



## Vanadium slag crushing and milling plant

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## Vanadium slag crushing and milling plant – Executive Summary

Highveld Steel and Vanadium was founded in 1960 with the objective of building a unique plant with the ability of beneficiating vanadium bearing Titaniferrous ore from the Bushveld Igneous mineral complex. Highveld remains the only company in South Africa with the processing facility to beneficiate this ore reserve for the production of steel as well as vanadium slag.

Recent developments have resulted in the directors voluntarily filling for business rescue which amongst others opens the opportunity for the sale of assets as individual operating units.

The new vanadium slag crushing plant was commissioned in 2007. It was designed to mill a -13 mm vanadium spinel slag at a rate of 15 tons per hour to a fineness of 80% passing through a 75 micron screen.

The wind down of EVRAZ Highveld offers investors a unique opportunity to acquire a versatile, crushing and milling plant, or alternatively rent the facility for toll milling.





## Introduction

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Process overview

Investment case

Investment case: Pig Iron

Investment case: Ferro Chrome

Manning requirements

Maintenance requirements

Environmental considerations

Conclusion and way forward



## INTRODUCTION

- EVRAZ Highveld Steel and Vanadium (“Highveld Steel”) was, prior to its business rescue proceedings, South Africa’s second largest steel maker and the primary producer of medium and heavy structural sections.
- Highveld Steel has contributed significantly to the South African economy, supporting South Africa’s industrial and economic development.
- During April 2015, Highveld Steel filed for voluntary business rescue as a result of lack of funding in challenging market conditions and ceased operations during July 2015.
- Under the direction of the of the business rescue practitioners and management, Highveld Steel:
  - Negotiated with creditors to enable suppliers to continue business with Highveld when operations restarts.
  - Performed various trials on the Open Slag Bath furnaces to verify the flexibility of units for example investigated the potential for ferroalloy production.
  - Successfully decommissioned the operations under a controlled environment and preserved assets for future start-up.
  - Commenced with care and maintenance on strategic assets.
  - Identified various assets as future strategic assets which can be sold as loose standing operational units.

De-commissioned operations

Preserved assets in care and maintenance mode

Identified strategic assets for future sale

- Highveld Steel has identified the Vanadium slag crushing and milling plant as a strategic asset capable of profitably toll milling a range of products. The location and layout of the asset allows for a stand-alone operation.



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## VANADIUM PLANT: PROCESS OVERVIEW



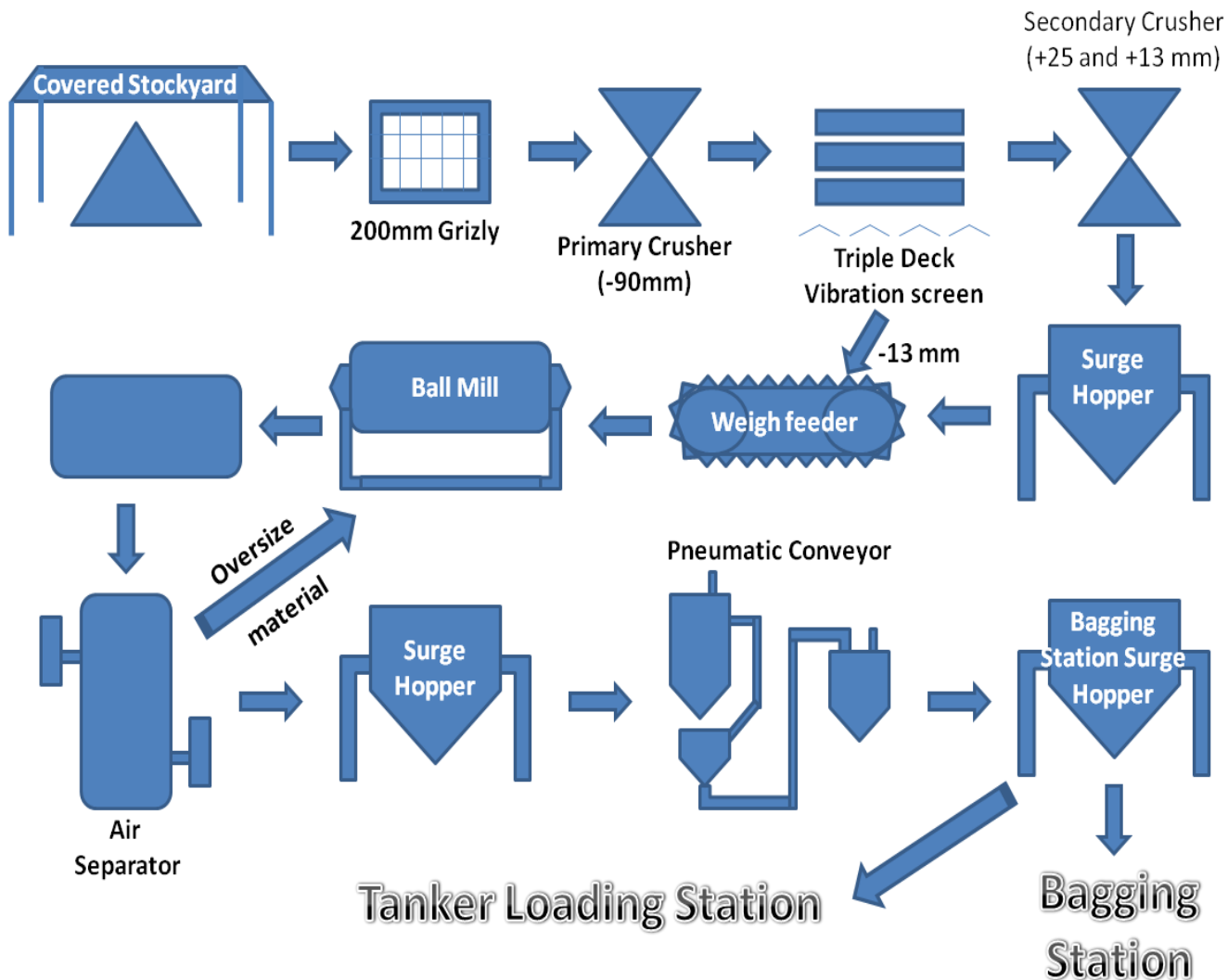
Dedicated raw material receipt & storage area



Robust crushing and milling facility



Undercover and paved loading and dispatch area





## VANADIUM SLAG CRUSHING AND SCREENING PLANT: CRUSHING SECTION

- The material to be processed is off loaded in an undercover stock area.
- The material is then passed through a 200mm square grizley into a hopper. A hydraulic pecker can be installed to help break up larger pieces or remove them.
- An apron feeder discharges the material onto a 900mm conveyor which feeds the primary crusher.
- The primary crusher reduces the feed from -200mm to -90 mm.
- A 600mm wide conveyor belt transfers the material from the crushing building to the screening building.



Dedicated raw material receipt & undercover storage area



200 mm square grizley

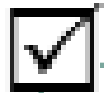


primary and secondary crushers



## VANADIUM CRUSHING AND MILLING PLANT: SCREENING SECTION

- The feed from the primary crusher is passed over a triple deck vibrating screen.
- The triple deck screen consists of a 90mm, 25mm and 13mm screen.
- The plus 90 mm acts as a scalping screen to remove any plus 90 mm particles assumed to be uncrushable.
- The 25 mm screen acts as a relief screen to ensure that the 13 mm screen is not overloaded. The oversize from both the 25 mm and 10 mm screens is combined and conveyed back to the secondary Jaw Crusher.
- The minus 13 mm material is conveyed by a bucket elevator to the top of the milling building to a surge hopper.



Triple deck  
screen



90 mm scalping  
screen



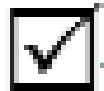
25 mm relief  
screen





## VANADIUM SLAG CRUSHING AND MILLING PLANT: MILLING AREA

- The surge hopper has a 150 ton capacity and is equipped with two discharge hoppers.
- These two hoppers feed two identical milling circuits.
- The discharge hoppers feed onto a belt weigh feeder which feeds the mill at a preset rate.
- The mill is fed via leaf type seals.
- The mill is driven by a 300kW squirrel cage motor and rotates at 21.66 rpm and is equipped with a barring system to turn the mill at 0.22 rpm.
- The discharge end of the mill has slotted liners that discharges the milled material onto a trommel screen.
- The oversize from the trommel screen is discharged onto a single deck vibrating screen where fines are returned to the product stream.
- The product from the mill is transferred to a magnetic separator via a bucket elevator.



Two identical milling circuits



Single deck vibrating screen to recover product after the mill



Magnetic separator



## VANADIUM SLAG CRUSHING AND MILLING PLANT: MILLING SECTION

- The non magnetic fraction is transferred via a bucket elevator to a air separation unit.
- Various blade configurations can be used to achieve the desired split. Currently the plant is set up for producing a fines of 80% passing through 75 micron at a rate of 7.5 tons per hour.
- The oversize is returned to the mill feed.
- The undersize reports to a surge bin.
- The product is then transferred by pneumatic conveyor to the loading station.
- The milled and sized material can either be loaded into bags or tankers.



Two air separation units & storage area



Pneumatic conveyor



Tanker jet loader and bagging station



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## VANADIUM SLAG CRUSHING AND MILLING PLANT: MAINTENANCE REQUIREMENTS – CRUSHING PLANT

- Replace secondary crusher mounting base.
- Lagging of secondary feed, primary feed and primary transfer conveyor head pulleys.
- Repair primary transfer conveyor delivery chute to the triple deck screen.
- Extending the hand rails and platform for better modification of the primary crusher guard.
- Apron feeder - installing plates around it.
- Repairs of primary crusher feed chute.



## VANADIUM SLAG CRUSHING AND MILLING PLANT:: MAINTENANCE REQUIREMENTS – MILLING PLANT

- No.2 ball mill door clamps installation.
- Replace long bucket elevator side bottom covers at ball mill 1.
- Replace long bucket elevator side bottom covers at ball mill 2.
- Replace magnetic separator a drive shaft.
- Install support columns on air sep chute.
- Replacement of bifurcating chute.
- Replace chain bucket Top and bottom guides.
- Repairs to suction tank no1 and grit to be installed.
- Replace and repair roof above magnetic separator.



## VANADIUM SLAG CRUSHING AND MILLING PLANT:: MAINTENANCE REQUIREMENTS – MILLING PLANT

- Drum magnet replacement.
- Grease system installation for magnet shaft pulleys.
- Vibration monitoring on ball mill and gearbox.
- Mill vent fan replacement.
- Repairs to cones in silos.
- Inspect Ball mill Pinion bearings.
- Ball mill liner bolts.



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## VANADIUM SLAG CRUSHING AND MILLING PLANT: ENVIRONMENTAL CONSIDERATIONS



Complies with  
duty of care



Bunded areas



No detrimental  
environmental  
impact on receiving  
environment

- The plant is sited on a paved footprint and complies with the duty of care principles.
- Dust capture systems return the fugitive dust to the product stream.
- Water management is facilitated by bunded areas.
- Environmental impact surveys were done by Golder and no detrimental impact on the receiving environment has been identified that may have been caused by constituents of concern.





## CONCLUSION AND WAY FORWARD

- As illustrated in this presentation, the vanadium slag crushing and milling plant is well positioned to offer an investor the opportunity to process a wide range of products.
- This plant offers amongst others the following opportunities to a potential investor:
  - Versatile equipment.
  - Strategically located facility situated close to major routes.
  - Access to established infrastructure including electricity supply, compressed air supply, rail links, etc.
  - Immediate access to market compared to a similar sized green fields project.
  - Direct access to required skills to re-start and operate the facility.
- In order to preserve it, the asset was placed under care and maintenance.



## ENVIRONMENTAL COMPLIANCE

The prospective bidder must determine all environmental legal responsibilities, in line with the prevailing legislation as may be amended from time to time, relating to the processes and activities to be undertaken by the prospective bidder and, if successful, to ensure full environmental compliance with such identified responsibilities. All planned processes and activities including any identified environmental responsibilities in relation thereto, will be made clear to Highveld in writing, as part of the bid process, to ensure a transparent relationship and agreement on the environmental compliance requirements. The prospective bidder must lead any discussions with the relevant environmental authorities and obtain the required environmental authorisations relating to the various environmental compliance requirements. The prospective bidder will carry all costs associated with such authorisations and discussions. Any supporting information required from Highveld relating to environmental concerns and compliance requirements must be identified by the prospective bidder and, if available, will henceforth be supplied by Highveld and not be unreasonably withheld, to support the drive of the prospective bidder towards environmental compliance.



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