CORPORATION LIMITED

TSUMEB South West Africa

TSUMEB

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If you do not receive all the pages, please telephone or telex.

To FAX 011 -793 2413

Council for Mineral Technology

MINTEK

Randburg / South Africa Att. Mr A. Schouk.ens

Pyromet Division

Message No. Mar 21, 1988

Page 1 of 1

From Dr Haegele. Chf Met

Cher Albert

Assay of 10-Bulk Sample of Tsumeb Lead Blast Furnace Slag

|  |  |
| --- | --- |
| **ELEMENTS** | **ASSAY, kg/t** |
| Zinc | 108 |
| Lead | 23 |
| Germanium | ;450 |
| Gallium | .180 |
| Sulfur, Total | 6.2 sic! |
| Sulfate | 2.0 |
| Carbon, Total | 1.1 sic! |
| Chlorine | .200 |
| Arsenic | 4.0 |
| Copper | 4.2 |
| Silver | .002 |
| Cadmium | .010 |
| Iron Fe | 156 |
| Lime Cao | 233 |
| Silica SiO2 | 262 |
| Aluminum Al | 21 |
| Magnesium Mg | 37 |

Kind regards, also to Chris Viljoen Robert

10 TON SLAG SAMPLE TO MINTEK (4-3-88)

**TSUMEB CORPORATION LIMITED**

**ASSAY REPORT**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SAMPLE NUMBER** | **DESCRIPTION** | **Cu** | **Pb** | **Zn** | **As** | **Cd** | **Si02** | **Ca** | **Ag**  **g/t** |
| **3-3** | Special BFS Dispatched to MINTEK | 0,42 | 2,30 | 10,’8 | 0,4 | Tl,001 | 26,2 | 23,3 | 2 |
|  | ex Mr C Viljeon | **Al** | **Mg** | **Ge** | **Ga** | **S** | **C** |  |  |
|  |  | 2,1 | 3,7 | D,D4E | O,18 | 0,55 | D,16 |  |  |
|  |  |  |  |  |  |  |  |  |  |

**CHEMIST\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Typical Data of Coal**

**Type: Nut Coal**

Reflected are all receipts during the period May – July ,1983

**Distribution by Origin**

|  |  |
| --- | --- |
| Douglas Colliery | 7.9 % by mass |
| Phoenix | 3.7 |
| Springbok | 12.7 |
| Tavistock | 8.1 |
| Transvaal Navigation | 67.6 |

**Size Distribution**

|  |  |
| --- | --- |
| > 20 mm | 89 % by mass |
| C: 5mm | 2 |

**Bulk Densities**

|  |  |
| --- | --- |
| Lo9se | 0.a0 t/m3 |
| Packed | 0:91 |

**Coal Analysis**

|  |  |
| --- | --- |
| Gross Calorific Value | 2 .9 GJ/t |
| Volatiles | 28.9 % by mass |
| Fixed Carbon | 55.8 |
| Ash | 15.3 |
| Residual Moisture | 1.3 |
| Sulfur (S) | 1.4 |
| Chlorine (Ct) | 0.1 |
| Fluorine (F) | 90 .g/t |
| Arsenic (As) | l.O |

**Ash Analysis**

|  |  |
| --- | --- |
| Silica (Si02) | 44.1 % by mass |
| Alumina (A.£203) | 27.4 |
| Iron (as Fe203) | 7.0 |
| Lime (Cao) | 8.0 |
| Magnesia (Mg0) | 9.3 |
| Phosphorus (as P205) | 0.59 |

AFROX Oxygen Plants

Capacity, t/d of Oxygen

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Description |  |  |  |  |  |  |  |  |
|  |  |  | 28 | 55.4 | 150 | 200 | 250 | 492 |
| TOTAL INVESTMENT |  | Kran | 6000 | 7030 | 13450 | 13700 | 17600 | 33000 |
| Capital Cost CIJ |  | Kran | 5800 | 6800 | 13200 | -13400 | 17300 | 32700 |
| Management Fees |  | Kran | 200 | 230 | 250 | 300 | 300 | 300 |
| Management Fees, of capital Costs |  |  | 3.41/4 | 3.41/4 | 1.9- | 2.23/4 | 1.7i- | 0.9i- |
| Investment .t /t of Oxygen |  |  | 214 | 127 | 90 | 69 | 68 | 67 |
|  |  |  |  |  |  |  |  |  |
| Investment Ratios |  |  | 100.0” | 59.21/4 | 41.8” | 3:2.0i- | 31 e:< | 31.3 |
| Power Requirement |  | kW | 755 | 1245 | 1245 | 2700 | 3815 | 4950 |
| 9350Energy Requirement |  | Kwh/d | 18120 | 29880 | 64800 | 91560 | 118800 | 224400 |
| Energy Ration |  | kWh/t of oxygen | 647 | 539 | 432 | 458 | 457 | 456 |
| Energy cost |  | RAN/t of oxygen | 32-36 | 26-9 | H60 | 22.89 | 22.85 | 22-80 |

C1 Including spares, GST, and pre-commissioning interest

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To FAX Message No.

Babcock Africa (Pty) Limited Feb 16, 1988, Johannesburg

Attention Dr F. Chittenden Page 1 of 1

from Dr Haegele, Chf Met

Slag Fuming Computer Simulation

Thank you for your telefax of Feb 12 and also for the report on microprobe analysis of Tsumeb slag from Pretoria University.

Input for Kellog's program:

1. Slag Composition: as you assumed

2. Ambient Conditions (min and max averaged over whole year);

Atmospheric Pressure: 87.4 - 88.3 kPa

Temperature: 288 - 304 K

Relative Humidity: 17 - 69 percent

3. Coal Analysis: We receive coal from a number of collieries; typical would be Nut Coal ex Transvaal Navigation. Since we do not make an ultimate analysis, the figures for this coal were taken from Bulletin No. 100, Nat Inst Coal Research, and refer to air-dry basis:

Moisture 2.3 %

Ash 13.7 (0.6 % pyrite) 69.6

Carbon 69.6

Hydrogen 4.3

Nitrogen 1.7

Organic Sulfur 0.3 (i.e., not pyrites) 8.1

Oxygen 8.1

As regards local charcoal, no ultimate analysis is available, and I can only supply the following:

Moisture 3 % approximately

Ash on dry Basis 11.3 %

Fixed Carbon 73.0

Volatiles 15.7

4.and 5. Thermodynamic Data: We are at peace if you take the figures applying to El Paso.

6. Throughput of 300 t/d of cold slag is our design figure; batch size and cycle time would have to be chosen such that steam production is optimum. You surely will have to melt part of the cold slag before fuming? Good luck and kind regards.

TELEX

8812-0KHD D

OCTOBER 1, 1987

TO KHD KOELN FM TSUMEB

AT DR CHAUDHURI/MR FRITSCH

RE YTLX AUG 16, NO. 9-2325-5-0119

file G FUMINB

WE ARE LOOKING FORWARD TO RECEIVE YOUR BUDGET QUOTATION FOR FUMING TSUMEB SLAG IN A CONTOP REACTOR; THIS MATTER WAS EXTENSIVELY DISCUSSED WITH MR FRITSCH DURING HIS RECENT VISIT TO TSUMEB.

AS REGARDS YOUR PLANNING DATA WE ADVISE AS FOLLOWS:

1. TREATMENT RATE 300 T/D OF DRY SLAG IS CORRECT.

2. YOUR SLAG ASSAY FIGURES ARE MORE OR LESS CORRECT; HOWEVER PLEASE AMEND AS FOLLOWS:

LEAD 2.2 - 2.4 PERCENT

IRON/ FEO 20 - 24

SILICA/ S102 24 - 25

LIME/ CAO 20 - 22

ADD MOLYBDENUM/ MO 0.22 PERCENT

DENSITY TRUE 3415 KG/M3, BULK APPROX 2000 KG/M3

SIZE DISTRIBUTION:

+ 4.0 MM 1 PERCENT; ASSUME MAX 50 MM

- 4.0 + 2.0 13

- 2.0 + 1.0 22

- 1.0 + 0.5 42

- 0.5 + 0.3 12

- 0.3 10

3. COAL: YOUR FIGURES ACCEPTABLE

PLEASE NOTE THE FOLLOWING LATEST FIGURES ON SOUTH AFRICAN COAL

- AS USED AT TSUMEB (TRANSVAAL NAVIGATION SMALL NUTS):

CALORIFIC VALUE 27.0 GJ/T

MOISTURE 2.3 PERCENT AIR DRY BASIS

FIX CARBON 54.1

VOLATILE MATTER 26.7

ASH 16.3

TOTAL SULFUR 0.57

C 69.6

H 4.3

N 1. 7

0 8.1

SWELLING NO. 1

ASH FUSION/ HEMI + 1673 K

ABRASIVE INDEX 180

HARDGROVE INDEX 50

COAL ASH: THE FOLLOWING FIGURES WOULD BE CONSISTENT WITH THOSE

ABOVE:

S102 48.8 PERCENT OF ASH

AL203 34.2

FE203 6.2

P205 0.6

TI02 1.8

CAO 3.3

MGO 1.4

NA20 + K20 0.7

S03 2.6

4. TECHNICAL OXYGEN IS PRESENTLY NOT AVAILABLE IN ANY QUANTITIES

OTHER THAN 3 T/D PLANT FOR LOCAL USE.

HOT AIR AVAILABLE EX COPPER REVERB AIR PREHEATERS BUT USED AS SECONDARY AIR FOR THIS FURNACE; 17 M3/S NTP, 565 K, 2.8 KPA.

STEAM GENERATION IN THE TWO BOILERS OF N0.2 FURNACE PRESENTLY OPERATED IS DESIGNED FOR 23 T/H EACH AT 2.95 MPA AND 627 K; AT PRESENT FIRING RATE ONLY 40 PERCENT OF THIS CAPACITY IS USED.

5.SCOPE OF YOUR ENVISAGED OFFER IS FINE; HOWEVER, PLEASE DETAIL EACH PROCESS STEP AND COST IT SEPARATELY ('MODULAR DESIGN').

ARE YOU CONSIDERING A POSSIBLE FINER GRIND OF SLAG TO CYCLONE, I.E., OF LESS THAN 1 MM?

HAVE YOU PERHAPS FOLLOWED UP DR HANUSCH' RECENT STATEMENT IN ERZ­ METALL ABOUT HIGH 'PRIMARY' (I.E. IN CYCLONE?) ELIMINATION EFFICIENCIES OF ZINC (93 PERCENT) AND GERMANIUM (92 PERCENT) UNDER MORE REDUCING CONDITIONS?

REGARDS HAEGELE

-680 WK

8812-0 KHD D

8 7-D8-26 10. 04

KHD KOELN 291/D595 87-08-26 09.34

TSUMEB CORPORATION LTD., SOUTHWEST AFRICA

ATTN: MESSR-S. (, DR. HAEGEL

RE: SMELTING OF LEAD SHAFT FURNACE SLAG - OUR NO. 9-2325-5-0119 WE REFER TO YOUR VISIT TO OUR OFFICE IN COLOGNE DURING 11/12.8.87

IN THE ABOVE-MENTIONED SUBJECT MATTER AND TAKE THIS OPPORTUNITY

TO THANK YOU FOR YOUR INTEREST SHOWN FOR THE CONTOP TECHNOLOGY. WE ARE PLEASED TO LEARN THAT YOU ARE INTERESTED IN RECEIVING

A BUDGET OFFER FOR THE ABOVE-MENTIONED SMELTING PROJECT BY THE END OF OCTOBER 1987.

WE INTEND TO USE THE FOLLOWING PLANNING DATA WHICH WERE COMMUNICATED TO US IN THE PAST.

1. SMELTING CAPACITY: 300 TONS DRY SLAG PER DAY

2.

|  |  |  |
| --- | --- | --- |
| **SLAG ASSAY** | **AV** | **RANGE** |
| ZN | 11.5 PERCENT | (1 D-13) |
| PB | 2.5 | (2-3) |
| AS | D.4 | MAX |
| GE | 450 GIT |  |
| FEO | 19 PERCENT | (18-20) |
| S10 2 | 28.5 | (27-30) |
| CA0 | 23 | (22-24) |
| IGO | 5.5 | (5-6) |
| AAL203 | 4.S | (4-5) |
| MOISTURE | 6.0 | MAX |
| SIZE | SO MM MAX |  |

3.

|  |  |
| --- | --- |
| **POWDERED COAL** | CAL. VALUE 27.32 GJ/T COAL |
| C | 71.2 PERCENT |
|  | 1.0 |
| HiSo | I?.5 |
| H | 4.5 |
| O | 3.5 |
| Ti | 1.3 |
| ASH | 16.0 |

3.1.

|  |  |
| --- | --- |
| **ASH ASSAY** | **PERCENTAGE** |
| S10 2 | 45 |
| AL203 | 35 |
| CAO + MGO | 10 |
| FE203 | 10 |

4. FURTHER PLS INDICATE ABOUT

. - AVAILABILITY OF TECHNICAL OXYGEN AND/OR HOT AIR (AMOUNT AND TEMPERATURE)

- STEAM DATA CP, T) FOR YOUR EXISTING BOILER CIRCUIT

5.WE SUGGEST THE FOLLOWING SCOPE OF OFFER:

-SLAG GRINDING, DRYING, SMELTING AND MELT CONDITIONING, GAS COOLING AND GAS DEDUSTING, GRANULATION OF SLAG FROM CONTOP SMELTING.

YOUR EARLY REPLY WILL DE OF MUCH HELP IN COMMENCING WITH OUR METALLURGICAL/TECHNICAL CALCULATIONS.

BEST REGARDS,

KHO HUMBOLDT WEDAG, COLOGNE

DR. CHAUDHURI/FRITSCH++

-680 WK

Analysis of Tsumeb Lead Blast Furnace Slag dispatched to St Joe for Test work April 1987

|  |  |  |
| --- | --- | --- |
| **Description** | **Coarse Slag** | **Milled Slag** |
| TRUE DENSITY, t/m3 | 3.41 | 3.42 |
|  |  |  |
| CHEMICAL ASSAY, kg/t | 967.215 | 972.906 |
|  |  |  |
| Zinc, as Zn and ZnCl | 115.000 143.146 | 116.000 144.391 |
| Lead, as Pb and PbCl | 24.000 25.853 | 22.000 23.699 |
| Germanium, as Ga and Ge02 | 0.440 0.634 | 0.420 0.605 |
| Gallium, as Ga and Ga01.5 | 0.210 0.282 | 0.210 0.282 |
|  |  |  |
| Copper, as Cu | 4.300 4.300 | 4.000 4.000 |
| Silver, as Ag | 0.002 0.002 | 0.002 0.002 |
| Arsenic, as As and As01.5 | 3.800 5.017 | 3.900 5.149 |
| Cadium, as Cd | 0.060 0.060 | 0.060 0.060 |
| Sulfur, as Sand S03 | 5.900 14.732 | 6,000 14.982 |
|  |  |  |
| Iron, as Fe and FeCl | 161.000 207.124 | 161.000 207.124 |
| Silica, as Si and Si02 | 114.055 244.000 | 116.860 250.000 |
| Alluminium, as Al and Al01.5 | 24.000 45.347 | 25.000 47.237 |
| Calcium, as Ca and CaCl | 158.664 222.000 | 156.520 219.000 |
| Magnesium, as Mg and MgCl | 33.000 54.717 | 34.000 56.375 |
|  |  |  |
| **PARTICLE SIZE DISTRIBUTION, p/m** | 1000 | 1000 |
| > 4000 um | 12 | 0 |
| 2000 - 4000 | 131 | 0 |
| 1000 - 2000 | 223 | 0 |
| 500 - 1000 | 417 | 1 |
| 300 - 500 | 116 | 3 |
| 210 300 | 36 | 8 |
| 149 - 210 | 19 | 27 |
| 74 149 | 18 | 165 |
| 74 | 28 | 796 |