to the credit policy, consistency in collection of repayments from customers and advance payments enable this optimum balance to be achieved.

2.2 Inventory

Inventory increased from R10 m in 2017/2018 to R11m in 2018/2019. The increase is mainly due to more project related consumables that were held as inventory at reporting date compared to the previous year.

2.3 Short Term Investments

Mintek’s liquidity remains conservative as cash and cash equivalents increased from R429m to R447m. Mintek holds short term fixed deposits with various reputable financial institutions. These funds are partly earmarked for financing Mintek liabilities and other capital expenditure. The returns earned on these funds are in line with the repurchase interest rate. Interest received from these investments decreased from R30m in 2017/2018 to R28m in 2018/2019.

2.4 Trade Payables

Trade payables increased by 142% from R16.4m in 2017/2018 to R39.7m in the current year. Other payables relate to payments received in advance from customers, leave pay and other salary related accruals. Payment terms with suppliers are strictly adhered to in order to manage cash outflows and prompt payments.

2. 4 Unspent conditional grants and receipts

Included in current liabilities is project related unspent conditional grants of R167m (R160m: 2018) where conditions are yet to be fulfilled. These grants are recognised as deferred income and they arise as a result of contracts undertaken for several government departments and institutions in respect of amounts received in cash not yet accounted for as revenue.
Mintek re-assessed the useful life of all zero value assets due to the fact that they are still in use and have future economic value. The amount recognised for this adjustment during the year under review was R0.5m compared to R6.5m for prior year.

5. Equity and Liabilities

5.1 Retirement Benefit Obligation

Mintek has a long term obligation for post-retirement medical aid to qualifying employees. The liability declined from R20m in 2017/2018 to R13m in 2018/2019. An amount of R2.8m (R1.8m: 2017/2018) was reclassified as the current portion of the medical aid obligation. Settlements to employees decreased from R5m in 2017/2018 to R1.8m during the year under review.

An actuarial valuation is performed annually to estimate and discount the liability to its present value. During the year under review the liability was re estimated and re measured to its present value with an interest charge of R1.7m (R2.2m: 2017/2018) and against which an actuarial gain of R6.2m (R3.3m: 2017/2018) was recognised. The gain arose due to lump sum settlements of member’s liabilities and higher withdrawals than expected. The gain was also due to the increase in the net discount rate used to discount the liability and a change in the benchmark medical schemes option to a lower contribution.

5.2 Equity

Equity consists of a revaluation reserve and accumulated surplus. The revaluation reserve decreased from R147m in 2017/2018 to R145m. The decrease is mainly due to a transfer to accumulated surplus. The amount transferred is equal to the difference between depreciation based on the revalued carrying amount and the historical carrying amounts of assets. Retained surplus increased from R510m in 2017/2018 to R516m.

4. Property, Plant, Equipment and Intangible Assets

The net book value of assets at reporting date amounted to R429m during the year under review. The PPE was impacted by a write back of assets and accumulated depreciation due to a change in accounting policy as a result of the first time adoption of GRAP. Prior year figures have been restated.

In order to sustain its long term growth Mintek invested R37m in fixed assets. This is a 24% decline from the R62m that was invested in the previous financial year. Depreciation for the prior year was also restated from R17m to R42m. The assets that were written back are written off over their useful lives in terms of Mintek’s accounting policy.
**6. Whistle blowing**

The ARC received and dealt with any concerns or complaints, whether from within or outside of Mintek, relating to fraud, corruption, theft and maladministration.

**7. The quality of management and quarterly reports submitted in terms of the PFMA**

The ARC reports that, during the year under review, they were presented with regular quarterly management reports to enable them to:

i. Monitor the integrity, accuracy and reliability of the financial position of Mintek;

ii. Review the management accounts of Mintek to provide the accounting authority with an authoritative and credible view of the financial position of Mintek;

iii. Review the disclosure in the financial reports of Mintek and the context in which statements on the financial health of Mintek are made; and

iv. Review all material information presented together with the management accounts.

**8. Evaluation of financial statements**

The ARC has evaluated the group and the company Financial Statements for the year ended 31 March 2019 and management has assured the ARC that they fully complied in all material aspects with the requirements of the Public Finance Management Act (PFMA) no. 1 of 1999, as amended by Act 29 of 1999, and South African Statements of Generally Accepted Accounting Practice (SA Statements of GAAP).

The directors are of the opinion, based on the information and explanations given by management, that the system of internal control provides reasonable assurance that the financial records may be relied on for the preparation of the annual financial statements. However, any system of internal financial control can provide only reasonable, and not absolute, assurance against material misstatement or deficit.

The directors have reviewed the economic entity’s cash flow forecast for the year to 31 March 2020 and, in the light of this review and the current financial position, they are satisfied that the economic entity has or has access to adequate resources to continue in operational existence for the foreseeable future.

The annual financial statements set out on pages 115 to 153, which have been prepared on the going concern basis, were approved by the directors on 26 July 2019 and were signed on behalf by:

**ND Masemola**
Chairperson of the Board

**Dr M Motuku**
CEO / President
The directors have the pleasure of presenting their report, which forms part of annual financial statements for the year ended 31 March, 2019.

1. Nature of the business

Mintek is South Africa’s national mineral research organisation and is one of the world’s leading technology organisations specialising in mineral processing, extractive metallurgy and related areas. Mintek works closely with the mining industry and other R&D institutions and provides service test work, process development and optimisation, consulting and innovative products to clients worldwide. Mintek is a state owned science council which reports to the Minister of Mineral Resources.

2. Material changes in the group

There were no material changes in the group during the financial year 2018/2019.

3. Review of activities and results

3.1 Revenue

Revenue for the year amounted to R562m, (2017/2018: R527m), representing a 7% increase from the prior year.

3.2 Expenditure

Operating expenditure grew by 5% from R557m in 2017/2018 to R585m during the year under review. The expenditure increase is in line with inflation. The main contributors to the expenditure were employee costs, fees for services and general expenditure. Employee costs as a percentage of total expenditure decreased by 3% to 57%. This is mainly due to a decrease in the staff complement.

3.3 Net Surplus

Mintek’s profitability position improved from a restated deficit of R5m in 2017/2018 to a net surplus of R5m.

3.4 Net Working Capital

Mintek’s liquidity position remained strong during the year under review as current liabilities were adequately covered by current assets.

3.5 Investments in subsidiaries

Mintek holds 100% of issued share capital of Mindev (Proprietary) Limited. Mindev is engaged in the commercialisation of Mintek patents and technology through identification of suitable partners to advance such interests by way of direct investment in equity through Joint Ventures. The carrying amount of the investment amounted to R40m at reporting date.

3.6 Property, Plant, Equipment and Intangible Assets

The value of Mintek assets increased slightly from R430.7m to R432.8m. These assets are stated at cost less accumulated depreciation and impairments. Land and buildings are carried at revalued amounts which is the fair value at the date of revaluation less accumulated impairments. Valuations are performed every five years to ensure that the fair value of the revalued assets does not differ materially from their carrying amount. The latest revaluation was performed on 18 April 2016. Depreciation is calculated on straight line basis.

During the year Mintek’s investment in property, plant, equipment and intangible assets decreased from R52m in 2017/2018 to R39m. The capital expenditure was funded by internal cash generations and government grants.

3.7 Equity and Liabilities

Mintek’s equity amounted to R662m (2017/2018, R656m). The revaluation reserve relates to the revaluation surplus that arose on the revaluation of land and buildings during the previous year in line with the five year cycle.

The prior financial years retained surplus were restated as a result of a reversal of grant funding previously written off to assets. The reversal was part of the adjustments that were made due to the first time adoption of GRAP.

4. Changes in accounting policy

Mintek changed its reporting framework from SA Generally Accepted Accounting Principles (SA GAAP) to Generally Recognised Accounting Practice (GRAP). The impact of the changes was mainly on revenue, retained income, property, plant, equipment and intangible assets. The change has been accounted for retrospectively and the comparative amounts have been restated: The effect of this change in accounting policy is as follows:

5. Going concern

Mintek annual financial statements have been prepared on the going concern basis. The Board has performed a formal review of Mintek’s ability to continue trading as a going concern in the foreseeable future and based on this review, considers that the presentation of the financial statements on this basis is appropriate. There are no pending or threatened legal or arbitration proceedings, which have had or may have a material effect on the financial position of the Group.
6. Events after the reporting date

There have been no facts or circumstances of a material nature that have arisen between the financial year-end and the date of this report.

7. Other matters

Further information on the activities, performance and financial position of the Group is presented in the consolidated annual financial statements and notes thereto.

There were no current material significant negotiations for major transactions at the reporting date.

8. Country of incorporation

Mintek is incorporated in South Africa.

9. Registered office and postal address

200 Malibongwe Drive, Randburg 2194
Private Bag X3015
Randburg, 2125
South Africa

10. Auditors

Auditor General of South Africa (AGSA)

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REPORT OF THE AUDITOR—GENERAL TO PARLIAMENT ON THE MINTEK GROUP

Report on the audit of the consolidated and separate financial statements

Opinion

1. I have audited the consolidated and separate financial statements of the Mintek group and its subsidiary (the group) set out on pages 115 to 153, which comprise the consolidated and separate statement of financial position as at 31 March 2019, and the consolidated and separate statement of financial performance, statement of changes in net assets, and cash flow statement and the statement of comparison of budget information with actual information for the year then ended, as well as the notes to the consolidated and separate financial statements, including a summary of significant accounting policies.

2. In my opinion, the consolidated and separate financial statements present fairly, in all material respects, the consolidated and separate financial position of the Mintek group as at 31 March 2019, and its financial performance and cash flows for the year then ended in accordance with the South African Standards of Generally Recognised Accounting Practice (SA standards of GRAP) and the requirements of the Public Finance Management Act of South Africa, 1999 (Act No. 1 of 1999) (PFMA) and the Companies Act of South Africa, 2008 (Act No. 71 of 2008) (Companies Act).

Basis for opinion

3. I conducted my audit in accordance with the International Standards on Auditing (ISAs). My responsibilities under those standards are further described in the auditor-general’s responsibilities for the audit of the consolidated and separate financial statements section of this auditor’s report.

4. I am independent of the public entity in accordance with sections 290 and 291 of the International Ethics Standards Board for Accountants’ Code of ethics for professional accountants (IESBA code), parts 1 and 3 of the International Ethics Standards Board for Accountants’ International Code of Ethics for Professional Accountants (including International Independence Standards) and the ethical requirements that are relevant to my audit in South Africa. I have fulfilled my other ethical responsibilities in accordance with these requirements and the IESBA codes.

5. I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my opinion.

Emphasis of matter

6. I draw attention to the matter below. My opinion is not modified in respect of this matter.

Restatement of corresponding figures

7. As disclosed in note 27 to the financial statements, the corresponding figures for 31 March 2018 were restated as a result of an error in the financial statements of the entity at, and for the year ended 31 March 2019.

Other matter

8. I draw attention to the matter below. My opinion is not modified in respect of this matter.

Unaudited supplementary schedules

9. The supplementary information set out on pages 102 to 104 does not form part of the financial statements and is presented as additional information. I have not audited these schedules and, accordingly, I do not express an opinion thereon.

Responsibilities of the accounting officer for the consolidated and separate financial statements

10. The board of directors, which constitutes the accounting authority is responsible for the preparation and fair presentation of the consolidated and separate financial statements in accordance with the SA standards of GRAP and the requirements of the PFMA and the Companies Act and for such internal control as the accounting authority determines is necessary to enable the preparation of consolidated and separate financial statements that are free from material misstatement, whether due to fraud or error.
11. In preparing the consolidated and separate financial statements, the accounting authority is responsible for assessing the Mintek group and its subsidiary's ability to continue as a going concern, disclosing, as applicable, matters relating to going concern and using the going concern basis of accounting unless the appropriate governance structure either intends to liquidate the public entity or to cease operations, or there is no realistic alternative but to do so.

Auditor–general’s responsibilities for the audit of the consolidated and separate financial statements

12. My objectives are to obtain reasonable assurance about whether the consolidated and separate financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor’s report that includes my opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with ISAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these consolidated and separate financial statements.

13. A further description of my responsibilities for the audit of the consolidated and separate financial statements is included in the annexure to this auditor’s report.

Report on audit of the annual performance report

Introduction and scope

14. In accordance with the Public Audit Act of South Africa, 2004 (Act No. 25 of 2004) (PAA) and the general notice issued in terms thereof, I have a responsibility to report material findings on the compliance with the public entity with specific matters in key legislation. I performed procedures to identify findings but not to gather evidence to express assurance.

15. My procedures address the reported performance information, which must be based on the approved performance planning documents of the public entity. I have not evaluated the completeness and appropriateness of the performance indicators included in the planning documents. My procedures also did not extend to any disclosures or assertions relating to planned performance strategies and information in respect of future periods that may be included as part of the reported performance information. Accordingly, my findings do not extend to these matters.

16. I evaluated the usefulness and reliability of the reported performance information in accordance with the criteria developed from the performance management and reporting framework, as defined in the general notice, for the following selected strategic objectives presented in the annual performance report of the entity for the year ended 31 March 2019:

<table>
<thead>
<tr>
<th>Strategic objectives</th>
<th>Pages in the annual performance report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic objective 2: Research and develop efficient mineral processing technologies and value added products and services</td>
<td>157 – 158</td>
</tr>
<tr>
<td>Strategic objective 3: Promote the mineral – based economies of rural and marginalised communities</td>
<td>159 – 159</td>
</tr>
</tbody>
</table>

17. I performed procedures to determine whether the reported performance information was properly presented and whether performance was consistent with the approved performance planning documents. I performed further procedures to determine whether the indicators and related targets were measurable and relevant, and assessed the reliability of the reported performance information to determine whether it was valid, accurate and complete.

18. I did not identify any material findings on the usefulness and reliability of the reported performance information for the selected strategic objectives.

Other matter

19. I draw attention to the matter below.

Achievement of planned targets

20. Refer to the annual performance report on pages 155 to 165 for information on the achievement of planned targets for the year and explanations provided for the under/ over achievement of a number of targets.

21. In accordance with the PAA and the general notice issued in terms thereof, I have a responsibility to report material findings on the compliance with the public entity with specific matters in key legislation. I performed procedures to identify findings but not to gather evidence to express assurance.

22. The material findings on compliance with specific matters in key legislation are as follows:

Annual financial statements

23. The financial statements submitted for auditing were not prepared in accordance with the requirements of section 55(1) of the PFMA. Material misstatements for change in accounting estimates disclosure note identified by the auditors in the submitted financial statements were subsequently corrected, resulting in the financial statements receiving an unqualified audit opinion.

Other information

24. The accounting authority is responsible for the other information. The other information comprises the information included in the annual report which includes the director’s report and the audit committee’s report and the company secretary’s certificate as required by the Companies Act. The other information does not include the consolidated and separate financial statements, the auditor’s report thereon and those selected strategic objectives presented in the annual performance report that have been specifically reported on in this auditor’s report.

25. My opinion on the financial statements and findings on the reported performance information and compliance with legislation do not cover the other information and I do not express an audit opinion or any form of assurance conclusion thereon.

26. In connection with my audit, my responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the consolidated and separate financial statements and the selected strategic objectives presented in the annual performance report, or my knowledge obtained in the audit, or otherwise appears to be materially misstated.

27. I considered internal control relevant to my audit of the consolidated and separate financial statements, reported performance information and compliance with applicable legislation; however, my objective was not to express any form of assurance thereon. The matters reported below are limited to the significant internal control deficiencies that resulted in the findings on compliance with legislation included in this report.

28. Senior management did not ensure that adequate reviews are performed on the submitted financial statements to ensure that they are accurate and complete and compliant with the South African Standards of Generally Recognised Accounting Practice (SA standards of GRAP), which resulted in material amendments to the annual financial statements.
ANNEXURE – AUDITOR-GENERAL’S RESPONSIBILITY FOR THE AUDIT

1. As part of my responsibility for the audit of the financial statements, I exercise professional judgement and maintain professional scepticism throughout my audit of the consolidated and separate financial statements, and the procedures performed on reported financial information for selected strategic objectives and on the public entity’s compliance with respect to the selected subject matters.

Financial statements

2. In addition to my responsibility for the audit of the consolidated and separate financial statements as described in the auditor’s report, I also:

- Identify and assess the risks of material misstatement of the consolidated and separate financial statements whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the public entity’s internal control.

- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the accounting authority.

- Conclude on the appropriateness of the accounting authority’s use of the going concern basis of accounting in the preparation of the financial statements. I also conclude, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Mintek group and its subsidiary’s ability to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor’s report to the related disclosures in the financial statements about the material uncertainty or, if such disclosures are inadequate, to modify the opinion on the financial statements. My conclusions are based on the information available to me at the date of the auditor’s report. However, future events or conditions may cause a public entity to cease to continue as a going concern.

Communication with those charged with governance

3. I communicate with the accounting authority regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

4. I also confirm to the accounting authority that I have complied with relevant ethical requirements regarding independence, and communicate all relationships and other matters that may reasonably be thought to have a bearing on my independence and where applicable, related safeguards.

Statement of Financial Position as at 31 March 2019

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>ECONOMIC ENTITY</th>
<th>CONTROLLING ENTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOTE(S)</td>
<td>2019</td>
<td>2018 Restated*</td>
</tr>
<tr>
<td>Assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Current Assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property, plant and equipment</td>
<td>4</td>
<td>427,832,073</td>
</tr>
<tr>
<td>Intangible assets</td>
<td>5</td>
<td>4,944,194</td>
</tr>
<tr>
<td>Investments in controlled entities</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Total Assets</td>
<td>432,776,367</td>
<td>430,665,290</td>
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<tr>
<td>Current Assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventories</td>
<td>9</td>
<td>11,577,117</td>
</tr>
<tr>
<td>Receivables from exchange transactions</td>
<td>10</td>
<td>37,473,932</td>
</tr>
<tr>
<td>Cash and cash equivalents</td>
<td>11</td>
<td>446,823,715</td>
</tr>
<tr>
<td>Total Assets</td>
<td>495,874,764</td>
<td>472,283,876</td>
</tr>
<tr>
<td>Liabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Current Liabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loans from economic entities</td>
<td>7</td>
<td>10,412,036</td>
</tr>
<tr>
<td>Retirement benefits</td>
<td>8</td>
<td>10,412,036</td>
</tr>
<tr>
<td>Total Liabilities</td>
<td>20,824,072</td>
<td>35,928,056</td>
</tr>
<tr>
<td>Current Liabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payables from exchange transactions</td>
<td>14</td>
<td>80,130,973</td>
</tr>
<tr>
<td>VAT payable</td>
<td>5</td>
<td>1,835,477</td>
</tr>
<tr>
<td>Deposits</td>
<td>24,298</td>
<td>24,298</td>
</tr>
<tr>
<td>Retirement benefits</td>
<td>8</td>
<td>2,787,964</td>
</tr>
<tr>
<td>Unspent conditional grants and receipts</td>
<td>12</td>
<td>167,017,044</td>
</tr>
<tr>
<td>Provisions</td>
<td>2,560,321</td>
<td>2,560,321</td>
</tr>
<tr>
<td>Total Liabilities</td>
<td>256,155,474</td>
<td>228,346,823</td>
</tr>
<tr>
<td>Net Assets</td>
<td>662,083,521</td>
<td>656,637,820</td>
</tr>
<tr>
<td>Reserves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revaluation reserve</td>
<td>159,632,507</td>
<td>159,632,507</td>
</tr>
<tr>
<td>Accumulated surplus</td>
<td>516,838,541</td>
<td>509,662,243</td>
</tr>
<tr>
<td>Total Net Assets</td>
<td>662,083,521</td>
<td>656,637,820</td>
</tr>
</tbody>
</table>
## Statement of Financial Performance

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>ECONOMIC ENTITY</th>
<th>CONTROLLING ENTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOTE(S) 2019</td>
<td>2018 Restated*</td>
<td>2019</td>
</tr>
</tbody>
</table>

### Revenue

**Revenue from exchange transactions**

- Rendering of services: 256,880,600 233,536,433 256,880,600 233,536,433
- Rental income: 2,946,457 2,756,281 2,946,457 2,756,281
- Discount received: 56,543 74,158 56,543 74,158
- Recoveries - Insurance claims and staff obligations: 1,514,448 594,921 1,514,448 594,921
- SDL refund: 428,517 537,562 428,517 537,562
- Sundry income: 928,085 1,514,637 928,085 1,514,637
- Interest received - investment: 15 28,450,163 30,284,982 28,450,163 30,284,982
- Gain on foreign exchange: - 2,400,415 - 2,400,415

**Total revenue from exchange transactions**: 293,605,228 269,298,974 293,605,228 269,298,974

### Statement of Changes in Net Assets

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>REVALUATION RESERVE</th>
<th>ACCUMULATED SURPLUS</th>
<th>TOTAL NET ASSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOTE(S) 2019</td>
<td>2018 Restated*</td>
<td>2019</td>
<td>2018 Restated*</td>
</tr>
</tbody>
</table>

### Expenditure

- Employee related costs: (306,561,191) (300,856,767) (306,561,191) (300,856,767)
- Depreciation and amortisation: (42,053,208) (42,053,208) (42,053,208) (42,053,208)
- Finance costs: 43,513 (1,129,118) 43,513 (1,129,118)
- Debt Impairment: (314,734) (12,001) (314,734) (12,001)
- Loss on disposal of assets and liabilities: (279,754) (534,662) (279,754) (534,662)
- Loss on foreign exchange: - (37,007) - (37,007)
- Interest on retirement benefits: (1,700,000) (2,000,000) (1,700,000) (2,000,000)
- General expenses: (91,758,574) (91,115,284) (91,758,574) (91,115,284)
- Fees for services: (112,067,221) (95,011,696) (112,067,221) (95,011,696)
- Auditors remuneration: (1,875,652) (2,816,025) (1,875,652) (2,816,025)
- Useful lives adjustment: 5,140,835 6,496,487 5,140,835 6,496,487
- Actuarial gain: 6,255,511 3,220,009 6,255,511 3,220,009
- Bursary costs: (11,430,659) (10,539,524) (11,430,659) (10,539,524)

**Total expenditure**: (656,601,134) (532,872,403) (656,601,134) (532,872,403)

**Surplus (deficit) for the year**: 5,445,700 (5,854,579) 5,445,700 (5,854,579)
**Cash Flow Statement**

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>NOTE(S)</th>
<th>2019</th>
<th>2018 Restated*</th>
<th>2019</th>
<th>2018 Restated*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cash flows from operating activities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipts</td>
<td></td>
<td>529,255,889</td>
<td>484,642,152</td>
<td>529,255,888</td>
<td>484,642,152</td>
</tr>
<tr>
<td>Interest income</td>
<td></td>
<td>28,450,163</td>
<td>30,284,982</td>
<td>28,450,163</td>
<td>30,284,982</td>
</tr>
<tr>
<td>Other receipts</td>
<td></td>
<td>5,874,050</td>
<td>5,477,559</td>
<td>5,874,050</td>
<td>5,477,559</td>
</tr>
<tr>
<td>Fair value adjustment</td>
<td></td>
<td></td>
<td>-</td>
<td>693,250</td>
<td>-</td>
</tr>
<tr>
<td><strong>Net cash flows from operating activities</strong></td>
<td></td>
<td>563,580,101</td>
<td>521,097,943</td>
<td>563,580,101</td>
<td>521,097,943</td>
</tr>
<tr>
<td><strong>Payments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finance costs</td>
<td></td>
<td>43,513</td>
<td>(1,129,118)</td>
<td>43,513</td>
<td>(1,129,118)</td>
</tr>
<tr>
<td><strong>Net cash flows from investing activities</strong></td>
<td></td>
<td>(506,141,087)</td>
<td>(502,347,166)</td>
<td>(506,141,087)</td>
<td>(502,347,166)</td>
</tr>
<tr>
<td><strong>Net increase/(decrease) in cash and cash equivalents</strong></td>
<td></td>
<td>57,439,014</td>
<td>18,750,777</td>
<td>57,439,014</td>
<td>18,750,777</td>
</tr>
<tr>
<td>Purchase of property, plant and equipment</td>
<td></td>
<td>(37,034,390)</td>
<td>(51,460,031)</td>
<td>(37,034,390)</td>
<td>(51,460,031)</td>
</tr>
<tr>
<td>Purchase of other intangible assets</td>
<td></td>
<td>(2,268,716)</td>
<td>(573,773)</td>
<td>(2,268,716)</td>
<td>(573,773)</td>
</tr>
<tr>
<td><strong>Net cash flows from investing activities</strong></td>
<td></td>
<td>(39,303,106)</td>
<td>(52,034,804)</td>
<td>(39,303,106)</td>
<td>(52,034,804)</td>
</tr>
</tbody>
</table>

**Statement of Comparison of Budget and Actual Amounts**

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>APPROVED BUDGET</th>
<th>ADJUSTMENTS</th>
<th>FINAL BUDGET</th>
<th>ACTUAL AMOUNTS ON COMPARABLE BASIS</th>
<th>DIFFERENCE BETWEEN FINAL BUDGET AND ACTUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic entity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Statement of Financial Performance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue from exchange transactions</td>
<td></td>
<td>229,444,912</td>
<td>-</td>
<td>229,444,912</td>
<td>256,680,800</td>
</tr>
<tr>
<td>Rendering of services</td>
<td></td>
<td>2,678,125</td>
<td>-</td>
<td>2,678,125</td>
<td>2,946,457</td>
</tr>
<tr>
<td>Rent</td>
<td></td>
<td>49,000</td>
<td>-</td>
<td>49,000</td>
<td>56,543</td>
</tr>
<tr>
<td>Recoveries - insurance claims and Breach of contract income</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1,514,448</td>
</tr>
<tr>
<td>SDL refund</td>
<td></td>
<td>479,200</td>
<td>-</td>
<td>479,200</td>
<td>428,517</td>
</tr>
<tr>
<td>Sundry income</td>
<td></td>
<td>420,000</td>
<td>-</td>
<td>420,000</td>
<td>928,085</td>
</tr>
<tr>
<td>Interest received - investment</td>
<td></td>
<td>32,504,658</td>
<td>-</td>
<td>32,504,658</td>
<td>28,450,163</td>
</tr>
<tr>
<td><strong>Total revenue from exchange transactions</strong></td>
<td></td>
<td>365,574,895</td>
<td>-</td>
<td>365,574,895</td>
<td>291,204,813</td>
</tr>
<tr>
<td><strong>Revenue from non-exchange transactions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government grants &amp; subsidies</td>
<td></td>
<td>196,460,000</td>
<td>-</td>
<td>196,460,000</td>
<td>268,441,606</td>
</tr>
<tr>
<td><strong>Transfer revenue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total revenue</strong></td>
<td></td>
<td>562,034,895</td>
<td>-</td>
<td>562,034,895</td>
<td>559,646,419</td>
</tr>
<tr>
<td><strong>Expenditure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td></td>
<td>(338,901,648)</td>
<td>-</td>
<td>(338,901,648)</td>
<td>(306,561,191)</td>
</tr>
<tr>
<td>Depreciation and amortisation</td>
<td></td>
<td>(14,593,182)</td>
<td>-</td>
<td>(14,593,182)</td>
<td>(24,053,208)</td>
</tr>
<tr>
<td>Finance costs</td>
<td></td>
<td>(2,000,000)</td>
<td>-</td>
<td>(2,000,000)</td>
<td>43,513</td>
</tr>
<tr>
<td>Debt Impairment</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(314,734)</td>
</tr>
<tr>
<td>General Expenses</td>
<td></td>
<td>(198,002,073)</td>
<td>-</td>
<td>(198,002,073)</td>
<td>(205,735,760)</td>
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<tr>
<td><strong>Total expenditure</strong></td>
<td></td>
<td>(553,496,903)</td>
<td>-</td>
<td>(553,496,903)</td>
<td>(554,621,380)</td>
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<tr>
<td>Operating surplus</td>
<td></td>
<td>8,537,992</td>
<td>-</td>
<td>8,537,992</td>
<td>5,025,039</td>
</tr>
<tr>
<td>Loss on disposal of assets and liabilities</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(279,754)</td>
</tr>
<tr>
<td>Gain on foreign exchange</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2,400,415</td>
</tr>
<tr>
<td>Actuarial gains/losses</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(1,700,000)</td>
</tr>
<tr>
<td><strong>Surplus before taxation</strong></td>
<td></td>
<td>8,537,992</td>
<td>-</td>
<td>8,537,992</td>
<td>5,445,700</td>
</tr>
<tr>
<td><strong>Actual Amount on Comparable Basis</strong></td>
<td></td>
<td>8,537,992</td>
<td>-</td>
<td>8,537,992</td>
<td>5,445,700</td>
</tr>
</tbody>
</table>

**ECONOMIC ENTITY CONTROLLING ENTITY**

**FIGURES IN RAND**

<table>
<thead>
<tr>
<th>2019</th>
<th>2018 Restated*</th>
<th>2019</th>
<th>2018 Restated*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Flow Statement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Statement of Comparison of Budget and Actual Amounts</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ECONOMIC ENTITY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CONTROLLING ENTITY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FIGURES IN RAND</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>APPROVED BUDGET</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ADJUSTMENTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FINAL BUDGET</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ACTUAL AMOUNTS ON COMPARABLE BASIS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DIFFERENCE BETWEEN FINAL BUDGET AND ACTUAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>REFERENCE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FINANCIAL PERFORMANCE**
1. Presentation of Annual Financial Statements

The annual financial statements have been prepared in accordance with the Standards of Generally Recognised Accounting Practice (GRAP), issued by the Accounting Standards Board in accordance with Section 91(1) of the Public Finance Management Act (Act 1 of 1999) (PFMA).

These annual financial statements have been prepared on an accrual basis of accounting and are in accordance with historical cost convention as the basis of measurement, unless specified otherwise. They are presented in South African Rand.

A summary of the significant accounting policies, which have been consistently applied in the preparation of these annual financial statements, are disclosed below.

These accounting policies are consistent with the previous period, except for the changes set out in note 26 First-time adoption of Standards of GRAP.

1.1 Going concern assumption

These annual financial statements have been prepared based on the expectation that the economic entity will continue to operate as a going concern for at least the next 12 months.

1.2 Materiality

Material omissions or misstatements of items are material if they could, individually or collectively, influence the decisions or assessments of users made on the basis of the financial statements. Materiality depends on the nature or size of the omission or misstatement judged in the surrounding circumstances. The nature or size of the information item, or a combination of both, could be the determining factor.

Assessing whether an omission or misstatement could influence decisions of users, and so be material, requires consideration of the characteristics of those users. The Framework for the Preparation and Presentation of Financial Statements states that users are assumed to have a reasonable knowledge of government, its activities, accounting and a willingness to study the information with reasonable diligence. Therefore, the assessment takes into account how users with such attributes could reasonably be expected to be influenced in making and evaluating decisions.

1.3 Consolidation

Basis of consolidation

Consolidated annual financial statements are the annual financial statements of Mintek Group and all controlled entities, including special purpose entities, which are controlled by the controlling entity.

The consolidated annual financial statements incorporate the annual financial statements of the Mintek Group and all controlled entities, including special purpose entities, which are controlled by the controlling entity.

Consolidated annual financial statements are prepared using uniform accounting policies for like transactions and other events in similar circumstances.

Control exists when Mintek has the power to govern the financial and operating policies of another entity so as to obtain benefits from its activities.

The revenue and expenses of Mintek are included in the consolidated annual financial statements from the transfer date or acquisition date as defined in the Standards of GRAP on Transfer of functions between entities under common control. The revenue and expenses of Mintek are based on the values of the assets and liabilities recognised in Mintek’s annual financial statements at the acquisition date.

The annual financial statements of Mintek and its subsidiary used in the preparation of the consolidated annual financial statements are prepared as of the same date. All intra-entity transactions, balances, revenues and expenses are eliminated in full on consolidation.

Non-controlling interest in the net assets of the economic entity are identified and recognised separately from the controlling entity’s interest therein, and are recognised within net assets.

Changes in Mintek’s ownership interest in Mintdev that do not result in a loss of control are accounted for as transactions that affect net assets.

1.4 Property, plant and equipment

Property, plant and equipment are tangible non-current assets (including infrastructure assets) that are held for use in the production or supply of goods or services, rental to others, or for administrative purposes, and are expected to be used during more than one period.

The cost of an item of property, plant and equipment is recognised as an asset when:

- it is probable that future economic benefits or service potential associated with the item will flow to the economic entity; and
- the cost of the item can be measured reliably.

Property, plant and equipment is initially measured at cost.

The cost of an item of property, plant and equipment is the purchase price and other costs attributable to bring the item to the location and condition necessary for it to be capable of operating in the manner intended by management. Trade discounts and rebates are deducted in arriving at the cost.

Where an asset is acquired through a non-exchange transaction, its cost is its fair value as at date of acquisition.

Where an item of property, plant and equipment is acquired in exchange for a non-monetary asset or monetary assets, or a combination of monetary and non-monetary assets, the asset acquired is initially measured at fair value (the cost). If the acquired item’s fair value was not determinable, it’s deemed cost is the carrying amount of the asset(s) given up.

When significant components of an item of property, plant and equipment have different useful lives, they are accounted for as separate items (major components) of property, plant and equipment.

Costs include costs incurred initially to acquire or construct an item of property, plant and equipment and costs incurred subsequently to add to, replace part of, if a replacement cost is recognised in the carrying amount of an item of property, plant and equipment, the carrying amount of the replaced part is derecognised.

Recognition of costs in the carrying amount of an item of property, plant and equipment ceases when the item is in the location and condition necessary for it to be capable of operating in the manner intended by management.

Major inspection costs which are a condition of continuing use of an item of property, plant and equipment and which meet the recognition criteria above are included as a replacement in the cost of the item of property, plant and equipment. Any remaining inspection costs from the previous inspection are derecognised.

Property, plant and equipment is carried at cost less accumulated depreciation and any impairment losses.

Property, plant and equipment is carried at cost less accumulated depreciation and any impairment losses except for land and buildings which is carried at revalued amount being the fair value at the date of revaluation less any subsequent accumulated depreciation and subsequent accumulated impairment losses.

Land and buildings is carried at revalued amount, being the fair value at the date of revaluation less any subsequent accumulated depreciation and subsequent accumulated impairment losses.

Revaluations are made every 5 years to ensure that the carrying amount does not differ materially from that which would be determined using fair value at the end of the reporting period.

When an item of property, plant and equipment is revalued, any accumulated depreciation at the date of the revaluation is restated proportionately with the change in the gross carrying amount of the asset so that the carrying amount of the asset after revaluation equals its revalued amount.

When an item of property, plant and equipment is revalued, any accumulated depreciation at the date of the revaluation is eliminated against the gross carrying amount of the asset and the net amount restated to the revalued amount of the asset.

Any increase in an asset’s carrying amount, as a result of a revaluation, is credited directly to a revaluation surplus. The increase is recognised in surplus or deficit to the extent it reverses a revaluation decrease of the same asset previously recognised in surplus or deficit.

Any decrease in an asset’s carrying amount, as a result of a revaluation, is recognised in surplus or deficit in the current period. The decrease is debited directly to a revaluation surplus to the extent of any credit balance existing in the revaluation surplus in respect of that asset.

The revaluation surplus in equity related to a specific item of property, plant and equipment is transferred directly to retained earnings when the asset is derecognised.

The revaluation surplus in equity related to a specific item of property, plant and equipment is transferred directly to retained earnings as the asset is used. The amount transferred is equal to the difference between depreciation based on the revalued carrying amount and depreciation based on the original cost of the asset.

Property, plant and equipment are depreciated on the straight line basis over their expected useful lives to their estimated residual value. The useful lives of items of property, plant and equipment have been assessed as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Depreciation method</th>
<th>Average useful life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>Straight line</td>
<td>Indefinitely</td>
</tr>
<tr>
<td>Buildings</td>
<td>Straight line</td>
<td>50 years</td>
</tr>
<tr>
<td>Plant and machinery</td>
<td>Straight line</td>
<td>5 - 10 years</td>
</tr>
<tr>
<td>Furniture and fixtures</td>
<td>Straight line</td>
<td>5 - 10 years</td>
</tr>
<tr>
<td>Motor vehicles</td>
<td>Straight line</td>
<td>5 years</td>
</tr>
<tr>
<td>Office equipment</td>
<td>Straight line</td>
<td>5 - 10 years</td>
</tr>
<tr>
<td>IT equipment</td>
<td>Straight line</td>
<td>3 - 5 years</td>
</tr>
<tr>
<td>Other equipment</td>
<td>Straight line</td>
<td>5 - 10 years</td>
</tr>
</tbody>
</table>

The depreciable amount of an asset is allocated on a systematic basis over its useful life.
Each part of an item of property, plant and equipment with a cost that is significant in relation to the total cost of the item is depreciated separately.

The depreciation method used reflects the pattern in which the asset’s future economic benefits or service potential are expected to be consumed by Mintek. The depreciation method applied to an asset is reviewed at least at each reporting date and, if there has been a significant change in the expected pattern of consumption of the future economic benefits or service potential embodied in the asset, the method is changed to reflect the changed pattern. Such a change is accounted for as a change in an accounting estimate.

Mintek assesses at each reporting date whether there is any indication that the economic entity expectations about the residual value and the useful life of an asset have changed since the preceding reporting date. If any such indication exists, the economic entity revises the expected useful life and/or residual value accordingly. The change is accounted for as a change in an accounting estimate.

The depreciation charge for each period is recognised in surplus or deficit unless it is included in the carrying amount of another asset.

Items of property, plant and equipment are derecognised when the asset is disposed of or when there are no further economic benefits or service potential expected from the use of the asset.

The gain or loss arising from the derecognition of an item of property, plant and equipment is included in surplus or deficit when the item is derecognised. The gain or loss arising from the derecognition of an item of property, plant and equipment is determined as the difference between the net disposal proceeds, if any, and the carrying amount of the item.

Mintek separately discloses expenditure to repair and maintain property, plant and equipment in the notes to the financial statements (see note 4).

Mintek discloses relevant information relating to assets under construction or development, in the notes to the financial statements (see note 4).

### 1.5 Intangible assets

An intangible asset is identifiable if it either:
- is separable, i.e. is capable of being separated from an entity and sold, transferred, licensed, rented or exchanged, either individually or together with a related contract, identifiable assets or liability, regardless of whether the entity intends to do so; or
- arises from binding arrangements (including rights from contracts), regardless of whether those rights are transferable or separable from Mintek or from other rights and obligations.

A binding arrangement describes an arrangement that confers similar rights and obligations on the parties to it as if it were in the form of a contract.

An intangible asset is recognised when:
- it is probable that the expected future economic benefits or service potential that are attributable to the asset will flow to Mintek; and
- the cost or fair value of the asset can be measured reliably.

Mintek assesses the probability of expected future economic benefits or service potential using reasonable and supportable assumptions that represent management’s best estimate of the set of economic conditions that will exist over the useful life of the asset.

Where an intangible asset is acquired through a non-exchange transaction, its initial cost at the date of acquisition is measured at its fair value as at that date.

Intangible assets are carried at cost less any accumulated amortisation and any impairment losses.

The amortisation period and the amortisation method for intangible assets are reviewed at each reporting date.

Reassessing the useful life of an intangible asset with a finite useful life after it was classified as indefinite is an indicator that the asset may be impaired. As a result the asset is tested for impairment and the remaining carrying amount is amortised over its useful life.

Internally generated brands, mastheads, publishing titles, customer lists and items similar in substance are not recognised as intangible assets.

Internally generated goodwill is not recognised as an intangible asset.

Amortisation is provided to write down the intangible assets, on a straight line basis, to their residual values as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Depreciation method</th>
<th>Average useful life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer software</td>
<td>Straight line</td>
<td>3 - 5 years</td>
</tr>
</tbody>
</table>

### 1.6 Investments in controlled entities

**Mintek annual financial statements**

Investments in controlled entities are consolidated in Mintek annual financial statements. Refer to the accounting policy on Consolidations (Note 1.3).

In Mintek’s separate annual financial statements, investments in controlled entities are carried at cost.

The entity applies the same accounting for each category of investment.

Investments in controlled entities that are accounted for in accordance with the accounting policy on Financial instruments in the consolidated annual financial statements, are accounted for in the same way in Mintek’s separate annual financial statements.

<table>
<thead>
<tr>
<th>1.7 Financial instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A financial instrument is any contract that gives rise to a financial asset of one entity and a financial liability or a residual interest of another entity.</td>
</tr>
</tbody>
</table>

The amortised cost of a financial asset or financial liability is the amount at which the financial asset or financial liability is measured at initial recognition minus principal repayments, plus or minus the cumulative amortisation using the effective interest method of any difference between that initial amount and the maturity amount, and minus any reduction (directly or through the use of an allowance account) for impairment or uncollectibility.

Credit risk is the risk that one party to a financial instrument will cause a financial loss for the other party by failing to discharge an obligation.

Currency risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in foreign exchange rates.

Derecognition is the removal of a previously recognised financial asset or financial liability from an entity’s statement of financial position.
- It is settled at a future date.
- The effective interest method is a method of calculating the amortised cost of a financial asset or a financial liability (or group of financial assets or financial liabilities) and of allocating the income or interest expense over the relevant period.
- The effective interest rate is the rate that exactly discounts estimated future cash payments or receipts through the expected life of the financial instrument or, when appropriate, a shorter period to the net carrying amount of the financial asset or financial liability.

When calculating the effective interest rate, an entity shall estimate cash flows considering all contractual terms of the financial instrument (for example, prepayment, call and similar options) but shall not consider future credit losses. The calculation includes all fees and points paid or received between parties to the contract that are an integral part of the effective interest rate (see the Standard of GRAP on Revenue from Exchange Transactions), transaction costs, and all other premiums or discounts.

There is a presumption that the cash flows and the expected life of a group of similar financial instruments can be estimated reliably. However, in those rare cases when it is not possible to reliably estimate the cash flows or the expected life of a financial instrument (or group of financial instruments), the entity shall use the contractual cash flows over the full contractual term of the financial instrument (or group of financial instruments).

Fair value is the amount for which an asset could be exchanged, or a liability settled, between knowledgeable willing parties in an arm’s length transaction. A financial asset is:
- cash;
- a residual interest of another entity; or
- a contractual right to:
  - receive cash or another financial asset from another entity; or
  - exchange financial assets or financial liabilities with another entity under conditions that are potentially favourable to the entity.

A financial liability is any liability that is a contractual obligation to:
- deliver cash or another financial asset to another entity; or
- exchange financial assets or financial liabilities under conditions that are potentially unfavourable to the entity.

Interest rate risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market interest rates.

Liquidity risk is the risk encountered by an entity in the event of difficulty in meeting obligations associated with financial liabilities that are settled by delivering cash or another financial asset.

Market risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market prices. Market risk comprises three types of risk: currency risk, interest rate risk and other price risk.

A financial asset is past due when a counterparty has failed to make a payment when contractually due.

Transaction costs are incremental costs that are directly attributable to the acquisition, issue or disposal of a financial asset or financial liability. An incremental cost is one that would not have been incurred if the entity had not acquired, issued or disposed of the financial instrument.

Financial instruments at amortised cost are non-derivative financial assets or non-derivative financial liabilities that have fixed or determinable payments, excluding those instruments that:
- the entity designates at fair value at initial recognition; or
- are held for trading.

Financial instruments at cost are investments in residual interests that do not have a quoted market price in an active market, and whose fair value cannot be reliably measured.

Financial instruments at fair value comprise financial assets or financial liabilities that are:
- derivatives;
- contingent consideration of an acquirer in a transfer of functions between entities not under common control to which the Standard of GRAP on Transfer of Functions Between Entities Not Under Common Control (GRAP 106) applies;
- combined instruments that are designated at fair value;
- instruments held for trading. A financial instrument is held for trading if for which there is evidence of a recent actual pattern of short term profit-taking; and
- non-derivative financial assets or financial liabilities with fixed or determinable payments that are designated at fair value at initial recognition; and
- financial instruments that do not meet the definition of
The cost of inventories comprises all of costs of purchase, costs of conversion and other costs incurred in bringing the inventories to their present location and condition.

The cost of inventories of items that are not ordinarily interchangeable and goods or services produced and segregated for specific Mine and is assigned using specific identification of the individual costs.

When inventories are sold, the carrying amounts of those inventories are recognised as an expense in the period in which the related revenue is recognised. If there is no related revenue, the expenses are recognised when the goods are distributed, or related services are rendered. The amount of any write-down of inventories to net realisable value or current replacement cost and all losses of inventories are recognised as an expense in the period the write-off or loss occurs. The amount of any reversal of any write-down of inventories, arising from an increase in net realisable value or current replacement cost, are recognised as a reduction in the amount of inventories recognised as an expense in the period in which the reversal occurs.

1.10 Impairment of cash-generating assets

Cash-generating assets are assets used with the objective of generating a commercial return. Commercial return means that positive cash flows are expected to be significantly higher than the cost of the asset.

Impairment is a loss in the future economic benefits or service potential of an asset, over and above the systematic recognition of its depreciable amount. The depreciable amount is the recoverable amount of the asset, net of accumulated depreciation and estimated impairment losses thereon.

A cash-generating unit is the smallest identifiable group of assets used with the objective of generating a commercial return that generates cash inflows from continuing use that are largely independent of the cash inflows from other assets or groups of assets.

Costs of disposal are incremental costs directly attributable to the disposal of an asset, excluding finance costs and income tax expense.

Depreciation (amortisation) is the systematic allocation of the depreciable amount of an asset over its useful life.

Recoverable amount of an asset or a cash-generating unit is the higher its fair value less costs to sell and its value in use. Useful life is either:
- the period of time over which an asset is expected to be used by the economic entity; or
- the number of production or similar units expected to be obtained from the asset by the economic entity.

Judgements made by management in applying the criteria to designate assets as cash-generating assets or non-cash-generating assets, are as follows:

1.11 Share capital / contributed capital

An equity instrument is any contract that evidences a residual interest in the assets of an economic entity after deducting all of its liabilities.

1.12 Employee benefits

Defined contribution plans

Payments to defined contribution retirement benefit plans are charged as an expense as they fall due.

Payments made to industry-managed (or state plans) retirement benefit schemes are dealt with as defined contribution plans where Mintek’s obligation under the schemes is equivalent to those arising in a defined contribution retirement benefit plan.

Defined benefit plans

For defined benefit plans the cost of providing the benefits is determined using the projected credit method. Actuarial valuations are conducted on an annual basis by independent actuaries separately for each plan.

Consideration is given to any event that could impact the funds up to end of the reporting period when the interim valuation is performed at an earlier date.

Past service costs are recognised immediately to the extent that the benefits are already vested, and are otherwise amortised on a straight line basis over the average period until the amended benefits become vested.

To the extent that, at the beginning of the financial period, any cumulative unrecognised actuarial gain or loss exceeds ten percent of the greater of the present value of the projected benefit obligation and the fair value of the plan assets (the corridor), that portion is recognised in surplus or deficit over the expected average remaining service lives of participating employees. Actuarial gains or losses within the corridor are not recognised.

Gains or losses on the curtailment or settlement of a defined benefit plan is recognised when the entity is demonstrably committed to curtailment or settlement.

When it is virtually certain that another party will reimburse some or all of the expenditure required to settle a defined benefit obligation, the right to reimbursement is recognised as a separate asset. The asset is measured at fair value. In all other respects, the asset is treated in the same way as plan assets.

In surplus or deficit, the expense relating to a defined benefit plan is presented as the net of the amount recognised for a reimbursement.

The amount recognised in the statement of financial position represents the present value of the defined benefit obligation as adjusted for unrecognised actuarial gains and losses and unrecognised past service costs, and reduces by the fair value of plan assets.

Any asset is limited to unrecognised actuarial losses and past service costs, plus the present value of available refunds and reduction in future contributions to the plan.

1.13 Provisions and contingencies

Provisions are recognised when:
- Mintek has a present obligation as a result of a past event;
- it is probable that an outflow of resources embodying economic benefits or service potential will be required to settle the obligation; and
- a reliable estimate can be made of the obligation.

The amount of a provision is the best estimate of the expenditure expected to be required to settle the present obligation at the reporting date.

Where the effect of time value of money is material, the amount of a provision is the present value of the expenditures expected to be required to settle the obligation.

The discount rate is a pre-tax rate that reflects current market assessments of the time value of money and the risks specific to the liability.

Where some or all of the expenditure required to settle a provision is expected to be reimbursed by another party, the reimbursement is recognised when, and only when, it is virtually certain that reimbursement will be received if the economic entity settles the obligation. The reimbursement is treated as a separate asset. The amount recognised for the reimbursement does not exceed the amount of the provision.

Provisions are reviewed at each reporting date and adjusted to reflect the current best estimate. Provisions are reversed if it is no longer probable that an outflow of resources embodying economic benefits or service potential will be required, to settle the obligation.

Where discounting is used, the carrying amount of a provision increases in each period to reflect the passage of time. This increase is recognised as an interest expense.

A provision is used only for expenditures for which the provision was originally recognised. Provisions are not recognised for future operating surplus (deficit).

If an entity has a contract that is onerous, the present obligation (net of recoveries) under the contract is recognised and measured as a provision.
No obligation arises as a consequence of the sale or transfer of an operation until the economic entity is committed to the sale or transfer, that is, there is a binding arrangement.

After their initial recognition contingent liabilities recognised in entity combinations that are recognised separately are subsequently measured at the higher of:

• the amount that would be recognised as a provision; and
• the amount initially recognised less cumulative amortisation.

Contingent assets and contingent liabilities are not recognised. Contingencies are disclosed in note 23.

1.14 Commitments

Items are classified as commitments when Mintek has committed itself to future transactions that will normally result in the outflow of cash.

Disclosures are required in respect of unrecognised contractual commitments.

Commitments for which disclosure is necessary to achieve a fair presentation should be disclosed in a note to the financial statements, if both the following criteria are met:

• Contracts should be non-cancellable or only cancellable at significant cost (for example, contracts for computer or building maintenance services); and
• Contracts should relate to something other than the routine, steady, state business of the entity – therefore salary commitments relating to employment contracts or social security benefit commitments are excluded.

1.15 Revenue from exchange transactions

Revenue is the gross inflow of economic benefits or service potential during the reporting period when those inflows result in an increase in net assets, other than increases relating to contributions from owners.

An exchange transaction is one in which Mintek receives assets or services, or has liabilities extinguished, and directly gives approximately equal value (primarily in the form of goods, services or use of assets) to the other party in exchange.

Fair value is the amount for which an asset could be exchanged, or a liability settled, between knowledgeable, willing parties in an arm’s length transaction.

Measurement

Revenue is measured at the fair value of the consideration received or receivable for goods and services provided in the normal course of business, net trade discounts and volume rebates, and value added tax.

Fair value is the amount for which an asset could be exchanged, or a liability settled, between knowledgeable, willing parties in an arm’s length transaction.

Sale of goods

Revenue from the sale of goods is recognised when all the following conditions have been satisfied:

• Mintek has transferred to the purchaser the significant risks and rewards of ownership of the goods;
• Mintek retains neither continuing managerial involvement to the degree usually associated with ownership nor effective control over the goods sold;
• The amount of revenue can be measured reliably;
• It is probable that the economic benefits or service potential associated with the transaction will flow to Mintek; and
• The costs incurred or to be incurred in respect of the transaction can be measured reliably.

Rendering of services

When the outcome of a transaction involving the rendering of services can be estimated reliably, revenue associated with the transaction is recognized by reference to the stage of completion of the transaction at the reporting date. The outcome of a transaction can be estimated reliably when all the following conditions are satisfied:

• The amount of revenue can be measured reliably;
• It is probable that the economic benefits or service potential associated with the transaction will flow Mintek;
• The stage of completion of the transaction at reporting date can be measured reliably; and
• The costs incurred for the transaction and the costs to complete the transaction can be measured reliably.

When the outcome of the transaction involving the rendering of services cannot be estimated reliably, revenue is recognized only to the extent of the expenses recognized that are recoverable.

Interest, rental income and other income items

Revenue arising from the use by others of entity assets yielding interest, royalties, rental income and other income is recognized when:

• It is probable that the economic benefits or service potential associated with the transaction will flow to Mintek; and
• The amount of the revenue can be measured reliably.

Interest is recognized, in surplus or deficit, using the effective interest rate method.

Rental income is recognized on the accrual basis in accordance with the substance of the relevant agreements.

1.16 Revenue from non-exchange transactions

Revenue comprises gross inflows of economic benefits or service potential received and receivable by Mintek, which represents an increase in net assets, other than increases relating to contributions from owners.

Conditions on transferred assets are stipulations that specify the purpose for which the transferred asset can be used, except to the extent that a liability is also recognized in respect of the same inflow.

Revenue from non-exchange transactions is measured at the amount of the increase in net assets recognized by the entity.

When, as a result of a non-exchange transaction, the entity recognizes an asset, it also recognizes revenue equivalent to the amount of the asset measured at its fair value as at the date of acquisition, unless it is also required to recognize a liability. Where a liability is required to be recognized it will be measured as the best estimate of the amount required to settle the obligation at the reporting date, and the amount of the increase in net assets, if any, recognized as revenue.

When a liability is subsequently reduced, because the taxable event occurs or a condition is satisfied, the amount of the reduction in the liability is recognized as revenue.

Transfers

Apart from Services in kind, which are not recognized, the entity recognizes an asset in respect of transfers when the transferred resources meet the definition of an asset and satisfy the criteria for recognition as an asset.

The entity recognizes in respect of transfers when the transferred resources meet the definition of an asset and satisfy the criteria for recognition as an asset.

Transferred assets are measured at their fair value as at the date of acquisition.

1.17 Borrowing costs

Borrowing costs are interest and other expenses incurred by an entity in connection with the borrowing of funds. Borrowing costs are recognized as an expense in the period in which they are incurred.

1.18 Translation of foreign currencies

Foreign currency transactions

A foreign currency transaction is recorded, on initial recognition in Rands, by applying the foreign currency amount the spot exchange rate between the functional currency and the foreign currency at the date of the transaction.

At each reporting date:

• foreign currency monetary items are translated using the closing rate;
• non-monetary items that are measured in terms of historical cost in a foreign currency are translated using the exchange rate at the date of the transaction; and
• non-monetary items that are measured at fair value in a foreign currency are translated using the exchange rates at the date when the fair value was determined.

Exchange differences arising on the settlement of monetary items or on translating monetary items at rates different from those at which they were translated on initial recognition during the period or in previous annual financial statements are recognized in surplus or deficit in the period in which they arise.

When a gain or loss on a foreign currency item is recognized directly in net assets, any exchange component of that gain or loss is recognized directly in net assets. When a gain or loss on a non-monetary item is recognized in surplus or deficit, any exchange component of that gain or loss is recognized in surplus or deficit.

Cash flows arising from transactions in a foreign currency are recorded in Rands by applying to the foreign currency amount the exchange rate between the Rand and the foreign currency at the date of the cash flow.
1.19 Irregular expenditure

Irregular expenditure as defined in section 1 of the PFMA is expenditure other than unauthorised expenditure, incurred in contravention of or that is not in accordance with a requirement of any applicable legislation, including:

(a) The PFMA
(b) Mintek Procurement Policy
(c) National Treasury Regulations

National Treasury practice note no. 4 of 2008/2009 which was issued in terms of sections 76(1) to 76(4) of the PFMA requires the following (effective from 1 April 2008):

Irregular expenditure that was incurred and identified during the current financial year and which was not condoned by the National Treasury or the relevant authority must be recorded appropriately in the irregular expenditure register. If liability for the irregular expenditure can be attributed to a person, a debt account must be created if such a person is liable in law. Immediate steps must thereafter be taken to recover the amount from the person concerned. If recovery is not possible, the accounting officer or accounting authority may write off the amount as debt impairment and disclose such in the relevant note to the financial statements. If the irregular expenditure has not been condoned and no person is liable in law, the expenditure related thereto must remain against the relevant programme/expenditure item, be disclosed as such in the note to the financial statements and updated accordingly in the irregular expenditure register.

All expenditure relating to irregular expenditure is recognized as an expense in the statement of financial performance in the year that the expenditure is incurred.

1.20 Cash and cash equivalents

Cash and cash equivalents comprise cash-on-hand and demand deposits, and other short-term highly liquid investments that are readily convertible to a known amount of cash and are subject to an insignificant risk of changes in value. These are initially recognised at cost and subsequently recorded at fair value.

Notes to the Annual Financial Statements

2. Changes in accounting policy

The annual financial statements have been prepared in accordance with Standards of Generally Recognised Accounting Practice (GRAP) on a basis of restating prior year as the first time adoption of GRAP.

The aggregate effect of the changes in accounting policy on the annual financial statements for the year ended 31 March 2019 is disclosed in Note 25 to the financial statements:

3. New standards and interpretations

3.1 Standards and interpretations issued, but not yet effective

Mintek adopted GRAP standards effective from 1 April 2018 as per Directive 12. All applicable standards have been complied with and the effect of this change is reflected in note 25 Prior year adjustments.

Mintek has not applied the following standards and interpretations, which have been published and are mandatory for the Mintek’s accounting periods beginning on or after 01 April 2019 or later periods:

<table>
<thead>
<tr>
<th>STANDARD/INTERPRETATION:</th>
<th>EFFECTIVE DATE:</th>
<th>EXPECTED IMPACT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAP 35: Consolidated Financial Statements</td>
<td>01 April 2019</td>
<td>Unlikely there will be a material impact</td>
</tr>
<tr>
<td>GRAP 18 (as amended 2016): Segment Reporting</td>
<td>01 April 2019</td>
<td>Unlikely there will be a material impact</td>
</tr>
<tr>
<td>GRAP 20: Related parties</td>
<td>01 April 2019</td>
<td>Unlikely there will be a material impact</td>
</tr>
<tr>
<td>GRAP 17 (as amended 2016): Property, Plant and Equipment</td>
<td>01 April 2019</td>
<td>Unlikely there will be a material impact</td>
</tr>
<tr>
<td>GRAP 21 (as amended 2016): Impairment of non-cash-generating assets</td>
<td>01 April 2019</td>
<td>Unlikely there will be a material impact</td>
</tr>
<tr>
<td>GRAP 26 (as amended 2016): Impairment of cash-generating assets</td>
<td>01 April 2019</td>
<td>Unlikely there will be a material impact</td>
</tr>
</tbody>
</table>

The above standards are all effective for financial years commencing 1 April 2019. They are similar to existing standards being applied by the company and are unlikely to impact the financial position and performance of the entity, but may impact the extent of disclosures provided.
### 4. Property, Plant and Equipment

**CONTROLLING AND ECONOMIC ENTITY**

<table>
<thead>
<tr>
<th></th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost / Valuation</strong></td>
<td>2019</td>
<td>2018</td>
</tr>
<tr>
<td>Land</td>
<td>112,334,241</td>
<td>112,334,241</td>
</tr>
<tr>
<td>Buildings</td>
<td>99,484,425</td>
<td>93,804,844</td>
</tr>
<tr>
<td>Plant and machinery</td>
<td>32,761,186</td>
<td>30,846,685</td>
</tr>
<tr>
<td>Furniture and fixtures</td>
<td>9,303,111</td>
<td>9,114,264</td>
</tr>
<tr>
<td>Motor vehicles</td>
<td>263,285</td>
<td>7,330</td>
</tr>
<tr>
<td>IT equipment</td>
<td>25,785,671</td>
<td>7,482</td>
</tr>
<tr>
<td>Funded assets</td>
<td>350,475,496</td>
<td>207,977,360</td>
</tr>
<tr>
<td>Other equipment</td>
<td>16,147,233</td>
<td>378,155,654</td>
</tr>
<tr>
<td>Laboratory equipment</td>
<td>101,441,609</td>
<td>96,778,313</td>
</tr>
</tbody>
</table>

**Carrying Value**

|                  | 2019       | 2018       |
| Land             | 112,334,241| 112,334,241|
| Buildings        | 93,804,844 | 66,862,536 |
| Plant and machinery | 30,846,685 | 21,339,658 |
| Furniture and fixtures | 9,114,264 | 2,761,619 |
| Motor vehicles   | 7,330      | 209,747    |
| IT equipment     | 7,482      | 25,785,671 |
| Funded assets    | 207,977,360| 155,830,741|
| Other equipment  | 378,155,654| 12,018,222 |
| Laboratory equipment | 96,778,313 | 101,441,609|

**Accumulated depreciation and accumulated impairment**

|                  | 2019       | 2018       |
| Land             |           |           |
| Buildings        | 32,621,889| 30,571,929|
| Plant and machinery | 11,522,128 | 21,832,281|
| Furniture and fixtures | 11,426,482 | 2,761,619 |
| Motor vehicles   |           |           |
| IT equipment     | 15,049,888|          |
| Funded assets    | 207,977,360|          |
| Other equipment  | 378,155,654|          |
| Laboratory equipment | 45,884,553 |          |

**Carrying Value**

|                  | 2019       | 2018       |
| Land             | 112,334,241| 112,334,241|
| Buildings        | 66,862,536 | 66,862,536 |
| Plant and machinery | 21,339,658 | 21,339,658 |
| Furniture and fixtures | 2,761,619 | 2,761,619 |
| Motor vehicles   | 209,747    | 209,747    |
| IT equipment     | 25,785,671 | 25,785,671 |
| Funded assets    | 155,830,741| 155,830,741|
| Other equipment  | 12,018,222 | 12,018,222 |
| Laboratory equipment | 101,441,609 | 101,441,609|

---

### RECONCILIATION OF PROPERTY, PLANT AND EQUIPMENT - CONTROLLING ENTITY - 2019

<table>
<thead>
<tr>
<th></th>
<th>Opening balance</th>
<th>Additions</th>
<th>Disposals</th>
<th>Transfers</th>
<th>Adjustments</th>
<th>Depreciation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>112,334,241</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>112,334,241</td>
</tr>
<tr>
<td>Buildings</td>
<td>63,232,916</td>
<td>5,679,581</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>68,912,517</td>
</tr>
<tr>
<td>Plant and machinery</td>
<td>9,014,304</td>
<td>264,587</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9,278,891</td>
</tr>
<tr>
<td>Furniture and fixtures</td>
<td>3,499,782</td>
<td>207,961</td>
<td>(3,216)</td>
<td>(251,829)</td>
<td>352,477</td>
<td>(1,043,456)</td>
<td>2,761,619</td>
</tr>
<tr>
<td>Motor vehicles</td>
<td>282</td>
<td>255,955</td>
<td></td>
<td>494</td>
<td></td>
<td></td>
<td>209,747</td>
</tr>
<tr>
<td>IT equipment</td>
<td>9,767,128</td>
<td>4,007,544</td>
<td>(256,434)</td>
<td>(1,312,570)</td>
<td>2,223,772</td>
<td>(3,893,657)</td>
<td>10,735,783</td>
</tr>
<tr>
<td>Funded assets</td>
<td>170,178,294</td>
<td>3,607,206</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>153,785,490</td>
</tr>
<tr>
<td>Other equipment</td>
<td>4,600,457</td>
<td>8,754,807</td>
<td>(841)</td>
<td>(986,352)</td>
<td>172,360</td>
<td>(522,209)</td>
<td>51,018,222</td>
</tr>
<tr>
<td>Laboratory equipment</td>
<td>55,477,565</td>
<td>14,256,849</td>
<td>(19,263)</td>
<td>(9,455,051)</td>
<td>1,080,639</td>
<td>(5,783,683)</td>
<td>55,557,056</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>428,104,969</strong></td>
<td><strong>37,034,390</strong></td>
<td><strong>(279,754)</strong></td>
<td><strong>(671,052)</strong></td>
<td><strong>4,694,036</strong></td>
<td><strong>(41,050,516)</strong></td>
<td><strong>427,832,073</strong></td>
</tr>
</tbody>
</table>
**Notes to the Annual Financial Statements**

**4. Property, Plant and Equipment (continued)**

### RECONCILIATION OF PROPERTY, PLANT AND EQUIPMENT - CONTROLLING ENTITY - 2018

<table>
<thead>
<tr>
<th></th>
<th>Opening Balance</th>
<th>Additions</th>
<th>Disposals</th>
<th>Transfers</th>
<th>Adjustments</th>
<th>Depreciation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land</strong></td>
<td>112,334,241</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>112,334,241</td>
</tr>
<tr>
<td><strong>Buildings</strong></td>
<td>63,049,984</td>
<td>-</td>
<td>-</td>
<td>2,118,874</td>
<td>107,354</td>
<td>(2,043,096)</td>
<td>63,232,916</td>
</tr>
<tr>
<td><strong>Plant and machinery</strong></td>
<td>20,672,592</td>
<td>80,517</td>
<td>(20,739)</td>
<td>(10,141,636)</td>
<td>285,141</td>
<td>(1,861,508)</td>
<td>9,014,304</td>
</tr>
<tr>
<td><strong>Furniture and fixtures</strong></td>
<td>3,570,125</td>
<td>387,027</td>
<td>(23,668)</td>
<td>-</td>
<td>553,140</td>
<td>(996,642)</td>
<td>3,498,782</td>
</tr>
<tr>
<td><strong>Motor vehicles</strong></td>
<td>434</td>
<td>-</td>
<td>(2)</td>
<td>-</td>
<td>(150)</td>
<td>282</td>
<td></td>
</tr>
<tr>
<td><strong>IT equipment</strong></td>
<td>6,984,317</td>
<td>2,142,908</td>
<td>-</td>
<td>(313,878)</td>
<td>-</td>
<td>-</td>
<td>9,767,128</td>
</tr>
<tr>
<td><strong>Motor vehicles</strong></td>
<td>434</td>
<td>-</td>
<td>(2)</td>
<td>-</td>
<td>(150)</td>
<td>282</td>
<td></td>
</tr>
<tr>
<td><strong>IT equipment</strong></td>
<td>6,984,317</td>
<td>2,142,908</td>
<td>-</td>
<td>(313,878)</td>
<td>-</td>
<td>-</td>
<td>9,767,128</td>
</tr>
<tr>
<td><strong>Motor vehicles</strong></td>
<td>434</td>
<td>-</td>
<td>(2)</td>
<td>-</td>
<td>(150)</td>
<td>282</td>
<td></td>
</tr>
<tr>
<td><strong>IT equipment</strong></td>
<td>6,984,317</td>
<td>2,142,908</td>
<td>-</td>
<td>(313,878)</td>
<td>-</td>
<td>-</td>
<td>9,767,128</td>
</tr>
<tr>
<td><strong>Motor vehicles</strong></td>
<td>434</td>
<td>-</td>
<td>(2)</td>
<td>-</td>
<td>(150)</td>
<td>282</td>
<td></td>
</tr>
</tbody>
</table>

**4.1 Property, Plant and Equipment - Economic Entity - 2019**

<table>
<thead>
<tr>
<th></th>
<th>Additions</th>
<th>Disposals</th>
<th>Transfers</th>
<th>Adjustments</th>
<th>Depreciation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Buildings</strong></td>
<td>2,517,064</td>
<td>14,443,755</td>
<td>-</td>
<td>(99,616,809)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Plant and machinery</strong></td>
<td>137,920,928</td>
<td>15,682,286</td>
<td>-</td>
<td>(42,105,759)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Furniture and fixtures</strong></td>
<td>20,672,592</td>
<td>80,517</td>
<td>-</td>
<td>(3,000,180)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Motor vehicles</strong></td>
<td>1,917,297</td>
<td>476,842</td>
<td>(22,933)</td>
<td>2,642,203</td>
<td>174,468</td>
<td>55,477,565</td>
</tr>
<tr>
<td><strong>IT equipment</strong></td>
<td>41,684,124</td>
<td>18,252,696</td>
<td>(153,444)</td>
<td>2,017,811</td>
<td>19,943</td>
<td>112,334,241</td>
</tr>
</tbody>
</table>

**4.2 Property, Plant and Equipment - Economic Entity - 2018**

<table>
<thead>
<tr>
<th></th>
<th>Additions</th>
<th>Disposals</th>
<th>Transfers</th>
<th>Adjustments</th>
<th>Depreciation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Buildings</strong></td>
<td>2,517,064</td>
<td>14,443,755</td>
<td>-</td>
<td>(99,616,809)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Plant and machinery</strong></td>
<td>137,920,928</td>
<td>15,682,286</td>
<td>-</td>
<td>(42,105,759)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Furniture and fixtures</strong></td>
<td>20,672,592</td>
<td>80,517</td>
<td>-</td>
<td>(3,000,180)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Motor vehicles</strong></td>
<td>1,917,297</td>
<td>476,842</td>
<td>(22,933)</td>
<td>2,642,203</td>
<td>174,468</td>
<td>55,477,565</td>
</tr>
<tr>
<td><strong>IT equipment</strong></td>
<td>41,684,124</td>
<td>18,252,696</td>
<td>(153,444)</td>
<td>2,017,811</td>
<td>19,943</td>
<td>112,334,241</td>
</tr>
</tbody>
</table>

Mintek reassessed the useful life of all assets at period end. For items that are still in use and have future economic value, useful life was extended. The useful lives were extended based on the assumptions that assets will be replaced in the next two years due to a capitalisation plan. The original acquisition value for these assets were R20,548,497 and the resultant depreciation write back was calculated rentals were then capitalised at 13.5%.

**Depreciation rates**

The depreciation methods and average useful lives of property, plant and equipment have been assessed as follows:

<table>
<thead>
<tr>
<th>Asset Type</th>
<th>Depreciation Method</th>
<th>Expected Useful Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>Straight line</td>
<td>50 years</td>
</tr>
<tr>
<td>Buildings</td>
<td>Straight line</td>
<td>5 - 10 years</td>
</tr>
<tr>
<td>Plant and machinery</td>
<td>Straight line</td>
<td>5 - 10 years</td>
</tr>
<tr>
<td>Furniture and fixtures</td>
<td>Straight line</td>
<td>5 - 10 years</td>
</tr>
<tr>
<td>Motor vehicles</td>
<td>Straight line</td>
<td>5 years</td>
</tr>
<tr>
<td>Equipment</td>
<td>Straight line</td>
<td>5 - 10 years</td>
</tr>
<tr>
<td>IT equipment</td>
<td>Straight line</td>
<td>3 - 5 years</td>
</tr>
</tbody>
</table>

**Other Information**

Revaluation at cost:

<table>
<thead>
<tr>
<th>Economic Entity</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revaluation at cost</td>
<td>211,818,666</td>
<td>206,139,085</td>
</tr>
<tr>
<td>Directors' valuation</td>
<td>211,818,666</td>
<td>206,139,085</td>
</tr>
</tbody>
</table>

Portion 175 and portion 226 of the farm Kiplotent, 203-03 Johannesburg, with buildings thereon and the sectional title of units at Malanshof Heights located at Erf 560 Malanshof. The value of the land and building complexes were estimated at R204,030,411 by Resident Projects (Pty) Ltd, an independent valuator, during the financial year ending 31 March 2016. The valuation is done every 5 years and the latest valuation report was issued on 18 April 2016. The key assumptions used were that the value of the property be based as sale of vacant land and buildings for rental investment using various rental income figures for different areas of the Mintek property. These calculated rentals were then capitalised at 13.5%.

**Property, Plant and Equipment in the Process of Being Constructed or Developed**

**CUMULATIVE COSTS OF CAPITAL PROJECTS UNDER CONSTRUCTION RECOGNISED IN THE CARRYING VALUE OF PROPERTY, PLANT AND EQUIPMENT**

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Opening Balance</th>
<th>Additions</th>
<th>Disposals</th>
<th>Transfers</th>
<th>Adjustments</th>
<th>Depreciation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASD Upgrade Phase 2</td>
<td>7,387,548</td>
<td>2,118,674</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9,506,222</td>
</tr>
<tr>
<td>Upgrade of Chiller Plant</td>
<td>1,314,594</td>
<td>3,971,955</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5,286,549</td>
</tr>
<tr>
<td>Laboratory equipment</td>
<td>7,967,898</td>
<td>12,535,718</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>20,403,616</td>
</tr>
<tr>
<td>Other equipment</td>
<td>9,733,516</td>
<td>2,489,581</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>12,223,097</td>
</tr>
</tbody>
</table>

**Carrying value of property, plant and equipment is that is taking a significantly longer period of time to complete than expected**

- **ASD Upgrade Phase 2**
  - The plans were redesigned which resulted in delays in finalising the funder process. The original completion date of October 2018 has been delayed by a year to September 2019.

- **Upgrade of Chiller Plant**
  - The plans were redesigned which resulted in delays in finalising the funder process. The original completion date of October 2018 has been delayed by over a year to October 2019.
### Notes to the Annual Financial Statements

#### 4. Property, plant and equipment (continued)

**EXPENDITURE INCURRED TO REPAIR AND MAINTAIN PROPERTY, PLANT AND EQUIPMENT**

Expenditure incurred to repair and maintain property, plant and equipment included in Statement of Financial Performance:

<table>
<thead>
<tr>
<th></th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contracted services</strong></td>
<td>11,777,144</td>
<td>9,990,578</td>
<td>11,777,144</td>
<td>9,990,578</td>
</tr>
<tr>
<td><strong>Materials purchased</strong></td>
<td>3,410,123</td>
<td>2,892,815</td>
<td>3,410,123</td>
<td>2,892,815</td>
</tr>
<tr>
<td></td>
<td>15,187,267</td>
<td>12,883,393</td>
<td>15,187,267</td>
<td>12,883,393</td>
</tr>
</tbody>
</table>

#### 5. INTANGIBLE ASSETS

<table>
<thead>
<tr>
<th></th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computer software, other</strong></td>
<td>10,465,894</td>
<td>7,170,717</td>
</tr>
<tr>
<td></td>
<td>(4,610,396)</td>
<td>(4,610,396)</td>
</tr>
<tr>
<td></td>
<td>5,855,500</td>
<td>2,560,321</td>
</tr>
</tbody>
</table>

**Reconciliation of intangible assets - Controlling entity - 2019**

<table>
<thead>
<tr>
<th></th>
<th>Opening balance</th>
<th>Additions</th>
<th>Transfers</th>
<th>Adjustments</th>
<th>Amortisation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer software, other</td>
<td>2,560,321</td>
<td>2,268,716</td>
<td>671,050</td>
<td>448,799</td>
<td>(1,002,692)</td>
<td>4,944,194</td>
</tr>
</tbody>
</table>

**Reconciliation of intangible assets - Controlling entity - 2018**

<table>
<thead>
<tr>
<th></th>
<th>Opening balance</th>
<th>Additions</th>
<th>Transfers</th>
<th>Adjustments</th>
<th>Amortisation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer software, other</td>
<td>1,985,443</td>
<td>573,773</td>
<td>-</td>
<td>612,783</td>
<td>(611,678)</td>
<td>2,560,321</td>
</tr>
</tbody>
</table>

**Pledged as security**

None of intangible assets pledged as security.
### 6. Investments in controlled entities

<table>
<thead>
<tr>
<th>Name of company</th>
<th>Held by</th>
<th>% holding 2019</th>
<th>% holding 2018</th>
<th>Carrying amount 2019</th>
<th>Carrying amount 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mindev (Pty) Ltd</td>
<td>Mintek</td>
<td>100.00 %</td>
<td>100.00 %</td>
<td>39,515,043</td>
<td>39,515,043</td>
</tr>
</tbody>
</table>

The carrying amounts of controlled entities are shown net of impairment losses.

Mindev is engaged in the commercialisation of Mintek’s patents and technology through the identification of suitable partners to advance such interests by way of direct investment in equity and through joint ventures. Mintek holds 100% of the issued share capital of Mindev (Propriety) Limited. The carrying amounts of the subsidiary is shown net of impairment losses.

### 7. Loans from economic entities

<table>
<thead>
<tr>
<th>Economic entity</th>
<th>Controlling entity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mindev (Pty) Ltd</td>
<td>Mintek</td>
</tr>
</tbody>
</table>

The amount due to Mindev relates to the income received on the sale of technologies in Mindev. The funds were deposited into Mintek’s bank account as Mindev does not have a bank account. These monies are held on Mindev’s behalf. There are therefore no fixed terms of repayment and is interest free.

The carrying amount of loans to and from economic entities are denominated in the following currencies:

<table>
<thead>
<tr>
<th>Currency</th>
<th>Carrying amount 2019</th>
<th>Carrying amount 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rand</td>
<td>39,515,043</td>
<td>39,515,043</td>
</tr>
</tbody>
</table>

### 8. Retirement benefits

#### Defined benefit plan

**Post retirement medical aid plan**

Medical cover is provided through a number of different schemes. Post-retirement medical cover in respect of qualifying employees is recognised as an expense over the expected remaining service lives of the relevant employees. Mintek has an obligation to provide medical benefits to certain pensioners and dependents. These liabilities have been provided for in full, calculated on an actuarial basis. These liabilities are unfunded. Periodic valuation of this obligation is carried out by an independent actuary every year, the latest one being 31 March 2019.

The amounts recognised in the statement of financial position are as follows:

<table>
<thead>
<tr>
<th>Carrying value</th>
<th>Present value of the defined benefit obligation-wholly unfunded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-current liabilities</td>
<td>13,200,000</td>
</tr>
<tr>
<td>Current liabilities</td>
<td>39,515,043</td>
</tr>
</tbody>
</table>

The economic entity expects to contribute R 229,913 to its defined benefit plans in the following financial year.

#### Other assumptions

The results are dependent on the assumptions used. The table below shows how the past service cost as at 31 March 2019 would be impacted by changes to these assumptions:

<table>
<thead>
<tr>
<th>Assumptions used at the reporting date</th>
<th>Sensitivity analysis on past service cost</th>
<th>Discount rate increased by 1% p.a.</th>
<th>Discount rate decreased by 1% p.a.</th>
<th>Subsidy inflation increased by 1% p.a.</th>
<th>Subsidy inflation decreased by 1% p.a.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected increase in healthcare costs</td>
<td>7.50 %</td>
<td>8.90 %</td>
<td>8.90 %</td>
<td>7.50 %</td>
<td>7.70 %</td>
</tr>
</tbody>
</table>

### 9. Inventories

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost 2019/18</th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumables</td>
<td>8,268,046</td>
<td>7,129,715</td>
<td>8,268,046</td>
<td>7,129,715</td>
<td></td>
</tr>
<tr>
<td>Work in progress</td>
<td>2,270,469</td>
<td>976,026</td>
<td>2,270,469</td>
<td>976,026</td>
<td></td>
</tr>
<tr>
<td>Finished goods</td>
<td>1,038,602</td>
<td>1,467,251</td>
<td>1,038,602</td>
<td>1,467,251</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11,577,117</td>
<td>9,572,992</td>
<td>11,577,117</td>
<td>9,572,992</td>
<td></td>
</tr>
</tbody>
</table>

### 10. Receivables from exchange transactions

<table>
<thead>
<tr>
<th>Description</th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade debtors</td>
<td>21,708,510</td>
<td>25,385,217</td>
<td>21,708,510</td>
<td>25,385,217</td>
</tr>
<tr>
<td>Employee costs in advance</td>
<td>12,500</td>
<td>118</td>
<td>12,500</td>
<td>118</td>
</tr>
<tr>
<td>Prepayments</td>
<td>2,652,377</td>
<td>2,192,296</td>
<td>2,652,377</td>
<td>2,192,296</td>
</tr>
<tr>
<td>Deposits</td>
<td>275,093</td>
<td>275,000</td>
<td>275,093</td>
<td>275,000</td>
</tr>
<tr>
<td>Project work in progress</td>
<td>12,828,952</td>
<td>6,170,447</td>
<td>12,828,952</td>
<td>6,170,447</td>
</tr>
<tr>
<td></td>
<td>37,473,932</td>
<td>34,023,077</td>
<td>37,473,932</td>
<td>34,023,077</td>
</tr>
</tbody>
</table>

### Fair value of trade and other receivables

<table>
<thead>
<tr>
<th>Description</th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade and other receivables</td>
<td>37,473,932</td>
<td>34,023,077</td>
<td>37,473,932</td>
<td>34,023,077</td>
</tr>
</tbody>
</table>
Notes to the Annual Financial Statements

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>ECONOMIC ENTITY</th>
<th>CONTROLLING ENTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>2018</td>
<td>2019</td>
</tr>
</tbody>
</table>

10. Receivables from exchange transactions (continued)

Trade and other receivables past due but not impaired

Trade and other receivables which are less than 3 months past due are not considered to be impaired. At 31 March 2019, R 686,604 (2018: R 1,229,857) were past due but not impaired.

The carrying amount of trade and other receivables are denominated in the following currencies:

-/rand 20,259,215 23,089,737 20,259,215 23,089,737
-/us dollar 937,787 1,942,102 937,787 1,942,102
-/euro 72,705 353,378 72,705 353,378
-/aud 435,803 - 435,803 -

21,705,510 25,385,217 21,705,510 25,385,217

Reconciliation of provision for impairment of trade and other receivables

Opening balance 302,291 289,290 302,291 289,290
Provision for impairment - Trade debtors - 55,955 - 55,955
Provision for impairment - Staff debtors - 105,252 - 105,252
Amounts written off as uncollectible - Staff debtors (246,336) (143,571) (246,336) (143,571)
Amounts settled - (4,635) - (4,635)
Amounts written off as uncollectible - Trade debtors (55,955) - (55,955) -

302,291 289,290 302,291 289,290

11. Cash and cash equivalents

Cash and cash equivalents consist of:

Cash on hand 41,305 31,483 41,305 31,483
Bank balances 65,590,485 20,002,343 65,590,485 20,002,343
Short-term deposits 381,191,925 408,653,981 381,191,925 408,653,981

446,823,715 428,687,807 446,823,715 428,687,807

Credit quality of cash at bank and short term deposits, excluding cash on hand

Management considers that all of the above cash and cash equivalents categories are of good quality by reference to external credit ratings. The maximum exposure to credit risk at the reporting date is the fair value of each class of cash and cash equivalents mentioned above. The fair value approximates the carrying amount of the balance. All cash and cash equivalents held by the entity are available for use.

The cash and cash equivalents are not pledged as security for financial liabilities except for R2,155,000 (2018 - R2,155,000) which is held as a cession by Absa Bank Limited for banking facilities.

12. Unspent conditional grants and receipts

Unspent conditional grants and receipts comprises of:

Unspent grants 167,017,044 159,632,507 167,017,044 159,632,507

These unspent grants are projected related where the conditions are yet to be fulfilled. These amounts are invested in ring-fenced investments until utilised.


Reconciliation of provisions - Economic entity - 2019

<table>
<thead>
<tr>
<th></th>
<th>Opening Balance</th>
<th>Additions</th>
<th>Reversed during the year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product warranties</td>
<td>901,535</td>
<td>1,022,670</td>
<td>(901,535)</td>
<td>1,022,670</td>
</tr>
</tbody>
</table>

Reconciliation of provisions - Economic entity - 2018

<table>
<thead>
<tr>
<th></th>
<th>Opening Balance</th>
<th>Additions</th>
<th>Reversed during the year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product warranties</td>
<td>1,056,107</td>
<td>901,535</td>
<td>(1,056,107)</td>
<td>901,535</td>
</tr>
</tbody>
</table>

The provision for product warranties arises from Mintek recognising its probable liability for meeting its obligation in terms of products and services as stipulated in its contracts with its customers.

14. Payables from exchange transactions

Trade payables 39,734,668 16,418,271 39,734,668 16,418,271
Other salary payables 10,028,642 14,891,137 10,028,642 14,891,137
Accrued leave pay 11,267,249 10,987,222 11,267,249 10,987,222
Accrued bonus 518,554 478,734 518,554 478,734
Accruals 8,168,967 6,938,371 8,168,967 6,938,371

80,130,973 59,199,052 80,130,973 59,199,052

Fair value of trade and other payables

Trade payables 80,130,973 59,199,051 80,130,973 59,199,051

Provisions are made for possible leave that will be taken or paid out in cash. This is based the number of days accumulated at the reporting date.

15. rendering of services

Product and services 116,730,068 122,890,150 116,730,068 122,890,150
MTEF revenue 87,867,775 62,590,090 87,867,775 62,590,090
Contract research 52,282,757 48,053,193 52,282,757 48,053,193

256,880,600 233,536,433 256,880,600 233,536,433

16. Investment revenue

Interest revenue

Bank 28,482,239 29,591,730 28,482,239 29,591,730
Interest charged on trade and other receivables 52,282,757 48,053,193 52,282,757 48,053,193

28,450,163 30,284,962 28,450,163 30,284,962
Notes to the Annual Financial Statements

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Government grants and subsidies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating grants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government grant (operating) - MTEF</td>
<td>55,578,320</td>
<td>52,813,928</td>
<td>55,578,320</td>
<td>52,813,928</td>
</tr>
<tr>
<td></td>
<td>244,710,626</td>
<td>240,404,719</td>
<td>244,710,626</td>
<td>240,404,719</td>
</tr>
<tr>
<td>Capital grants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government grant (capital) - SciVote</td>
<td>23,730,984</td>
<td>17,314,131</td>
<td>23,730,984</td>
<td>17,314,131</td>
</tr>
<tr>
<td></td>
<td>268,441,606</td>
<td>257,718,850</td>
<td>268,441,606</td>
<td>257,718,850</td>
</tr>
<tr>
<td><strong>Employee related costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic</td>
<td>299,205,242</td>
<td>300,178,594</td>
<td>299,205,242</td>
<td>300,178,594</td>
</tr>
<tr>
<td>UIF</td>
<td>1,100,736</td>
<td>1,157,154</td>
<td>1,100,736</td>
<td>1,157,154</td>
</tr>
<tr>
<td>Leave pay provision charge</td>
<td>6,252,213</td>
<td>5,521,019</td>
<td>6,252,213</td>
<td>5,521,019</td>
</tr>
<tr>
<td><strong>Finance costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade and other payables</td>
<td>867</td>
<td>2,508</td>
<td>867</td>
<td>2,508</td>
</tr>
<tr>
<td>Fair value adjustments on payables</td>
<td>(44,380)</td>
<td>1,126,610</td>
<td>(44,380)</td>
<td>1,126,610</td>
</tr>
<tr>
<td></td>
<td>(43,513)</td>
<td>1,120,118</td>
<td>(43,513)</td>
<td>1,120,118</td>
</tr>
<tr>
<td><strong>Taxation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reconciliation of the tax expense</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reconciliation between applicable tax rate and average effective tax rate.</td>
<td>28.00 %</td>
<td>28.00 %</td>
<td>- %</td>
<td>- %</td>
</tr>
<tr>
<td>Applicable tax rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No provision for income tax was made for the company during the current financial year as Mintek is exempt in terms of section 10(1)(CA)(i) of the Income Tax Act, No. 58 of 1962; and Mindev is a dormant company. Tax provisions and liabilities are with respect to Mindev and are payable through that entity.

21. Cash generated from operations

**Surplus / (deficit)**

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,445,700</td>
<td>(5,854,579)</td>
<td>5,445,700</td>
<td>(5,854,579)</td>
<td></td>
</tr>
</tbody>
</table>

**Adjustments for:**

- Depreciation and amortisation
- Losses on sale of assets
- Gain / loss on foreign exchange
- Debt impairment
- Movements in retirement benefit liabilities
- Movements in warranty provisions
- Foreign exchanges gains / (losses)
- Rounding

**Useful lives adjustments**

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>(43,513)</td>
<td>1,120,118</td>
<td>(43,513)</td>
<td>1,120,118</td>
<td></td>
</tr>
</tbody>
</table>

**Changes in working capital:**

- Inventories
- Receivables from exchange transactions
- Consumer debtors write-off
- Payables from exchange transactions
- VAT
- Unspent conditional grants and receipts
- Consumer deposits

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>57,439,014</td>
<td>18,750,777</td>
<td>57,439,014</td>
<td>18,750,777</td>
<td></td>
</tr>
</tbody>
</table>

22. Commitments

**Authorised capital expenditure**

- Property, plant and equipment

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>8,259,148</td>
<td>1,752,362</td>
<td>8,259,148</td>
<td>1,752,362</td>
<td></td>
</tr>
</tbody>
</table>

**Total capital commitments**

- Contracted for

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
</table>

**Authorised operational expenditure**

- Contracted for

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>2019</th>
<th>2018</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
</table>

This committed expenditure relates to plant and equipment and will be financed by available existing cash resources.

**Operating leases - as lessee (expense)**

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>425,806</td>
<td>594,459</td>
<td>425,806</td>
</tr>
</tbody>
</table>
Notes to the Annual Financial Statements

23. Contingencies
Mintek has disputed employment contracts with former employees, the aggregate of which is not expected to exceed R 419,000 (2018: R 679,915). This amount includes estimated legal costs and disbursements and does not factor the success rate of the individual cases. Cessions in favour of Absa Bank for R 2,155,000 (2018: R 2,155,000) to meet requirements for credit card and other banking facilities has been registered.

24. Related Parties
Controlling entity
The Group comprises of Mintek and its wholly owned subsidiary Mindev (Proprietary) Limited. Mindev is engaged in the commercialisation of Mintek patents and technology through the identification of suitable partners. The Group, in the ordinary course of business, enters into various sale and purchase transactions with related parties. None of the directors, officers or major shareholders of the Mintek Group or, to the knowledge of Mintek, their families, had any interest, direct or indirect, in any transactions which has affected or will materially affect Mintek or its investment or subsidiary.

Related party transactions
Related party transactions exist within the Group. These transactions were all concluded at arm’s length and therefore disclosed here only for information purposes. Details of material transactions with related parties not disclosed elsewhere in the financial statements are as follows:

Related party balances
Loan accounts - Owing to related parties

<table>
<thead>
<tr>
<th>ECONOMIC ENTITY</th>
<th>2019</th>
<th>2018</th>
<th>CONTROLLING ENTITY</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mindev (Pty) Ltd</td>
<td>-</td>
<td>-</td>
<td>39,515,043</td>
<td>39,515,043</td>
<td></td>
</tr>
</tbody>
</table>

Amounts included in Deferred Income regarding related parties

<table>
<thead>
<tr>
<th>ECONOMIC ENTITY</th>
<th>2019</th>
<th>2018</th>
<th>CONTROLLING ENTITY</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Mineral Resources</td>
<td>108,536,021</td>
<td>115,949,048</td>
<td>108,536,021</td>
<td>115,949,048</td>
<td></td>
</tr>
<tr>
<td>Mining Qualification Authority</td>
<td>1,104,928</td>
<td>1,130,048</td>
<td>1,104,928</td>
<td>1,130,048</td>
<td></td>
</tr>
<tr>
<td>Department of Science and Technology</td>
<td>56,859,540</td>
<td>40,780,456</td>
<td>56,859,540</td>
<td>40,780,456</td>
<td></td>
</tr>
<tr>
<td>National Lotteries Board</td>
<td>164,872</td>
<td>1,111,993</td>
<td>164,872</td>
<td>1,111,993</td>
<td></td>
</tr>
<tr>
<td>National Research Foundation</td>
<td>280,026</td>
<td>549,285</td>
<td>280,026</td>
<td>549,285</td>
<td></td>
</tr>
<tr>
<td>Technology Innovation Agency</td>
<td>71,457</td>
<td>71,457</td>
<td>71,457</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total | 167,017,044 | 159,632,507 | 167,017,044 | 159,632,507 |

Amounts included in Trade receivables regarding related parties

<table>
<thead>
<tr>
<th>ECONOMIC ENTITY</th>
<th>2019</th>
<th>2018</th>
<th>CONTROLLING ENTITY</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining Qualification Authority</td>
<td>700,287</td>
<td>877,202</td>
<td>700,287</td>
<td>877,202</td>
<td></td>
</tr>
<tr>
<td>Department of Mineral Resources</td>
<td>-</td>
<td>110,866</td>
<td>-</td>
<td>110,866</td>
<td></td>
</tr>
<tr>
<td>Department of Science and Technology</td>
<td>136,040</td>
<td>1,281,997</td>
<td>136,040</td>
<td>1,281,997</td>
<td></td>
</tr>
<tr>
<td>National Research Foundation</td>
<td>2,687,198</td>
<td>2,792,937</td>
<td>2,687,198</td>
<td>2,792,937</td>
<td></td>
</tr>
<tr>
<td>CSIR</td>
<td>27,448</td>
<td>3,078</td>
<td>27,448</td>
<td>3,078</td>
<td></td>
</tr>
<tr>
<td>Council of Geoscience</td>
<td>1,899,464</td>
<td>-</td>
<td>1,899,464</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Total | 5,451,037 | 5,146,070 | 5,451,037 | 5,146,070 |

Sales to related parties

<table>
<thead>
<tr>
<th>ECONOMIC ENTITY</th>
<th>2019</th>
<th>2018</th>
<th>CONTROLLING ENTITY</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Mineral Resources</td>
<td>328,833,623</td>
<td>302,997,809</td>
<td>328,833,623</td>
<td>302,997,809</td>
<td></td>
</tr>
<tr>
<td>Department of Science and Technology</td>
<td>50,607,820</td>
<td>47,750,698</td>
<td>50,607,820</td>
<td>47,750,698</td>
<td></td>
</tr>
<tr>
<td>Department of Energy</td>
<td>-</td>
<td>975,000</td>
<td>-</td>
<td>975,000</td>
<td></td>
</tr>
<tr>
<td>National Research Foundation</td>
<td>2,348,599</td>
<td>3,356,452</td>
<td>2,348,599</td>
<td>3,356,452</td>
<td></td>
</tr>
<tr>
<td>Council of Geoscience</td>
<td>1,983,643</td>
<td>540,911</td>
<td>1,983,643</td>
<td>540,911</td>
<td></td>
</tr>
<tr>
<td>Technology Innovation Agency</td>
<td>-</td>
<td>74,272</td>
<td>-</td>
<td>74,272</td>
<td></td>
</tr>
<tr>
<td>Mining Qualification Authority</td>
<td>6,152,928</td>
<td>4,904,050</td>
<td>6,152,928</td>
<td>4,904,050</td>
<td></td>
</tr>
<tr>
<td>CSIR</td>
<td>119,542</td>
<td>39,965</td>
<td>119,542</td>
<td>39,965</td>
<td></td>
</tr>
<tr>
<td>Water Research Council</td>
<td>-</td>
<td>1,046,500</td>
<td>-</td>
<td>1,046,500</td>
<td></td>
</tr>
<tr>
<td>National Lotteries Board</td>
<td>947,121</td>
<td>896,779</td>
<td>947,121</td>
<td>896,779</td>
<td></td>
</tr>
<tr>
<td>The South African Medical Research Council</td>
<td>-</td>
<td>170,192</td>
<td>-</td>
<td>170,192</td>
<td></td>
</tr>
</tbody>
</table>

Total | 390,993,276 | 362,752,628 | 390,993,276 | 362,752,628 |
Notes to the Annual Financial Statements

25. Board Members and Executive Management Remuneration

Executive

2019

<table>
<thead>
<tr>
<th>Emoluments</th>
<th>Performance Bouns and Other Expenses</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr M Motuku (Appointed 01/01/2019)</td>
<td>884,406</td>
<td>884,406</td>
</tr>
<tr>
<td>DM Msiza (Acting to 31/07/2019)</td>
<td>218,941</td>
<td>5,296</td>
</tr>
<tr>
<td>AD McKenzie</td>
<td>2,061,773</td>
<td>173,999</td>
</tr>
<tr>
<td>SA Simelane</td>
<td>2,264,872</td>
<td>194,438</td>
</tr>
<tr>
<td>Dr M Simelane</td>
<td>2,061,773</td>
<td>2,194,021</td>
</tr>
<tr>
<td>FG Njoka</td>
<td>1,982,892</td>
<td>231,338</td>
</tr>
<tr>
<td>Dr DM Powell (Resigned 31/07/2018)</td>
<td>581,762</td>
<td>813,100</td>
</tr>
<tr>
<td></td>
<td>10,056,419</td>
<td>908,065</td>
</tr>
</tbody>
</table>

2018

<table>
<thead>
<tr>
<th>Emoluments</th>
<th>Performance Bouns and Other Expenses</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM Msiza (Acting from14/09/2017)</td>
<td>423,165</td>
<td>450,260</td>
</tr>
<tr>
<td>AD McKenzie</td>
<td>1,902,401</td>
<td>2,040,139</td>
</tr>
<tr>
<td>SA Simelane</td>
<td>2,089,800</td>
<td>2,135,332</td>
</tr>
<tr>
<td>Dr M Simelane</td>
<td>1,902,401</td>
<td>2,125,332</td>
</tr>
<tr>
<td>FG Njoka</td>
<td>1,829,617</td>
<td>1,865,846</td>
</tr>
<tr>
<td>Dr DM Powell</td>
<td>1,655,891</td>
<td>1,749,944</td>
</tr>
<tr>
<td>MA Mngomezulu (Contract ended 03/09/2017)</td>
<td>1,270,293</td>
<td>1,688,146</td>
</tr>
<tr>
<td></td>
<td>11,113,668</td>
<td>934,028</td>
</tr>
</tbody>
</table>

Non-executive

2019

<table>
<thead>
<tr>
<th>Directors’ fees</th>
<th>Expenses</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>ND Masemola</td>
<td>208,384</td>
<td>148,441</td>
</tr>
<tr>
<td>MJ Rachidi</td>
<td>232,104</td>
<td>238,179</td>
</tr>
<tr>
<td>D Dlamini</td>
<td>119,666</td>
<td>125,542</td>
</tr>
<tr>
<td>CK McClain</td>
<td>125,725</td>
<td>128,132</td>
</tr>
<tr>
<td>PM Mohombi</td>
<td>125,725</td>
<td>131,948</td>
</tr>
<tr>
<td>S Ngwenya</td>
<td>125,725</td>
<td>131,948</td>
</tr>
<tr>
<td>Dr S Simayi</td>
<td>125,725</td>
<td>131,948</td>
</tr>
<tr>
<td>Dr S Mohlala</td>
<td>125,725</td>
<td>131,948</td>
</tr>
<tr>
<td></td>
<td>1,216,407</td>
<td>1,294,343</td>
</tr>
</tbody>
</table>

2018

<table>
<thead>
<tr>
<th>Directors’ fees</th>
<th>Expenses</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>ND Masemola</td>
<td>137,573</td>
<td>148,441</td>
</tr>
<tr>
<td>MJ Rachidi</td>
<td>163,307</td>
<td>170,362</td>
</tr>
<tr>
<td>D Dlamini</td>
<td>97,226</td>
<td>101,785</td>
</tr>
<tr>
<td>CK McClain</td>
<td>57,849</td>
<td>61,645</td>
</tr>
<tr>
<td>PM Mohombi</td>
<td>88,033</td>
<td>91,943</td>
</tr>
<tr>
<td>S Ngwenya</td>
<td>78,462</td>
<td>82,258</td>
</tr>
<tr>
<td>Dr S Simayi</td>
<td>78,462</td>
<td>82,258</td>
</tr>
<tr>
<td>Dr S Mohlala</td>
<td>93,647</td>
<td>98,206</td>
</tr>
<tr>
<td></td>
<td>778,899</td>
<td>821,120</td>
</tr>
</tbody>
</table>

Notes to the Annual Financial Statements

26. Change in accounting estimate

Property, plant and equipment and intangible assets

Mintek reassessed the useful life of all assets at period end. For items that are still in use and have future economic value, useful life was extended. The useful lives were extended based on the assumptions that assets will be replaced in the next two years due to a capitalisation plan. The original acquisition value for these assets were R20,548,497 and the resultant depreciation write back was R5,140,835 of which R4,694,036 relates to property, plant and equipment and R446,799 relates to intangible assets.

The amount of the effect in future periods is not disclosed as it is impracticable to estimate.
27. Prior period errors
Bursary costs has been reclassified as General Expenses compared the previous classification as Employee Costs in prior years. In terms of GRAP 25 - Employee Benefits paragraph 9, bursaries costs are not recognised as employee benefits. Also bursaries are paid to full-time students who are not employees of Mintek as well.

The correction of the error results in adjustments as follows:

Statement of financial position

Table: Financial Performance - Key Performance Indicators

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>ECONOMIC ENTITY</th>
<th>CONTROLLING ENTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2019</td>
<td>2018</td>
</tr>
<tr>
<td>Depreciation</td>
<td>(17,098,137)</td>
<td>(25,530,679)</td>
</tr>
</tbody>
</table>

28. Prior-year adjustments - First time adoption of GRAP

Presented below are those items contained in the statement of financial position, statement of financial performance and cash flow statement that have been affected by prior-year adjustments:

Statement of financial position

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>ECONOMIC ENTITY</th>
<th>CONTROLLING ENTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2019</td>
<td>2018</td>
</tr>
<tr>
<td>Property, plant and equipment</td>
<td>4</td>
<td>248,478,101</td>
</tr>
</tbody>
</table>

Controlling entity - 2018

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>ECONOMIC ENTITY</th>
<th>CONTROLLING ENTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2019</td>
<td>2018</td>
</tr>
<tr>
<td>Property, plant and equipment</td>
<td>4</td>
<td>271,492,584</td>
</tr>
</tbody>
</table>

Statement of financial performance

<table>
<thead>
<tr>
<th>FIGURES IN RAND</th>
<th>ECONOMIC ENTITY</th>
<th>CONTROLLING ENTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2019</td>
<td>2018</td>
</tr>
<tr>
<td>Revenue from non-exchange transactions</td>
<td>187,590,791</td>
<td>17,314,131</td>
</tr>
<tr>
<td>Depreciation</td>
<td>(17,098,137)</td>
<td>(25,530,679)</td>
</tr>
<tr>
<td>Retained income for the year</td>
<td>170,492,654</td>
<td>(8,216,548)</td>
</tr>
</tbody>
</table>

Change in accounting policy

The entity has changed its reporting framework to Generally Recognised Accounting Principles (GRAP) from previously reporting in terms SA Generally Accepted Accounting Principles (SA GAAP). The major impact of this change was the reversal of the set-off of capital grant funding directly against the acquisition values of the assets procured resulting in the asset having a zero book value. These previous funding applications have been reversed and recognising the full capital as revenue. The assets have been depreciated on a straight line basis over the expected useful lives of these assets.
Notes to the Annual Financial Statements

**ECONOMIC ENTITY** | **CONTROLLING ENTITY**
---|---
**FIGURES IN RAND** | 2019 | 2018 | 2019 | 2018
---|---|---|---|---
**Economic entity**<br>Categories of Financial Instruments |  |  |  | 
---|---|---|---|---
**Group 2019** | At Fair Value | At Amotised Cost | Total | 
---|---|---|---|---
Financial assets | 37,473,932 | 37,473,932 |  | 
---|---|---|---|---
Receivables | - | 37,473,932 | 37,473,932 | 
---|---|---|---|---
Cash and cash equivalents | 446,823,715 | - | 446,823,715 | 446,823,715
---|---|---|---|---
446,823,715 | 37,473,932 | 484,297,647 | 
---|---|---|---|---
Financial liabilities |  |  |  | 
---|---|---|---|---
payables | - | 80,130,973 | 80,130,973 | 
---|---|---|---|---
---|---|---|---|---
**Group 2018** | At fair value | At Amotised Cost | Total | 
---|---|---|---|---
Financial assets | 34,023,077 | 34,023,077 |  | 
---|---|---|---|---
Receivables | - | 34,023,077 | 34,023,077 | 
---|---|---|---|---
Cash and Cash equivalents | 428,687,807 | - | 428,687,807 | 428,687,807
---|---|---|---|---
428,687,807 | 34,023,077 | 462,710,884 | 
---|---|---|---|---
Financial liabilities |  |  |  | 
---|---|---|---|---
payables | - | 59,199,052 | 59,199,052 | 
---|---|---|---|---
---|---|---|---|---
30. Irregular expenditure (continued) |  |  |  | 
---|---|---|---|---
Add: Irregular Expenditure - current year | 17,210 | - | 17,210 | 
---|---|---|---|---
Less: Amounts condoned | (6,622) | - | (6,622) | 
---|---|---|---|---
Less: Amounts recovered | (6,598) | - | (6,598) | 
---|---|---|---|---
- | - | - | 
---|---|---|---|---
33. Budget differences
**Material differences between budget and actual amounts**
---|---|---|---|---
33.1. Commercial income did not materialise as originally anticipated due to lower economic activities in the mining sector where research and development is concerned.
---|---|---|---|---
33.2. No budget is assigned for insurance recoveries of breach of study income debt as it is not anticipated that these events will occur in the financial year.
---|---|---|---|---
33.3. The estimated cash was lower due to lower commercial income resulting in lower investment income.
---|---|---|---|---
33.4. The budget for government grants only related to revenue for operational expenditure. The application of GRAP 23 from 1 April 2018 increased the revenue as funds for capital expenditure has now been accounted for.
---|---|---|---|---
33.5. The savings realised on personnel expenditure is mainly due to freezing of positions and delay in filling essential positions, such as the CEO.
---|---|---|---|---
33.6. Depreciation as budgeted did not make provision for the effect of GRAP 17 where funded assets would also attract depreciation.
---|---|---|---|---
33.7. Savings realised throughout the year as a result of fewer projects executed.
---|---|---|---|---
33.8. No budget is set for foreign exchange differences as it is unpredictable and does not form part of the normal operations of Mintek.
---|---|---|---|---
### Mindev (Pty) Ltd Statement of Financial Position

<table>
<thead>
<tr>
<th>Figures in Rand</th>
<th>Note(s)</th>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Current Assets</td>
<td>2</td>
<td>39,514,943</td>
<td>39,514,943</td>
</tr>
<tr>
<td>Equity and Liabilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share capital</td>
<td>3</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Retained income</td>
<td></td>
<td>39,514,943</td>
<td>39,514,943</td>
</tr>
<tr>
<td>Total Equity</td>
<td></td>
<td>39,514,943</td>
<td>39,514,943</td>
</tr>
</tbody>
</table>

### Mindev (Pty) Ltd Statement of Changes in Equity

<table>
<thead>
<tr>
<th>Figures in Rand</th>
<th>Share capital</th>
<th>Retained income</th>
<th>Total equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance at 01 April 2017</td>
<td>100</td>
<td>39,514,843</td>
<td>39,514,943</td>
</tr>
<tr>
<td>Balance at 01 April 2018</td>
<td>100</td>
<td>39,514,843</td>
<td>39,514,943</td>
</tr>
<tr>
<td>Balance at 31 March 2019</td>
<td>100</td>
<td>39,514,843</td>
<td>39,514,943</td>
</tr>
</tbody>
</table>
Mindev (Pty) Ltd Accounting Policies

1. Significant accounting policies

The principal accounting policies applied in the preparation of these financial statements are set out below.

1.1 Financial instruments

These financial assets are classified as loans and receivables.

1.2 Taxation

Current tax assets and liabilities

Current tax for current and prior periods is, to the extent unpaid, recognised as a liability. If the amount already paid in respect of current and prior periods exceeds the amount due for those periods, the excess is recognised as an asset.

Current tax liabilities (assets) for the current and prior periods are measured at the amount expected to be paid to (recovered from) the tax authorities, using the tax rates (and tax laws) that have been enacted or substantively enacted by the end of the reporting period.

Tax expenses

Current and deferred taxes are recognised as income or an expense and included in profit or loss for the period, except to the extent that the tax arises from:

- a transaction or event which is recognised, in the same or a different period, to other comprehensive income, or
- a business combination.

Current tax and deferred taxes are charged or credited to other comprehensive income if the tax relates to items that are credited or charged, in the same or a different period, to other comprehensive income.

Current tax and deferred taxes are charged or credited directly to equity if the tax relates to items that are credited or charged, in the same or a different period, directly in equity.

1.3 Share capital and equity

An equity instrument is any contract that evidences a residual interest in the assets of an entity after deducting all of its liabilities.

Ordinary shares are recognised at par value and classified as ‘share capital’ in equity. Any amounts received from the issue of shares in excess of par value is classified as ‘share premium’ in equity. Dividends are recognised as a liability in the company in which they are declared.

Mindev (Pty) Ltd Notes to the Financial Statements

2. Loan to shareholding

Mintek

The loan is interest free and has no repayment terms.

<table>
<thead>
<tr>
<th>Split between non-current and current portions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-current assets</td>
</tr>
<tr>
<td>Current assets</td>
</tr>
</tbody>
</table>

3. Share capital

Authorised

1,000 Ordinary shares of R1 each

<table>
<thead>
<tr>
<th>2019</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>1,000</td>
</tr>
</tbody>
</table>

4. Related parties

The Group comprises of Mintek and its wholly owned subsidiary Mindev (Proprietary) Limited. Mindev is engaged in the commercialisation of Mintek patents and technology through the identification of suitable partners. The Group, in the ordinary course of business, enters into various sale and purchase transactions with related parties.

None of the directors, officers or the shareholder of the Mintek Group or, to the knowledge of Mintek, their families, had any interest, direct or indirect, in any transactions which has affected or will materially affect Mintek or its investment or subsidiary.

Relationships

Holdings company Mintek

Related party balances

Loan accounts - Owing by related parties

| Mintek | 39,514,943 | 39,514,943 |

5. Directors’ remunerations

No remunerations were paid to the directors or any individuals holding a prescribed office during the year.
Organisational development: the proportion of staff with Doctoral degrees was exceeded due to better retention of employees at this level.

Beneficiation to value added products and services: Mintek developed applications for precious-, ferrous- and base metals in amongst others, the area of Nanotechnology. Pictured above are NCR®s Heavy metal adsorbent resins.

Organisational development the proportion of staff with Doctoral degrees was exceeded due to better retention of employees at this level.
## Key Performance Indicators

### Strategic Objective 1: Enhance Mintek’s Visibility and Credibility to all Stakeholders

<table>
<thead>
<tr>
<th>Strategic Programmes per Objective</th>
<th>Activity per Programme</th>
<th>Performance Indicator</th>
<th>Target 2018/19</th>
<th>Achievements</th>
<th>Actual</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated marketing and communication functions</td>
<td>Updating and implementing the marketing and communications plan approved and implemented</td>
<td>Annually updated marketing and communications plan approved and implemented</td>
<td>1</td>
<td>1</td>
<td>Annual target achieved.</td>
<td></td>
</tr>
<tr>
<td>Mintek promotion</td>
<td># of technical articles in credible publications</td>
<td>36</td>
<td>59</td>
<td>Annual targets exceeded.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP creation and transfer</td>
<td># of Patents filed</td>
<td>7</td>
<td>3</td>
<td>Due to latent difficulties in effective protection, patent applications for the recovery of REE from phosphogypsum by Hydrothermal Alteration and the Purification of Base Metal Streams by Autogenic Reactant Generation were not completed as planned. In addition, the loss of senior staff members during the year impacted on the delivery of this KPI.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td># of IP license agreements</td>
<td>1</td>
<td>0</td>
<td>The prospective client could not reach a decision for the conclusion of the agreement.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td># of discoveries (IPR-PFRED Act)</td>
<td>19</td>
<td>16</td>
<td>Loss of senior staff members impacted on delivery of this KPI.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attained annual customer satisfaction target</td>
<td>19</td>
<td>16</td>
<td>Mintek will be simplifying its ordering and payment processes for customers.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enhanced media exposure</td>
<td>Advertising Value Equivalent (AVE) in R million</td>
<td>25.00</td>
<td>36.14</td>
<td>Target exceeded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enhanced relations with oversight bodies</td>
<td># of requests for technical assistance to the DMR (upon request)</td>
<td>1</td>
<td>1</td>
<td>Annual targets achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td># of presentations to Parliament on impact of Mintek’s work and role</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timely submission of Shareholder’s Compact</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timely submission of quarterly reports on the attainment of targets in the scorecard</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Integration of staff exchange</td>
<td># of visits and # of instances of staff exchange</td>
<td>4</td>
<td>6</td>
<td>Annual target exceeded.</td>
<td></td>
</tr>
</tbody>
</table>

### Strategic Objective 2: Research and Develop Efficient Mineral Processing Technologies and Value Added Products and Services

<table>
<thead>
<tr>
<th>Strategic Programmes per Objective</th>
<th>Activity per Programme</th>
<th>Performance Indicator</th>
<th>Target 2018/19</th>
<th>Achievements</th>
<th>Actual</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Develop analytical methods and supply of services</td>
<td># of methods</td>
<td>6</td>
<td>3</td>
<td>Annual target not achieved due to the loss of senior staff.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rand value (Rm)</td>
<td>41.0</td>
<td>15.0</td>
<td>Annual target not achieved due to low sample volumes. Marketing efforts will be intensified.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td># of methods</td>
<td>6</td>
<td>6</td>
<td>Annual target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Develop mineralogical methods and supply of services</td>
<td># of internal reports</td>
<td>15</td>
<td>15</td>
<td>Annual target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td># of external reports</td>
<td>10</td>
<td>33</td>
<td>Annual target exceeded as a result of more work than planned on Certified Reference Materials.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Develop new technologies under state grant</td>
<td># of internal reports</td>
<td>72</td>
<td>109</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td># of new technologies</td>
<td>4</td>
<td>5</td>
<td>Annual targets exceeded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td># of prototypes evidenced by reports</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commercial investigations and feasibility studies</td>
<td># of reports</td>
<td>16</td>
<td>19</td>
<td>Annual target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rand value of Certified Reference Materials (CRM) sales (Rm)</td>
<td>25.0</td>
<td>26.8</td>
<td>Annual targets exceeded due to fast tracking of work. R&amp;D management resources were diverted to the execution of more commercial projects.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rand value of control system sales (Rm)</td>
<td>3.0</td>
<td>3.8</td>
<td>Annual target exceeded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provision of Mineral Economics and Strategy advice</td>
<td># of external reports</td>
<td>92</td>
<td>91</td>
<td>Annual target not achieved due to less than expected commercial work, especially PGM.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td># of reports</td>
<td>8</td>
<td>13</td>
<td>Annual target exceeded due to higher demand for support by the Executive.</td>
<td></td>
</tr>
</tbody>
</table>
### Strategic Objective 2: Research and Develop Efficient Mineral Processing Technologies and Value Added Products and Services

#### Strategic Programmes Per Objective

<table>
<thead>
<tr>
<th>PROGRAMME</th>
<th>ACTIVITY PER PROGRAMME</th>
<th>PERFORMANCE INDICATOR</th>
<th>TARGET 2018/19</th>
<th>ACHIEVEMENTS</th>
<th>ACTUAL</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits to value added products and services</td>
<td>Develop applications for precious-, ferrous- and base metals in the areas of: Environment &amp; Health (HV, Water, Toxicology and Food Security)</td>
<td># of internal reports</td>
<td>15</td>
<td>22</td>
<td>Annual target exceeded. Internal reports are compiled to track progress of staff members on various projects in AMD.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Develop water efficient processes and flow sheets to optimise water consumption and enable processing of ore bodies in water stricken areas</td>
<td># of internal reports</td>
<td>13</td>
<td>14</td>
<td>Target exceeded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Develop energy efficient processes, flow sheets and control technologies that minimise energy consumption and carbon emissions</td>
<td># of internal reports</td>
<td>8</td>
<td>10</td>
<td>Target exceeded due to fewer commercial work received and therefore manpower was utilised on science vote projects, especially those aligned to South Africa’s NDF.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Develop waste management and recycling technologies for treating and recycling wastes in order to extend mineral resources</td>
<td># of internal reports</td>
<td>6</td>
<td>10</td>
<td>Target exceeded due to additional reports on greenhouse gas emissions. An MTEF-funded CRT project was not originally planned.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rehabilitate derelict &amp; ownerless mine sites</td>
<td>Number of sites rehabilitated</td>
<td>6</td>
<td>2</td>
<td>Target not achieved due to strikes from local communities.</td>
<td></td>
</tr>
<tr>
<td>Green Technologies</td>
<td></td>
<td># of external reports</td>
<td>4</td>
<td>6</td>
<td>Target exceeded due to slightly higher number of small value commercial investigations completed. This might be indicative that industry is concerned about water and recovery issues.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td># of external reports</td>
<td>4</td>
<td>7</td>
<td>Target exceeded due to slightly higher number of bench scale type commercial investigations received on optimisation of energy consumption of the mills.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td># of external reports</td>
<td>1</td>
<td>0</td>
<td>Target not achieved.</td>
<td></td>
</tr>
</tbody>
</table>

### Strategic Objective 3: Promote the Mineral-Based Economies of Rural and Marginalised Communities

#### Strategic Programmes Per Objective

<table>
<thead>
<tr>
<th>PROGRAMME</th>
<th>ACTIVITY PER PROGRAMME</th>
<th>PERFORMANCE INDICATOR</th>
<th>TARGET 2018/19</th>
<th>ACHIEVEMENTS</th>
<th>ACTUAL</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of technologies and strategies relevant to rural and marginalised communities</td>
<td>Establish technologies and strategies relevant to small scale operators, for transfer to rural and marginalised communities</td>
<td># of technologies adopted or developed</td>
<td>2</td>
<td>2</td>
<td>Target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td># of feasibility reports</td>
<td>12</td>
<td>15</td>
<td>Target exceeded - More enquires (lignite, lime/stone, clay) received this year which resulted in increase of feasibility reports.</td>
<td></td>
</tr>
<tr>
<td>Economically sustainable businesses created in rural and marginalised communities</td>
<td>Develop and support economically sustainable rural and marginalised communities</td>
<td># of new businesses created</td>
<td>5</td>
<td>6</td>
<td>Targets exceeded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td># of jobs created from new businesses</td>
<td>50</td>
<td>51</td>
<td>Targets exceeded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>% of businesses still in existence after 1 year</td>
<td>95</td>
<td>100</td>
<td>All (4/4) businesses created last year still in existence (100%).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>% of businesses still in existence after 2 years</td>
<td>73</td>
<td>74</td>
<td>(55/74) businesses still in existence after 2 years (74%).</td>
<td></td>
</tr>
<tr>
<td>Training and skills development interventions in rural and marginalised communities</td>
<td>Provide value-added beneficiation training relevant to rural and marginalised communities.</td>
<td># of people trained</td>
<td>120</td>
<td>130</td>
<td>Targets exceeded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maintain accreditation in jewellery manufacturing / design and small scale mining as evidenced in certificate or report</td>
<td>Maintained</td>
<td>Maintained</td>
<td>Target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td># of retrenched mineworkers trained</td>
<td>120</td>
<td>145</td>
<td>Target exceeded as more ex-mineworkers were identified during identification process and discussions with municipalities and mining companies.</td>
<td></td>
</tr>
</tbody>
</table>
### STRATEGIC OBJECTIVE 4 Uphold Good Governance Practices

<table>
<thead>
<tr>
<th>STRATEGIC PROGRAMMES PER OBJECTIVE</th>
<th>ACTIVITY PER PROGRAMME</th>
<th>PERFORMANCE INDICATOR</th>
<th>TARGET 2018/19</th>
<th>ACHIEVEMENTS</th>
<th>ACTUAL</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhanced fiscal discipline and the effective management of resources</td>
<td>BEE procurement as a % of total discretionary spend</td>
<td>% BEE Spend of total discretionary spend</td>
<td>90</td>
<td>97</td>
<td>Increased focus on strategic spending resulted in a higher BEE% spend.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Strengthened Internal Financial Controls</td>
<td>Unqualified audit as evidenced in audit report</td>
<td>Unqualified</td>
<td>Unqualified</td>
<td>Target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sound Debtor Management</td>
<td>% Debtors write off of commercial revenue</td>
<td>&lt;0.25</td>
<td>0</td>
<td>Target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average Debtors Days</td>
<td>&lt;50</td>
<td>37</td>
<td>Target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Income</td>
<td>Rand Value (R’000)</td>
<td>562 035</td>
<td>562 047</td>
<td>Target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Net Result (surplus)</td>
<td>Rand Value (R’000)</td>
<td>8 536</td>
<td>5 446</td>
<td>Target not met due to higher costs on import items due to depreciation of the rand.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optimal Yield on Investment</td>
<td>% Return on investment</td>
<td>5.0</td>
<td>7.2</td>
<td>Strategic placement of short term deposits yielded higher than anticipated returns.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Capital Expenditure</td>
<td>Rand Value (Including Funding) (R’000)</td>
<td>54 714</td>
<td>39 303</td>
<td>Total capital spend not met due to reassessment of requirement for budgeted items in light of low commercial income.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintained balance between R&amp;D and Commercial Revenue streams</td>
<td>Ratio of Research / Total Revenue expressed as a %</td>
<td>≥60</td>
<td>61</td>
<td>Target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintained balance between TCTC Salary Bill/Total Expenditure</td>
<td>Ratio of TCTC Salary Bill / Total Expenditure expressed as a %</td>
<td>≤58</td>
<td>55</td>
<td>Target within range. Lower ratio due to high spend on operational income increasing the expenditure base.</td>
<td></td>
</tr>
</tbody>
</table>

### STRATEGIC OBJECTIVE 4 Uphold Good Governance Practices

<table>
<thead>
<tr>
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<th>ACTUAL</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhanced organisational efficiencies</td>
<td>Enhanced Liquidity Ratio</td>
<td>Liquidity Ratio</td>
<td>≥2</td>
<td>1.9</td>
<td>Target not met due to reclassification of short term portion of PRMA liability leading to increased current liabilities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improved cash flows from operations</td>
<td>Cash generated from operations after working capital (excluding movements in deferred income) (R’000)</td>
<td>&gt;2 000</td>
<td>50 054</td>
<td>Target exceeded due to increased depreciation as a result of adoption of GRAP standards and increased trade payables as a result of large credit balances for customers classified as trade payables.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Productivity Ratio</td>
<td>Recoverability %</td>
<td>85</td>
<td>74</td>
<td>Target not achieved due to lower commercial activity during the year than anticipated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Energy Efficiency</td>
<td>Power factor correction (target was changed to 0.9–1)</td>
<td>0.90</td>
<td>0.94</td>
<td>Target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ICT Security</td>
<td>Intrusions/virus breakouts on system</td>
<td>&lt;3</td>
<td>0</td>
<td>No virus breakouts or intrusions detected during the year. Target achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monitoring of critical facility availability</td>
<td>Upside/availability of ICT facilities (%)</td>
<td>&lt;98.0</td>
<td>99.7</td>
<td>Targets exceeded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upside/availability of critical facilities (%)</td>
<td>&lt;85</td>
<td>98</td>
<td>Targets exceeded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compliance with national and international regulatory frameworks, and applicable standards</td>
<td>Compliance with appropriate standards, regulations and legislation</td>
<td>% achievement of compliance checklist</td>
<td>100</td>
<td>100</td>
<td>Target achieved.</td>
</tr>
<tr>
<td></td>
<td>Internal Audits conducted</td>
<td>No. of audits</td>
<td>18</td>
<td>16</td>
<td>Target not achieved. Five (5) audits were completed at the end of April 2019. The Internal Audit Supervisor position was vacant since December 2018 and was only filled on 12th of March 2019. This caused a delay in the completion of the planned audits.</td>
<td></td>
</tr>
</tbody>
</table>
### STRATEGIC OBJECTIVE 4

**Uphold Good Governance Practices**

<table>
<thead>
<tr>
<th>STRATEGIC PROGRAMMES PER OBJECTIVE</th>
<th>ACTIVITY PER PROGRAMME</th>
<th>PERFORMANCE INDICATOR</th>
<th>TARGET 2018/19</th>
<th>ACHIEVEMENTS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance with national and international regulatory frameworks, and applicable standards</td>
<td>Review of applicable Audit Charters</td>
<td>No. of reviews</td>
<td>2</td>
<td>1</td>
<td>The previous ARC Charter was reviewed in May 2018, and the next review of the Charter is due in May 2019.</td>
</tr>
<tr>
<td></td>
<td>Fraud Awareness Campaigns</td>
<td>No. of campaigns</td>
<td>8</td>
<td>9</td>
<td>Target exceeded.</td>
</tr>
<tr>
<td>Enhanced Safety, Health, Environment and Quality</td>
<td>Maintain Mintek Accreditation status</td>
<td>Maintained</td>
<td>Maintained</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Achieved target for Fatalities</td>
<td>0</td>
<td>0</td>
<td>Targets achieved.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Achieved target for Lost Time Injury Frequency Rate (LTIFR)</td>
<td>&lt;1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### STRATEGIC OBJECTIVE 5

**Develop Human Capital and Organisational Skills to Build World Class R&D Excellence**

<table>
<thead>
<tr>
<th>STRATEGIC PROGRAMMES PER OBJECTIVE</th>
<th>ACTIVITY PER PROGRAMME</th>
<th>PERFORMANCE INDICATOR</th>
<th>TARGET 2018/19</th>
<th>ACHIEVEMENTS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhanced Skills Development</td>
<td>WSP Compliance Report</td>
<td></td>
<td>1</td>
<td>1</td>
<td>Target achieved in Q1.</td>
</tr>
<tr>
<td></td>
<td>Total spend on training expressed as a % of payroll</td>
<td></td>
<td>2.0</td>
<td>1.8</td>
<td>Target not achieved due to repriorisation and change in focus towards SET base skills that was made in Q4.</td>
</tr>
<tr>
<td></td>
<td>Number of partnerships maintained</td>
<td></td>
<td>6</td>
<td>8</td>
<td>Target achieved during the year.</td>
</tr>
<tr>
<td></td>
<td># of partnerships maintained with previously disadvantaged Higher Education Institutions</td>
<td></td>
<td>2</td>
<td>3</td>
<td>Target achieved.</td>
</tr>
<tr>
<td>Science, Technology, Engineering and Maths (STEM) Promotion</td>
<td>Annual Minquiz competition</td>
<td></td>
<td>1</td>
<td>1</td>
<td>Target achieved.</td>
</tr>
<tr>
<td></td>
<td># of undergraduate bursars</td>
<td></td>
<td>18</td>
<td>25</td>
<td>Target exceeded.</td>
</tr>
<tr>
<td></td>
<td>% Under-graduates Absorption Rate</td>
<td></td>
<td>100</td>
<td>n/a</td>
<td>There were no bursars that needed to be absorbed during the period. All bursars continued with post graduate studies.</td>
</tr>
<tr>
<td></td>
<td># of post graduate bursars</td>
<td></td>
<td>9</td>
<td>19</td>
<td>Target exceeded as 6 more bursars were accepted at the beginning of the year.</td>
</tr>
<tr>
<td></td>
<td>% Postgraduate Absorption Rate</td>
<td></td>
<td>100</td>
<td>n/a</td>
<td>Not applicable. Bursars expected to complete studies from June 2019.</td>
</tr>
<tr>
<td>Effective Full-time Bursary Programme</td>
<td># of undergraduate bursars</td>
<td></td>
<td>40</td>
<td>39</td>
<td>Target not achieved due to deferment on studies.</td>
</tr>
<tr>
<td></td>
<td># of Honors/ Other bursars</td>
<td></td>
<td>17</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td></td>
<td># of Masters bursars</td>
<td></td>
<td>26</td>
<td>38</td>
<td>Combined, the post graduates exceeded the target.</td>
</tr>
<tr>
<td></td>
<td># of Doctoral bursars</td>
<td></td>
<td>7</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>
## Key Performance Indicators

### Strategic Objective 5: Develop Human Capital and Organisational Skills to Build World Class R&D Excellence

<table>
<thead>
<tr>
<th>Strategic Programmes per Objective</th>
<th>Activity per Programme</th>
<th>Performance Indicator</th>
<th>Target 2018/19</th>
<th>Achievements Actual</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Training and Skills Development</strong></td>
<td>Work Integrated Learning, Studenthips and Internship Programmes</td>
<td># of Candidates enrolled</td>
<td>60</td>
<td>60</td>
<td>Target achieved.</td>
</tr>
<tr>
<td></td>
<td>Artisan Learnership Programme</td>
<td># of Persons enrolled</td>
<td>6</td>
<td>9</td>
<td>Target exceeded due to more artisans enrolled internally and externally.</td>
</tr>
<tr>
<td></td>
<td>Development Programmes for recent graduate scientists &amp; engineers</td>
<td>% Retention of internal and absorption of external learners</td>
<td>0</td>
<td>100</td>
<td>Target achieved. Contracts of employment for 4 artisans were concluded.</td>
</tr>
<tr>
<td></td>
<td>Development Programme for researchers, scientists, engineers and technicians</td>
<td>Graduate Development Programme review report</td>
<td>1</td>
<td>0</td>
<td>Graduates are expected to complete studies in June 2019.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>An approved programme</td>
<td>1</td>
<td>0</td>
<td>The programme was postponed to next financial year to align its objectives to the process of reviewing the SET base development programme.</td>
</tr>
<tr>
<td><strong>Organisational Development</strong></td>
<td></td>
<td>Report on compliance with DoL regulations</td>
<td>1</td>
<td>1</td>
<td>Target achieved.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% of women at Mintek (towards achievement of Employment Equity targets)</td>
<td>46</td>
<td>42</td>
<td>Target not achieved. Mintek has a stretch target for this KPI.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% employees with disability (towards achievement of Employment Equity targets)</td>
<td>3</td>
<td>3</td>
<td>Target achieved.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interventions to increase women representation in Mintek</td>
<td>1</td>
<td>1</td>
<td>Target achieved in Q2.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Overall % of designated groups (towards achievement of Employment Equity targets)</td>
<td>90</td>
<td>92</td>
<td>Target exceeded.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Structured mentorship programme to transfer skills and knowledge from specialists to mid-level professionals</td>
<td>10</td>
<td>18</td>
<td>Target exceeded.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compliance with Performance Management Policy</td>
<td>100</td>
<td>91</td>
<td>Target not achieved.</td>
</tr>
<tr>
<td><strong>Employee Health and Wellness</strong></td>
<td>Enhanced Employee Health and Wellness Programme</td>
<td>% of employees participating in structured interactions between specialists and mid-level professionals</td>
<td>10</td>
<td>18</td>
<td>Target exceeded.</td>
</tr>
<tr>
<td><strong>Effective Human Resource systems</strong></td>
<td></td>
<td>Enhanced administrative efficiency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average time (in months) to fill vacancies</td>
<td></td>
<td>2.5</td>
<td>Target achieved.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vacancy rate</td>
<td></td>
<td>5</td>
<td>Targets achieved.</td>
</tr>
</tbody>
</table>
Monitoring the process of dispensing biomolecules onto nitrocellulose membranes, a process which takes place in the Mintek/DST Nanotechnology Innovation Centre (NIC) Cleanroom.


14. Van der Walt SH, Skepu A & Sikhwivhu L. What value can the NicTm™ facility add to your research? 8th DST/Mintek NIC workshop, 26-28 March 2018, Mintek, Randburg, South Africa.


27. Erwee M. & Reynolds Q. Interactive visualization of Pyrometallurgical phase diagrams. SAIMM Digitalization in Mining Conference. 6-7 June 2018, The Focus Rooms, Sunninghill, Johannesburg, South Africa.


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38. Knoblauch N. The Continuous Improvement of a Copper Concentrator by Advanced Potassium Control. SAIMM Copper Cobalt Africa. 9-12 July 2018, Avani Victoria Falls Resort, Victoria Falls Livingstone, Zambia.


42. Makamu S. Treatment options for processing double refractory material from the Barberton Greensstone Belt in South Africa. ALTA 2018. Nickel-Cobalt-Copper Conference. 21-23 May 2018, Perth, Western Australia.


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92. Steenkamp J, Reynolds Q, Erwee M & Swanepool S. Freeze-lining formation in SAFs producing FeCr in South Africa. TMS 2019, 10-14 March 2019, San Antonio, Texas, USA.


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