Healy Q
Dunkle Coal

Fairbanks
5/2/71

To Robert S Warfield
Mining Engineer
USGS

From Mining Engineer
Fairbanks

Subject Report on Dunkle Coal Property

I do not know who wrote the enclosed subject report. I got a copy from Carl Kreilhaus a few days ago.

From the summary description of the "Dunkle Reactor" p.2 I can vaguely picture equipment that would accomplish coking coal in an "atmosphere of steam" - it would be good to get some information about the equipment and processing. Although the report is [illegible] years old, p.5 has some interesting comparisons see bottom of page.

Encl
J Mulligan

Duane
Dave Thomas

W. E. DUNKLE COAL PROPERTY

The W. E. Dunkle Coal Property comprises 2560 acres in the Broad Pass area, Alaska. The acreage contains extensive deposits of cheaply mined lignite coal. The coal is typically high in inherent moisture.

After several years continuous research work Mr. Dunkle designed apparatus and devised a method of processing this coal into a fuel of excellent quality and low cost. By his process moisture can be economically removed from the coal down to zero percentage if desired. The removal of six or seven hundred pounds of moisture from 2000 lbs of coal and the resultant saving in freight rates (at 20 cents per 100 pounds) more than cover the cost of processing and the upgrading of the processed coal makes its delivered B.T.U. per penny per lb price the cheapest fuel in the rail belt area.

By special method and treatment Mr. Dunkle also succeeded in eliminating spontaneous combusion hazards in all stages of handling: in drying, shipping and in storage. That this is true in the handling of coal tonnage, as well as in laboratory experiment, has been borne out by the handling of coal at the mine and by coal recently shipped to Fairbanks for burning at the Fairbanks Exploration Company Power Plant. It will be interesting to have additional data on the handling of this processed coal in large amounts but our experience to date sufficiently corroborates Mr. Dunkle's findings to merit confidence in his established method and technique. Mr. Dunkle's plant designs, plans, techniques and detailed figures and calculations are available for study.

Briefly they estimate that a processing plant to handle 250,000 tons of coal a year could be erected for $200,000 or even less. That 250,000 tons of processed coal could readily be sold to yield a take home profit of some $500,000 per year.

He proposed to contract out the mining of the several million tons of coal easily mined by cheap strip and/or hydraulicing methods.

Ample clear water supply under a good head is easily available for any purpose.

A short R.R. spur over an already existing road bed would be quickly installed at small cost. Broad Pass is just about half way between the markets of the South end and the North end of the railroad and being almost at Summit presents a down haul in either direction.

An adequate flying field has been developed on the property.

The following account attempts to give the general facts relative to the Dunkle property while not going into specific detail.

Abundant and detailed records substantiating the general facts are available.

General Facts.

The coal lands under consideration comprise 2560 acres in the Broad Pass area of the Alaska Railroad belt. The land is held by Wesley Earl Dunkle and Gladys E. Dunkle under permits issued by the Bureau of Land Management, Department of Interior. The coal is lignite.

The ground having been diligently prospected and developed and coal in commercial quantities having been proven the Bureau of Land Management is now required by law to issue Preference Right Leases which are now being processed. These leases run for fifty years and royalty is payable in the maximum amount of 25 cents per ton of coal sold. This royalty is subject to revision over long periods. In addition there is a rental charge per acre of 25 cents per annum.

Of importance is the fact there is a depletion allowance in coal mining of ten per cent of the gross income, up to, but not exceeding 50% of the net profit after depreciation and before taxes. Because there is no property investment in the coal itself there is nothing to write off for coal purchase and so the depletion allowance is to a great extent straight profit.

Specific description of the leases as filed with the U.S.G.S. and Bureau of Land Management, Maps and Drill Logs are available for detailed study.

PERMIT 011636 FAIRBANKS: 1920 acres (as amended) Located close to the Alaska Railroad at Mile 304 (about midway between Fairbanks and Anchorage).

The coal seams in this area lie essentially horizontal. They are marked by long gentle undulations in which the slopes average two or three degrees. There are five seams in a stratographical height of about 200 feet, they are the Hinchey; the Texas; The Dunkle-Brandel; the Stroufe; and the Capper, now renamed the Bruce.

The country is gently rolling and the ground unfrozen, that is to say, there is no perma frost. Large areas of all the seams can be mined by either stripping or hydraulicing methods without exceeding a three to one overburden to coal ratio. There is a plentiful and easily available supply of clear water under a good head for any purpose.

As the result of a drilling, open cut and tunnelling program carried on over the past several years, many millions of tons of clean coal that can be stripped or mined at low cost have been proven.

In the Dunkle Brandel Seam alone, in the immediate vicinity of the holes and cuts, more than eight million tons in solid coal is proved and over much of the area the ratio of overburden is less than two to one. This is the coal that will doubtless be mined first.

The drilling shows the coal to be little disturbed and that it maintains its thickness over wide areas. The drilling also proved that the sharp up-turns and contortions at the outcrops are purely local due to frost action and heaving and are not faults as superficial observation might indicate.

In this part of Alaska, where faulting or enough deformation of the beds to cause even moderately steep folding occurs, the coal tends to be up-graded into either sub-bituminous or bituminous classifications. The coal of the Broad Pass Field is definitely lignite, close to the top of the lignite classification. It is typically high in moisture.

The U.S.G.S. and Bureau of Mines men who investigated the Broad Pass area during the war and wrote Bulletin 963-E did not sample the coal of this

area. They put cuts in it but did not sample it. The explanation may be that it looks very much like the high ash coal they did sample back of Broad Pass station and they must have assumed it was the same dirty coal.

Drill holes put down late last Fall (1957) have succeeded in tracing the Dunkle-Brandel seam to within half a mile of the R.R. track. A tentative site was chosen for the tipple, processing plant and camp near the location of an old gravel pit onced served by a short spur of the Alaska Railroad. The cost of rehabilitating this spur to serve the coal mine would be negligible. An adequate flying field developed by Mr. Dunkle is also immediately adjacent to the site and a plentiful supply of clear water under a good head is easily available for all purposes, including that of Automatic Giant Hydraulic mining.

The Sroufe seam lies under the Dunkle-Brandel seam and shows 20 feet of solid coal (no partings). In some areas where the Dunkle-Brandel seam is eroded, the Stroufe seam comes to the surface or is only a short distance below it. (NOTE: The Stevens Bed...Old Coal Creek Mine...Bulletin 963-E...Plate 26 just east of Section 23:... This bed is NOT included in any estimates of possible mining along Coal Creek, for the reason that it is high ash coal and although the seam is conspicuous and continuous is only 7 feet thick. Samples taken, by Ken Hinchey in 1954 were from this seam. The Stevens bed lies highest stratographically).

Analyses of the coal of the Dunkle-Brandel and other seams and drill logs and maps are available for detailed study.

PERMIT 027608: Middle Fork. 640 acres.

Exploratory and development work in this area has proven the existence of one main seam downstream of high grade lignite coal with approximately 800,000 tons available for easy strip or hydraulic mining. Indications are that a much greater tonnage exists to be mined by these methods but further work is necessary for proof. Where the work has been done the coal lies more or less with the hillside resulting in the ratio of overburden to coal of not more than four to one.

Superficially the coal appears to occur in two seams, but the lower showing is a continuation of the upper showing due to a fairly long folding which changed the strike and dip of the coal in the downstream limb. The lower showing therefore instead of having a seam parallel to the upper showing, (in which case it would have crossed the creek and been lost in the low land of the east side) now is shown to extend downstream for a long distance on the west side, gradually leaving the creek and climbing the hill which forms the west bank of the creek. The dip of the seam and the slope of the hillside are practically the same so it looks as though there were a thick slab of coal lying along the hillside for a third of a mile or more. It is known it continues for at least two hundred feet because that is the coal that can be seen there when the ground is bare. It is known from the showing upstream that there is at least one seam twelve feet thick only twelve feet out in the hanging wall of the main seam. It is expected that this will follow along in the hanging wall going downstream parallel to the main seam and that this too will furnish a considerable tonnage of stripping coal. This information was forthcoming after the original cut had been squared up and a tunnel started very close to the foot wall. Previous work with a bull-dozer undertaken by a man who did not follow instructions was done well back in the footwall of the seam where there was not the least chance of cutting any of the coal that showed up along the bank.

A road has been opened up from Colorado Station (Mile 297) on the A.R.R. to this camp site. With a little more work it could be made into a fast truck road but a R.R. spur track about 1 1/2 miles in length and with one bridge (estimated cost $10,000.00) would connect the mine with the mainline of the A.R.R. There would be no point in using the truck road or Colorado Station in this case. A good flying field is also right on the road.

There is a plentiful supply of clear water under good head available for all purposes including hydraulicing.

The foregoing resume should be sufficient to make it clear that extremely large tonnages of easily mined coal are available in easily accessible and advantageous position on the A.R.R. in the areas held under Permits 027608 Anchorage and 011636 Fairbanks. Maps, drill logs and analyses are available for detailed and specific study.

DUNKLE REACTOR AND COAL PROCESSING METHOD:

Although the coal from both areas burns well in its raw state in ordinary stoves the fact that it has a high moisture content makes it uneconomical to ship in its raw state and also makes it impractical as a fuel for power plant furnaces. Mr. Dunkle decided that by removing a considerable percentage of the inherent moisture the fuel could be beneficiated to produce low cost highly efficient fuel.

Existing methods of drying and processing low grade coals proved unsatisfactory for one reason or another and were discarded. Finally after some three years of continuous research work Mr. Dunkle devised a process and designed a simple reactor which successfully met the problems connected with this particular coal. Briefly stated the coal is dried in an atmosphere of steam.

This can be done by either direct application of steam or by indirect heating using steam for heat in heat exchanger tubes. The coal MUST be dried in an atmosphere of steam. In both methods the steam that is in direct contact with the coal, in other words, the atmosphere in which it is done, derives from the moisture in the coal itself.

The drying is done at normal atmospheric pressure therefore requiring no pressure vessel either of minus pressure such as vacuum or plus pressure. The enveloping steam atmosphere is necessary in order to keep the coal from checking. This process can be accomplished at economical speed without 'popcorning' the coal. The over-all effect is to shrink the coal while retaining its original form. It shows larger percentages in smaller sizes by screening because each particle has shrunk rather than becoming divided. Which is graphically shown by the fact that a bucket full of wet coal weighs 30 lbs and a bucket full of dried coal weighs 30 lbs.

The coal itself is up-graded, toughened and hardened in the processing and gives a black streak instead of the typical brown streak of the raw coal. It is interesting to note here that the coals of the Healy River area present a much more difficult drying problem as they easily slack into small particles and in fact go to dust if left out in the open and do the same if heated. The coals of the Broad Pass area are more definitely lignitic in type and retain their fibrous character on drying.

SPONTANEOUS COMBUSTION PROBLEMS DEALT WITH:

It is important here to understand certain general factors relative to spontaneous combustion and in turn their bearing on the processing of the coals under consideration. The simple cause of spontaneous combustion is oxidation at a rate in excess of the rate of removal of the heat caused by oxidation. Considering any particular substance subject to oxidation the rate of oxidation increases very rapidly with increase in temperature and with the amount of surface exposed in any enclosed space. For a given weight of the substance the surface increases very rapidly with increase in fineness of particles. It is the lignite 'fines' which cause the trouble. It has been shown by experiment by the Bureau of Mines that if all the fines below 3/8 round hole mesh are removed from dried North Dakota lignite that the coal can be stored in deep thick piles for a long period without any tendency to heat. The Broad Pass coal by analysis, age, formation, texture, etc., is very similar to North Dakota lignite.

Because of the cheapness of the Broad Pass coal the fines could be entirely discarded but it would be advantageous to use some if not all of the fines as drying fuel. It is <u>imperative</u> the dried coal be shipped minus the fines.

When active carbon such as fresh lignite or charcoal is exposed to moist air it rapidly adsorbs moisture from the air and reacts with the oxygen of the air. Both reactions are exothermic. In the case of the water vapor each pound adsorbed throws off very close to 1000 BTUs and this heat must be removed by natural air circulation or it causes trouble. The same is true of the heat caused by oxidation.

Mr. Dunkle found that if the lignite is coated with a film of oil it will no longer adsorb water vapor. The oil film was further demonstrated to greatly inhibit the tendency to oxidize and therefore the tendency to spontaneous combustion when stored en masse. Adding the oil also keeps the dust formation down. A very small quantity of oil is added per ton of dried, cooled and screened coal. Data on kind of oil and quantity, where and how applied are available for detailed study.

Some twenty tons of this coal so processed and shipped to Fairbanks for testing in the F.E. Power Plant there more than substantiated the expected results and this despite many adverse factors attendant on the processing of the coal in the prototype reactor built and perfected by Mr. Dunkle just before his death in September of 1957. Factors which would not be present in either a pilot or full scale operating plant.

Mr. Dunkle's operating plant plans call for continuous conveyor type processing with heating pipes, cooling pipes, oiling device and final screening features as inherent parts of the fully automatic and mechanized plant.

In the prototype reactor the coal had to be hand crushed, hand fed into the reactor and owing to cramped space an inadequate fan and dust removal mechanism employed.

Further the piles of coal were covered with snow and the men were working in sub zero weather with an inadequate electric power supply and in inadequate quarters. Despite these miserable conditions the test was spectacularly successful and amply proved Mr. Dunkle's estimates.

It can be confidentally stated that the coal of the Broad Pass area can be economically and successfully processed and be in a strongly competitive position relative to the other coals available in Alaska.

Plant designs, formulas and figures are available for detailed study.

ANALYSIS OF PRESENT MARKET:

Contracts Awarded for Fiscal Year 1958.

Mine	To	Tons	Price	Total
Cripple Creek Coal Company	Ladd A.F. Base	60,000	$ 6.96	$417,600.00
Same	Eielson A.F. Base	40,000	6.96	278,400.00
Sub-bituminous coal	Moist 22%;	Ash dry 13.4%;	BTU dry 10,980 per lb.	
Usibelli Coal Co.	Ladd A.F. Base	160,000	$ 6.82	$1,091,000.00
Sub-bituminous coal	Moist. 24.6%; 23.7%	Ash dry " " 11.0%; 9.0%	BTU dry " " 11,200 11,408	
Suntrana Coal Co.	Eielson A.F. Base	160,000	$ 7.34	$1,174,400.00
Sub-bituminous	Moist 22.7%;	Ash dry 9.6%;	BTU dry 11,199	
Mrak Coal Co.	Fort Richardson	60,000	$12.90	$774,000.00
Bituminous Coal	Moist 8.2%;	Ash dry 13.7%;	BTU dry 12,463 per lb.	
Evan Jones Coal Co.	Elmendorf	110,000	$ 12.65	$1,391,500.00
Bituminous	Moist 7.9%;	Ash dry 14.2%	BTU dry 12,235 per lb.	
Evan Jones Coal Co.	Fort Rich.	94,000	$12.65	$1,189,100.00
	Specifications the same as above			
Arctic Coal Co.	Elmendorf	50,000	$ 6.13	$ 306,500.00
Sub-bituminous	Moist 24.3%;	Ash dry 11.5%;	BTU dry 10,950 per lb.	

Mine	BTU per lb 'as received'	BTU per 1¢ 'as received'
Cripple Creek	8564	16,170
Usibelli	8588	16,547
Suntrana	8657	15,514
Mrak	11441	14,782
Evan Jones	11268	14,788
Arctic	8289	15,168
DUNKLE COAL	9346	18,525

(Dunkle coal supplied to F. E. Co., Fairbanks, Alaska - January 1958)

Fills Wide Need for Fuel of Low Cost and Good Quality.

There is good reason to believe that the Broad Pass processed coal would find an eager market. Its use would present considerable saving in money to the military installations. For instance the combined fuel bill at Elmendorf AFB and Fort Richardson for 1958 F.Y. is approximately $4,500,000. This is being purchased at a price of about 15,000 BTUs per one cent as received. Broad Pass coal would furnish approximately 18,500 BTUs per one cent in coal of a quality that will more than meet their capacity requirements in steam. $4,500,000 x 15/18 amounts to $3,750,000 a saving of $750,000 for the year. However it is unlikely that one mine would obtain the entire contract since it is a matter of policy to try to keep several mines in operating condition. Bids are not strictly competitive but subject to negotiation. In this connection it should be mentioned that a mine must have military accreditation before being eligible to contract.

Mr. Robert May of the Bureau of Mines who visited the Broad Pass mine gave assurance there would be no difficulty in getting accreditation.

On the basis of exhaustive calculations made by Mr. Dunkle the take home profit of the Dunkle coal for 250,000 tons per year would be $500,000. In view of his always conservative figures and in the light of the recent tryout of the coal at Fairbanks this would seem well within range both as to present Alaska market for the coal and reasonable profit.

POTENTIAL MARKET:

Japan purchases some six million tons of coal per year from this country....purchases are made on the East Coast for shipment in Jap bottoms through the Panama Canal and on the West Coast for the back haul to Japan. Prices at present being paid by Japan would place Alaskan coals in a strongly competitive position with stateside coals. However the quality and character of much of the Alaskan coal does not meet Japanese requirements and in other cases Alaskan coals would be of doubtful shipping character. It was Mr. Dunkle's opinion, until recently, that Healy and Broad Pass coals would not ship successfully, however, after much experimentation with the Broad Pass processed coal he was of the opinion it would ship successfully and meet Japanese requirements (including that of the fixed carbon percentage). The Broad Pass coals very low sulphur content .1 and .2 percent by-analysis) is also important. The Alaska Railroad would give a preferential tariff on coal to be exported and the price Broad Pass coal could be delivered to the Seward dock would undoubtedly be strongly attractive to Japanese buyers while yielding a handsome profit to the Broad Pass mine (figures available.)

California presents another possibility as a market if, as seems likely, a preferential freight rate could be negotiated with Coastwise shipping or one of the barge services from Alaska. More information is needed for a study of this market.

MINE MOUTH POWER PLANT POSSIBILITIES:

Recent policy has resulted in the development of Mine Mouth Power Plants with their attendant transmission lines and grid systems in the Continental United States. It is being strongly advocated by many interested persons for Alaska and a recent survey by a group of consulting engineers employed by the Golden Valley Electrical Assn. of Fairbanks to investigate the feasibility of such a plant for the Healy district has resulted in a favorable report. This report is to be made the basis for an application for a loan from REA to finance the project.

It can here be stated categorically that if such a plant is desirable in the Healy field a similar plant in the Broad Pass area would be doubly so. Amount and availability of cheap coal, geographical positfon and last, but not least important, a plentiful supply of clear water close by and under a good head.

Moreover the Broad Pass and Colorado Station area is heavily mineralized and it is only a question of time until major mining activities are developed in the area. The Golden Zone Mine is in the heart of the largest known porphry formation in Alaska. Gold, Silver, Copper, Zinc, Zirconium exist in quantity while trace minerals of many kinds at present only identified in laboratory samples indicate interesting possibilities for a brilliant future for the district. Adequate power and fuel supplies would do much to encourage major mining developments in the area.

Rumoured establishment of missile bases in the Railbelt area likewise present potential power requirements of magnitude. It is significant in this connection to note that great manufacturing companies are showing increasing disposition to locate major plants as close as possible to known COAL resources. The Federal Power Commission estimates that hydroelectric plants can be expected to supply only 8 1/2 per cent of the new generating capacity needed in the next 20 years while 14 1/2 percent may come from atomic energy plants. This means that the bulk of future needs, 77 per cent, will have to come from steam plants burning fossil fuels. Admiral Rickover's statement in hearings before Committees in the 84th Congress dealt with nuclear power plants in precise and uncompromising terms. As against conventional power sources it is unlikely atomic power will be a practical and economic possibility for the next decade.

The power situation in Alaska certainly does not justify the expenditure of the astronomical sums incidental to the installation of an atomic power plant and certainly it would be a great hardship on users of power to have to pay the present average cost per kilowatt hour of atomic power....some 35 mills as against about seven.