# Sukulu Phosphate Project
# Scoping Study Report
## (Feasibility Study Phase 1)

**Report Prepared for**

## Nilefos Minerals Limited

**Report No 400092**

**25 October 2010**

**(Effective Date 1 January 2010)**

SRK Consulting
Engineers and Scientists

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**(Feasibility Study Phase 1)**

## Nilefos Minerals Limited

**SRK Project Number 400092**

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# Section Index

[Note: Each section is preceded by its own Table of Contents; List of Figures; List of Tables]


| Section Number | Description | Pages |
|---|---|---|
| - | Executive Summary | 1 - 7 |
| 1 | Introduction | 1.1 - 1.14 |
| 2 | Tenure | 2.1 - 2.13 |
| 3 | Geology and Resources | 3.1 - 3.43 |
| 4 | Mining | 4.1 - 4.12 |
| 5 | Mineral Processing | 5.1 - 5.36 |
| 6 | Tailings Disposal | 6.1 - 6.19 |
| 7 | Conceptual Water Supply | 7.1 - 7.17 |
| 8 | Mine Infrastructure | 8.1 - 8.20 |
| 9 | Logistics | 9.1 - 9.18 |
| 10 | Environment | 10.1 - 10.16 |
| 11 | Marketing | 11.1 - 11.12 |
| 12 | Economic Analysis | 12.1 - 12.17 |
| 13 | Feasibility Study Work Program | 13.1 - 13.17 |
| 14 | Conclusions and Recommendations | 14.1 - 14.2 |

# Executive Summary

Nilefos Minerals Limited ("Nilefos") holds the mineral rights to the Sukulu Phosphate Project (the "Project") located near the town of Tororo in south-eastern Uganda. The Project consists of a carbonatite pipe that contains a large amount of apatite and magnetite minerals.

The deposit is unique within the eastern Uganda complexes, because it consists almost entirely of carbonatite rocks. This, coupled with its history of weathering, created a phosphorus-iron-niobium enriched eluvial soil. The soil has accumulated in three structural and topographical valleys (North, South and West) and in a perimeter zone encircling the carbonatite hills. The results of previous evaluations and initial field observations ranked the highest phosphate potential in the valleys, followed by the perimeter zone and finally the unweathered carbonatite parent rocks.

The deposit was first developed in the 1950's when a small operation making single superphosphate was built and operated. This continued to operate until the political troubles of the late 1970's caused it to close and the plant was sold for scrap.

A number of assessments were conducted on the Project from the 1980s through to the present, and in 2007/8 a preliminary assessment study was undertaken by SRK Consulting (USA), culminating in the production of a non-JORC compliant resource estimate of 206Mt grading 12.8% $P_2O_5$ at a 0% cut-off. The table below details the SRK (USA) resource estimates at different cut-off grades.

| Cut-off Grade | Soil (Mt) | $P_2O_5$ (%) | $P_2O_5$ (kt) |
|---|---|---|---|
| **Measured & Indicated Resources (Non-JORC compliant)** | | | |
| 0% | 174.1 | 12.80% | 22 363 |
| 4% | 173.9 | 12.90% | 22 358 |
| 8% | 163.1 | 13.30% | 21 618 |
| 12% | 110.2 | 14.60% | 16 078 |
| 16% | 23.6 | 17.70% | 4 178 |
| 20% | 1.9 | 21.30% | 402 |
| **Inferred Resources (Non-JORC compliant)** | | | |
| 0% | 31.5 | 12.70% | 3 990 |
| 4% | 31.4 | 12.70% | 3 988 |
| 8% | 27.4 | 13.60% | 3 721 |
| 12% | 17.1 | 15.50% | 2 654 |
| 16% | 6.0 | 18.40% | 1 102 |
| 20% | 1.0 | 22.50% | 231 |

A pilot plant was also designed and delivered to the site by SRK (USA), which has not been used yet due to some past dissent by residents at the mine site.

In 2008, Nilefos commissioned the Institute of Minerals and Materials Technology ("IMMT") (formerly Regional Research Laboratory, RRL) located in Bhubaneswar, India, to investigate flow sheet improvements designed to lift $P_2O_5$ recoveries.

In 2009, Nilefos appointed SRK Consulting (South Africa) (Pty) Ltd ("SRK") to implement a study programme to finally advance the Project to a feasibility study level of confidence. This work was to be done in two phases:

- Phase 1 - A review of the work done to date to obtain an understanding of the work already completed,
  - A preliminary assessment of project potential and likely project risks by proposing and broadly evaluating a possible project design at conceptual level,
  - Identification of the outstanding data and work required to advance the Project to a feasibility study level of confidence, together with an estimation of the time and budget required to do this additional work;
- Phase 2 - Drawing on the results of the previous phase, to undertake the required data collection and engineering design work to advance the Project to the required feasibility study standard.

This report sets out the results of SRK's phase 1 review.

SRK received and assessed most of the previous data, information, study work and reports. Certain SRK specialists then visited the site in Uganda, to familiarise themselves with the previous exploration work well as with the site conditions.

It was noted that Nilefos' tenure currently consists of a 'Retention Licence' for the deposit area itself that is valid to 23rd June 2011. It may be necessary for Nilefos to negotiate a larger area than this, to cater for infrastructure and tailings disposal requirements. Also there have been challenges to the Nilefos tenure in the past, the latest of which resulted in a court injunction against further work by Nilefos on the site. It is SRK's understanding that these legal challenges have now largely been resolved in favour of Nilefos.

The proposed conceptual project design that was accepted for the phase 1 assessment is as follows:

- The project is split into two production phases:
  - The first production phase will mine and process the ore to produce approximately 70ktpa of phosphate fertilizer for the East African regional market;
  - The second production phase will consist of an expansion to add approximately 1Mtpa of apatite concentrate for export via Mombasa.
- Mining for both phases to be conducted using a conventional truck and shovel method. The loaders will load the residual soil into 60t six-wheel-drive articulated dump trucks ("ADTs") for delivery to the processing plant.
- Concentrators to match the production requirements, based on the IMMT design, will be provided to produce an apatite concentrate. Technology to be applied will include magnetic separation, screening, milling, two-stage flotation and dewatering of flotation concentrate. The proposed flowsheet excludes desliming ahead of flotation. $P_2O_5$ recoveries in the region of 21% are indicated.

The Phase 1 (IMMT) concentrator will have a feed capacity of 50tph producing some 67ktpa of apatite concentrate.

The Phase 2 (IMMT) concentrator will have a feed capacity of 3 x 250tph to produce 1Mtpa of apatite concentrate. Technology to be applied will be as for Phase 1.

- Phase 1 will then include the following facilities for the production of single superphosphate ("SSP") and triple superphosphate ("TSP"):
  - Sulphur burning sulphuric acid plant with capacity of 250tpd or 82.5ktpa;
  - Hemihydrate phosphoric acid plant with capacity 100tpd phosphoric acid or 54ktpa P2O5;
  - Fertilizer manufacturing facility with capacity 200tpd SSP or 150tpd TSP, or 31.4ktpa SSP plus 39.4ktpa TSP;
  - If only SSP is produced, the facility will have a capacity of 69.0ktpa SSP.
- The Phase 1 SSP and TSP will be dried and packaged into 50kg bags and delivered to East African customers by road.
- The phosphate rock concentrate produced in Phase 2 is planned to be placed in $1m^3$ bulk bags which will be transported by rail to Mombasa in containers or sealed wagons, for export.
- Supporting infrastructure has been provided for. These facilities have been sized to be initially suitable for Phase 1, although space has been allowed to expand these facilities as necessary to accommodate Phase 2. The main infrastructure items are:
  - Power supply for phase 1 will be 3.5MW. This can be supplied at 33kV by UMEME from the existing sub station at Tororo. Phase 2 power will require 22.5MW. This large amount of power will require a new 132kV overhead power line from the planned new hydropower station at Jinja (about 135km).
  - Water supply for both phases will be taken from a new weir and pumping station on the nearby Malaba river.
  - It was assumed that all transport logistical arrangements for Phase 1 will be conducted by road. For Phase 2, the additional transport logistics will be conducted by rail from Mombasa, via the concessionaire for this railway ('Rift Valley Railways'). A new railway siding at the mine has been provided for Phase 2. The initial logistics study indicated that sufficient spare capacity exists at Mombasa in terms of freight forwarding, bonded warehousing, materials handling, etc.
  - All roads, buildings, workshops, stores etc have been provided for with the exception of employee housing, where it has been assumed that employees will provide their own accommodation within the town of Tororo as part of their remuneration packages.
- Wastes produced from the process plants include the following:
  - Gypsum will be produced from the phosphoric acid plant, which will be disposed of in a lined tailings disposal facility.
  - Large amounts of flotation slimes will be produced from the concentrators. This material is likely to be problematic because of the fineness of the material. It is likely that this material will remain unconsolidated and will need to be contained within an earth or other impoundment wall.
  - In addition, coarse and fine magnetite tailings will be produced which might represent a future mineral resource. However, this material could possibly be used to form the impoundment wall for the flotation tailings, thereby offering a cost-effective solution to the

disposal of both tailings. This would however sterilise the magnetite tailings from being recovered in the future. The use of the magnetite tailings material to form the impoundment wall for the flotation slimes has been assumed for this study.

An initial marketing study has revealed that there is a shortage of fertiliser for the East African market. Also the quality of the phosphate rock concentrate that will be produced during Phase 2 of the project will be of good quality and should command good prices in the export market.

Environmentally, apart from the tailings disposal issues mentioned above, the major concern relates to the need to resettle approximately 2 000 families from the deposit area. This does not include additional areas that may be necessary for the placement of infrastructure and tailings disposal facilities. It is SRK's understanding that the Government of Uganda will assist with the resettlement program in return for an interest in the project.

Estimated total capital costs for the two project phases are set out in the table below. Based on the economic analysis conducted, the production of fertilizer has been limited to SSP only.

| Description | Capital Estimates (US$million) | | |
|---|---|---|---|
| | Phase 1 Project Capital | Phase 2 Project Capital | Replacement/ Sustaining Capital for LoM |
| **Phase 1, SSP only** | | | |
| Project Capital | 192.7 | | |
| Sustaining Capital | | | 60.2 |
| **Phase 1 SSP only + Phase 2 concentrate** | | | |
| Project Capital | 192.7 | | |
| Additional Project Capital | | 366.6 | |
| Sustaining Capital | | | 119.9 |

Estimated total operating costs for the two project phases are as follows:

- Phase 1 operating cost (steady-state): US$19.0million per annum (US$59.51/t RoM) (US$170.60/t SSP)

- Phase 2 total operating cost (steady state): US$135.3million per annum (US$26.43/t RoM) (US$121.00/t product - concentrate+SSP)

An economic model was prepared for the conceptual project described above. This yielded an IRR of 14.1% ($NPV_{10}$ of US$85million) for the Phase 1 and Phase 2 concentrate with SSP scenario.

Variation of NPV with discount rate for the four different production scenarios are set out below.

| | | PHASE 1 – TOTALS | | PHASE 2 – LoM TOTALS | |
|---|---|---|---|---|---|
| **NPV** | | **Conc only** | **SSP only** | **Conc only** | **SSP only** |
| 0% | (US$m) | -214 | 1 352 | 309 | 908 |
| 6% | (US$m) | -131 | 263 | -16 | 254 |
| 8% | (US$m) | -119 | 163 | -59 | 155 |
| 10% | (US$m) | -109 | 101 | -86 | 85 |
| 12% | (US$m) | -101 | 60 | -102 | 36 |
| Peak funding | (US$m) | -214 | -193 | -479 | -383 |
| IRR | (%) | <0.0% | 17.8% | 5.4% | 14.1% |

The results from the study suggest that the inclusion of TSP has a major reduction on the project value and increases the complexity of the processing plant and the risks associated with the project. While it may be premature to reject this option at this stage, this will need to be critically re-evaluated in the phase 2 feasibility study stage.

The return for building and operating only the Phase 1 SSP scenario of the project (i.e. without building phase 2) was an IRR of 17.8% ($NPV_{10}$ of US$101 million).

Thus, having completed the phase 1 preliminary and scoping assessment of the Sukulu project, SRK believes that the following conclusions may be drawn:

- There are, at this stage, no evident 'Fatal Flaws' in the conceptualised project.
- The project appears to have the potential to be viable, within the constraints and assumptions made for the conceptual scoping study.
- The project should be limited to the production of SSP, but the annual production volume needs to be re-assessed.
- Areas where improvement to the project returns may be possible, relate principally to areas where significant capital and operating cost savings might be achieved. At this stage these 'areas of opportunity' are seen to be:
  - Trade-offs and optimisations, during more detailed design. These pertain particularly to the selection/optimisation of the product to be sold during the phase 1 operation as well as to the optimisation of the phase 1 production rate.
  - The possibility of using contractors for the mining operations.
  - The possibility of storing the tailings material in the mined-out areas of the orebody.
  - The possibility of regeneration of power using waste heat from the sulphuric acid plant.

  These items should be specifically addressed during the detailed feasibility study.
- The current marketing assessment indicates that there is a shortage of fertiliser within the East African region. In this regard the Sukulu project could be of strategic importance to local agriculture and industries.
- There are however still a number of areas of risk inherent in the project, that have been identified in this scoping study. The more significant risks are outlined below:
  - **Tenure**: Although Nilefos are in possession of a 'Retention Licence' for the orebody, there have been challenges to Nilefos' tenure; the latest in the form of a court injunction.

Also, the current licence area does not include sufficient ground for the project tailings disposal and infrastructure. This applies also to servitudes that will be necessary for power lines and water pipelines.

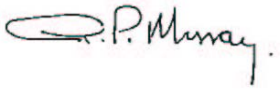
These issues need to be resolved by Nilefos.

- **Geology**: Although good work has been done in the past with respect to Resource definition, further site investigation work needs to be conducted relating to verification of the resource estimates and the variability of the metallurgical characteristics across the ore body. At the same time, some investigation into possible mineralisation below the known ore body needs to be undertaken.
- **Metallurgy**: Good work has been undertaken in past studies, leading to the development of an innovative process flow sheet. However, the process flow sheet that has been developed for this project is not yet proven at commercial scale. This needs to be addressed by pilot plant work.
- **Tailings disposal**: Although initial indications are that solutions exist for the disposal of the large amount of problematic unconsolidated tailings, the nature and characteristics of the tailings material need to be established by test work in order to confirm the assumptions.

  In this regard, it is a central assumption that the magnetite tailings can be utilised as wall-building material to contain the unconsolidated flotation tailings; thereby sterilising the magnetite tailings from being a possible future resource. The acceptability of this assumption needs to be confirmed.
- **Infrastructure**: In general, the infrastructure requirements have been reasonably defined by this scoping study. However the following items still need specific attention:
  - The ability of UMEME to reliably supply the required power to Sukulu.
  - The availability of the existing cement factory railway siding for use by Sukulu.
  - The future capacity of the Malaba river to supply sufficient water to Sukulu.
  - The Return Water Dams sizing to minimise discharges to the river system during the rainy seasons.
  - The availability of sufficient housing and/or accommodation in Tororo for the Sukulu operating staff.
- **Logistics**: The ability of RVR to reliably transport the plant consumables and reagents as well as the phosphate rock concentrate to/from Mombasa needs further investigation.
- **Marketing**: Two draft off-take agreements for phosphate rock that Nilefos obtained in the past from reputable potential export customers attest to the likely quality of the Sukulu phosphate rock concentrate. However, products from the new pilot plant test work should be sent to potential customers for further testing and negotiation of updated off-take agreements.
- **Environmental**: The environmental requirements and potential impacts that have been identified during the scoping study are largely as expected for a project of this nature. However, the resettlement plan for affected people will be of critical importance and needs to be extended and updated. In this regard a full social program including public participation meetings will be necessary.

Overall, SRK believes that the Sukulu project has demonstrated reasonable potential, within the constraints and assumptions of this scoping study.

It is our recommendation that the project be advanced to the phase of detailed feasibility study (phase 2). The budget estimate of costs to undertake this study is detailed in the Appendix to Chapter 13 of this report and amounts to US$6.79million, (excluding Nilefos expenses and also excluding VAT and other taxes or levies).



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