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REPORT No. 7
OF 1943.

TM 7/1943

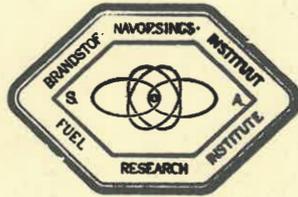
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RAPPORT No. _____
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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

BRANDSTOF-NAVORSINGS-INSTITUUT VAN SUID-AFRIKA.

SUBJECT :
ONDERWERP: REPORT ON THE SHIPMENT OF COAL FROM THE

MERTHYR COLLIERY.

DIVISION :
AFDELING: CHEMISTRY.

NAME OF OFFICER :
NAAM VAN AMPTENAAR: DR. F.J. TROMP.

FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

REPORT ON THE SHIPMENT OF COAL FROM THE
MERTHYR COLLIERY.

1. The Board, at its eighty-fifth meeting asked the Director to report upon the question whether the liability of Merthyr coal to spontaneous combustion is such as to constitute a danger to life or property, and to make proposals to the Board in regard to the grading of Merthyr coal.
2. The relevant sub-sections of section 9 of the Fuel Research Act are:-

Sub-section (4): "The Institute may in its discretion refuse to issue a grading certificate or prohibit the issue of a grading certificate by any person authorized by it to issue grading certificates in respect of any coal submitted for grading, if the liability of such coal to spontaneous combustion is deemed by it to constitute a danger to life or property," "

Sub-section (5): "Against any such refusal or prohibition or withdrawal by the Institute an appeal may be brought to the Minister."

Sub-section (6): "Upon any such appeal the Minister, after any such inquiry or investigation as he may deem fit to make, may in his discretion direct the Institute to issue or restore such grading certificate as the case may be. The decision of the Minister shall be final and conclusive."
3. Sub-section (4) allows the Institute to interfere with the Common Law right of collieries to ship their coal. It is submitted that this right of interference can only be exercised when the Institute has sufficient proof to allow it to deem that the liability of any coal to spontaneous combustion is such as to constitute a danger to life or property. The onus of proof is on the Institute and mere suspicion is not sufficient to discharge that onus.
4. The Institute has no evidence, and no allegation has been received by it, that Merthyr coal, by itself, has in the past heated unduly or caught fire.
5. The following cases of undue heating of coal mixtures, containing Merthyr coal as one of the constituents, have been reported:
 - (a) On the 26th and 27th of June, 1942, 963 tons of Burnside coal and 50 tons of Merthyr coal were stacked together at the Bluff. On the 19th of August the stack caught fire. The Institute's representative at Durban did not make any allegation that the fire originated in one of the coals.

- (b) On the 18-20th of September, 1942, 1615 tons of Burnside coal and 136 tons of Merthyr coal were bunkered on the S.S. Ocean Valley. On the 1st November a fire broke out in this bunker. No allegation was made as to the particular coal responsible for the fire.
- (c) On the 22nd of July, 1942, the S.S. Glenwood bunkered 878 tons of Burnside coal, 265 tons of Merthyr coal and 46 tons of Durban Navigation coal at Durban. The Institute was informed that this bunker heated and it was necessary to discharge the bunker at New York.
- (d) On the 23rd and 24th of June, 1942, the S.S. bunkered 650 tons of Northern Natal Navigation coal, 240 tons of Durban Navigation coal, 218 tons of Hlobane coal, 100 tons of Burnside coal and 35 tons of Merthyr coal. The bunker caught fire on the 9th of September. The Coaling Master at Durban expressed the verbal opinion to the Institute's representative that the fire originated where the Merthyr coal was put down.
- (e) On the 16th of September, 1942, the S.S. Leana took as cargo 2511 tons of Durban Navigation coal, 1660 tons of Hlobane coal, 679 tons of Burnside coal, 185 tons of Natal Navigation coal and 125 tons of Merthyr coal. The Institute was informed that the cargo heated.
- (f) On the 6th of October, 1942, the S.S. Saronicus took as cargo 1890 tons of Durban Navigation coal, 1107 tons of Hlobane coal, 677 tons of Burnside coal, 605 tons of Northern Natal Navigation coal and 45 tons of Merthyr coal. The Institute was informed that the cargo heated.

- 6. Mr. Gilbert, the Managing Director of the Dundee Coal Company, in a letter, dated 15th June, 1943, to the Institute, states that from April 1940 to October 1943, 64126 tons of coal from the Merthyr adit were bunkered.
- 7. It will be seen from the cases mentioned under 5(a) to 5(f) that in each case the ship contained both Burnside and Merthyr coal. No evidence is available that Burnside coal, alone, has heated unduly.
- 8. Since the present war the number of cases of undue heating or fires of shipment coal reported to the Institute, has increased considerably. Of the 21 ships reporting undue heating during the present war 18 ships had Burnside coal. Of these 20 at least 5 and not more than 7 also had Merthyr coal. A number of other Natal coals was also present in practically all of these ships.
- 9. The Institute's information regarding the undue heating of South African coal on board ships before the present war, are confined to nine cases. Three of these

ships carried mixtures of Northern Natal Navigation, Hlobane and Natal Navigation coals. Two ships had mixtures of Northern Natal Navigation and Hlobane coals. One ship carried Hlobane coal only, one carried Durban Navigation coal only, one carried Enyati coal only and one carried a mixture of Enyati coal and Burnside coal. In all cases foreign coal was present except in the case mentioned where Hlobane coal only was carried.

10. The above information creates no more than a suspicion that Merthyr coal may have been responsible for the undue heating in a few of the cases where this occurred. The suspicion that Burnside coal may have been responsible is equally strong.

11. Other factors being the same, a soft coal will be more liable to spontaneous combustion than a hard coal. Burnside and Merthyr coals are the two softest Natal coals.

12. Other factors being the same, a mature coal will be less liable to spontaneous combustion than a more immature coal. Burnside and Merthyr coals are amongst the most mature Natal coals.

13. According to a recent pamphlet, "The Storage of Coal for Industrial Purposes", by R.A.A. Taylor of the Fuel Research Station, Greenwich: "The evidence imputing an unfavourable character to many other conditions that have been associated with spontaneous heating is inconclusive. Such conditions are, for example, a high content of sulphur or pyrites in the stored coal A high content of sulphur or of pyrites has for a long time been thought to promote spontaneous heating. It is now considered very doubtful, however, whether this is so."

The percentages of sulphur in Burnside and Merthyr coals are given in the Appendix.

14. Certain tests have been suggested overseas for determining the liability of fine coal to spontaneous combustion. The tests devised by Wheeler, Windmill, Parr and others have been applied to Natal coals. According to these tests the liability of all Natal coals to spontaneous combustion is negligible. Burnside coal appears to be the least liable. Merthyr coal has not been tested. In view of the unreliability of the practical interpretation of these tests it is not considered necessary to test Merthyr coal.

15. In the attached Appendix Dr. Bushell gives physical and analytical data of Burnside and Merthyr coals. These data have not been completed at the time of writing this report. In view of what has been stated above it is clear, whatever these data may be, that it is very difficult to draw any conclusion from them. If the data for these two coals are the same it does not show that Merthyr coal is safe. It may be that Merthyr and Burnside coals both are dangerous. If the data for the two coals are different it does not show that Merthyr coal is dangerous, since many more fires have occurred in mixtures containing Burnside coal than in mixtures containing Merthyr coal.

16. Merthyr coal, as well as some other Natal coals, may be dangerous, or may be rendered dangerous by the comminution inflicted upon them at the Bluff. One or more Natal coals are dangerous under present conditions, but with the information at present available the identification of such coal or coals would be a matter of guessing. Under these circumstances I feel that the Institute has not discharged the onus of proving that Merthyr coal is dangerous to life or property owing to its liability to spontaneous combustion. I therefore recommend that a grading certificate be granted to Merthyr Colliery to enable it to ship coal for bunker and cargo purposes.

1/7/1943.

F. J. TROMP.
DIRECTOR.

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APPENDIX.

REPORT NO. 7 OF 1943.

ANALYSES OF BURNSIDE AND MERTHYR COALS.

(1) Samples.

(a) Burnside:-

The sample consisted of 1000 lbs of + 1½" coal. Increments weighing 25 lbs, were taken from tubs - each tub providing one increment - over a period of three hours. The coal was mined from the bottom seam only, the section worked being known as No. 2 Cross. This section is the closest point in the Burnside workings to the workings of Merthyr Colliery.

(b) Merthyr:-

The sample consisted of 1000 lbs of Round coal taken in 25 increments partly from truck tops and partly from the end of the Round coal loading chute. The sample represents the coal mined over a period of 3 - 4 hours.

(2) Proximate Analysis.

	Burnside	Merthyr
Cal. Val. lbs/lb	13.9	13.0
% Moisture	0.8	1.1
% Ash	11.8	16.1
% Volatile Matter	24.1	17.8
% Fixed Carbon	63.3	65.0
Swelling Number	7½	2
Ash Fusion Temperature °C	+ 1400	+ 1400

(3) Ultimate Analysis.

The results are expressed on a dry ash-free basis.

	Burnside	Merthyr
% Carbon	86.5	85.9
% Hydrogen	5.1	4.9
% Nitrogen	2.0	2.2
% Sulphur	2.2	3.6
% Oxygen	4.2	3.4

(4) Sulphur Distribution.

	Burnside	Merthyr
% Total Sulphur	1.95	2.96
% Organic Sulphur	0.79	0.56
% Mineral Sulphur	1.16	2.40

(5) Shatter Test.

50 Lbs of coal (4" - 6" lumps) were dropped 5 times from a height of 6 feet, and the broken coal screened.

(a) Fractional/.....

(a) Fractional Screen Analysis:-

Screen size ins.	Burnside	Merthyr
+ 2	34.7	33.3
+ $1\frac{1}{2}$ - 2	12.4	7.1
+ 1 - $1\frac{1}{2}$	12.4	13.5
+ $\frac{1}{2}$ - 1	16.7	18.2
+ $\frac{1}{4}$ - $\frac{1}{2}$	8.8	10.1
+ $\frac{1}{8}$ - $\frac{1}{4}$	5.5	7.9
- $\frac{1}{8}$	9.3	10.1

(b) Cumulative Screen Analysis:-

Screen size ins.	Burnside	Merthyr
On 2	34.7	33.3
on $1\frac{1}{2}$	47.1	40.4
on 1	59.5	53.9
on $\frac{1}{2}$	77.2	72.1
on $\frac{1}{4}$	86.0	82.2
on $\frac{1}{8}$	91.5	90.1
Total	100.8	100.2

Two further 50 lb samples have been kept (a) dry and (b) damp. After a month shatter tests will be carried out to determine the effect of weathering on the breakage of these two coals.

(6) Spontaneous Combustion Tests.

(a) Winmill's absorption of oxygen from air:

C.c.s. of Oxygen absorbed at N.T.P. per 100gms. coal in 96 hours	Burnside	Merthyr
at 30°C	36	34
at 60°C	106	328

(b) Stopes and Wheelers Ignition Temperature:-

Burnside	Merthyr
196°C	190°C

This apparatus is slightly modified and the values are relative only. Other values obtained on South African coals are Vryheid Coronation, 204°C; Natal Cambrian 181°C; Northfield 186°C; Durban Navigation 181°C; Coronation (Kromdraai) 175°C; Witbank South 183°C.

CASE NO.	NAME OF SHIP	DATE OF LOADING	DATE OF FIRE	BUNKERS, CARGO OR STACK	FOREIGN COAL PRESENT Tons.
1	Aloe	14/1/31	13/4/31	Cargo	Unknown
2	Dalfram	5/12/34	29/12/34	Bunkers	Unknown
3	Unden	19/2/35	9/4/35	Bunkers	230
4	Erica	16/4/35	12/7/35	Bunkers	None
5	Calumet	6/1/36	24/2/36	Bunkers	354
6	Drómoro Castle	6/4/36 7/5/36	13/7/36	Bunkers	Yes quantity unknown
7	Cheldale	21/2/36	13/4/36	Bunkers	331
8	Evagoras	8/5/39	15/5/39	Bunkers	38
9	Luciston	4/3/39 13/4/39	26/4/39	Bunkers	No
10	Narvik	24/6/42	9/9/42	Bunkers	Unknown
11	At Bluff	27/6/42	19/8/42	Stack	No
12	Glenwood	22/7/42	Unknown	Bunkers	Unknown
13	Leana	16/8/42	Unknown	Cargo	Unknown
14	Saronicus	6/10/42	Unknown	Cargo	Unknown
15	Pilar de Larrinagar	22/10/42	Unknown	Bunkers	Unknown
16	Ocean Valley	20/9/42	1/11/42	Bunkers	None
17	Tyndareus	29/11/42	Unknown	Cargo	None
18	Alice Moller	24/10/42	10/1/43	Cargo	None
19	Efthalia Mari	13/12/42	4/2/43	Cargo	None
20	Fort Kootenay	14/12/42	12/2/43	Bunkers	Unknown
21	Elizabethville	21/12/42	1/2/43	Bunkers	440
22	Strategist	3/1/43	15/3/43	Bunkers	Yes quantity unknown
23	Fort Pine	30/3/43	1/4/43	Bunkers	Unknown
24	Nirvana	22/1/43 1/4/43	20/4/43	Bunkers	Unknown
25	Nurtureton	8/3/43	3/5/43	Cargo	None
26	Taygetos	27/2/42	Unknown	Cargo	None
27	Empire Addison	20/5/42	Unknown	Bunkers	Unknown
28	Kambe	4/1/43	Unknown	Bunkers	Unknown
29	City of Keelung	21/12/42	Unknown	Bunkers	Unknown
30	Epaminandos C. Embiricos	22/3/43	Unknown	Cargo	None
31	Agulhas	23/3/43	Unknown	Bunkers	Unknown
32	Empire Lionel	18/2/43	31/3/43	Bunkers	None
33	Dunfries	8/2/43	No fire quality of bunkers only		Yes
34	Forbin	2/3/43	No fire " " " "		
35	Empire Voice	24/9/43	unknown	Bunkers	700 tons 190 tons
36	Empire Conrad	3/2/43	4/3/43	Bunkers	?
37	Hilda Moller	29/1/43		Bunkers	
38	Fort Luntle	2/1/44	coal hot only when unloading 7/2/44	Cargo (No 1 + No 2)	None {No 1 No 2
39	Fort Bedford	See file	for this case - difficult to fit into		
40	Fort Hudsons Hope	2/11/43	14/12/43	Cargo (No 5)	
41	Robert Treat	18/2/44	approx 5/4/44	Cargo (No 2)	None
42	Richard Stockton	13/2/44	approx 5/4/44	Cargo (No 2)	None
43	Loran Incheape	10/2/44	approx 5/4/44	Cargo (No 1)	None
44	Manika Protobapa	26/1/44 (?)	10/3/44	Cargo	None
45	Alexandra	23/1/44	28/2/44	Cargo	None

FIRES ON SHIPS

WEIGHTS OF SOUTH AFRICAN COALS PRESENT - Tons.									REMARKS	
URBAN AV.	HLOBANE	BURN- SIDE	MER- THYR	ENYATI	NORTHERN NATAL NAV.	NATAL NAV. (NORTH- FIELD)	CAM- BRIAN	VRYHEID CORON.		TSHOBA ↓
-	-	5836	-	1910	-	-	-	-	-	
-	85	-	-	-	87	1034	-	-	-	
-	441	-	-	-	510	361	-	-	-	
-	2152	-	-	-	-	-	-	-	-	
-	697	-	-	-	225	-	-	-	-	
053	-	-	-	-	-	-	-	-	-	
682	-	-	-	-	-	-	-	-	-	
-	303	-	-	-	661	-	-	-	-	
-	-	-	-	484	-	-	-	92	-	
-	-	-	-	-	435	370	-	-	Coaling Master con-	
575	-	-	-	-	76	-	-	-	siders coal loaded	
-	-	-	-	-	-	-	-	-	on 4/3/39 to be the	
240	218	100	35	-	650	-	-	-	cause.	
-	-	±963	± 50	-	-	-	-	-	Total 1013 tons	
46	-	878	265	-	-	-	-	-	-	
2511	1660	679	125	-	-	185	-	-	-	
1800	1107	677	45	-	605	-	-	-	-	
-	-	663	-	-	-	-	143	140	-	
575	245	845	182	222	177	-	-	-	-	
-	-	1615	136	-	-	-	45	-	-	
170	1727	579	-	-	1231	982	-	-	-	
3423	1775	372	128	-	1003	745	-	-	-	
2818	1037	1013	-	-	716	224	-	-	-	
563	225	375	-	-	91	217	476	397	-	
146	730	974	-	45	461	174	172	-	-	
117	-	-	-	328	-	-	683	35	-	
-	-	80	-	93	-	-	223	121	-	
835	-	-	-	-	-	-	185	69	-	
797	-	-	-	129	-	-	92	357	-	
3645	1914	-	-	-	1691	1277	-	-	-	
2881	1253	1476	295	-	754	412	-	-	-	
299	24	632	45	56	-	-	45	140	-	
770	69	25	-	133	468	41	-	-	-	
264	326	254	-	292	-	41	45	-	-	
2706	814	1284	-	-	651	492	-	-	-	
-	137	470	-	138	90	-	756	297	-	
				217			1281	163		

377	517	350	175	96	45	170
798	213	134	1274	124		

*some doubt see files
Oct Nov. 1943*

348	261	119	?	36	186	31	189	90	
579	142	443	?	93	263	180	144	128	
469	416	344	?		160				
<i>this table</i>									
2894	2089	1883	?		1120	322		532	
488	359	499	?	142	322	300	127	346	59
631	791	594	?	159	282	-	-	120	92
-	152	390	?	274	417	381	140	61	-
2358	1276	2508	?	126	35	-	127	69	-
1592	1048	1263	?	45	948	238	90	405	-

Tshoba