CERRO DE PASCO CORPORATION

40 WALL STREET, NEW YORK 5, N. Y.

# MEMORANDUM

No. 35-52

July 14, 1952

To: The Directors

From: R. P. Koenig

Subject: Coal and Coke

It has been recognized by the Management of the Corporation that the reserves of the Goyllarisquisga coal mine are in all probability insufficient to provide an adequate supply of coal and coke commensurate with either the increased rate of metal production or the large reserves of lead and zinc known to exist. The problem has received an increasing amount of attention during the past twenty-four months. The development of sufficient coal reserves will require considerable exploration and research, as well as a major capital expenditure for properties, their development and for mining plants. Previous exploration has shown that potential coal fields exist in three areas in central Perú, all of which are tributary to the Oroya Smelter and are economically exploitable. The fields are: the immediate environs of Goyllarisquisga, the Oyon-Checras area, and the Jatunhuasi coal field. In addition, it may be necessary to purchase some of our supplies of anthracite coal from independently operated mines in the Chimbote coal field of northern Perú.

The three fields (not including Chimbote) are believed to contain more than sufficient solid fuels for the needs of the Corporation during its forseeable life.

The problem of a balanced fuel supply is complex, and investigations have progressed sufficiently to form a basis for recommendations, and requests for A.F.E.'s, both of which are being prepared. The purpose of this memorandum is to provide the Directors with a general picture of the coal problem.

1. Location of Coal Sources. The Oyon-Checras field lies on the western side of the Continental Divide, almost due west of Cerro de Pasco. It is easily accessible only from the coast, and its development will necessitate a 75 km. road, or other means of transportation to connect with the Cerro de Pasco railroad.

The Jatunhuasi field lies some 80 km. south of Oroya. Most of the field is in short trucking distance from the Yauricocha railroad.

The Chimbote mines lie inland from the port of the same name, about 360 km. north of Lima. It is mentioned herein only as a possible source of anthracite coal for the Sterling process.

2. Characteristics of the Various Coals. The most important characteristic of the coal required for Corporation needs is that of cokability. Goyllar coal is unique in this respect and remains the only certain source of raw material for metallurgical coke, which is essential for lead smelting at the present state of technological development of the art. However, recent exhaustive tests have proved that a minor quantity of Goyllar coal, when mixed with either Oyon or Jatunhuasi coals, can make a satisfactory coke. The possibility of finding significant tonnages of coking coal at Oyon is remote and should be completely discounted. In general, a mix of 60% to 75% medium volatile Oyon coal and 40% to 25% Goyllar washed coal will make satisfactory coke. The same applies to a mixture of 60% or less Jatunhuasi and 40% or more Goyllar coal.

Goyllar coal, as a fuel, is inferior to both Oyon and Jatunhuasi coals. The superiority of the latter two results from the fact that they have a higher combustible and lower ash content than either Goyllar raw or washed coal. Oyon coal, however, is not a suitable fuel for uses in which lump sizes are necessary, such as domestic and locomotive fuel, because of its extreme friability.

The following are approximate analyses of the three coals (dry basis):

| | Volatiles | Fixed Carbon | Ash |
|---|---|---|---|
| Goyllar | | | |
| Raw | 26% | 21% | 53% |
| Washed | 36% | 39% | 25% |
| Oyon, Raw | 15% | 60% | 25% |
| Jatunhuasi, Raw | 32% | 50% | 18% |
| Chimbote anthracite, washed | 3.% | 87% | 10% |

Certain parts of the Oyon and Jatunhuasi fields show lower ash contents than the above analyses and Oyon contains some coal approaching the analysis of anthracite (plus 75% fixed carbon).

Neither Jatunhuasi nor Oyon requires beneficiation for use in coke making in blends with Goyllar coal. The latter, on the other hand, must be washed in order to increase the carbon content to that necessary for coking coal.

3. Conservation of Goyllar Coal. The coal program as visualized at present embodies conservation of the Goyllar coking coal, not only by blending it with other types and thereby extending the life of its reserves, but also by minimizing utilization of Goyllar coal for other fuel purposes. In the past, Goyllar coal has been used in most Corporation fuel needs, including camp heating, reverberatory fuel, steam production, and railroads. During recent years many of our locomotives have been converted to oil. With the impending increase in fuel oil prices it is possible that the future trend will be reconversion to coal, provided adequate reserves at competitive costs are available. While it is not practicable to utilize all mine and coal washery products

in coke-making, the substitution of Oyon or Jatunhuasi coal for fuel uses, and improvements in the beneficiation of Goyllar coal will be directed toward that end. Blending of the various coals for coking will also permit the utilization of the low fixed carbon Goyllar by-products with the relatively high carbon Oyon and Jatunhuasi coals. When Goyllar coal is coked alone, the carbon content must be plus 38%, and washery by-products of lower carbon content must be diverted for use as fuel.

The need for conservation measures is rapidly approaching the urgent category. It is planned that the first step in the program will be to start production in the Jatunhuasi field for non-coking requirements and to make the necessary changes to the Goyllar washery at La Fundicion to reduce by-product production to a minimum. This will permit reduction of Goyllar output to about 65% of current production.

4. Total Requirements of Coal. The total requirements of coal for the life of Corporation mines and custom sources can be approximated only in a very general way. However, it seems pertinent to analyze the relationship between coal and metal on a long term basis.

a. Coke and Lead Smelting. Present estimates of ore reserves in Central Perú indicate that the production of refined lead may reach a total of 1,800,000 short tons, including 500,000 tons of custom lead which, at .3 tons of fixed carbon for each ton of lead, will require a total of 540,000 tons of fixed carbon in the form of coke. The tonnage of lead does not include the lead content of the low grade Cerro pyrite orebody which might increase the figures by about 75%.

The requirement of 540,000 tons of fixed carbon may be reduced to raw coal requirements on several bases, as follows. (The usage of Goyllar coal as listed is on the basis of instituting strict conservation measures.):

| Case | Source | D.S.T. Raw Coal |
|---|---|---|
| 1 | Goyllar raw coal (no mixing with Oyon) | 3,300,000 |
| 2 | Oyon and Goyllar Blend of 50% Oyon raw and 50% Goyllar washed: | |
| | Oyon (raw) | 550,000 |
| | Goyllar (raw) | 1,230,000 |
| | Total | 1,780,000 |
| 3 | Oyon and Goyllar Blend of 75% Oyon raw and 25% Goyllar washed: | |
| | Oyon (raw) | 750,000 |
| | Goyllar (raw) | 550,000 |
| | Total | 1,300,000 |
| 4 | Jatunhuasi and Goyllar Blend of 60% Jatunhuasi raw and 40% Goyllar washed: | |
| | Jatunhuasi (raw) | 710,000 |
| | Goyllar (raw) | 1,100,000 |
| | Total | 1,810,000 |

Thus, in accordance with Case 3 above, it can be visualized that the Corporation might need on the order of 1,500,000 tons of Goyllar coal for smelting all lead ore, including that of Cerro pyrite and other potential lead deposits in Central Perú. As an alternative in case the reserves of coke and coal should be exhausted in the distant future, electric smelting of lead might be resorted to, which would require about half the amount of fixed carbon ordinarily consumed in blast furnace smelting. The technology of this process has not yet been worked out on a commercial basis. The fixed carbon could probably be in the form of anthracite or low volatile coal rather than coke.

The use of Jatunhuasi coal in the blend in place of Oyon coal, as shown in Case 4, would not substantially change the requirement for new coal, but would increase the Goyllar requirement as compared to Case 3.

b. Coal for Sterling Process. Total future production of recoverable zinc in Corporation mines may eventually reach 3,500,000 tons, not including zinc in the low grade Cerro pyrite ores. The Sterling Process requires approximately .3 tons of fixed carbon per ton of zinc produced, or a total of 1,050,000 tons of carbon. The equivalent tonnage of anthracite coal at 80% fixed carbon would be about 1,310,000 tons. If the Cerro pyrite orebody and other potential sources of zinc in Central Perú are considered, the total possible requirements might be doubled or even tripled.

c. Carbon for Ammonium Sulphate Manufacture. The proper type of coal for use in an ammonium sulphate plant, which is now under consideration, is not precisely known. It is believed that a 200-ton-per-day plant would require some 80 tons of fixed carbon or, if anthracite is to be used, about 100 tons of coal per day. Forty years' operation of such a plant might, therefore, require some 1,400,000 tons of anthracite coal.

The use of coal in the manufacture of ammonium sulphate can be largely eliminated by deriving the necessary hydrogen by electrolysis of water. This process, while economically and technically proven (e.g. Trail, British Columbia), requires a large capital investment for the necessary electrical energy.

d. Reverberatory Fuel. At the present time the annual fuel consumption in the reverberatories is about 7,500 tons of coal, 27,000 tons of fuel oil, plus 3,100 tons of oil equivalent from coke oven by-product gas and tar. Consumption of coal is in the form of washery by-products which cannot presently be used for other purposes. The cost of fuel oil is expected to increase in the future and may reach a point at which coal becomes competitive. In that case, the equivalent to 27,000 tons of oil in the form of coal would be about 55,000 tons of Jatunhuasi grade per year. With an increase in lead production, additional coke requirements will result in increased quantities of by-product tar and gas. Therefore, if oil fuel were eliminated, the net maximum annual requirement would be about 60,000 tons of Jatunhuasi coal.

In the case of copper reserves, it is difficult to estimate a total metal content of possible ores in Central Perú. Coal is competitive with oil only if coal reserves are more than adequate for all purposes. A provision of 1,000,000 tons of coal for reverberatory fuel appears to be adequate.

e. Miscellaneous Requirements. Miscellaneous requirements include coal for steam production, railroads, space heating and minor smelter uses. During 1951 a total of about 30,000 tons of raw and washed coal containing about 32% carbon were consumed. If the higher grade Jatunhuasi coal is used, the requirement would be about 25,000 tons, which may increase to 40,000 tons per year in the future. Thus, a forty-year supply would be about 1,600,000 tons. Goyllar coal will continue to provide some quantity of by-product coal for miscellaneous uses. As it is expected that such production will decline rapidly, the by-product tonnage will be small.

f. Summary of Coal Requirements:

| | D.S.T. |
|---|---|
| Coking Coal, | |
| Goyllar | 2,000,000 |
| Jatunhuasi | 1,300,000 |
| Sterling Process, | |
| Anthracite or High Carbon | |
| Oyon | 2,600,000 |
| Ammonium Sulphate Plant | |
| Anthracite (?) | 1,500,000 |
| Reverberatory Fuel | |
| Jatunhuasi or Oyon | 1,000,000 |
| Miscellaneous | |
| Jatunhuasi or Oyon | 1,600,000 |
| | 10,000,000 |

With the possible exception of anthracite coal, the present reserves at Goyllar, Oyon, Checras and Jatunhuasi are considered to be sufficient for the above needs. Anthracite can be purchased from Chimbote, but the source might not be dependable on a long term basis. While there are adequate reserves of anthracite in this field, the marketing policy of the present owners is quite unpredictable.

Coking coal listed above will provide about 1,000,000 tons of fixed carbon in the form of coke. To provide the same amount of carbon from a mix of 25% Goyllar and 75% Oyon, 1,100,000 tons of the former and 1,350,000 tons of the latter would be required.

5. Annual Requirements of Coal. The following table shows the estimated coal requirements during the next six years:

| | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 |
|---|---|---|---|---|---|---|
| Coking Coal | 120,000(1) | 72,000(2) | 72,000(2) | 62,000(3) | 62,000(3) | 87,000(3) |
| Sterling Coal | 7,000 | 10,000 | 10,000 | 20,000 | 25,000 | 25,000 |
| Ammonium Sulphate | - | - | - | 30,000 | 30,000 | 30,000 |
| Reverberatory Fuel | 7,000(1) | 6,000(4) | 6,000(4) | 6,000 | 6,000 | 6,000 |
| Miscellaneous | 30,000(1) | 25,000(4) | 25,000(4) | 30,000 | 40,000 | 40,000 |
| Total Coal | 164,000 | 113,000 | 113,000 | 148,000 | 163,000 | 183,000 |

The source of the requirements might be as follows:

| | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 |
|---|---|---|---|---|---|---|
| Goyllar | 140,000 | 50,000 | 50,000 | 27,000 | 27,000 | 37,000 |
| Oyon or Jatunhuasi | 0 | 22,000 | 22,000 | 35,000 | 35,000 | 50,000 |
| Jatunhuasi | 17,000(5) | 31,000 | 31,000 | 36,000 | 46,000 | 46,000 |
| Anthracite (from various sources) | 7,000 | 10,000 | 10,000 | 50,000 | 55,000 | 55,000 |
| Total | 164,000 | 113,000 | 113,000 | 148,000 | 163,000 | 188,000 |

(1) Goyllar
(2) Goyllar 50%, Oyon (or Jatunhuasi) 50%
(3) " 25% " 75%
(4) Jatunhuasi
(5) Possibly from Goyllar

6. Reserves of Coal. The question of coal reserves in the various fields can be answered in a general way, as follows:

| | Proved and Probable | | Possible | Total |
|---|---|---|---|---|
| Goyllar | 1,960,000 | | 1,000,000 | 2,960,000 |
| Checras | no data | | Substantial | |
| Oyon | no data | High Carbon - | 2,000,000 | |
| | | Coking - | 4,000,000 | |
| | | Other - | 6,000,000 | 12,000,000 |
| Jatunhuasi | no data | | 10,000,000 | 10,000,000 |
| Chimbote | | Plus | 2,000,000 | 2,000,000 |
| | | | 25,000,000 | 26,960,000 |

While the total tonnage of coal available is in all probability much more than sufficient for the future needs of the Corporation insofar as fuel and coke are concerned, there remains the question of a sufficient supply of anthracite or a high carbon substitute for reduction purposes in the Sterling and Ammonium Sulphate plants. The two plants may eventually require a total of 4,000,000 tons of that class. Present indications are that at least a part of the high carbon coal requirements may be developed in the Oyon and Checras field. Oyon coal, on the other hand, is inferior as an all purpose fuel to that of Jatunhuasi because of its physical characteristics.

7. Property Acquisition. As previously mentioned, acquisition of ground is going forward in both the Jatunhuasi and Oyon fields, principally by option and denouncement.

No open ground exists in the Oyon field, which is held largely by the Peruvian Government, the Delgado, and the Fernandini families. Preliminary working arrangements have been made with the first two, and it is expected that the rights of the Fernandini's can be obtained on a reasonable basis. The Checras area, just south of Oyon, is, with the exception of a few claims, covered by a Corporation exploration denouncement.

At Jatunhuasi the most favorable part of the coal formation is held by the Loret de Mola family. It is now believed that the ground is obtainable for $130,000. This, together with certain Corporation ground and recent exploration denouncements, will give the Corporation control of the field.

The properties mentioned do not cover all possible reserves listed in Section 6 herein. They do, however, cover sufficient ground to provide for reserves for many years, and also would put the Corporation in a good position for dealing with the other minor property holders.

8. Cost of the Program. It is presently estimated on a most provisional basis that the cost of bringing the respective fields into production would be approximately as follows:

Jatunhuasi (at 170,000 tons per year)

| | |
|---|---|
| Property | $ 200,000 |
| Development and Equipment | 2,000,000 |
| | $2,200,000 |

Oyon (at 170,000 tons per year)

| | |
|---|---|
| Property | $ 100,000 |
| Development and Equipment | 3,000,000 |
| Transportation and Facilities | 2,000,000 |
| | $5,100,000 |

The heavy cost of transportation from Oyon includes a 75 km. road, trucks and all facilities. There is a possibility that a part of the cost of a road might be underwritten by the Government, in which event the cost of the Oyon development would be substantially reduced from the above figure.

In comparing the necessary investment in the two fields, it should be borne in mind that a small and inexpensive operation at Oyon is not feasible, whereas at Jatunhuasi the cost of a 30,000-ton-per-year plant without a washery would be approximately as follows:

| | |
|---|---|
| Property | $200,000 |
| Development and Equipment | 525,000 |
| | $725,000 |

9. Production Costs. The significant cost basis for any coal should be the unit cost of contained carbon in the case of coking coal, and coal used for reduction purposes, and the unit cost per BTU for coal used as fuel.

For mine run coal, the estimated production costs from the three fields delivered to rail head compareas follows:

| | Per Ton of Coal | Per Ton of Carbon | Per Million BTU's |
|---|---|---|---|
| Goyllar (1951) | $4.73 | $23.50 | $0.390 |
| Oyon at 170,000 tons/yr. | 7.21 | 12.00 | .328 |
| Jatunhuasi at 30,000 tons/yr. | 5.60 | 13.50 | .285 |

Obviously, the above costs would be modified by present and future washing practice, and rail transport costs. However, a comparison of costs for coal delivered at Oroya is complicated by various by-products of La Fundicion washery, and their end use, and could not be presented without a lengthy analysis.

10. Program of Development. The foregoing demonstrates that it is improbable that adequate supplies of all classes of coal can be obtained from any one field. Therefore, the Corporation, in order to insure continued efficient operation, may find it necessary to develop both Jatunhuasi and Oyon. However, a decision must be made as to which field to develop first. The relative factors can be summarized as follows:

a. Jatunhuasi. The field may be put into production on a limited basis with a relatively low investment. Its accessibility, the fact that only one property purchase is involved, and the ease with which the regular coal beds can be developed, are all in its favor. The coking properties of the coal, while inferior to that of Oyon, are considered to be satisfactory. The only objection to Jatunhuasi is that there is no possibility of developing suitable Sterling fuel.

b. Oyon. The field will require the heavy investment of a 75 km. road even for a small operation. Several properties, including a Government coal reserve, are involved. Preliminary tests during 1951 indicated that Oyon coal might make coke without blending. Recent tests have proven that this is not the case, and that Goyllar coal must be blended. While there is a fair possibility for development of Sterling fuel at Oyon, test work to date has not given tangible results.

In view of the above facts, the Management is now considering an approach to the problem as follows:

(a) Acquire all possible property at Jatunhuasi and obtain a foothold in Oyon. This phase of the program is already under way.

(b) Develop Jatunhuasi to produce coal at the rate of 30,000 tons per year for use as fuel, as a substitute for Goyllar coal.

(c) Make certain changes to La Fundicion coal washery in order to conserve Goyllar coal.

(d) During development and early operation of Jatunhuasi, the questions of cokability, and of the doubtful supply of high carbon coal for Sterling Process use can be investigated fully.

(e) Until the problem of Sterling coal is solved, Chimbote anthracite and imported coal can be used. Negotiations for supplies of Chimbote coal are now in progress. A year's supply of imported anthracite is already on hand.

(f) If and when it is proven that Jatunhuasi cannot supply the grades of coal required, Oyon will be developed.

During the past two years the Corporation has retained the services of Mr. Evan Bennett, Coal Consultant, who has advised the management on the conduct of the coal program. His two reports, the first dated June 1, 1951, and the second dated July 1, 1952, give detailed information regarding all phases of the program. Appendices attached to this memo were summarized from Mr. Bennett's reports and other sources in the files of the Corporation.

In late 1951 the Curran Coal Carbonizing Co. carried out coking tests of various mixtures of Oyon, Jatunhuasi, and Goyllar coal at their St. Louis laboratories. Mr. John E. Cox of the Curran Company supervised additional tests carried out at Oroya early in 1952.

The Ayrshire Collieries Co. is presently making washability tests on the Jatunhuasi coals. Tests have been completed on Oyon coal, and a summary of the results is included in Appendix C.

Robert P. Koenig

RPK:fns:jc
Enclosures - Appendices A,B,C, D; Map.

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Appendix A
To Memo to Directors No.35-52
Dated July 14, 1952

GOYLLARISQUISGA MINE

* * * *

The Goyllarisquisga mine has produced a total of more than 7,000,000 tons of coal to date. The possibility is remote for finding any substantial tonnage in addition to the present reserve of 1,960,000 short tons of coal.

In the area to the west of Goyllar are numerous coal outcrops, some of which have been exploited in a small way. Thoroughgoing exploration has not developed any indication of economic coal deposits.

The only possible area for developing any sizeable tonnage in the Goyllar field is the eastern limb of the basin in which the Goyllar mine is located. The area is presently being explored by underground workings from the Goyllar mine, and by drilling from the surface. Indications are that coal may exist in an area of several square miles. The 1,000,000 tons of possible coal listed in Section No.6 are a measure of the potentialities of the area. However, recent development has shown that the ground is faulted and broken, and at this writing, the possibilities for developing 1,000,000 tons of mineable coal are not considered to be good.

In addition to the problem of sufficient reserves, Goyllar is under the handicap of a very poor grade of coal. Cost of the coal mined is reasonably low, but costs per unit of fuel value are excessive. As exploration and development of the basin proceed, the difficulties in handling and transporting the coal increase. As a result, the present reserves and the possible coal in the eastern part of the basin would be mined at a higher cost than present production. Because of the irregular and broken nature of the coal seams, modern mechanical mining tools cannot be used to advantage.

Appendix B
To Memo to Directors No.35-52
Dated July 14, 1952

JATUNHUASI

* * *

The Jatunhuasi deposit lies about 80 kilometers south of Oroya and extends some 25 kilometers in a southeasterly direction from the southern part of the Yauricocha railroad (see map attached). Some 10 kilometers of the outcrop are within 1 to 2 kilometers' trucking distance from the railroad.

1. Geology and Coal Deposits. The Jatunhuasi coal is in the same formation in which coal occurs at both Goyllar and Oyon. It is, however, much less disturbed by deformation than the other two. The coal outcrops may be traced fairly continuously throughout its strike. The coal measures take the form of a syncline, the eastern limb of which outcrops as indicated on the attached map. The syncline is known to be 10 to 12 kilometers in width, but the western outcrop shows little coal. A number of small developments, including the Corporation's Cosmos and Negro Bueno mines, show that the coal thickness varies between 55 cm. and 1 meter. The dip of the coal is fairly regular at 25 to 30 degrees to the southwest. In the major part of the field the regularity of the formation lends itself to low cost mining by standard methods. Both the roof and floor of the seam are hard and stand well. It is expected that mechanical equipment will be applicable.

2. Reserves. In 1922 four drill holes were put down by the Corporation calculated to cut the seams 1,000 meters down the dip from the outcrops. Two holes showed coal at 77 and 86 cm. thickness, a third cut an igneous sill at the coal horizon, and the fourth showed no coal.

On the basis of 24 kilometers length, 1,000 meters down the dip, 70 cm. thickness and a 50% factor, Bennett calculates that 8,736,000 tons of coal may exist. The figure is rounded off to 10,000,000 tons in Section 6 of this memorandum. Actually it is possible that the coal may extend considerably more than 1,000 meters down the dip.

3. Properties. The following is quoted from Bennett's report of July 1, 1952:

> "Of the 24 kilometer band of coal along the east leg of the Jatunhuasi syncline, the north half is fairly well controlled by the Cia. Minera de Jatunhuasi, owned by the Loret de Mola family. Negotiations with them have been under way for several weeks, and it seems likely we may be able to buy their holdings outright for $125,000.
>
> "To the south of their holdings, the Rizo-Patron group owns a band over three kilometers long. They were approached regarding an option, as was also Pascual Lehter who owns the Victoria claims, at the south end of the field, without definite action to date.

"Before approaching these owners and revealing our renewed interest in the Jatunhuasi field, the Corporation wisely filed a blanket exploration denouncement, to forestall interlopers."

4. Washability. The Aryshire Collieries Corp. is now making washability tests on Jatunhuasi coal, and the results are not yet available. The chief problem is to eliminate the high sulphur content as well as to eliminate ash.

Preliminary experiments at Oroya have indicated that the coal is amenable to sink-float treatment which may increase the carbon content from about 48% to 57%.

5. Coking. The following is quoted from Bennett's report of July 1, 1952:

"Six samples were taken in four mines - the Nueva Selica, Negro Bueno, Cosmos, and Isolina mines. Samples 5, 6 and 7 were taken from ten meter winzes, mostly below water level, while 1, 2 and 3 came from long exposed faces on the main working levels. On these six samples and combinations of them we ran 35 tests.

"None yielded a standard coke without blending. One only took 20% of Goyllar, and one took 49%. The average Goyllar required was 39%.

"Oxidation: repetition of tests 30 days after initial test showed no difference. The fact that deep level samples, below water table, were no better than samples from long exposed faces indicates that the coal does not oxidize or deteriorate in cokability.

"Depth: Deep level samples showed no important difference in cokability."

6. Analysis. Jatunhuasi coal is classed as medium volatile bituminous, and is remarkably uniform throughout the length of the field. The approximate analysis of mine run coal is as follows:

| | |
|---|---|
| Moisture | 6.0% |
| Volatiles (dry basis) | 28.0 |
| Fixed Carbon " " | 48.0 |
| Ash " " | 18.0 |
| Sulphur " " | 6.0 |

The fixed carbon can be increased to plus 50%, and the ash and sulphur contents reduced, by means of hand picking.

Appendix C
To Memo to Directors No.35-52
Dated July 14, 1952

# OYON-CHECRAS

* * * *

The coal formations of the Oyon and Checras areas are more or less contiguous, and in a geological sense form a single field. From an operating standpoint, however, they should be regarded as separate units.

1. Geology and Coal Deposits. The Oyon coal occurs in a tightly-folded anticline which is exposed along the valley of the Conocpata river just west of the Continental Divide at a point due west of Cerro de Pasco (see attached map). The formations and the coal are somewhat broken by faulting. Some of the coal exposures are quite wide and in a few areas are as much as 3 to 10 meters in width. Generally the coal is steeply dipping, soft and the walls are weak. For these reasons, the extraction method would necessarily be similar to the flat back cut and fill method used in mining metallic veins.

2. Reserves. The most important deposits occur in what is known as the Conocpata area, which has been under detailed examination for the past seven months. The area is about 4 by 1.5 kilometers and is believed to contain the 10,000,000 tons of coal listed in Section 6, of which about 4,000,000 tons may be suitable for coking. Some deposits exist outside the Conocpata area, but the tonnages are not large.

The reserves in the Checras area have not been estimated, but are probably much less than those of the Oyon area.

3. Properties. The Oyon area, including the Conocpata block is covered by a Government Coal Reserve and privately-owned claims within the Reserve, and is not open to further denouncement. Some years ago the Government made an examination of their holdings, but decided not to start mining operations, chiefly because of the high cost which would not be competitive with other fuel sources for use in the Lima area. Preliminary discussions have been held with the Government agencies involved. It has been determined that the Corporation may obtain mining rights on a reasonable basis, but no definite offer has yet been made by either party.

Privately-owned claims are as follows:

a. The Delgado family holds approximately 42 hectares, which have been optioned for two years by the Corporation for $72,365, with monthly payments of $140. The original option began in November 1951.

b. The E. Minaya holdings of 8 hectares were optioned for $2,000, payable in one year from February 1952.

c. The Sotel family holds three claims in the Conocpata block which are obtainable for $32,000. No option has been signed.

d. The Vallejo family holds four claims in the Conocpata block No offers have been made by either party.

In the Checras area, which is covered by a Corporation exploration denouncement (see map attached), are a few privately-held claims. The Parquin prospect, which contains anthracite coal, is obtainable on a two-year option at S/500,000 ($33,000).

4. Washability. Tests recently completed by the Ayrshire Collieries, Corp. show that washing of Oyon coal is is not economically attractive. It was found that the coal breaks down easily to very fine sizes (28.7% minus 100 mesh wet screening). It is not only difficult to wash, but also the product contains excessive moisture. Efficient washing would decrease the ash content by 11%, but at the same time the moisture content would be increased by 10.5%, and would necessitate thermal drying. The tests indicate that the only practical approach to beneficiation is by tabling, flotation, and filtration of the product.

5. Coking. The coking qualities of coal from the Conocpata area are variable. Tests early in 1952 indicated that much of the coal could be coked without blending with Goyllar. More recent tests have shown that there may be very little or no coal which will coke alone.

Approximately 150 tests have been run on 39 samples of Oyon coal and its mixtures with Goyllar coal. Only four of the 39 samples made acceptable coke without blending. In an average of all tests 36% of Goyllar coal was required to make standard coke. The average for the northern part of the Conocpata anticline was 32% Goyllar.

Mr. Bennett's interpretation of the tests (see his report dated July 1, 1952, page 27) are as follows:

> "(1) Moisture content is an index of weathering and will diminish in depth, with an increase in cokability.
>
> (2) Tongues of weathered zones extend to considerable depth and will make the coking quality quite irregular along the strike.
>
> (3) Faults and folding make sharp changes in the FC/V ratio, affecting the cokability from place to place.
>
> (4) At plus 60 meters depth, the average Goyllar blend required will probably be between 20 and 25%, with local variations of 0 to 60% which will be extinguished by spreading operations along the strike and stockpiling.
>
> (5) Oyon coal oxidizes rapidly and loses cokability. It should be used in not over 45 days after mining. In four to six months it loses practically all its coking power and will require 50 to 60%

Goyllar to make good coke. Development openings in the coal seams far in advance of mining have a considerable adverse effect."

6. Analysis of Coal. The classification of Oyon and Checras coals varies from a true anthracite to medium volatile bituminous. In the Conocpata area, and predominently elsewhere, it is a low volatile bituminous coal. The sulphur content is low everywhere in the field. Moisture is generally one or two percent in unweathered samples, but may be higher locally.

Mr. Bennett gives the average analysis of Conocpata coal in channel samples as follows:

| | |
|---|---|
| Moisture | 1.5% |
| Volatiles (dry basis) | 16.4% |
| Fixed Carbon (dry basis) | 66.3% |
| Ash " " | 16.1% |
| Sulphur " " | 1.2% |

Selected coal from certain parts of the Conocpata area, some of which is sold in small quantities to the Corporation, analyzes (dry basis), as follows:

| | |
|---|---|
| Volatiles | 15.0% |
| Fixed Carbon | 75.0% |
| Ash | 9.0% |
| Sulphur | 1.0% |

At the Janquil and Parquin showings in the Checras area a number of samples have been obtained, analyzing roughly as follows:

| | |
|---|---|
| Moisture | 1 to 6% |
| Volatiles | 3 to 12% |
| Fixed Carbon | 75 to 90% |
| Ash | 4 to 13% |
| Sulphur | .6 to 1.2% |

Appendix D
To Memo to Directors No.35-52
Dated July 14, 1952

REPORTS ON THE OYON AND JATUNHUASI COAL FIELDS

* * * *

Report on Oyon Coal Field, D.H.McLaughlin, 1921

Report on Jatunhuasi Coal Field, D.H.McLaughlin, January 23, 1922

La Zone Carbonera de Oyon y su Posibilidads Economicas, Banco Minera de Perú, April 13, 1946

Oyon-Pampahuay, Alberto Benadides, February 5, 1950

Coking Tests, Curran Carbonizing Co., May 1951

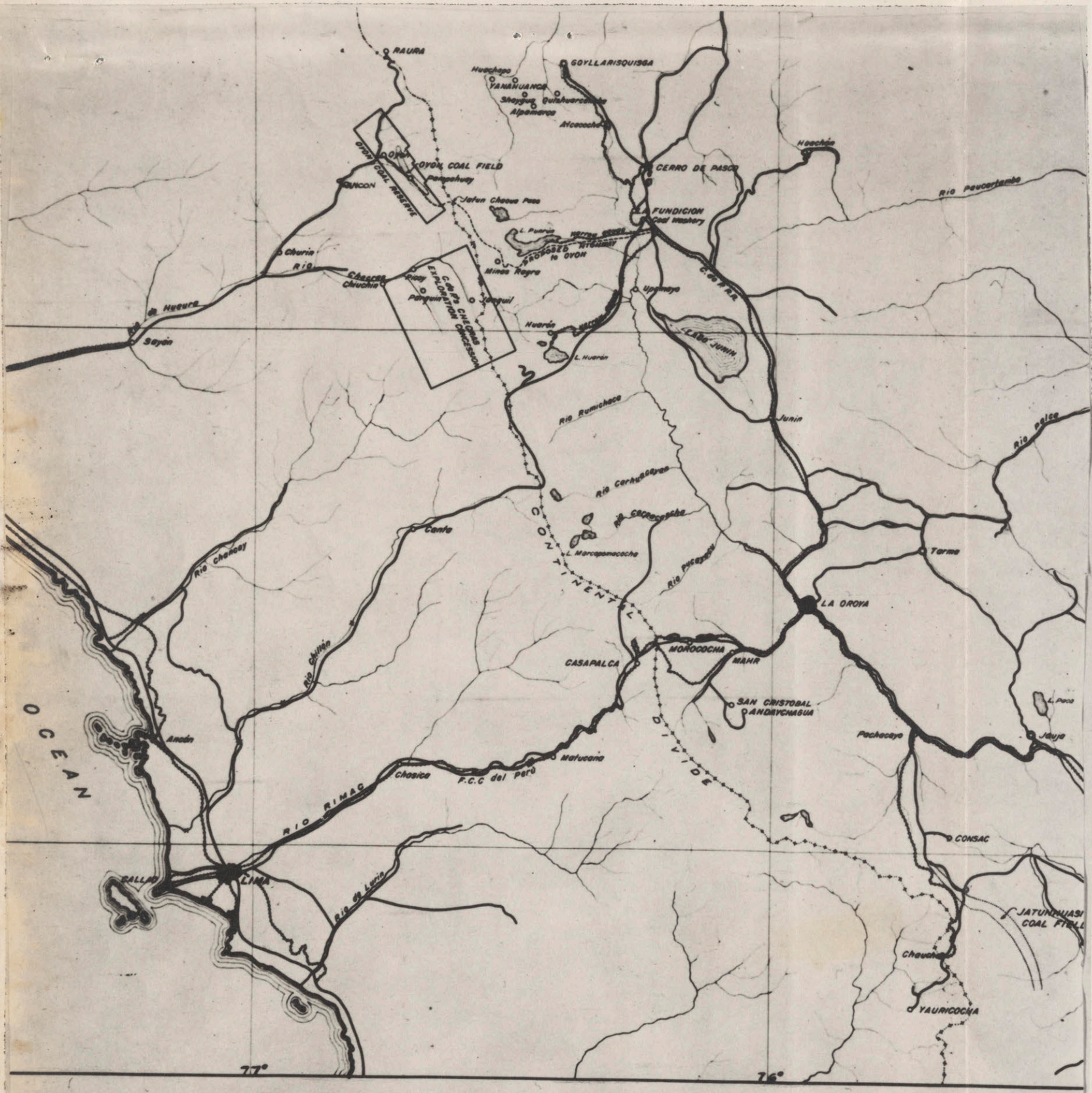
Report of Coal Investigations, Evan Bennett, June 1, 1951

Oyon Progress Report No.1, J. Birkbeck, October 6, 1951
Oyon Progress Report No.2, " " December 2, 1951
Oyon Progress Report No.3, " " February 23, 1952

Summary of Oyon Coking Tests, J. Canales, March 25, 1952

Summary of Tests made in Oroya, Perú, on Oyon Coal, Curran Carbonizing Co., John E. Cox, March 28, 1952

Coal Report, Evan Bennett, July 1, 1952




# PART OF CENTRAL PERU

SHOWING

# COAL FIELDS IN EXPLORATION

By CERRO DE PASCO COPPER CORPORATION

0 10 20 30 40 50 60

SCALE, KILOMETERS

January 31, 1951