Report Title:

PHASE II CALDERON PROCESS TO PRODUCE
DIRECT REDUCED IRON
RESEARCH AND DEVELOPMENT PROJECT

Report Type:

QUARTERLY

Reporting Period Start Date: 01/01/2006 End Date: 03/31/2006

Principal Author(s): ALBERT CALDERON

Report Issue Date: 04/19/2006

DOE Award No.: DE- FC22 -95PC92638

Submitting
Organization(s)

CALDERON ENERGY COMPANY

500 Lehman Avenue

Name & Address

P.O. Box 126

Bowling Green, OH 43402

(1)

(2)

(3)

(4)

(5)

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

QUARTERLY TECHNICAL PROGRESS REPORT
PHASE II CALDERON PROCESS TO PRODUCE DIRECT REDUCED IRON
RESEARCH AND DEVELOPMENT PROJECT

CALDERON ENERGY COMPANY
COOPERATIVE AGREEMENT NO. DE-FC22-95PC92638

Reporting Period: 1-01-06 to 3-31-06

Date of Report: 4-19-06;

Phase II Award Date: 6-23-00; Anticipated Completion Date: 12-03-06

Total Project: \$ 14,732,316.00 Total DOE Share This Action: \$6,457,000.00

Contracting Officer's Representative (COR): John Stipanovich;

Project Director: Albert Calderon

Assistant Project Director: Reina Calderon

Abstract

This project was initially targeted to the making of coke for blast furnaces by using proprietary technology of Calderon in a phased approach, and Phase I was successfully completed. The project was then re-directed to the making of iron units. In 2000, U.S. Steel teamed up with Calderon for a joint effort to produce directly reduced iron with the potential of converting it into molten iron or steel consistent with the Roadmap recommendations of 1998 prepared by the Steel Industry in cooperation with the Department of Energy by using iron ore concentrate and coal as raw materials, both materials being appreciably lower in cost than using iron pellets, briquettes, sinter and coke.

TABLE OF CONTENTS

Executive Summary	Page 1
Experimental / U.S. Steel Test	Page 3
Results and Discussion / U.S. Steel Test	Page 4
Experimental / Steel Dynamics (IDI)	Page 4
Results and Discussion / Steel Dynamics Tests	Page 6
Conclusion	Page 9
References	Page 10

Executive Summary

The commercialization path of the Calderon technology for making a feedstock for steelmaking with assistance from DOE initially focused on making coke and work was done which proved that the Calderon technology is capable of making good coke for hard driving blast furnaces. U.S. Steel which participated in such demonstration felt that the Calderon technology would be more meaningful in lowering the costs of making steel by adapting it to the making of iron - thus obviating the need for coke.

U.S. Steel and Calderon teamed up to jointly work together to demonstrate that the Calderon technology will produce in a closed system iron units from iron concentrate (ore) and coal competitively by eliminating pelletizing, sintering, coking and blast furnace operation. If such process steps could be eliminated, a huge reduction in polluting emissions and greenhouse gases (including CO₂) relating to steelmaking would ensue. Such reduction will restructure the steel industry away from the very energy-intensive steelmaking steps currently practiced and drastically reduce costs of making steel.

The development of a technology to lower U.S. steelmaking costs and become globally competitive is a priority of major importance. Therefore, the development work which Calderon is conducting presently under this Agreement with the U.S. Department of Energy becomes more crucial than ever.

The work performed during the first quarter of 2006, which the present Progress Report covers, was advanced on two parallel paths: the first is related to U.S. Steel Research and the second is related to Iron Dynamics (IDI), which is a division of Steel Dynamics.

With respect to U.S. Steel, a meeting took place in Monroeville on the 10th of January at which time it was concluded with the new team at U.S.S. Research that three 72-hour tests

be conducted at reasonably steady state with 80% metallization, as had previously been agreed between U.S. Steel and Calderon. A letter from U.S. Steel to this effect, dated February 6, followed; see Exhibit 1.

With respect to IDI, on January 27th, Mr. Mark Millett, Vice-President and General Manager of SDI/IDI, paid a visit to Calderon's facility in Bowling Green to observe a test of making iron/carbon product and in melting it into 20-lb ingots. At the end of the meeting he concluded that IDI and Calderon work together in using the Calderon technology to process EAF dust conjunctively with making iron since the major portion in the dust is iron oxide. He agreed to immediately ship a truckload of EAF dust and some scale to run experiments with the objective of recovering the Zn, whether in elemental form or as an oxide, as well as iron units, in order not to landfill the dust since it is considered to be a hazardous material. Also, since ZnO can be sold if it is >85% pure, it was not a disadvantage to recover the Zn as an oxide. If success were attained, the savings to SDI and IDI would be substantial.

Experimental / U.S. Steel Test

In preparation for the first 72-hour test, Calderon and David Rohaus, manager of this project at U.S. Steel, had a discussion to the effect that Calderon was intending to begin the three 72-hour tests, but that the fines under $\frac{1}{4}$ " from the material produced would be screened and not be included as an integral part of the metallization criteria since the plan is to recycle such fines and not charge them into the melting furnace. Previous analysis indicated that a major portion of $\frac{1}{4}$ " was low in metallization. To assist in moving the Calderon's process from dead center, Mr. Rohaus agreed that as long as the screenings were recycled it would be acceptable.

On March 6, at 5:00 a.m., the first of the 72-hour tests (Test Run 1-194) began from cold, and it was run for 88 hours, the first 16 hours were assigned to bring the process to steady state. The steady state portion of the test began at push 179. The total number of pushes during steady state was 987, at which time 2,591 lbs. of ore concentrate and 1,851 lbs. of coal were charged. The interruptions during the steady state operation were as follows: At push 428, the pusher stalled; the material exiting from the reactor into the elbow had to be poked to resume pushing. At push 696 (23 $\frac{1}{4}$ hrs. later), the pusher stalled again. By reversing the motion of the lance, the pusher resumed pushing. It appears that the first stall was caused by material stuck at the exit of the reactor, while the second stall appears to have been caused by the lance, in its extended position, preventing the forward movement of the material. Other events included a thermocouple being replaced at push 313. During the hourly routine cleanup of the oxygen lance tip, the condition of the nozzle through which the oxygen is injected, is routinely checked. During the 88-hour test, there was a nozzle change at push 345, at push 472, and at push 569, to maintain the proper injection of the oxygen.

Results and Discussion / U.S. Steel Test

As stated in previous reports, the measure of metallization is determined by the grindability of the iron/steel produced for rapid and on-the-spot determination of the degree of metallization by judging the quality of sparks. The total number of grinds performed during the 72 hours of steady state operation (the first 16 hours of the 88-hour test being discounted) was 1,634 grinds; of these, 1,464 sparked, indicating that metallization did take place from the ore concentrate and coal feed; based on these results, an 89.6% of grinds did spark.

The iron/carbon material was collected in drums "A" through "E" inclusive. Since drum "A" is the start-up drum, this drum was considered to be scrap. The material from drum "B" through drum "E" was screened by a $-\frac{1}{4}$ " screen to remove the recyclable material, which amounted to 21.94%. The material above $+\frac{1}{4}$ " was made ready for shipment to U.S. Steel. U.S. Steel informed Calderon that since the Research Department was moving to Homestead from Monroeville, it was not ready to receive the shipment until the personnel were settled. Calderon was to be notified as to when it would be appropriate to ship the material for detailed analysis with respect to metallization. As of this writing no notice has yet been received, but Calderon is expecting to receive such notice shortly.

Experimental / Steel Dynamics (IDI)

The Test Runs for IDI to recover ZnO and iron units from EAF dust during the 1st Quarter numbered 5 tests and are listed in Table 1; the feed materials that were charged during the tests and their percentages follow Table 1.

Table 1

Test Run #	Date 2006	Length in Hrs.	No. of Pushes
I - 191 – SDI #1	2/15 & 2/16	34 hrs. : 00 min.	387
I - 192 – SDI #2	2/22 & 2/23	33 hrs. : 30 min.	380
I - 193 – SDI #3	2/28 & 2/29	32 hrs. : 00 min.	364
I - 195 – SDI #4	3/23 & 3/24	35 hrs. : 30 min.	401
I - 196 – SDI #5	3/28 & 3/29	36 hrs. : 00 min.	398

Materials Charged in I - 191 – SDI # 1

Annulus Mix /Push
 EAF Dust 2.625 lbs. (100%)
 Coal (Elkhorn) 0.875 lbs.
 Total Weight 3.500 lbs.

Core Coal /Push 1.000 lb. (Elkhorn)

Materials Charged in I - 192 – SDI # 2

Annulus Mix / Push
 Ore Concentrate 2.363 lbs. (90%)
 EAF Dust 0.262 lbs. (10%)
 Sub Total 2.625 lbs. (100%)

Coal (Elkhorn) 0.875 lbs.
 Total 3.500 lbs.

Core Coal / Push 1.000 lb. (Elkhorn)

Materials Charged in I - 193 – SDI # 3

Annulus Mix / Push
 Ore Concentrate 2.100 lbs. (80%)
 EAF Dust 0.525 lbs. (20%)
 Sub Total 2.625 lbs. (100%)

Coal (Elkhorn) 0.875 lb.
 Total 3.500 lbs.

Core Coal / Push 1.000 lb. (Elkhorn)

Materials Charged in I - 195 – SDI # 4

Annulus Mix / Push	
Ore Concentrate	1.837 lbs. (70%)
EAF Dust	<u>0.788 lbs. (30%)</u>
Sub Total	2.625 lbs. (100%)
Coal (Elkhorn)	<u>0.875 lb.</u>
Total	3.500 lbs.
Core Coal / Push	1.000 lb. (Elkhorn)

Materials Charged in I - 196 – SDI # 5

Same as SDI # 4

Results and Discussion / Steel Dynamics Tests

During the visit of Mark Millet, VP of SDI and IDI, he was accompanied by Steve Rutherford, Manager of Engineering of the Iron Dynamics Division, who was assigned to coordinate with Calderon the supply of the materials and the testing program. A truckload of materials was delivered to Calderon in the early part of February, comprising 16 drums of AEF dust, whose analysis is shown in Exhibit 2, and 4 drums of scale.

A test run was scheduled for the 15th of February using 100% EAF dust. The test procedure was set in such a way that the dust would replace the ore concentrate entirely, and the run would be of around a 30-hour duration, wherein the first 16 hours would serve to attain steady state with the iron/carbon material collected in a first drum (drum "A") and be considered as scrap. The steady state iron/carbon material produced would be collected in a second drum (drum "B") for analysis by IDI. By checking the analysis of the Zn/ZnO residue in drum "B" it would be determined the extent to which the Zn/ZnO was extracted from the dust charged. It was decided that the approach in the test work would be divided into two parts.

The first part was to extract the Zn/ZnO from the charge via metallization with carbon while metallizing the Fe_2O_3 , as well as the ZnO, and the second part was to collect the Zn either in the form of elemental Zn or ZnO, the ZnO being marketable at 85% purity. The metallization of the Fe_2O_3 contained in the dust would also be valuable as iron units that can be charged into IDI's submerged arc furnace to replace briquettes currently made from iron ore fines and coal, which are fired with natural gas, both being costly.

Test # 1 was conducted following the same procedure as metallizing ore concentrate and coal in the Calderon reactor, except that the ore concentrate was substituted by the EAF dust. From the start of this test, it was observed that it was not possible to take optical temperatures from the inspection port normally used to take temperatures, the same port being also used to assess what goes on within the reactor and make adjustments accordingly. The environment within the reactor was exceedingly dusty, forcing the test to be conducted by guessing as to what was happening inside the reactor. But the objective was to reduce the ZnO to Zn and the Fe_2O_3 to Fe, and then check the iron/carbon product with respect of Zn/ZnO left in the iron/carbon product. This first test lasted 34 hours, and all the material produced was delivered to IDI with instruction to focus on the analysis of Drum "B." Once the analysis was performed, it showed that the iron/carbon material had 8.55% Zn, with an Fe content of 32.08%; see Exhibit 3.

It was decided that Test Run # 2 would contain 90% ore concentrate and only 10% EAF dust to enable the control of the operation, with the coal in the mix and in the core to remain unchanged. Also, the operational procedure was to remain unchanged. Test Run # 2, which lasted 33 hrs : 30 min, improved dramatically, enabling the taking of hourly temperatures. The materials were delivered to IDI, and analytical tests were conducted. The percent of the Zn

in the iron/carbon material was down to 0.434%, with an Fe of 46.37%; see Exhibit 4. It was quite encouraging, as it indicated that the extraction of the Zn in the form of ZnO was very effective, the original ZnO being reduced to Zn which rapidly was re-oxidized after leaving the reactor.

With such positive extraction results, it was decided to raise the EAF dust content in the mix from 10% to 20% in Test Run # 3. This was done following the previous operational procedure with a duration of 32 hours; Test Run # 3 was completed, and the materials were delivered to IDI for analysis. The results of such analysis showed that the Zn content was reduced to 0.390% and the Fe increased to 51.55% in the iron/carbon material analyzed in Drum "B"; see Exhibit 5.

It was then decided to increase the AEF dust to 30% in the mix for Test Run # 4. This run lasted 35 hrs : 30 min. The materials produced were delivered to IDI for analysis of Drum "B." The results were 0.502% for the Zn and 43.95% for the Fe; see Exhibit 6.

Test Run # 5 was a confirmation test wherein the AEF dust was maintained at 30% in the mix. The run lasted 36 hours. The materials in drum "B" were tested at IDI, resulting in a Zn content of 0.617% Zn and 48.41% Fe; see Exhibit 7.

It is to be noted that in Test Runs # 2 through # 5, the Zn remaining in the iron/carbon product exiting from the reactor was quite low. This indicated that the extraction of the Zn from the EAF dust, which causes its classification as hazardous material, is highly efficient; see Table 2.

Referring to Exhibit 2, it is to be noted that the Zn content in the EAF dust ranges between 12% and 20.7%, resulting in an average of 16.35%. Table 2 illustrates the highly

efficient extraction of the Zn in percentages which resulted in tests 2 through 5, indicating that the approach for the extraction step appears to be a correct approach.

Table 2

Test #	Average Zn In Dust	Remainder of Zn in Metallized Iron	Zn Removed	Extraction Efficiency in %
2	16.350	0.434	15.916	97.35%
3	16.350	0.390	15.96	97.61
4	16.350	0.502	15.85	96.93
5	16.350	0.617	15.733	96.23
Zn Extraction Average				97.03%

Conclusion

With respect to U.S. Steel, the results from the analysis of the first 72-hour Test Run will be awaited before the second 72-hour Test Run is conducted. Hopefully the results will be known by the end of May 2006 in order to conduct the second 72-hour Test Run before the end of the current (2nd) Quarter. After all the effort expended and expenditure incurred during the past 5 years to advance Calderon's unique technology to convert ore concentrate (fines) with coal, it is encouraging to have U.S. Steel agree to discount the -¼" iron/carbon fines from the metallized material produced and to recycle such fines. Calderon is sanguine that with persistence the three 72-hour tests with 80% average metallization can be consistently attained.

With respect to SDI (IDI), work will be focused on trapping the Zn/ZnO after it leaves the reactor in vapor form. Calderon has designed (and is currently fabricating) a collection unit to accumulate the Zn / ZnO that would be liberated from the vapor after it leaves the reactor. Once such equipment is put into service and de-bugged, the collection of the Zn/ZnO is quite

probable. Such collection would create the confidence towards the scale-up of the technology for commercial application.

Submitted by:

Albert Calderon
Project Director

References - Not Applicable

The work performed in this quarter which the report covers, was original work. No reference material was relied upon for the work.

United States Steel Corporation
Research and Technology Center
4000 Tech Center Drive
Monroeville, PA 15146
412 825 2124
fax: 412 825 2871
email: ejherrano@uss.com

Ernie J. Serrano
Technical Manager
Raw Materials and Ironmaking

February 6, 2006

Albert Calderon
President
Calderon Energy Company
500 Lehman Avenue
P.O. Box 126
Bowling Green, Ohio 43402

Mr. Calderon:

Thank you for the presentation you made in Monroeville on January 10, 2006 on the Calderon Process and for your kind hospitality during our visit to your facility on October 20, 2005. We appreciate your and your employees' efforts to have the test unit operating for our observations. We also commend you on the cleanliness and safety awareness of the test facility.

We have considered your proposal to approach the DOE with the results that you have achieved to date and have concluded that the design and operation of an electric powered homogenizer induction furnace would be difficult and uncertain if the degree of the feed material metallization is widely variable. Processing highly metallized material in the induction furnace will probably work well, however, we are concerned that the introduction of large amounts of partially metallized material will tend to chill the furnace and complicate its operation.

Thus, to proceed with the project we would like, as had been formally stated in the past, for you to achieve the goal of producing material that has an average metallization rate of 80 percent from three separate 72-hour continuous tests. If this can be achieved, we believe that further processing the material into hot metal and steel will be viable. At that point, we would consider further discussions about potential for collaborative Research.

Sincerely,

A handwritten signature in dark ink, appearing to read "Ernesto J. Serrano".

Ernesto J. Serrano

MATERIAL SAFETY DATA SHEET

ORIGINAL ISSUE: 2/01
REVISED: 7/02

Section 1. Identification	Information & Emergency Telephone Number: (219) 868-8191 – Safety Department
Product Name: Electric Arc Furnace Dust Common Name(s): EAF Dust, Baghouse Dust CAS Number: see below	Manufacturer: Steel Dynamics 4500 County Road 59 Butler, IN 46721

Note: EAF Dust contains Cadmium and Nickel which are confirmed cancer causing agents.

Section 2. Composition/Information on Ingredients

Material:	% Weight	Exposure Limits	
		OSHA PEL	ACGIH TLV
IRON 1309-37-1	36.28	10mg/m3 Dust and Fume	5mg/m3
ZINC 7440-66-6	12-20.7	10mg/m3	10mg/m3 Fume
CALCIUM 1317-65-3	3.76	15mg/m3 Dust	10mg/m3
MAGNESIUM 1309-48-4	2.61	N/A	10mg/m3 as Fume
MANGANESE 7439-96-5	2.21	3mg/m3 (STEL) as Fume	0.2mg/m3 as Mn
ALUMINUM 7429-90-5	0.32-0.37	15mg/m3	10mg/m3 Dust
LEAD 7439-92-1	0.17-0.24	0.05mg/m3	0.05mg/m3 as Pb
CHROMIUM 7440-47-3	0.1-0.15	0.5mg/m3	0.5mg/m3 as Cr
BARIUM 7440-39-3	0.04-0.06	0.5mg/m3	0.5mg/m3
VANADIUM 1314-62-1	0.04-0.047	0.5mg/m3 (C) as Dust	0.05mg/m3
NICKEL 7440-02-0	0.0185	1mg/m3	1.5mg/m3 as Ni
COPPER 7440-50-8	0.01	1mg/m3 as Dust	1mg/m3 as Dust
CADMIUM 7440-43-9	0.007-0.01	0.005mg/m3 as Dust	0.002mg/m3 as Cd
ARSENIC 7440-38-2	0.0014-0.0021		
SILVER 7440-22-4	0.001-0.002		

Section 3. Hazard Identification

EAF Dust is a rust/dark brown color with no odor.

EAF Dust also contains concentrations of Nickel and Cadmium, both of which are cancer causing agents.

DRUM B

TEST #1

Job: JOB.579

Sample ident = drumB 4 paul 2/25 9pm

oxide	Mass%	StdErr	El	Mass%	StdErr
Fe2O3	45.37	0.55	Fe	32.08	0.39
ZnO	10.64	0.34	Zn	8.55	0.26
SiO2	6.33	0.27	Si	2.96	0.13
CaO	5.16	0.25	Ca	3.69	0.18
MgO	3.53	0.20	Mg	2.13	0.12
Al2O3	2.97	0.19	Al	1.57	0.10
MnO	2.05	0.16	Mn	1.59	0.12
S	1.57	0.14	S	1.57	0.14
Na2O	1.29	0.13	Na	0.957	0.093
K2O	1.11	0.12	K	0.924	0.097
Cl	0.553	0.028	Cl	0.553	0.028
P2O5	0.377	0.019	Px	0.164	0.006
Cr2O3	0.199	0.022	Cr	0.136	0.015
Cu2O	0.123	0.014	Cu	0.098	0.011
TiO2	0.122	0.014	Ti	0.0730	0.0081
PbO	0.097	0.011	Pb	0.0898	0.0100
HfO2	0.0626	0.0053	Hf	0.0531	0.0045
Er2O3	0.0616	0.0068	Er	0.0539	0.0059
Sm2O3	0.0447	0.0096	Sm	0.0335	0.0063
Dy2O3	0.0338	0.0060	Dy	0.0294	0.0052
Tb4O7	0.0322	0.0099	Tb	0.0274	0.0084
PtO2	0.0251	0.0031	Pt	0.0216	0.0027
CoO	0.0171	0.0026	Co	0.0134	0.0021
V2O5	0.0164	0.0018	V	0.0092	0.0010
SrO	0.0144	0.0016	Sr	0.0122	0.0014
ZrO2	0.0115	0.0013	Zr	0.0065	
Ag2O	0.0114	0.0013	Ag	0.0106	
La2O3	0.0107	0.0016	La	0.0091	
Eu2O3	0.0102	0.0032	Eu	0.0088	
Pr2O3	0.0099	0.0042	Pr	0.0082	
SnO2	0.0094	0.0013	Sn	0.0074	0.0010
BaO	0.0091	0.0041	Ba	0.0082	0.0037
Ga2O3	0.0086	0.0014	Ga	0.0064	0.0010
WO3	0.0085	0.0038	W	0.0067	0.0030
GeO2	0.0061	0.0014	Ge	0.0056	0.0010

CARBON
17541

SULFUR
.82888

SILICAGON
197/24

ARL-XRF/UniQuant Analysis Report
 UniQuant Analysis

TEST #2

JOB JOB.681

Sample ident = drum b

3/3 11am

Oxide	Mass%	StdErr	El	Mass%	StdErr
Fe2O3	66.30	0.52	Fe	46.37	0.37
SiO2	6.78	0.28	Si	3.17	0.13
CaO	4.44	0.23	Ca	3.17	0.16
MgO	3.42	0.20	Mg	2.06	0.12
Al2O3	2.51	0.17	Al	1.33	0.09
	0.795	0.088	S	0.795	0.088
MnO	0.549	0.061	Mn	0.425	0.047
ZnO	0.541	0.060	Zn	0.434	0.048
Na2O	0.361	0.040	Na	0.268	0.030
K2O	0.180	0.020	K	0.149	0.017
TiO2	0.152	0.017	Ti	0.091	0.010
Cl	0.129	0.006	Cl	0.129	0.006
P2O5	0.118	0.006	Px	0.0515	0.0026
Dy2O3	0.0802	0.0088	Dy	0.0699	0.0077
Er2O3	0.0707	0.0096	Er	0.0618	0.0084
Sm2O3	0.065	0.013	Sm	0.056	0.011
Tb4O7	0.061	0.014	Tb	0.052	0.012
Cr2O3	0.0462	0.0051	Cr	0.0316	0.0035
HfO2	0.0428	0.0059	Hf	0.0363	0.0050
Co3O4	0.0167	0.0037	Co	0.0131	0.0029
SrO	0.0150	0.0017	Sr	0.0127	0.0014
CuO	0.0134	0.0017	Cu	0.0107	0.0014
V2O5	0.0126	0.0014	V	0.0071	0.0006
Ag2O	0.0065	0.0014	Ag	0.0061	0.0013
ZrO2	0.0033	0.0007	Zr	0.0024	0.0005

Carbon

REST= 0

D/S= 0.110341

Core normalisation to 100% : 90.2

CARBON
13.7460

SULFUR
131776

SATMAGAN
390-47

TEST #3 - SDI DUST

ARL-XRF/UniQuant Analysis Report
UniQuant Analysis

DRUM "B"

Sample Ident. = scap test3 3/9 1030pm

Oxide	Mass%	StdErr	El	Mass%	StdErr
Fe2O3	73.71	0.49	Fe	51.55	0.34
SiO2	9.48	0.33	Si	4.43	0.15
CaO	3.25	0.20	Ca	2.32	0.14
Al2O3	2.85	0.18	Al	1.51	0.10
MgO	2.27	0.17	Mg	1.37	0.10
S	1.13	0.12	S	1.13	0.12
MnO	1.03	0.11	Mn	0.794	0.087
ZnO	0.485	0.054	Zn	0.390	0.043
Na2O	0.363	0.040	Na	0.270	0.030
K2O	0.260	0.029	K	0.216	0.024
P2O5	0.222	0.011	Px	0.0971	0.0048
TiO2	0.149	0.017	Ti	0.0892	0.0099
Er2O3	0.0801	0.0097	Er	0.0700	0.0085
Cr2O3	0.0728	0.0081	Cr	0.0498	0.0055
Sm2O3	0.060	0.014	Sm	0.052	0.012
Tb4O7	0.059	0.015	Tb	0.050	0.013
Cl	0.0580	0.0029	Cl	0.0580	0.0029
HfO2	0.0574	0.0062	Hf	0.0487	0.0053
Co3O4	0.0298	0.0037	Co	0.0234	0.0029
CuO	0.0216	0.0024	Cu	0.0173	0.0019
SrO	0.0141	0.0016	Sr	0.0119	0.0013
V2O5	0.0132	0.0015	V	0.0074	0.0008
Ag2O	0.0065	0.0013	Ag	0.0061	0.0012
PbO	0.0040	0.0018	Pb	0.0037	0.0016
ZrO2	0.0039	0.0007	Zr	0.0029	0.0005
CdO	0.0030	0.0012	Cd	0.0026	0.0011

4.13 Carbon REST= 0
before normalisation to 100%

D/S= 0 110%

CARBON Sulfur Sulfur
4.1277 53.95 48.2 -58%

ARL-XRF/UniQuant Analysis Report
 IDI UniQuant Analysis

TEST #4

\uq4\JOB\JOB.800

Sample ident = sdi b drum 4 4/6 10.30p

Oxide	Mass%	StdErr	El	Mass%	StdErr
Fe2O3	62.83	0.54	Fe	43.95	0.38
SiO2	9.15	0.32	Si	4.28	0.15
Al2O3	3.45	0.20	Al	1.82	0.11
CaO	2.63	0.18	Ca	1.88	0.13
MgO	2.13	0.16	Mg	1.28	0.10
S	1.25	0.12	S	1.25	0.12
MnO	0.96	0.11	Mn	0.745	0.082
ZnO	0.624	0.069	Zn	0.502	0.056
Na2O	0.410	0.045	Na	0.305	0.034
K2O	0.252	0.028	K	0.209	0.023
P2O5	0.212	0.011	Px	0.0925	0.0046
TiO2	0.141	0.016	Ti	0.0845	0.0094
Cr2O3	0.0801	0.0089	Cr	0.0548	0.0061
Er2O3	0.0785	0.0083	Er	0.0686	0.0072
Sm2O3	0.072	0.012	Sm	0.062	0.011
Tb4O7	0.053	0.013	Tb	0.045	0.011
Cl	0.0451	0.0023	Cl	0.0451	0.0023
CuO	0.0423	0.0047	Cu	0.0338	0.0037
HfO2	0.0364	0.0050	Hf	0.0309	0.0042
Co3O4	0.0264	0.0032	Co	0.0208	0.0025
V2O5	0.0135	0.0015	V	0.0076	0.0008
SrO	0.0130	0.0014	Sr	0.0110	0.0012
Pr6O11	0.0129	0.0046	Pr	0.0107	0.0038
La2O3	0.0109	0.0014	La	0.0093	0.0012
WO3	0.0096	0.0029	W	0.0076	0.0023
Ag2O	0.0072	0.0012	Ag	0.0067	0.0011
ZrO2	0.0041	0.0006	Zr	0.0030	0.0005
Nb2O5	0.0020	0.0006	Nb	0.0014	0.0004

KnownConc=15.31 Carbon

REST= 0

D/S= 0.100Cellulose

Sum Conc's before normalisation to 100%: 99.0%

Carbon
15.31

Sulfur - Salmagan
53710 98-115

\uq4\JOB\JOB.799

Sample ident = sdi b drum 5 4/6 9.50p

Oxide	Mass%	StdErr	El	Mass%	StdErr
Fe2O3	69.21	0.51	Fe	48.41	0.36
SiO2	9.33	0.32	Si	4.36	0.15
Al2O3	3.49	0.20	Al	1.85	0.11
CaO	2.81	0.18	Ca	2.01	0.13
MgO	2.23	0.16	Mg	1.34	0.10
S	1.20	0.12	S	1.20	0.12
MnO	1.09	0.12	Mn	0.845	0.089
→ ZnO	0.768	0.085	Zn	0.617	0.068
Na2O	0.445	0.049	Na	0.330	0.037
K2O	0.266	0.029	K	0.221	0.024
P2O5	0.250	0.012	Px	0.109	0.005
TiO2	0.145	0.016	Ti	0.0869	0.0096
Cr2O3	0.096	0.011	Cr	0.0660	0.0073
Er2O3	0.0669	0.0097	Er	0.0585	0.0085
Sm2O3	0.051	0.014	Sm	0.044	0.012
Tb4O7	0.050	0.015	Tb	0.043	0.012
Cl	0.0421	0.0021	Cl	0.0421	0.0021
HfO2	0.0379	0.0052	Hf	0.0321	0.0044
CuO	0.0294	0.0033	Cu	0.0235	0.0026
Co3O4	0.0234	0.0037	Co	0.0184	0.0029
V2O5	0.0146	0.0016	V	0.0082	0.0009
SrO	0.0134	0.0015	Sr	0.0113	0.0013
WO3	0.0116	0.0033	W	0.0092	0.0026
La2O3	0.0102	0.0016	La	0.0087	0.0013
Ag2O	0.0085	0.0013	Ag	0.0079	0.0012
CdO	0.0045	0.0012	Cd	0.0039	0.0011
ZrO2	0.0043	0.0007	Zr	0.0032	0.0005
Nb2O5	0.0039	0.0007	Nb	0.0027	0.0005
Rh2O3	0.0035	0.0015	Rh	0.0028	0.0012
Ga2O3	0.0031	0.0013	Ga	0.0023	0.0010

KnownConc= 8.18 Carbon

REST= 0

D/S= 0.100Cellulos

Sum Conc's before normalisation to 100% : 99.2 %

CARBON - SULFUR - SATURAGAN
 8.18 1.48292 192-22.5