



Job File No.: 181202/65647-1407/M-NK-2015

CERTIFICATE OF SAMPLING AND ANALYSIS

In pursuance of an order for inspection given to us

BY : " CARBO ONE LIMITED "
TO INSPECT : Coal 0-50 mm, grade "T-coal 13% Ash" (as declared) in rail cars
BY : Sampling and Analysis
AT : Krasny Brod open cut, Kemerovo region, Russia
ON : 5 January 2015

WE HEREBY CERTIFY that we have performed sampling and analysis of the above mentioned commodity.

SAMPLING: Manual sampling as per ISO 18283 5.3. from the tops of the rail cars: Sampling material in motion, on systematic known mass intervals basis. Increments were collected from freshly exposed surface, on a mass interval basis, with fixed increment mass. Manual Sampling method was agreed with the SGS Principal, as sampling by other methods was not possible.

I. ANALYSES WERE PERFORMED IN SGS LABORATORY:

1. **Proximate analysis** was performed in SGS laboratory (Accreditation Certificate No. POCRU.0001.21TY38, valid till 22.09.2016) according to ISO Methods with results as follows:

Basis reported	Total moisture, % ISO 589-2003, ISO 5068-1- 2007	Ash, % ISO 1171-97	Yield of volatile matter, % ISO 562-98	Total sulphur, % ISO 19579-92	Gross calorific value, kcal/kg ISO 1928-76
As Received	4.9	13.3	11.3	0.27	6881
Air Dry Basis	0.8	13.9	11.8	0.28	7178
Dry Basis		14.0	11.9	0.28	7237
Dry Ash Free			13.8	0.33	8414

Net Calorific Value (as received) was calculated in accordance with ISO 1928:2009 (Pt. 12.2.2.1 и Pt E.3.3):

6697 kcal/kg.

2. **Screen test** were performed in accordance with ISO 1953 with results as follows:

Nominal Top Size (mm)	+50	25-50	13-25	6-13	3-6	1-3	0.5- 1	0- 0.5
Yield (%)	2.1	22.0	14.1	13.4	7.9	14.6	6.8	19.1

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3. Determination of characteristics of hygroscopic moisture was performed in accordance with GOST 8719-90 with results as follows:

Hygroscopic moisture: 1.92

4. Determination of characteristics of plastic layer was performed in accordance with GOST 1186-87 with results as follows:

Attribute	Unit	Value
X	mm	20
Y	mm	0

5. Ultimate analysis was performed in accordance with ISO methods with results as follows:

Element	Percentage, %	Test's methods
	Dry Ash Free basis	
Carbon	90.28	ISO 625-96 (GOST 2408.1-95), ISO 609-96 (GOST 2408.4-98)
Hydrogen	4.07	
Nitrogen	2.36	ISO 333-83 (GOST 28743-95)
Oxygen	2.96	ISO 1994-76 (GOST 2408.3-95)

6. Determination of chemical composition of ash was performed in accordance with ASTM D 3682-87 (GOST 10538-87) methods with results as follows:

Compounds	Percentage, %
Silicon dioxide	51.63
Alumina	23.35
Iron trioxide	8.19
Titanium dioxide	0.87
Calcium oxide	6.32
Magnesium oxide	2.71
Potassium oxide	1.585
Sodium oxide	0.307
Sulphur trioxide	4.207
Phosphorus oxide	0.599
Manganese oxide	0.228

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7. Determination of elements' content was performed in accordance with ISO and ASTM methods with results as follows:

Compounds	Percentage, %	Test's methods
Fluorine	0.013	ASTM D 3761-96
Chlorine	0.0089	ISO 587-97 (GOST 9326-2002)
Arsenic	< 0.0005	ISO 601-81, ISO 2590-73 (GOST 10478-93)
Phosphorous	0.036	ISO 662-81 (GOST 1932-93)

8. Determination of free swelling Index was performed in accordance with ISO 501-81 (GOST 20330-91) with results as follows:

FSI 0

9. Determination of Grey-King coke type was performed in accordance with ISO 502-82 (GOST 16126-91) with results as follows:

GREY-KING COKE TYPE A

10. Determination of Roga Index was performed in accordance with ISO 335-74 (GOST 9318-91) with results as follows:

RI 0(2:4)

11. Determination of plasticity according to Gieseler was performed in accordance with ASTM D 2639-98 with results as follows:

Attribute	Unit	Value
Initial softening Temperature	°C	-
Max. Fluidity Temperature	°C	-
Resolidification Temperature	°C	-
Max. fluidity	ddpm	-

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12. Audiber-Arnu Dilatometer test was performed in accordance with ISO 349-75 (GOST 13324-94) with results as follows:

Attribute	Unit	Value
Softening Temperature	°C	-
Max. Contraction Temperature	°C	-
Max. Dilatation Temperature	°C	-
Contraction	%	-
Dilatation	%	-

13. Determination of Hardgrove Index was performed in accordance with ISO 5074-80 (GOST 15489.2-93) with results as follows:

HGI 65

14. Determination of actual density was performed in accordance with GOST 2160-92 with results as follows:

AD 1.36 g/cm³

15. Determination of ash fusibility was performed in accordance with ASTM D1857-87. The reported results are as follows:

Attribute	Unit	Value	
		Oxidizing	Reducing
Initial deformation temperature	°C	1232	1173
Softening temperature	°C	1248	1191
Hemispherical temperature	°C	1288	1233
Fluid temperature	°C	1410	1361

16. Determination of petrographic composition and metamorphism stage was performed in accordance with ISO 7404 with results as follows:

Composition		Percentage, %
Coal		89
Mineral inclusions	Clay	10
	Quartz	-
	Sulphide	-
	Carbonate	1

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Microlythotype:

Microconstituent	Percentage, %
Vitrinite	30
Semivitrinite	12
Inertinite	58
Liptinite	-

Sum of the fusainized components

ΣOK 66 %

Rank V

Interval No.	Ro min	Ro max	Frequency, %
1	0.95	0.99	1
2	1.00	1.04	-
3	1.05	1.09	-
4	1.10	1.14	1
5	1.15	1.19	2
6	1.20	1.24	1
7	1.25	1.29	1
8	1.30	1.34	0
9	1.35	1.39	-
10	1.40	1.44	1
11	1.45	1.49	0
12	1.50	1.54	0
13	1.55	1.59	3
14	1.60	1.64	5
15	1.65	1.69	13
16	1.70	1.74	12
17	1.75	1.79	14
18	1.80	1.84	6
19	1.85	1.89	10
20	1.90	1.94	10
21	1.95	1.99	10
22	2.00	2.04	5
23	2.05	2.09	1
24	2.10	2.14	2
25	2.15	2.19	-
26	2.20	2.24	0
27	2.25	2.29	0
28	2.30	2.34	0
29	2.35	2.39	-

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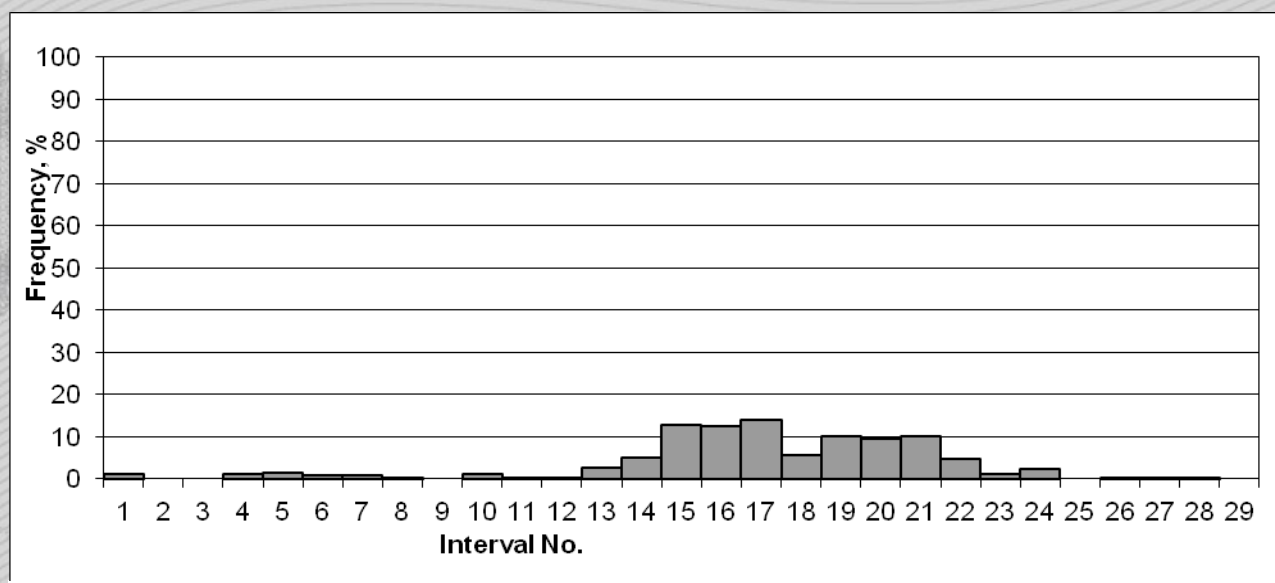
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**Reflectance indices R₀:**

Average	1.78
Minimum	0.95
Maximum	2.35
Standard deviation	0.217
Quantity of scissions	3

II. ANALYSES WERE PERFORMED IN SUBCONTRACTED LABORATORY:

The sample was sent to subcontracted laboratory OAO "Zapadno-Sibirski Ispytatelny Centr" (Accreditation Certificate No. POCC RU.0001.21 AЯ 07) for analysis, and the findings reported by OAO "Zapadno-Sibirski Ispytatelny Centr" were as follows:

1. Determination of elements' content was performed in accordance with GOST methods with results as follows:

Compounds	Percentage, %
Germanium	0.0001
Selenium	0.37*10 ⁻⁴
Gallium	0.0005
Mercury	0.06*10 ⁻⁴

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2. Determination of elements' content was performed in accordance with GOST methods with results as follows:

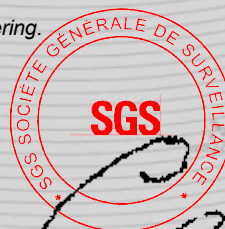
Element	Content, %	Element	Content, %	Element	Content, %
Ba	0.06	Cd	<0.001	Pb	<0.0002
Be	0.0002	Co	0.0001	Ag	<0.00001
B	0.004	Li	<0.001	Sc	0.0004
Bi	<0.0002	La	0.002	Sr	0.08
V	<0.001	Mn	0.01	Sb	<0.002
W	<0.002	Cu	0.0002	Ti	0.1
Yb	0.0002	Mo	0.0002	P	<0.1
Y	0.001	As	<0.01	Cr	<0.001
Nb	<0.001	Ni	0.0005	Ce	<0.02
Sn	<0.0002	Zr	0.01		
Zn	<0.003				

3. Determination of ash fusibility was performed in accordance with ISO 540-81(GOST 2057-94) with results as follows:

Attribute	Unit	Value / atmosphere
		Semireducing
Initial deformation temperature	°C	1220
Softening temperature	°C	1230
Hemispherical temperature	°C	1250
Fluid temperature	°C	1280

This document is a witness of services in collection and processing of information rendering.

Signed and dated
in Novokuznetsk / ES
20 January 2015



For and on behalf of
SGS Vostok Limited

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