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FUEL RESEARCH INSTITUTE

OF SOUTH AFRICA

ONDERWERP:
SUBJECT: SPONTANEOUS HEATING OF UMGALA COAL

AFDELING:
DIVISION: ENGINEERING/PILOT PLANTS

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SPONTANEOUS HEATING OF UMGALA COAL

1. Earlier studies [1)] have indicated that Umgala coal is prone to spontaneous heating and that ignition is likely to occur unless special precautions are taken during stockpiling.

Compaction of the coal to minimize air penetration is an effective way of preventing spontaneous heating. Unfortunately this is practically impossible at the Richard's Bay Coal Terminal (RBCT) and this, aided by favourable meteorological conditions, has already led to the spontaneous ignition of Umgala mixed smalls stockpiled at the Terminal.

The RBCT is thus faced with the problem of exporting coal in the heated state and some indication of the behaviour of such coal in transit is highly desirable.

2. Within a ship's hold ventilation is limited and aeration is likely to be restricted to the upper layers of coal only. However, even minimal aeration of coal at relatively elevated temperatures can create problems.

This was investigated as follows. A bulk sample of Umgala mixed smalls was allowed to heat spontaneously (by forced aeration) in the test bunker. When the maximum temperature (limited by the temperature monitoring equipment) was attained, aeration was stopped for fourteen days and the temperature monitored throughout. Fourteen days are considered a representative shipment period.

At the end of the fourteen day period aeration was recommenced to simulate conditions likely to be encountered during the off-loading of the coal.

An additional cooling/heating cycle was introduced for the sake of interest.

[1)] Reports No. 61 of 1976 and No. 79 of 1976.

The aeration rates applied correspond to a linear velocity in the empty bunker of 0,07 m/h. This is considered still in excess of that likely to be encountered in a ship's hold. As a final exercise a heating cycle was introduced using an aeration rate of one fifth of the previous rate.

3. During the loading of the test bunker a sample of coal was secured for size analysis, the results of which are reproduced below.

Size Consist

Size range	Fractional percentage
+¾"	18,6
-¾" +½"	16,3
-½" +¼"	28,2
-¼" +1/8"	22,7
-1/8"	14,2

4. The temperature history curve is reproduced in Figure I.

Curve A B represents the initial spontaneous heating of the coal due to forced aeration.

At point B ventilation was stopped and the temperature overshoot is attributed to the thermal inertia of the system. Curve B C represents cooling under conditions of zero ventilation. It will be noted that the exclusion of air completely arrests spontaneous heating but that due to the thermal inertia cooling by a mere $3^{o}C$ resulted in fourteen days.

At point C on the temperature history curve aeration was recommenced to simulate conditions likely to be encountered during the off-loading of the coal. The aeration rates for curves A B, C D, and E F are identical and that the heating rates for each of these are, for all practical purposes, identical. It must, therefore, be concluded that progressive oxidation of the coal's surface, at least within the oxidation range encountered in the experiment, has a negligible effect on the heating rate.

Curve G H represents the heating rate at reduced aeration rates (a fivefold reduction).

5. It is unlikely that aeration can be completely eliminated during the shipment of the coal. It is likely therefore that the temperature of the coal will increase somewhat during shipment, when loaded in a heated state, and that ignition can result after off-loading if ventilation conditions are favourable.

T C ERASMUS
ASSISTANT DIRECTOR

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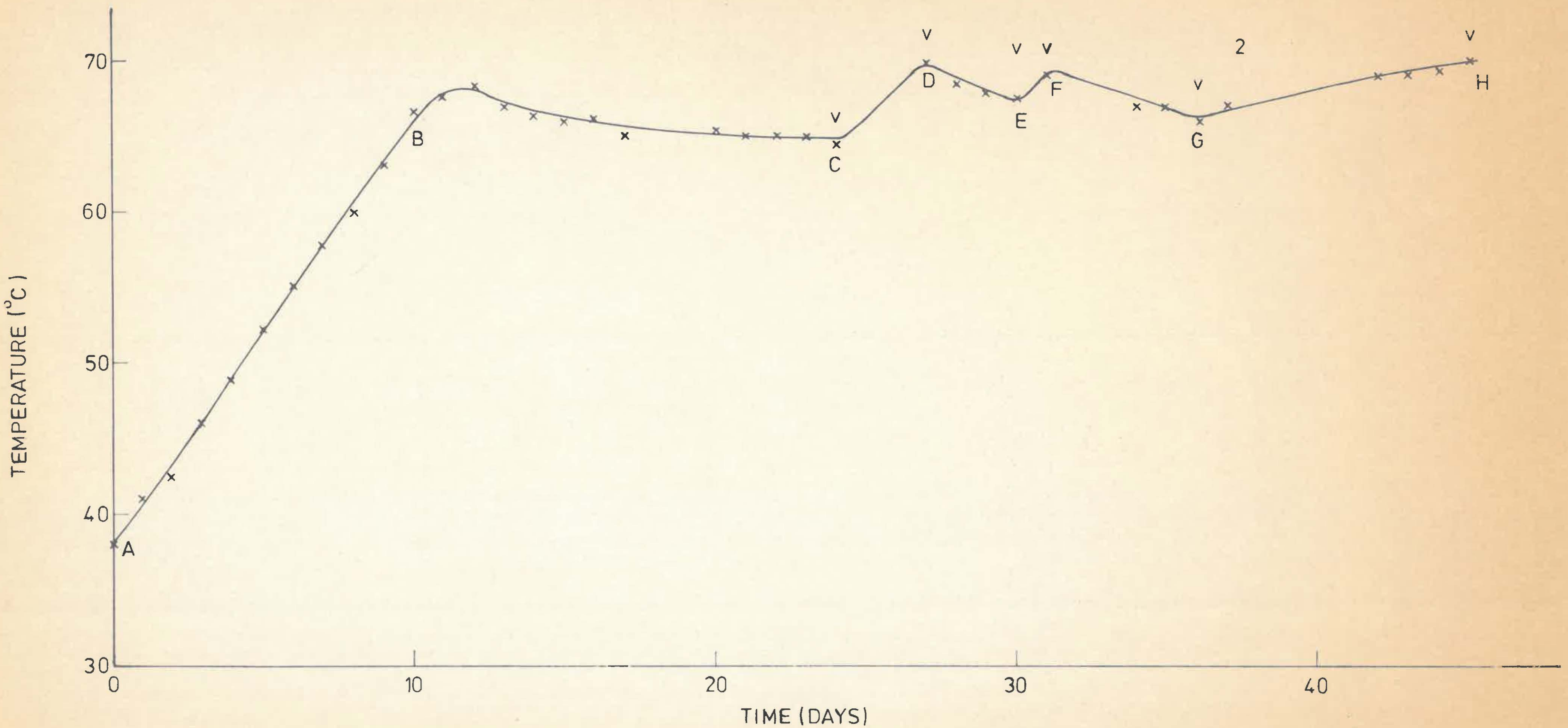

FIGURE 1

TEMPERATURE HISTORY OF UMGALA COAL