SUMMARY

OF

THE BOWRON RIVER COAL PROJECT

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1.0 PROJECT SUMMARY

Norco Resources Ltd. of Vancouver, Canada has explored the coal measures of the Bowron River Basin near Prince George, British Columbia, Canada over the past seven years. To date, this exploration has proven 50 million metric tonnes of high quality thermal coal which can be economically extracted by underground mining methods for sale to utilities and cement manufacturers. This coal is unusual in that it contains up to 3% (by volume) of clear amber resin particles which may prove to be a valuable by-product to the coal operation.

The project is conveniently located 40 miles from the city of Prince George which is considered to be the hub of B.C. transportation due to its central location. Two separate rail lines pass within 40 road miles of the property providing excellent access to two coastal coal ports either at Prince Rupert or Vancouver.

Norco signed a sales contract with Taiwan Power Company (T.P.C.) of Taiwan, R.O.C., in March, 1980, which was revised in April, 1982, to reflect their most recent coal demand. The latter agreement called for the delivery of 12,650,000 tonnes of the Bowron River coal over 24 years. It was also agreed that T.P.C. would invest C$15 Million dollars into the project for a 15% equity position.

However, due to the continuing world economic recession, negotiations with T.P.C. have slowed to such an extent that it appears the project has been put on hold until the next upswing in the coal cycle. Norco is now free to negotiate with any other interested end user.

2.0 PROJECT DESCRIPTION

2.1 Location and Access

The mining property lies approximately 40 miles E.S.E. of the city of Prince George in the province of British Columbia (Figure 1). It is situated in the middle and lower reaches of the Bowron River which, in turn, is a major tributary of the Fraser River. Access to the site from Prince George is via Highway 16 and well-maintained logging roads over the last eight miles to the actual location of the proposed surface facilities and underground mine entries. The coal produced from the preparation plant will be trucked either north to Hansard on the Canadian National Railway or west to Buckhorn on the British Columbia Railway. The former option would deliver the coal to the new Ridley Island coal terminal in Prince Rupert, B.C., while the latter would result in the coal being shipped through an existing facility in North Vancouver, B.C. The most appropriate route will be chosen after final negotiations with all interests concerned are completed.

2.2 Topography

The valley itself is flat-bottomed and surrounded by low hills having a maximum elevation of 2,000 feet above the valley floor. The Bowron River meanders along the western side of the valley, which is generally 5,000 feet to 7,000 feet wide. The valley floor is mainly glacial till, usually in the form of a ground moraine which covers the underlying bedrock as a blanket. There are some aquifers in the loose surface material, giving marshy conditions in portions of the valley floor.

2.3 Geology

The coal seams occur in sediments of Cretacous-Tertiary age consisting of conglomerates, sandstones, shales, and breccias. These sediments occupy the central valley area in the form of an assymetrical synclined basin with a steeply pitching flank on the western side and gently tipping or flat-lying strata on the eastern side. The hills on the perimeter of the valley are composed of volcanic rock of the Mississippi age, against which the sediments terminate. An independent geological summary is appended in Appendix VI.

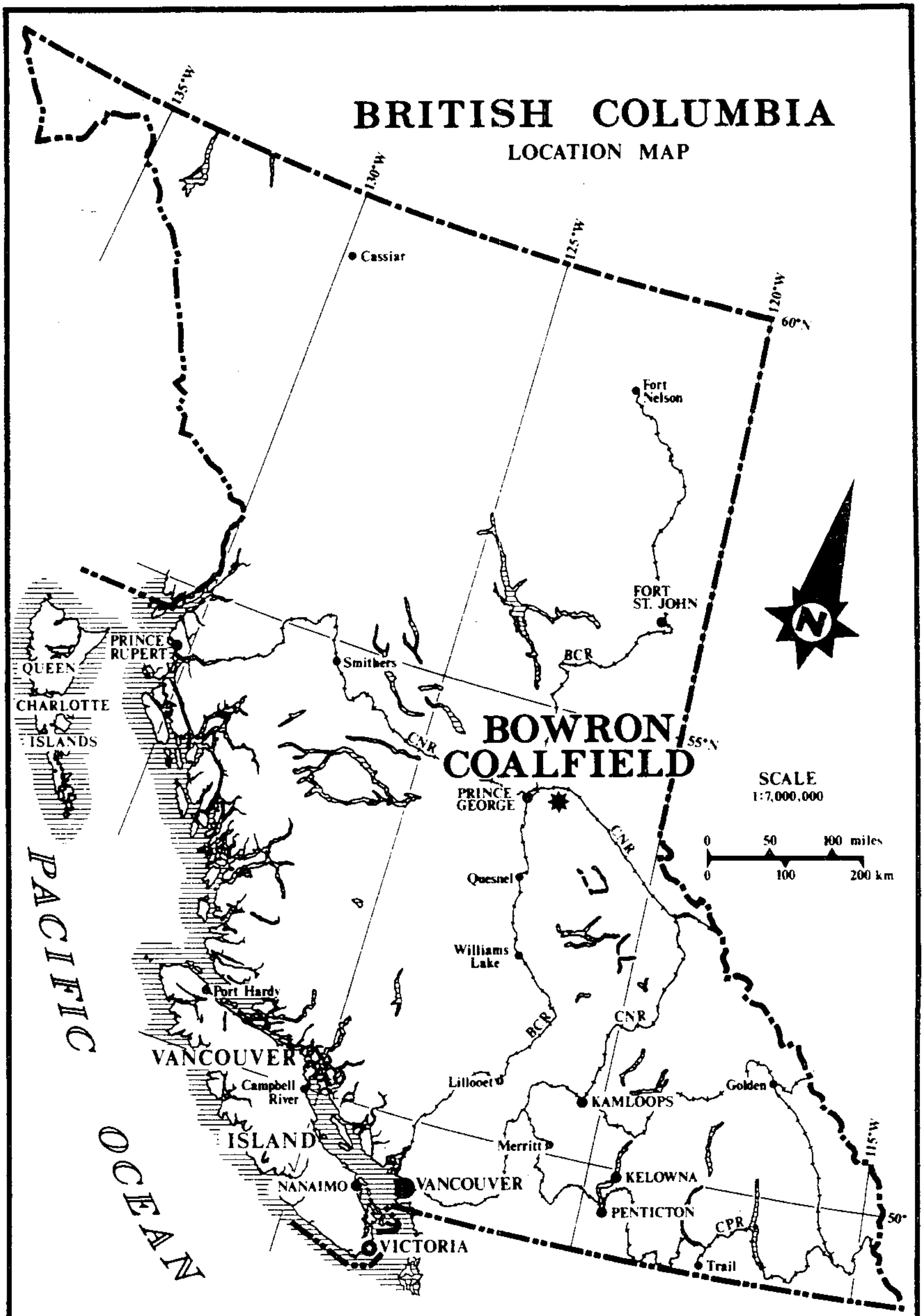
2.4 Exploration

In 1967, Northern Coal Mines Limited began an exploration programme on the property intending to sell the product on the Japanese market. Exploration by diamond drilling plus the drifting of two adits permitted the computation of coal reserves by Dr. J.M. Black at 21 million tonnes of in situ coal.

Bethlehem Copper Corp. negotiated an option agreement with Northern Mines in 1971 to explore the basin for metallurgical coal. A five-hole diamond drilling programme was conducted on the east side of the river. Since the coal uncovered was high grade bituminous "B" and not metallurgical coal, the option was dropped.

The following year, due to a lack of interest on world markets in thermal coal, Northern Coal Mines dropped all but three of its coal licences and deferred all further activity.

In 1976, Norco Resources Ltd. (a reorganization of Northern Coal Mines) resumed exploration work on the property. The old north workings were reopened and a large bulk sample was extracted for analysis purposes.



IGNA engineering & consulting ltd.	NORCO RESOURCES LTD. **BOWRON COALFIELD**	DATE
		FIG. No. 1

The following year, an extensive diamond drilling programme was initiated under the supervision of J.R. Kerr, P. Eng. The results of this drilling combined with previous work set a potential for 80 million tonnes of coal resources in the Bowron River Basin.

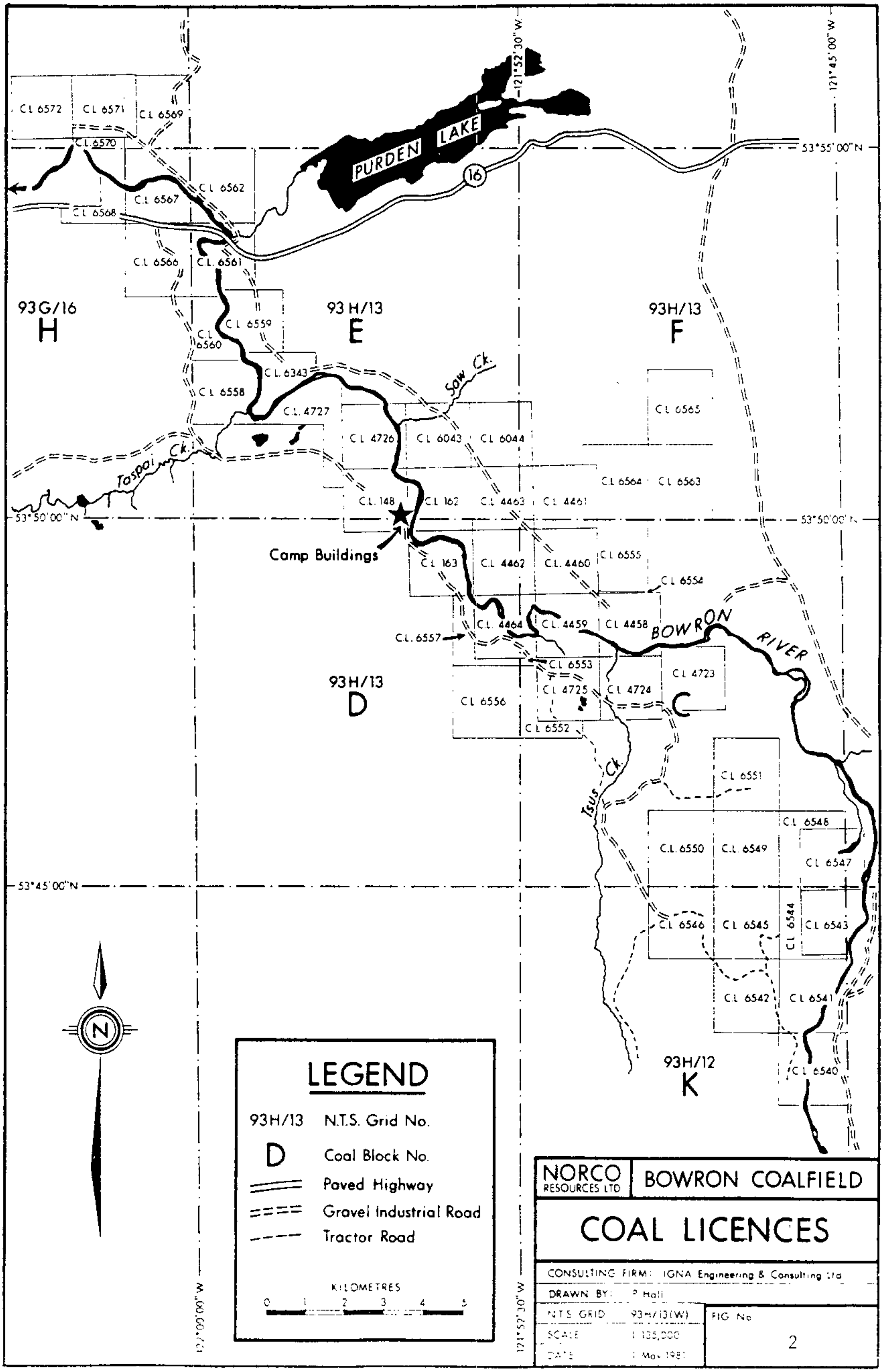
In February, 1978, six new licences were obtained by application from the Crown, while seven other adjoining licences were purchased from Zulu Explorations Ltd. (N.P.L.)

Throughout 1980, an exploration programme supervised by I. Borovic, P. Eng., of Igna Engineering and Consulting Ltd. was conducted south of the 1977 drilling area. Geological mapping, a seismic survey, diamond and rotary drilling with electrologging of the drill holes extended the known area of the basin and proved up additional reserves of 7.4 million tonnes of coal. Concurrently, as the exploration programme expanded the area of interest, new coal licences were applied for and obtained from the Crown. As of December 10, 1980, the property comprised 15 coal licences covering an area of 30,119 acres (see Figure 2).

To date, proven reserves have been independently calculated by Ruben Verzosa, P. Eng., to be 49,904,280 tonnes in the six licences explored. The potential reserves in the area yet to be explored is a further 96,076,800 tonnes using a 40 percent geologic factor to represent the confidence level.

2.5 Coal Quality

The analyses of the core hole samples indicate that the washed product will be very suitable for marketing as a high grade thermal coal with acceptable sulphur content to comply with environmental standards for stack emission. It is hard, with a high lustre, and is classed as high volatile bituminous "B" by A.S.T.M. standards—a fact which is confirmed by a mean maximum reflectance index of 0.65.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93G/16
H
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E
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F
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D
C
93H/12
K
Sow Ck.
Taspai Ck.
Tsus Ck.
BOWRON RIVER
Camp Buildings
C.L. 6572
C.L. 6571
C.L. 6569
C.L. 6570
C.L. 6562
C.L. 6567
C.L. 6568
C.L. 6566
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LEGEND
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NORCO RESOURCES LTD
BOWRON COALFIELD
COAL LICENCES
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N.T.S. GRID 93H/13(W)
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FIG. No
2

After mining, the coal will be washed in a coal preparation plant to remove shale and other impurities, thereby producing a consistent product for marketing. The plant will be designed to yield 900,000 tonnes per annum of clean coal with the following specifications:

Size	2" x 0
Total Moisture Content	8% - 10%
Inherent Moisture Content	2.5% - 3.0%
Ash Content	9.5% - 12%
Volatile Matter	33.5% - 35%
Sulphur	0.9% - 1.2%
Heating Value	12,200 - 12,700 BTU/lb.

2.6 Amber Resin

The Bowron River coal is quite unique in that it contains a clear amber colored resin which occurs as elongated blebs throughout the seam and shale partings. This amber resin (principally esters with very little ash) averages by visual estimation and tracing to over 1% of the seam by weight and with a specific gravity of 1.05 can be separated using standard gravity methods including froth flotation. The material has a softening temperature at over 800 degrees fahrenheit and is substantially insoluble in the conventional solvents.

The characteristics of this particular type of resin find an application as a substitute for expensive synthetic resins now being used in the manufacture of high temperature plastics, electrical insulators, and protective coatings (ref. Appendix I).

While there is much marketing work still to be done on this potentially valuable by product there can be reasonable expectation that significant revenues will be added to the project at very little expense to operations and capital as is shown in the Cash Flow Statements (Appendix IV and V).

2.7 Mining Methods

The property will be developed and exploited by the well-proven mining methods of continuous mining with pillar extraction by hydraulic monitor. After an initial five-heading development to the deepest area of the mine, an underground dewatering station will be installed to permit the operation of the most efficient method of transportation of the run-of-mine coal from the hydraulic and continuous mining sections via conveyors and pipline to the surface preparation plant. Production panels will be opened up by driving parallel two-heading drivages at 14 degrees to the rise leaving 300 ft. panels of coal between these main entries.

These panels so formed will be further divided by similar machines into 45' x 300' pillars for their later removal by hydraulic mining. In all, four roadheader type machines (one standby) and 2 hydraulic monitors (one standby) will be used to produce 881,000 metric tonnes of clean coal per annum. All coal will be sluiced from the face to the underground dewatering station. Preparation plant refuse material will be used to hydraulically stow the voids under the Bowron River created by the removal of the pillars, thereby serving the dual purpose of increasing the extraction percentage and lowering the environmental impact of surface waste disposal.

A full evaluation of all the mining techniques has been made in relation to production, manpower requirements, transportation, etc. with independent validation by international consultants. It is a common consensus that the project is economically viable under the mining plans proposed (ref. Appendix II and III).

APPENDIX II

PETER REES REPORT

APPENDIX I

MEMO DESCRIBING AMBER RESIN

NORCO RESOURCES LTD.

VANCOUVER, B. C.

MEMO DESCRIBING AMBER RESIN FOUND IN NORCO COAL DEPOSIT

K. DOUGLASS, P. ENG.

DIRECTOR, ENGINEERING SERVICES

AUGUST, 1979

MEMO DESCRIBING AMBER RESIN FOUND IN NORCO COAL DEPOSIT

1. Resin as Found in Coal

1 (a) A distinctive feature of the Norco deposit is the presence of two types of resin. They have been studied in the Battelle Memorial Institute in 1966 and 1967.

1 (b) The more common resin is finely disseminated, and is referred to in the Norco reports as "Refined Resin". It is a mixture of ester and carboxylic acid, and is readily soluble in conventional solvents. In application, this resin would compete with a synthetic in the paint and varnish industry, at a price of about $1.40 (U.S.) per pound (Rubber World, June, 1979). Although this material can be separated from the coal by solution, it is considered to be inferior to the associated Amber Resin, and the present operational plan calls for leaving this Refined Resin in the coal product, except for the minor amount that may be separated with Amber Resin.

1 (c) The Norco Amber Resin occurs as blebs in the coal and in shaly partings, as much as 15 mm in diameter, but generally flattened and elongated. Although this material has been studied in very small volumes, the Battelle reports give its composition as principally ester, with very little ash, and a softening point of about 450^{o} C. The material as mined is substantially insoluble in the conventional solvents. The unique characteristics

of this material promise applications in the fields of plastics and protective coatings, and the present operational plan provides for the recovery of a substantial volume of Norco Amber from the coal product. The material would be cleaned at the mine-site for shipment to market.

Norco Amber Resin is a clear, light-amber-colored material that can be identified readily in the coal. The material is very friable, and tends to fracture into small particles as the coal is crushed. The percentage to be found in the coal has been determined by tracing the outline of blebs exposed on the exterior surface of drill-core, and from the outlined area calculating the volume and weight of resin. Kerr (1978) has reported an average percentage of 1.2% through the coal measures, and a greater percentage of 2.5% in the commercial coal seams. The percentage reported appears reasonable to other geologists that have examined the core.

The proposed rate of coal production is one million tonnes per year, and the projected production of Norco Amber Resin is 20,000,000 pounds per year.

At this time the Norco Amber can be assumed to be a consistent product, because it contains very little impurity and has been normalized by geologic action.[2] Because the production of Amber Resin will be associated with the operation of a viable coal mine, this should be considered a reliable, long-term source of a high-quality resin product.

2. Potential Applications of Norco Amber Resin

2 (a) Plastics

As a material that is principally ester and has been subjected to extreme pressure and temperature through 55 to 58 million years, the Norco Amber Resin may find a specialized application in the plastics industry. Recent work reported in Materials Engineering (5 - 77) has been directed toward structural and protective materials stable under temperatures of 500° F to 700° F (260° C to 370° C), with the possibility of short-term exposures of 800° F (430° C). The Norco Amber Resin has demonstrated stability at a temperature over 430° C.

2 (b) Technical Coatings

2(b)i - Probably Norco Amber will prove to be more expensive than materials commonly used in decorative or common varnishes. The natural and synthetic resins have been developed to cover this field effectively and economically. It should be noted, however, that Battelle reports that Refined Resin, an inferior product in their opinion, could be used to produce a varnish equal or superior to coatings made with Congo resin, although considerably darker in colour.

2(b)ii - Norco Amber Resin can probably be used in a coating resistant to chemical action. The initial tests by Battelle indicate that the material as mined is, "for all practical purposes, completely insoluble in chloroform, benzene, or pyridine." Much work must be completed before this application can be presented to the industry, but the potential in terms of dollar volume is very great.

2(b)iii - As a high-temperature coating, Norco Amber Resin offers great potential. As reported by Battelle, "a differential thermal analysis in nitrogen, indicates that Amber Resin does not melt until approximately 450° C, at which temperature it is volatilized (probably with decomposition)." A protective coating incorporating Norco Amber Resin as the principal ingredient would find many uses, as indicated by the description of new high-temperature-resistant plastics in Materials Engineering (5 - 77) (See attached).

2(b)iv - A third potential application for Norco Amber Resin will depend on dielectric properties. Although not documented by the Battelle tests, these properties can reasonably be inferred from comparison with Baltic Amber, a material that is markedly resistant to the flow of electricity. Probably the best applications will be found where thermal stability is required with insulating qualities.

3. Comparison of Norco Amber with Other Natural Resins

3 (a) Most of the natural resins are complex assemblies of complex chemical products, and their properties vary widely, making classification difficult. The following ranking is therefore approximate and for descriptive purposes only.

Resin	Age	Origin	Melting Range	Acid Value *
Norco Resin	55-58 m yrs.	B. C.	450°C	
Baltic Amber	60-70 m yrs.	Baltic	280°C - 290°C	
Congo Copal	Fossil	Congo	100°C - 150°C	120-140
Kauri Copal	Fossil	New Zealand	100°C - 115°C	50-115
Dammar	Recent	Malaysia	70°C - 115°C	20-35

* The acid value is the expression for free acidity, and is determined by titration. The number expresses the milligrams of Potassium Hydroxide required to neutralize one gram of the test material.

3 (b) Norco Amber Resin, the material that we find in the Norco coal deposit, is the fossilized residue of coniferous trees that grew in Tertiary times in the Bowron Basin. Since deposition, this material has been subjected to great pressure and temperature over a period of 55 to 58 million years. We can assume that in this time the oleoresins found in recent resins have been driven off or modified, leaving a hard material that is stable at high temperatures.

Norco Amber Resin is principally ester, a clear, light-amber-coloured material that breaks with sharp edges and conchoidal fractures. A single microanalysis has been reported by Cyclone Engineering Sales Ltd., as follows:

Carbon	81.3%
Hydrogen	10.0%
Ash	0.4%

The composition of Baltic Amber is reported to be $C_{10}H_{16}O$, which would correspond very closely with these figures.

Norco Amber Resin is, for all practical purposes, completely insoluble in chloroform, benzene, or pyridine. It does not soften at temperatures as high as 400°C (750°F). A differential thermal analysis in nitrogen indicates that Amber Resin does not melt until about 450°C (840°F), at which temperature it is volatilized (probably with decomposition).

The resin is lighter than coal (approximately 1.1 specific gravity, compared with 1.35 to 1.40) and can be separated on this basis alone, after the coal is crushed. The resin, being friable, breaks up to a smaller size during the crushing. The separation can probably be assisted by froth flotation, using multiple cells in series if necessary.

3 (c) Baltic Amber has been known through history for its decorative and therapeutic values. It is the residue of an extinct conifer, Pinus Succinifera, of 60 to 70 million years age (Tertiary/Eocene).

The resin contains some bituminous substance, which remains in the residue after heating, and becomes an important part of amber varnish, a very hard material that was highly prized in early history. The resin is generally described by the formula $C_{10}H_{16}O$.

Baltic Amber, when finely divided, dissolves in cold Sulphuric Acid, also in hot Nitric Acid, and partially in alcohol, ether, chloroform, and turpentine. It melts at 280°C to 290°C with the release of white fumes. The hardness is 2.5, the specific gravity 1.05 to 1.10, and the refractive index 1.53 to 1.55.

Baltic Amber is now used primarily for the manufacture of jewelry. The volume available is small, the material is expensive, and the varnish made with Baltic Amber is quite dark in colour.

3 (d) Congo Copal is a broad descriptive term applied to fossil resin found in the area formerly known as the Belgian Congo. The material is located in the ground at depths as great as three feet by prodding with a steel-tipped shaft, or by recovery from stream-beds after washing from the banks. It is the hardest of the natural resins in commercial supply, and is known as the universal (natural) resin of the varnish maker.

The physical and chemical properties of Congo resin vary widely. The colour ranges from water-white to brown, and the acid values from 42 to 150. This, coupled with the requirement of cleaning the surface of lumps of resin found in the field, limits the large-scale use of this material in modern plants. Traditionally the running of Congo Copal is done in small batches by skilled craftsmen. The varnish produced in this way is, however, considered by many to be superior to varnish made with synthetic resins, and as recently as 1969 the market was stable at about 10,000 tons per annum.

3 (e) Kauri Copal is the fossil residue of an extinct conifer found in the ground in New Zealand. This resin has the lowest acid value of the fossil copals (50 to 115) and is readily soluble in alcohols, ketones, and some lacquer solvents. After the process of running, or heating, the resin could be used with the conventional vehicles to produce varnish, which was slow-drying but presented a very high gloss.

Kauri Copal is one of the natural resins no longer available in bulk quantities, and is not listed in market reports (American Paint Journal, 1979).

3 (f) Dammar is a recent exudation of a family of trees in the Malay Peninsula. It is readily soluble in turpentine and in coal-tar hydrocarbons, and consequently is widely used in the manufacture of so-called spirit varnishes. In this application the melting point (70^{o} - 115^{0} C) is not significant. The acid value is 20 to 35.

4. Market Potential

The plastics and varnish markets are both expanding rapidly as new materials and uses are identified. Norco Amber Resin can probably fill an important role in the market that exists at this time, but probably will take a more important part in materials and coatings that are not yet developed. The description of the present market is, then, no more than a starting point for the evaluation of this important material's market potential.

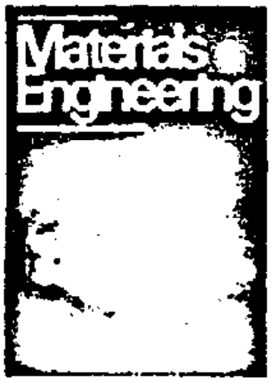
The records show the total shipment of copals from Africa in 1969 was at least 11,000 tons. Later records of imports to the United States (1970-72) indicate that the total shipments of natural resins would be at least 30,000 tons. The material was used primarily in the paint and varnish industry which has converted largely to synthetic resins because of assured supply, uniform specifications, and characteristics developed to meet specific needs. Norco Amber Resin, which claims the same advantages, can probably take a part of this market that requires its particular properties.

In its study of refined resin, a material that they consider inferior to the Amber Resin, the Battelle Memorial Institute compared varnishes made with refined resin and those made with high-grade Congo Copal, and found the refined resin to be superior, although considerably darker. The price for the synthetic equivalent of Congo Copal is now (June, 1979) reported in Rubber World to be from $1.38 (U.S.) to $1.41 (U.S.). A price of $1.60 (Can.) for refined resin is, then, conservative. The Norco Amber Resin, on the basis of the Battelle evaluation, should be more valuable.

Norco has learned of a British coal mine that is extracting and selling a resin as a by-product. We know only that the material is selling for about $8 per kilogram, or about $4 per pound, and from this information assume the material is a high-grade resin similar to Norco Amber Resin. We have written to London, asking for more information about this material and its marketing.

Probably the most significant information relating to potential markets is contained in Materials Engineering (Special Report, 5 - 77), describing a search for new heat-resistant plastics. A polyimide, developed for a specification of 500° to 550° F (260° to 290° C), has been reported at Langley by NASA. The material is relatively inexpensive, with raw materials costs anticipated to be $3.00 to $3.50 per pound. The material with the highest rating, up to 700° F (370° C) is a polyimide developed by Hughes Aircraft and available from Gulf Oil Chemicals. The material was available in 1977 at $75.00 per pound, and in full-scale production was expected to sell at $25.00 per pound. Norco Amber Resin, as mined, is reported to remain stable at 400° to 450° C, temperatures well above the specification temperature of this new, space-age plastic.

New heat resistant plastics cover 275-700 F range



A number of plastics introduced in the past three years feature improved heat resistance relative to former class grades while other recent grades of traditionally heat resistant families of plastics provide improvements in other important performance properties or processing characteristics.

by **John A. Vaccari**, Editor

Recent developments in plastics for improved heat resistance range from a new polyimide capable of sustaining temperatures of 700 F (644 K) to heat-stabilized polypropylenes for long-term use at 300 F (422 K). Some types, for example, the more heat resistant polypropylenes, are quite modestly priced, as low as $0.34/lb ($0.75/kg). Others, such as the new fluoroplastics, polysulfones and polyimides are far more expensive.

Polyimide takes 700 F+

The most heat resistant plastic introduced in the past three years is HR-600, an addition-curable thermosetting polyimide. Its outstanding properties stem largely from its ability to cross-link with little or no offgassing. Developed by Hughes Aircraft in research sponsored by the U.S. Air Force, it is available from Gulf Oil Chemicals. Developmental quantities of HR-600 are currently priced at $75/lb ($165/kg) in 100-lb (220-kg) lots, but Gulf expects the price to drop to $25/lb ($55/kg) for commercial quantities in 1978.

Graphite fiber-reinforced HR-600 laminates show weight losses of less than 1% after 500 hr in air at 500 F (533 K) and only 4% after 50 hr at 700 F (644 K). The new polyimide even may be able to withstand short time exposures to temperatures as high as 800 F (700 K).

At ambient temperatures, graphite-reinforced laminates have flexural strengths of over 200,000 psi (1380 MPa), flexural moduli above 16,000 psi (110 MPa) and short beam shear strengths of 17,000 psi (117 MPa). Solid lubricative composites, which also can be made with the polyimide, have extremely high wear resistance.

A promising, low cost, addition-type polyimide is in development at NASA (Langley). Called LARC-160, it is a solvent-free liquid system with excellent tack and drape in prepreg form enabling the production of complex shapes. Being a liquid system, it also enables "true autoclavability," or low pressure (200 psi, 1.4 MPa) forming, at 600 F (589 K). LARC-160 can withstand long-term exposure at temperatures of 500-550 F (533-561 K) and short-term exposure (200 hr) at temperatures as high as 600 F (589 K). It is potentially a relatively inexpensive material with raw materials costs anticipated to be just $3-3.50/lb ($6.60-7.70/kg).

Other recently introduced polyimide grades or forms are Fiberite's PI-700 series compounds and Du Pont's Kapton XH-649 film. PI-700 grades are also of the addition type noted for thermal stability and strength retention at high temperatures. XH-649 film, which is intended for advanced microcircuits, features excellent dimensional stability at high temperatures. Shrinkage, for example, is less than 0.005 in./in. (0.005 mm/mm) after 1 hr at 392 F (473 K).

More versatile epoxies

Most of the recent improvements in epoxies, traditionally one of the more heat resistant families of plastics, stem from the use of hardeners, modifiers and fillers. The result is a variety of new grades which either extend high temperature limits or combine high temperature resistance with improvements in thermal shock resistance or processability.

New novolac epoxies, for example, are said to be capable of withstanding temperatures in excess of 700 F (644 K). Partially responsible for such high operating temperatures is the use of dianhydride hardeners which are capable of increasing operating temperatures by about 90 F (50 K) over traditional anhydrides. The new novolacs also have excellent chemical resistance and low shrinkage and warpage characteristics.

Faster mold cycles and cure time are other recent developments in high temperature novolac epoxies. Dow Chemical's XD-7855 resin reduces mold cycle time to about one minute at 300 F (422 K). The resin's high glass transition temperature helps prevent lead shear in semiconductor applications, a problem when encapsulants expand too quickly and impose excessive stress on microleads.

Modified novolacs, such as Celanese's SU-8, combine heat distortion temperatures as high as 525 F (547 K) with rapid press cure. Used alone or with other resins, they are finding use for both electrical components and graphite-reinforced laminates.

Heat resistance, high strength and moisture resistance are combined in Ciba-Geigy's MY-720, a liquid diamine epoxy. Also used for graphite-reinforced aerospace structures, it features ambient flexural strengths of 67,000-75,000 psi (462-517 MPa) and can retain much of this strength at temperatures up to 400 F (478 K).

A more recent family of epoxies available from Ciba-Geigy are the hydantoin resins which provide outstanding adhesion, good dielectric characteristics and resistance to discoloration at high temperatures. The resins also have excellent light transmittance after thermal aging, and important property for their use as encapsulants of light emitting diodes. The resins can endure several thousand hours at temperatures in excess of 300 F (422 K) with minimal discoloration. They also can maintain considerable strength and rigidity at temperatures of 400 F (478 K).

"New novolac epoxies . . . are said to be capable of withstanding temperatures in excess of 700 F."

Work by Union Carbide indicates that the use of polyol modifiers in cycloaliphatic epoxies provides a better balance between heat distortion temperature and thermal shock resistance. Heat distortion temperatures for the modified epoxies are in the range of 295-309 F (419-427 K). As shown in Table 1, mechanical and electrical properties tend to decrease, as thermal shock resistance increases, with increasing modifier content. About 22% modifier additions seem to provide an optimum property balance.

Research by Cordova Chemical recently led to the development of a catalyst which eases the processing of epoxy-imide resins, giving these resins a possible processing advantage over polyimides. The resins provide heat distortion temperatures of about 430 F (493 K) and retain about 60% of their room temperature strength at 500-550 F (533-561 K). Potential uses include cloth impregnation of glass-reinforced laminates.

A new, highly filled epoxy casting resin, Emerson & Cuming's Stycast 2762 FT, combines high thermal conductivity with excellent dielectric characteristics. Low shrinkage and low exotherm during cure make it suitable for encapsulating or casting large sections. Suitable for service temperatures of −300 to 500 F (89-533 K), it can be used for various electronic and temperature control applications.

Triazine rivals epoxies

Triazine A, a thermosetting polymer introduced last year by Mobay Chemical, offers several advantages over conventional epoxies in printed circuit board applications, specifically higher service temperature, lower coefficient of thermal expansion, better dimensional stability and greater clad-laminate peel strength at temperatures of molten solder.

The new material has a glass transition temperature of 482 F (523 K). Flexural strength ranges from 89,000 psi (614 MPa) at ambient temperatures to 25,000 psi (172 MPa) at 482 F (523 K). In addition, it couples excellent room temperature dielectric properties with low dependence on temperature and frequency. Permittivity decreases slightly with increasing frequency, that is, from 4.4 at 50 c/s (Hz) to 4.1 at Gc/s (GHz). Room temperature dissipation factor is 0.003-0.007 in the same range.

Polyesters for 500-600 F

An injection moldable aromatic copolyester provides excellent dielectric and mechanical properties at temperatures above 500 F (533 K) and low moisture absorption. Developed by Carborundum and called Ekkcel 1-2000, it is suitable for long-term use at temperatures up to 550 F (561 K). Its moisture absorption after 24 hr in boiling water is less than 0.025%.

Introduced about three years ago, the material can be processed on standard injection molding equipment. Applications include high performance electrical and electronic components, bearings for fractional horsepower motors, radiation resistant valve parts and other products requiring high temperature strength.

Another recent polyester base material developed by Carborundum is a polyester (Ekonel) polytetrafluoroethylene (PTFE) fluoroplastic blend which provides long-term resistance to temperatures as high as 600 F (589 K). The composite also has low thermal expansion, dissipation and moisture absorbtion, and high dielectric strength and thermal conductivity. Uses include packing and compression ring sets, O-rings, spring-loaded and lip seals, self-lubricated bearings and pump seals and vanes.

New 'phenolics' for near 500 F

Another recent family of heat resistant thermosets is Ciby-Geigy's Xylok resins. Based on the condensation products of phenols and aralkyl ethers, their properties are said to be similar to phenolics with heat resistance to 480 F (522 K).

The resins are also noted for good mechanical strength, thermal stability and dielectric characteristics. Applications include electrical insulation parts, brake pads, motor components, bearings and handles for cooking utensils.

New fluoroplastic takes 550 F

The most recent fluoroplastic to become commercially available is Allied Chemical's CM-1, a hexafluoroisobutylene and vinylidene fluoride (HFIB-VF_2) thermoplastic having a maximum continuous service temperature of 550 F (561 K) and high creep resistance. It also possesses excellent chemical resistance, dielectric characteristics and release properties.

The new fluoroplastic is melt-processable and thus suitable for injection, compression and extrusion molding. Potential uses currently being explored include a variety of release coatings, chemical processing equipment components, fuel cell separators, bearings and other mechanical parts. It also can be used as a binder for various fiber-reinforced composites.

"The most recent fluoroplastic . . . HFIB-VF_2 . . . (has) a maximum continuous service temperature of 550F and high creep resistance."

Special fibers enhance fluoroplastics

Recent performance improvements in fluoroplastics also stem from the use of special reinforcing fibers rather than from the introduction of new base resins.

Use of long glass fibers and a special coupling agent, for example, enhances the mechanical properties of a new line of fluorinated ethylene propylene (FEP) fluoroplastics, Thermocomp LF, produced by LNP. In addition, the new grades provide improved flexural properties, dimensional stability and wear resistance while retaining the inherent electrical, thermal and chemical resistance of the base material. As a class, FEP plastics have a continuous service temperature of about 400 F (478 K).

At room temperature, the new compounds have 6000 psi (41 MPa) tensile strength, 10,500 psi (72 MPa) flexural strength and 800,000 psi (5520 MPa) flexural modulus which, as indicated in Table 2, are far superior to those of milled glass-filled FEP.

1 Properties of cycloaliphatic resins[a]

Property	Resin, 11.5% modifier[b]	Resin, 16.3% modifier[b]	Resin, 23.2% modifier[b]
Ten str,			
1000 psi	10.8	9.81	6.1
(MPa)	(74.5)	(67.6)	(42.1)
Ten mod,			
10^5 psi	14.6	11.3	10.9
(MPa)	(10,067)	(7791)	(7516)
Power factor, %[c]	9.9	78	>100
Vol res,			
ohm-cm	2×10^{16}	2×10^{16}	1×10^{15}
(ohm·m)[d]	(2×19^{14})	(2×10^{14})	(1×10^{13})
Heat distort			
temp, F	297	295	309
(K)	(420)	(419)	(427)
Ther shock res[e]	6.9	7.5	12.3

[a]All resins contain the same amount of anhydride hardener, [illegible] silica and curing agents. [b]Solid polycaprolactone diol modifier (PCL-300). [c]At 60 cyc/sec (60 Hz) and 302 F (423 K). [d]At 73 F (296 K). [e]Average cycles to failure (Union Carbide test).

2 Properties of glass-reinforced FEP

Property	Reinforcement	
	Long glass[a]	Milled glass
Ten str, psi (MPa)	6000 (41)	2400 (17)
Flex str, psi (MPa)	10,500 (72)	4000 (28)
Flex mod,		
10^3 psi	800	250
(10^3 MPa)	(5.5)	(1.7)
Wear factor (K)	15	28

[a]Thermocomp LF

3 Properties of styrenic terpolymer

Property	Base	40% glass	FR[a] with 30% glass
Specific gravity	1.1	1.42	1.52
Mold shrinkage			
in./in.	0.008	0.001	0.0015
(mm/mm)	(0.008)	(0.001)	(0.0015)
Water absorp, 24 hr, %	0.2	0.1	0.1
Ten str, 1000 psi	6.9	18	15.5
(MPa)	(48)	(124)	(107)
Flex mod, 1000	300	1200	990
psi (MPa)	(2069)	(8274)	(6826)
Imp str[b], ft-lb/	1.7	2.8	2.1
in. (J/m)	(91)	(149)	(112)
Heat defl temp[c],	275	305	300
F (K)	(408)	(425)	(422)
Coef of ther exp,			
10^{-5} in./in./F	2.5	1.2	1.3
(10^{-5} m/m/K)	(4.5)	(2.2)	(2.3)
Flammability, UL 94	HB	HB	V-0

[a]Flame retardant. [b]Izod (notched), 0.25-in. (6.4-mm) bar. [c]At 264 psi (1.8 MPa)

4 Heat-stabilized polypropylene[a]

Specific gravity	0.905
Melt flow, g/10 min	4
Mold shrinkage, in./in.	0.01-0.03
(m/m)	(0.01-0.03)
Water absorption, %, 24 hr	<0.01
Tensile strength, psi (MPa)	5000 (34.5)
Ultimate elongation, %	>100
Impact str[b], ft-lb/in. (J/m)	0.8 (42.7)
Flexural modulus, 10^5 psi (MPa)	2.0 (1379)
Tensile modulus, 10^5 psi (MPa)	2.5 (1724)
Hardness, Durometer D	78
Heat deflection temp, F (K)	
At 66 psi (0.46 MPa)	221 (378)
At 264 psi (1.8 MPa)	140 (333)
Melting point[c], F (K)	330 (439)
Vicat softening point, F (K)	302 (423)

[a]Diamond Shamrock PP8622. [b]Izod (notched). [c]Crystalline.

The better wear resistance of the new grades is indicated by their substantially lower wear factor (K). This combination of properties makes the materials especially suitable for high temperature bearings operating in corrosive media and for various electrical and electronic applications.

LNP also recently introduced a line of carbon fiber-reinforced fluoroplastics designated Thermocomp UC. Compared to glass-reinforced fluoroplastics, these compounds have lower coefficients of thermal expansion, which reduces shrinkage during molding, and good thermal conductivity. These property improvements are combined with the inherent thermal stability, chemical inertness and lubricity of the base material.

Another recent fluoroplastic is Du Pont's Tefzel 210. The ethylene tetrafluoroethylene (ETFE) fluoroplastic permits faster injection molding of intricate parts and faster extrusion of small-gage wire insulation. ETFE fluoroplastics are generally suitable for continuous use at temperatures as high as 300 F (422 K).

Tough polysulfone for 375 F+

A new polysulfone combines high heat resistance with exceptional toughness and resistance to environmental stress cracking. Designated Radel and produced by Union Carbide, the injection moldable and extrudable plastic is available in both opaque and transparent grades.

Radel has a heat deflection temperature of 400 F (477 K) and excellent oxidative and thermal stability for continuous use in air up to temperatures of at least 375 F (464 K). With a notched Izod impact strength of 15 ft-lb/in. (800 J/m), it is about three times tougher than polyarylsulfone and seven times tougher than polyethersulfone and conventional polysulfone. The new polysulfone is intended for applications in the aerospace, chemical processing and microelectronics industries.

About three years ago, LNP introduced new glass-reinforced and/or lubricated polyethersulfone compounds suitable for continuous use at temperatures up to about 360 F (455 K). Called Thermocomp JF, they also provide excellent dielectric characteristics, good mechanical properties and low shrinkage.

Special styrene a superior styrene

A line of new styrenic terpolymer compounds provides considerably greater heat resistance than conventional polystyrene. Developed by Dow Chemical and available from LNP in various color, glass-reinforced and flame retardant grades (see Table 3), the terpolymer has 264-psi (1.3-MPa) heat deflection temperatures ranging from 275 F (408 K) for the base material to 305 F (425 K) for the 40% glass-reinforced grade. In contrast, conventional polystyrene has a heat deflection temperature of about 220 F (378 K) for both general purpose and 30% glass-reinforced grades.

Introduced last year, the terpolymer is a candidate for pump housings and impellers, camera cases, business machine parts, electrical connectors and TV components. A 30% glass-reinforced grade with 15% TFE (tetrafluoroethylene) lubrication has potential for self-lubricated bearings and other parts requiring high wear resistance.

Heat stabilized polypropylenes

Improved stabilization systems have extended the maximum service temperature of polypropylene to as high as 300 F (422 K) in recent years. Hercules' talc-filled homopolymer (6XF4) and copolymer (7XF4) grades are good examples. The copolymer, which provides high impact strength but has a lower heat deflection temperature, withstands five months oven aging at 300 F (422 K). The homopolymer, with twice as much talc, can take about four months at these conditions.

Another new polypropylene with improved heat stabilization is Diamond Shamrock's appliance grade, PP8622 (see Table 4), which has an Underwriters Labs' relative thermal index of 239-248 F (388-393 K) in 0.03-0.06-in. (0.8-1.6-mm) thicknesses, respectively. Still another is Hercules' 6X-25 (240 F, 389 K) which has high resistance to elevated temperature aging in both dry and wet environments. Each of these grades is intended primarily for dishwasher liners.

A heat-stabilized, glass-reinforced grade recently introduced by LNP and designated MF-1006 HS has a thermal index rating of 221 F (378 K). At 140 F (333 K), it has a tensile strength of 4400 psi (30 MPa) and a tensile modulus of 460,000 psi (3170 MPa). □

Bowron River Coal Mine Project

British Columbia, Canada

Brief Initial Report following Visit 7-9th June, 1982.

I. The purpose of the visit by Mr. P.B. Rees in company with Mr. M. Wardlaw of Mowlem Mining Division was to:

(a) review the geological data and reserve assessment

(b) examine and discuss the proposed mining layout and strategy of development

(c) examine and discuss the proposed methods of mining, and levels of performance

(d) discuss the proposed plant and machinery envisaged for the development and construction period, and for later mining operations

(e) obtain better understanding of the coal qualities envisaged and the Coal Preparation facilities deemed necessary to meet the market requirements

(f) inspect on site the options available for the transport of coal to the various possible railheads

(g) examine and verify the basis of costing - both in Capital and Operating terms

(h) establish the basis for the financial structuring of the project, with particular detail on the availability of funds to cater for working capital requirements.

II. All of the first day, 8th June, was spent in frank and detailed discussion with Mr. E. Roberts, President of Norco Resources, Mr. Milo Filgas of R.F. Fry & Associates, and Mr. Geoffrey Herold, Assistant to Mr. Roberts. All were forthcoming in their attitude and approach, with the result that the meetings were both fruitful and informative.

On the following day the mine site was visited in company with the above three people and once again, all the options ranging through the siting of the drifts; further exploratory requirements; type and capacity of coal preparation; dirt disposal; manning and staffing; methods of coal getting and strategic mine layouts, to the three possible means of transporting the coal to differing railheads were examined. The alternative routes for coal transport were travelled by car, and a good idea gained of the relative advantages and disadvantages of each.

III. The main conclusions arrived at as a result of the two days of full and thorough joint examination of the facts and data available are outlined below:-

(a) Sufficient coal reserves are available and well enough proved to support the first 10 million tons of extractable coal - even at a 50% extraction ratio. The first 12 to 15 years of mine life is therefore assured. Beyond this the probability of proving further large areas of coal is high, and for which further exploration can be carried out whilst the mine is operational. There would not seem much merit in using precious capital funds on a further elaborate exploratory drilling programme at this stage, for unless the detailed mine plan and prospectus demonstrates a clear ability to reach 'payback' before year four to five in the DCF evaluations, the additional reserves so proved will count for little. What is important is the detailed proving of the coal reserves to be worked over the first ten years of life - and this has already been done sufficiently well to allow the preparation of seam contour maps, seam thickness maps, and general structure maps which in turn enable the preparation of the strategic layout plans for seam development.

(b) The seam analyses and characteristics developed to date are inadequate to base any firm design criteria for the coal preparation necessary to ensure final product quality. However, near enough approximations can be deduced to identify the processes required together with the broad capacities of the individual sections of such a plant. These can be verified by obtaining another four or so 3½" cores from judiciously placed holes along the western limb of the syncline where the seams are at their shallowest. Such holes need not be expensive and can be quickly organised. Washability curves can then be derived and sufficient data obtained to produce a broad coal flow specification from which the basic units of coal preparation can be designed. Flexibility and simplicity in design, construction and operation must be the keynote - to cater for possible changes at a later stage, both in production techniques and market requirements.

(c) the mine site is on flat land adjacent to the River Bowron and has been well maintained with good road access and excellent standard of construction camp. Some 50 acres have been cleared of forest and levelled, from which it appeared that the sub-soil to rock head is composed of a firm matrix of sandy clays and pebbles - which certainly looked easy to compact. Site investigation holes, however, are an essential and early requirement, both for finalising the position and line of drifts and the opencut/portal specification, as well as the foundation requirements for the proposed surface structures.

(d) the driving of the two drifts, which could well be less than 500 yards each dipping at 1 in 4, to intersect the thick lower seam about the 700 metre contour lines is the first mining priority. The exact seam position on the line of drifts can be accurately confirmed by one of the boreholes referred to earlier and also the nature of the roof and floor of the seam at the point of entry, together with details of any acquifers between the coal seam and the surface. This hole should therefore be the first of the additional coal exploratory holes to be drilled. The value of putting two drifts down simultaneously is that once the coal seam is intersected, caol production can commence immediately by forming five main developing entries, and driving them in a south-easterly direction along the axis of the syncline as far as the main NE/SW fault. In the 5 metre plus coal section it will be possible to select the mining section most suitable to the geological environment and also with a view to minimising dirt production. An average output of some 650 tons on single and 1250 tons on two shift working can be sensibly achieved, whilst at the same time main development roadways are being provided into the heart of the reserves, thus providing access to both flanks.

(e) during discussions with Messrs. E. Roberts and G. Herold, conceptual plans for working the thick lower seam by hydraulic methods were tabled, the basis of which were the development of short 10 to 15 metre pillars of coal by driving entries on an "apparent dip" of 1 in 4 to 1 in 5. Such gradients are suitable for the application of crawler mounted coal-getting machines, and the configuration of the entries such that standard type Room and Pillar mining or even longwall could be reverted to should the hydraulic method prove to be ineffective. At this stage such flexibility in layout is an important factor.

(f) the relatively steep gradients on the western limits leading to outcrops of the seam along a line almost parallel to the existing logging road provides the advantage of being able to effect easy connection to the surface as the mine workings extend southwards. In this way ready additional ventilation and escape roads can be provided. The possibility of transporting by pipeline down such stowing is worthy of detailed study. The gradients can be put to good use in facilitating hydraulic stowing and/or pump packing systems, with the object of improving the percentage extraction, stabilising subsidence, and reducing the size of dirt heaps with consequential environmental benefits.

(g) power supply through such large areas of forestation - subject in summer to extensive forest fires - could raise problems of cost, both initial and in maintenance over the years. The availability of a reliable and consistent source of power is essential to the safety of the mine from flooding and to ensure adequate ventilation at all times. There would therefore appear to be advantages in generating sufficient power on site from a modern fluidised bed style package generating plant, operated from coal produced by the mine itself. The technical efficacy and economic benefits of such an approach are worthy of careful study and evaluation in the design and prospectus stages, particularly bearing in mind that the power supply can be provided by 'modules' in phase with the power demands from increasing output. In evaluating this idea, the merit and financial advantage of burning the "dry fines" in the fluidised bed, and so avoid the need for fine washing with its attendant problems of water clarification, could be an important factor.

(h) the overland transport of coal to a railhead presents one of the main problems, and there would appear to be three basic alternatives to consider and evaluate, viz:-

(i) transport by 40 tone trucks over 64 km of "logging road" to the C.N.R. railway to the west of the mine site and some 10 km to the south of Prince George. Although a fairly long run, the standard of "logging road" was quite good and well maintained, and there was ample space with ready road access to a long stretch of railway track, conveniently situated immediately adjacent to Highway 97. The principal disadvantage is the "Spring reduction period" whereby the axle loading on all traffic along logging roads is reduced by some 40% for a period of two months. The effect of this could be minimised by declaring the mine annual holiday during this period; by stocking the surplus coal; and by deploying additional trucks over this period. All in all it is not an insurmountable problem, particularly when seen against all the other straightforward aspects.

(ii) transport by 40 ton trucks over some 12 km of logging roads to meet Highway 16 to the east of the mine site, then south along the paved surface of Highway 16 to another logging road leading to Hansard - a small 'whistle stop' on the C.N.R. railroad. Apart from a relatively short length (12 km) of paved highway, this alternative suffers the same Spring reduction over the greater part of the haul distance, plus the fact that the first section of roadway was in nowhere near such good condition as the first alternative, and in the third leg, the River Bowron was crossed by a temporary one lane bridge, which was doubtful for the carrying of 40 ton coal trucks. In terms of total distance there was little in it compared with alternative (i).

(iii) transport by 40 ton trucks as in (ii) above to Highway 16 - but turn northwards to Prince George, this being a paved highway for the greater part of the "haul". To overcome the Spring reduction on the short 12 km logging section it was proposed to construct a parallel road, thus eliminating all restrictions on overland transport of coal. The main disadvantage - and a serious one - was the fact that the proposed railhead was situated within half a mile of a large paper pulping mill, was very constricted, and in no way capable of handling train lengths of the size considered necessary to economically ship the coal to port for loading on ship.

(i) the need to maximise plant and equipment manufactured in the U.K. has a direct influence on the availability of funds. Several aspects were discussed and without going into detail in this report it can be confidently stated that at least CA$15 million worth of U.K. mining equipment and plant can be used to advantage.

The broad organisation chart drawn up by Eric Roberts covered the main disciplines involved and delineated a line of accountability to the main board NORTAI. It now remains, in conjunction with Mowlems, to allocate the suitably experienced and qualified staff to plan, design and construct the mine.

The mine prospect is a good one, having substantial reserves of good quality coal well capable of being mined and prepared to the specification demanded by Taiwan Power Company. A phased development, whereby investment and output is kept in stages with the requirement of the Taiwan Power Company should demonstrate a healthy cash flow situation and afford a resonable return on investment.

APPENDIX III

PRODUCTION SCHEDULE, LABOUR REQUIREMENTS, OPERATING COSTS, CAPITAL COSTS

NORCO RESOURCES LTD.

BOWRON COALFIELD
1 AUGUST 1982

TABLE No.

PRODUCTION SCHEDULE

(1000 Tonnes)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	→	2006	TOTALS
CONTINUOUS MINING												
UNIT No. / 2 SHIFT OP. / 3 SHIFT OP.												
1 — 184,000 T.P.A. — 276,000 T.P.A.												
2 — 184,000 T.P.A. — 276,000 T.P.A.												
3 — 184,000 T.P.A. — 276,000 T.P.A.												
4 — Standby												
Raw coal production		92	828	552	→							13,064
Clean coal (60% yield)		55	497	331	→							7,834
HYDRAULIC MINING												
MONITOR No. 1 - 1,000,000 T.P.A.												
MONITOR No. 2 - Standby												
Raw coal production				1000	→							22,000
Clean coal (55% yield)				550	→							12,100
TOTAL COAL SALABLE:		55	497	881	→							19,934

NORCO RESOURCES LTD.

BOWRON COALFIELD
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TABLE No.

LABOUR REQUIREMENTS AND BASE COSTS

COAL PRODUCTION PHASE I

CLASSIFICATION	1st SHIFT	2nd SHIFT	3rd SHIFT	TOTAL No. of MEN	RATE/MAN	TOTAL BASE COST P.A.
Mine Manager	1	-	-	1	65,000	65,000
Mine Undermanager	1	-	-	1	45,000	45,000
Ass't. Undermanagers	-	1	1	2	35,000	70,000
Firebosses	2	2	1	5	30,000	150,000
Surveyor	1	-	-	1	30,000	30,000
Surveyor's Ass't.	1	-	-	1	20,000	20,000
Chief Accountant	1	-	-	1	35,000	35,000
General Clerks	1	-	-	1	20,000	20,000
Storeman (Head)	1	-	-	1	25,000	25,000
Purchasing Officer	1	-	-	1	30,000	30,000
First Aid/ Security	1	1	1	3	25,000	75,000
Mechanical Engineer	1	-	-	1	45,000	45,000
Mechanical Foremen	1	1	1	3	30,000	90,000
Electrical Engineer	1	-	-	1	45,000	45,000
Electrical Foremen	1	1	1	3	30,000	90,000
Surface Foremen	1	1	-	2	30,000	60,000
Preparation Plant Super.	1	-	-	1	40,000	40,000
TOTAL STAFF & BASE COST PER YEAR	17	7	5	29	32,241	935,000

NORCO RESOURCES LTD.

BOWRON COALFIELD
1 AUGUST 1982

TABLE No.

LABOUR REQUIREMENTS AND BASE COSTS

COAL PRODUCTION PHASE I

CLASSIFICATION	1st SHIFT	2nd SHIFT	3rd SHIFT	TOTAL No. of MEN	RATE/MAN	TOTAL BASE COST P.A.
a) UNDERGROUND						
Miner Drivers	2	2	-	4	15.00	110,400
Miner Helpers	2	2	-	4	12.50	92,000
Ram Cars	2	2	-	4	14.00	103,040
Roof Bolters	2	2	2	6	14.00	154,560
Ventilation	1	1	-	2	12.50	46,000
Conveyors	1	1	-	2	11.50	42,320
Fitters	1	1	2	4	13.50	99,360
Electricians	1	1	2	4	15.00	110,400
Supplies	2	2	-	4	13.50	99,360
General	4	4	2	10	12.50	230,000
	18	18	8	44		
b) SURFACE GENERAL						
Equipment Operators	4	3	1	8	13.50	198,720
Tradesmen	1	1	-	2	13.50	49,680
Labourers	1	1	1	3	11.50	63,480
	6	5	2	13		
c) COAL PREPARATION PLANT						
Plant Operators	2	2	2	6	15.00	165,600
Labourers	1	1	1	3	11.50	63,480
	3	3	3	9		
d) MAINTENANCE						
Mechanics	2	1	-	3	13.50	74,520
Electricians	1	1	1	3	15.00	82,800
Welders	1	-	1	2	13.50	49,680
Labourers	1	1	-	2	11.50	42,320
	5	3	2	10		
TOTAL HOURLY EMPLOYEES AND BASE COST PER YEAR	32	29	15	76	13.43	1,877,720

NORCO RESOURCES LTD.

BOWRON COALFIELD
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TABLE No.

LABOUR REQUIREMENTS AND BASE COSTS

COAL PRODUCTION PHASE II

CLASSIFICATION	1st SHIFT	2nd SHIFT	3rd SHIFT	TOTAL No. of MEN	RATE / MAN	TOTAL BASE COST P.A.
Mine Manager	1	-	-	1	65,000	65,000
Mine Undermanager	1	-	-	1	45,000	45,000
Ass't. Undermanagers	-	1	1	2	35,000	70,000
Firebosses	3	3	3	9	30,000	270,000
Surveyor	1	-	-	1	30,000	30,000
Surveyor's Ass'ts.	1	1	1	3	20,000	60,000
Chief Accountant	1	-	-	1	35,000	35,000
General Clerks	2	1	-	3	20,000	60,000
Storeman (Head)	1	-	-	1	25,000	25,000
Storemen (General)	-	1	1	2	20,000	40,000
Purchasing Officer	1	-	-	1	30,000	30,000
Personnel/Safety/Training	1	-	-	1	35,000	35,000
First Aid/Security	1	1	1	3	25,000	75,000
Mechanical Engineer	1	-	-	1	45,000	45,000
Mechanical Foremen	1	1	1	3	30,000	90,000
Electrical Engineer	1	-	-	1	45,000	45,000
Electrical Foremen	1	1	1	3	30,000	90,000
Surface Foremen	1	1	-	2	30,000	60,000
Maintenance Planner	1	-	-	1	25,000	25,000
Preparation Plant Super.	1	-	-	1	40,000	40,000
TOTAL STAFF & BASE COST PER YEAR	21	11	9	41	30,122	1,235,000

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NORCO RESOURCES LTD.

BOWRON COALFIELD
1 AUGUST 1982

TABLE No.

LABOUR REQUIREMENTS AND BASE COSTS

COAL PRODUCTION PHASE II

CLASSIFICATION	1st SHIFT	2nd SHIFT	3rd SHIFT	TOTAL No. of MEN	RATE/MAN	TOTAL BASE COST P.A.
a) UNDERGROUND						
Miner Drivers	3	3	3	9	15.00	248,400
Miner Helpers	3	3	3	9	12.50	207,000
Ram Cars	3	3	3	9	14.00	231,840
Roof Bolters	6	6	6	18	14.00	463,680
Ventilation	3	3	3	9	12.50	207,000
Conveyors	3	3	3	9	11.50	190,440
Fitters	2	2	2	6	13.50	149,040
Electricians	2	2	2	6	15.00	165,600
Supplies	4	4	4	12	13.50	298,080
General	4	4	4	12	12.50	276,000
	33	33	33	99		
b) SURFACE GENERAL						
Equipment Operators	5	3	2	10	13.50	248,400
Tradesmen	1	1	-	2	13.50	49,680
Labourers	1	1	1	3	11.50	63,480
	7	5	3	15		
c) COAL PREPARATION PLANT						
Plant Operators	2	2	2	6	15.00	165,600
Labourers	1	1	1	3	11.50	63,480
	3	3	3	9		
d) MAINTENANCE						
Mechanics	1	1	1	3	13.50	74,520
Electricians	1	1	1	3	15.00	82,800
Welders	1	-	1	2	13.50	49,680
Labourers	1	1	-	2	11.50	42,320
	4	3	3	10		
TOTAL HOURLY EMPLOYEES AND BASE COST PER YEAR	47	44	42	133	13.39	3,277,040

NORCO RESOURCES LTD

BOWRON COALFIELD
1 AUGUST 1982

TABLE No.

LABOUR REQUIREMENTS AND BASE COSTS

COAL PRODUCTION PHASE III

CLASSIFICATION	1st SHIFT	2nd SHIFT	3rd SHIFT	TOTAL No. of MEN	RATE/MAN	TOTAL BASE COST P.A.
Mine Manager	1	-	-	1	65,000	65,000
Mine Undermanager	1	-	-	1	45,000	45,000
Ass't. Undermanagers	-	1	1	2	35,000	70,000
Firebosses	5	5	2	12	30,000	360,000
Surveyor	1	-	-	1	30,000	30,000
Surveyor's Ass'ts.	1	1	-	2	20,000	40,000
Chief Accountant	1	-	-	1	35,000	35,000
General Clerks	2	1	-	3	20,000	60,000
Laboratory	1	1	-	2	25,000	50,000
Storeman (Head)	1	-	-	1	25,000	25,000
Storemen (General)	1	1	1	3	20,000	60,000
Purchasing Officer	1	-	-	1	30,000	30,000
Personnel Manager	1	-	-	1	40,000	40,000
Safety/Training Officer	1	-	-	1	35,000	35,000
First Aid/Security	1	1	1	3	25,000	75,000
Mechanical Engineer	1	-	-	1	45,000	45,000
Mechanical Foremen	1	1	1	3	30,000	90,000
Electrical Engineer	1	-	-	1	45,000	45,000
Electrical Foremen	1	1	1	3	30,000	90,000
Surface Foremen	1	1	-	2	30,000	60,000
Maintenance Planner	1	-	-	1	25,000	25,000
Preparation Plant Super.	1	-	-	1	40,000	40,000
TOTAL STAFF & BASE COST PER YEAR	26	14	7	47	30,106	1,415,000

NORCO RESOURCES LTD.

BOWRON COALFIELD
1 AUGUST 1982

TABLE No.

LABOUR REQUIREMENTS AND BASE COSTS

COAL PRODUCTION PHASE III

CLASSIFICATION	1st SHIFT	2nd SHIFT	3rd SHIFT	TOTAL No. of MEN	RATE / MAN	TOTAL BASE COST P.A.
a) UNDERGROUND						
Miner Drivers	3	3	-	6	15.00	165,600
Monitor Operators	1	1	-	2	15.00	55,200
Miner Helpers	4	4	-	8	12.50	184,000
Roof Bolters	6	6	4	16	14.00	412,160
Ventilation	3	3	-	6	12.50	138,000
Conveyors (Flumes)	4	4	-	8	11.50	169,280
Fitters	2	2	2	6	13.50	149,040
Electricians	2	2	2	6	15.00	165,600
Supplies	4	4	2	10	13.50	248,400
Backfill	4	4	2	10	13.50	248,400
General	6	6	4	16	12.50	368,000
	39	39	16	94		
b) SURFACE GENERAL						
Equipment Operators	6	5	2	13	13.50	322,920
Tradesmen	2	2	-	4	13.50	99,360
Labourers	3	3	1	7	11.50	148,120
	11	10	3	24		
c) COAL PREPARATION PLANT						
Plant Operators	2	2	2	6	15.00	165,600
Labourers	2	2	2	6	11.50	126,960
	4	4	4	12		
d) MAINTENANCE						
Mechanics	3	2	1	6	13.50	149,040
Electricians	2	2	1	5	15.00	138,000
Welders	1	1	1	3	13.50	74,520
Labourers	1	1	1	3	11.50	63,480
	7	6	4	17		
TOTAL HOURLY EMPLOYEES AND BASE COST PER YEAR	61	59	27	147	13.28	3,591,680

PAYROLL BURDENS

Hourly Workers

	Value	% Affected	Pro rata Amount/hr
1) Afternoon Shift Diff.	$ 0.30/hr	39.1	$ .12
2) Night Shift Diff.	0.35/hr	19.4	.07
3) Underground Allowance	0.75/hr	62.6	.47
4) Wet Allowance	1.50/shift	20.0	.30
5) Travel Pay	5.00/shift	100.0	.63
6) Transportation Allowance	5.00/shift	100.0	.63
7) Statutory Holidays	5% x $13.50 Avg.	100.0	.68
8) Vacation Pay	6% x $13.50 Avg.	100.0	.81
9) Health Benefits	3.5% x $13.50 Avg.	100.0	.47
10) W.C.B., C.P.P., U.I.C.	8% x $13.50 Avg.	100.0	1.08
11) Protective Clothing	.5% x $13.50 Avg.	100.0	.07
			$ 5.33/hr

Based on average hourly wage of $13.50 /hour.

Hourly Payroll Burden: 5.33/13.50 = 39.5%

Overtime Allowance: 10.0%

49.5%

Therefore, use 50% Hourly Payroll Burden.

Staff

1) Travel Allowance	$10/shift	100%	$ 2,300/annum
2) Health Benefits	3.5% x $31,000/annum	100%	1,085/annum
3) W.C.B., C.P.P., U.I.C.	8%	100%	2,480/annum
			$ 5,865/annum

Based on average annual salary of $31,000.

Staff Payroll Burden: 5,685/31,000 = 18.9%

Therefore, use 20% Staff Payroll Burden.

OPERATING COSTS

The calculations set out below are on a yearly production basis for the following production periods:

(A)	PHASE I	October, 1983 - December, 1983
(B)	PHASE II	January, 1984 - December, 1984
(C)	PHASE III	January, 1985 - December, 2006

All costs are based on 1982 figures and are stated per clean metric tonne.

(1) Labour

(A) PHASE I (2 C.M. Units - 2 Shifts, 5-day week)

Total Production - 55,000 Tonnes

i) Staff

Mine Manager	1 x 11 months x 65,000/annum =	$ 59,580
Mine Undermanager	1 x 10 months x 45,000/annum =	37,500
Assistant Undermanagers	2 x 6 months x 35,000/annum =	35,000
Firebosses	5 x 5 months x 30,000/annum =	62,500
Surveyor	1 x 5 months x 30,000/annum =	12,500
Surveyor Assistants	1 x 5 months x 20,000/annum =	8,330
Chief Accountant	1 x 9 months x 35,000/annum =	26,250
General Clerks	1 x 4 months x 20,000/annum =	6,670
Storeman - Head	1 x 6 months x 25,000/annum =	12,500
First Aid/Security	3 x 6 months x 25,000/annum =	37,500
Purchasing Officer	1 x 9 months x 30,000/annum =	22,500
Mechanical Engineer	1 x 9 months x 45,000/annum =	33,750
Mechanical Foremen	3 x 4 months x 30,000/annum =	30,000
Electrical Engineer	1 x 9 months x 45,000/annum =	33,750
Electrical Foremen	3 x 4 months x 30,000/annum =	30,000
Surface Foremen	2 x 4 months x 30,000/annum =	20,000
Preparation Plant Super.	1 x 7 months x 40,000/annum =	23,330
Base Costs		$491,660
Burden @ 20%		98,330
Total Staff Costs		$589,990

Total Staff Costs (from previous page)		$ 589,990
ii) Hourly Workers - Start Sept. 1, 1983		
4 months @ $1,877,720/annum	$ 625,910	
Burden @ 50%	312,960	
Total Hourly Costs		938,870
Total Labour		$1,528,860
Contingencies @ 15%		229,330
1983 Labour Costs		$1,758,190

Unit Labour Cost: $31.97/tonne

(B) PHASE II (3 C.M. Units + 1 Standby - 3 Shifts, 5-day week)

Annual Production - 497,000 Tonnes

i) Staff		
Base Costs	1,235,000	
Burden @ 20%	247,000	
Total Staff Costs		1,482,000
ii) Hourly Workers		
Base Costs	3,277,040	
Burden @ 50%	1,638,520	
Total Hourly Costs		4,915,560
Total Labour		6,397,560
Contingencies @ 15%		959,634
1984 Labour Costs		$7,357,194

Unit Labour Cost: $14.80/tonne

(C) PHASE III (3 C.M. Units + 1 Standby - 2 Shifts, 5-day week)
(1 Hydraulic Monitor + 1 Standby - 2 Shifts, 5-day week)

Annual Production - 881,000 Tonnes

i) Staff

Base Costs	1,415,000	
Burden @ 20%	283,000	
Total Staff Costs		1,698,000

ii) Hourly Workers

Base Costs	3,591,680	
Burden @ 50%	1,795,840	
Total Hourly Costs		5,387,520
Total Labour		7,085,520
Contingencies @ 15%		1,062,828
1985 Labour Costs		$8,148,348

Unit Labour Cost: $9.25/tonne

For analysis purposes, use $9.25 per tonne labour cost. All labour in Phases I and II (1983 and 1984) is capitalized as a pre-commercial production expense.

(2) Material Costs

	Cost per Tonne	
Timber Supports	$ .14	
Roof Bolts	.94	
Cutter Picks & Roof Bolter Bits	.66	
Ventilation	.17	
Oils & Greases	.04	
Power Plant	1.00	
Fuel	.30	
Miscellaneous	.50	
Total		$ 3.75

(3) Maintenance Materials Costs - Underground

Continuous Miners	.37	
Diesel Vehicles	.14	
Other Face Equipment	.23	
Conveyors	.26	
Flumes	.02	
Pipes	.45	
General	.23	
Total		1.70

(4) Maintenance Materials Costs - Surface

Preparation Plant	1.00	
Workshop	.11	
General	.11	
Miscellaneous	.17	
Total		1.39

Material Cost is: $ 6.84

(5) Other Operating Costs

		Cost per Tonne
(A) Trucking to Prince George		
- 64 km @ 8¢		5.12
(B) Tippling		
Labour	.35	
Power	.05	
Maintenance	.10	
		.50
(C) Royalties & Fees		
Province of B.C., 3.5% Minehead	1.20	
Zulu Explorations Ltd.	.20	
Marketing, 2.0% Minehead	.69	
Management, 2.0% F.O.B.T.	1.18	
		3.27
(D) Office Overhead		
Materials, Taxes, Phone, Travel, Insurance, etc.		1.00
Total of Other Operating Costs		$ 9.89

(6) Summary

Labour	$ 9.25
Materials	6.84
Other	9.89
Total Cost F.O.R. Prince George	$25.98

NORCO RESOURCES LTD.

TABLE No.

BOWRON COALFIELD
1 AUGUST 1982

CAPITAL EXPENDITURE SCHEDULE
EXPLORATION, DEVELOPMENT AND SURFACE
(1982 Cdn. $1000's)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1.0 EXPLORATION																								
1.1 Drilling	300	1,000																						
1.2 Geophysical	50	100																						
1.3 Analysis & Washabilities	30	30																						
1.4 Professional Fees	100	150																						
	480	1,280																						
2.0 ENGINEERING																								
2.1 Design	150	150																						
2.2 Environmental	100	100																						
2.3 Surveying	50	100																						
2.4 Project Management	260	780																						
	560	1,130																						
3.0 MINE DEVELOPMENT																								
3.1 Camp	251	536																						
3.2 Clearing	20	30																						
3.3 Auxiliary Power	300	100																						
3.4 Excavation	500																							
3.5 Drifts	1,000	2,500																						
3.6 Haul Road	60	250																						
3.7 Underground Dewater Stn.				800									800											
	2,131	3,416		800									800											
4.0 SURFACE FACILITIES																								
4.1 Bath House		300																						
4.2 Lamp Room		30																						
4.3 First Aid Room		20																						
4.4 Mines Rescue		50																						
4.5 Mine Office Building		250																						
4.6 Workshop and Stores		400																						
4.7 Site Services		200																						
4.8 Refuse Disposal		70																						
		1,320																						
5.0 SURFACE EQUIPMENT																								
5.1 Mine Fan		260							160				260											
5.2 Slope Conveyor		660																						
5.3 Rail Loadout		2,000																						
5.4 Main Power		5,400																						
5.5 Winch													1,000											
		8,320							160				1,260											
6.0 MOBILE EQUIPMENT																								
6.1 D8 Bulldozer (1 only)		370								370								370						
6.2 966 Loader (1 only)		250								250								250						
6.3 Rock Trucks (2 only)		180					180					180					180							
6.4 5T Crane (1 only)		82								82								82						
6.5 Water Truck (1 only)		35								35								35						
6.6 No.14 Grader (1 only)		140								140								140						
6.7 Firetruck (1 only)		70								70								70						
6.8 Ambulance (1 only)		25								25								25						
6.9 5T Flatbed (1 only)		20								20								20						
6.10 4X4 Pick-ups (6 only)		120					120					120					120							
		1,292					300			992		300					300	992						
7.0 COAL PREPARATION PLANT																								
7.1 Plant and Ancillaries		3,940	3,000																					
7.2 Hydraulic Backfill System			1,000										1,000											
		3,940	4,000										1,000											
8.0 PREPRODUCTION COSTS																								
8.1 Phase I Labour		1,758																						
8.2 Phase II Labour			7,357																					
		1,758	7,357																					
9.0 MISCELLANEOUS																								
9.1 Recruitment		100	100	100																				
9.2 Housing Subsidies		250	50	100																				
9.3 Inventory Stores		600	200	200																				
9.4 Inventory Coal		1,390																						
		2,340	350	400																				
	3,171	24,796	11,707	1,200			300		160	992		300	3,060				300	992						

NORCO
RESOURCES LTD.

TABLE No.

BOWRON COALFIELD
1 AUGUST 1982

CAPITAL EXPENDITURE SCHEDULE
UNDERGROUND
(1982 Cdn. $1000's)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
10.0 UNDERGROUND EQUIPMENT																								
10.1 Heading Machines		2,200	2,200						2,200	1,100						2,200	1,100							
10.2 Diesel Ram Cars		400	400																					
10.3 Roof Bolters		140	140						140	70						140	70							
10.4 Feeder Breakers		120	120						120	460						120	460							
10.5 Supply Vehicles		120	120						120	120						120	120							
10.6 Man Riding Cars		120	360						120	360						120	360							
10.7 Support Vehicles		300	300						300	300						300	300							
10.8 Panel Electricals		200	200						200	100						200	100							
10.9 Panel Conveyors		100	100																					
10.10 Panel Miscellaneous		300	300																					
10.11 Main Conveyor		200	1,200																					
10.12 Flumes			100																					
10.13 H.T. Cable		100	200						100	200						100	200							
10.14 Transformers		150	150						150	150						150	150							
10.15 Main Hydraulic Equipment			3,400											1,000										
10.16 Firefighting		100	200																					
10.17 Misc. Pumps and Pipes		200							200							200								
		4,750	9,830						3,650	2,860				1,000		3,650	2,860							
SURFACE TOTALS BY YEAR	3,171	24,796	11,707	400			300		160	992		300	2,260				300	992						
UNDERGROUND TOTALS BY YEAR		4,750	9,830	800					3,650	2,860			800	1,000		3,650	2,860							
SELECTIVE CONTINGENCY	200	2,500	1,300	200					400	300			500	100		400	300							
TOTAL YEARLY CAPITAL COSTS	3,371	32,046	22,837	1,400			300		4,210	4,152		300	3,560	1,100		4,050	3,460	992						

TOTAL SURFACE = $45,378,000.

TOTAL UNDERGROUND = 30,200,000.

TOTAL CONTINGENCIES = 6,200,000.

TOTAL CAPITAL COSTS = 81,778,000. (includes $9,115,000. capitalized labour)

APPENDIX IV

BASE CASE - DATA AND ASSUMPTIONS, CASH FLOW, BALANCE SHEETS

BASE CASE

1.0 DATA AND ASSUMPTIONS

Coal Sales Price = $59.00 (Can.) in 1983, $68.15 in 1984.

All Capital and Operating Costs are escalated @ 10% per annum beginning 1983.

Sales Price is escalated @ 10% per annum after last price stated above.

Discount Rate = 10%.

Loan Interest @ 12% is accrued for one year, added to principle and new value is amortized over the next seven years.

Equity Investment = $25,000,000.

Total Loans = $36,000,000.

15% contingency on labour amounts to $1,413,000 by 1984.

1.5% contingency on coal revenue amounts to $1,189,000 by 1984.

Capital cost contingencies amount to $4,523,000 by 1984.

Total contingencies come to $7,125,000 by 1984.

2.0 RESULTS

Total Accumulated Cash Flow	$332,751,000
Net Present Value @ 10%	$46,851,000
Equity Payout (Current Dollars)	1989
Equity Payout (Discount Dollars)	1992

Note: No allowance has been made for reinvestment or interest on cash flow over the life of the project.

NORCO RESOURCES LTD.
BOWRON RIVER COAL PROJECT
PRO-FORMA INCOME STATEMENT
(ALL AMOUNTS ARE STATED IN THOUSANDS)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
COAL PRODUCTION (TONNES)	0	55	497	881	881	881	881	881	881	881	881	881	881	881	881
RESIN PRODUCTION (POUNDS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COAL REVENUES	$0	$3,245	$33,871	$66,044	$72,649	$79,913	$87,905	$96,695	$106,365	$117,001	$128,701	$141,572	$155,729	$171,302	$188,432
RESIN REVENUES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL REVENUES	0	3,245	33,871	66,044	72,649	79,913	87,905	96,695	106,365	117,001	128,701	141,572	155,729	171,302	188,432
DIRECT COSTS															
LABOR	0	0	0	10,847	11,931	13,124	14,437	15,881	17,469	19,216	21,137	23,251	25,576	28,133	30,947
MATERIAL & SUPPLY	0	559	5,557	6,496	7,146	7,860	8,647	9,511	10,462	11,509	12,659	13,925	15,318	16,850	18,535
FUEL	0	30	301	352	387	426	468	515	567	623	686	754	829	912	1,004
RESIN COSTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POWER	0	67	668	1,173	1,290	1,419	1,561	1,717	1,889	2,077	2,285	2,514	2,765	3,041	3,346
SUPPLY & TRANSPORTATION	0	1,248	12,400	24,179	26,597	29,257	32,183	35,401	38,941	42,835	47,118	51,830	57,013	62,715	68,986
PORT CHARGES	0	242	2,405	4,690	5,159	5,675	6,243	6,867	7,554	8,309	9,140	10,054	11,060	12,166	13,382
OTHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	2,146	21,331	47,737	52,511	57,762	63,538	69,892	76,881	84,569	93,026	102,328	112,561	123,817	136,199
GROSS PROFIT	0	1,099	12,540	18,307	20,138	22,152	24,367	26,804	29,484	32,432	35,675	39,243	43,167	47,484	52,232
GENERAL & ADMIN EXPENSES															
MANAGEMENT COSTS	0	300	677	1,321	1,453	1,598	1,758	1,934	2,127	2,340	2,574	2,831	3,115	3,426	3,769
ADMIN EXPENSES	0	61	601	1,173	1,290	1,419	1,561	1,717	1,889	2,077	2,285	2,514	2,765	3,041	3,346
PRIVATE ROYALTIES	0	35	381	743	818	900	990	1,089	1,197	1,317	2,535	2,789	3,068	3,375	3,712
DEPLETION	0	109	989	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753
DEPRECIATION	0	312	2,821	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
INTEREST	0	0	1,882	4,652	4,150	3,588	2,958	2,253	1,463	1,731	2,306	2,052	1,768	2,716	2,698
CONTINGENCY	0	49	508	991	1,090	1,199	1,319	1,450	1,595	1,755	1,931	2,124	2,336	2,570	2,826
	0	866	7,860	15,633	15,554	15,457	15,338	15,196	15,025	15,974	18,384	19,063	19,805	21,881	23,104
NET INCOME BEFORE TAXES	0	233	4,680	2,674	4,584	6,695	9,028	11,608	14,459	16,459	17,291	20,180	23,362	25,603	29,128
INCOME TAXES															
CURRENT	0	61	667	1,301	1,431	1,774	4,063	6,303	7,265	7,830	9,218	12,205	12,153	15,672	18,812
DEFFERRED	0	55	1,780	(77)	818	1,528	(108)	(1,506)	(1,156)	(762)	(2,039)	(3,051)	(948)	(3,027)	(4,094)
	0	117	2,447	1,224	2,249	3,302	3,955	4,797	6,110	7,068	7,180	9,154	11,205	12,645	14,718
NET INCOME (LOSS)	0	117	2,233	1,451	2,335	3,393	5,074	6,811	8,349	9,391	10,112	11,026	12,157	12,959	14,410
ADD NON-CASH CHARGES															
DEPLETION	0	109	989	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753
DEPRECIATION	0	312	2,821	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
DEFFERRED INCOME TAX	0	55	1,780	(77)	818	1,528	(108)	(1,506)	(1,156)	(762)	(2,039)	(3,051)	(948)	(3,027)	(4,094)
CASH FLOW FROM OPERATIONS	0	593	7,823	8,127	9,906	11,675	11,719	12,058	13,947	15,382	14,826	14,728	17,962	16,685	17,070
ADD INCREASE IN EQUITY	5,000	20,000	0	0	0	0	0	0	0	0	0	0	0	0	0
ADD INCREASE IN DEBT	0	14,000	22,000	0	0	0	0	0	8,574	9,432	0	0	9,415	3,452	0
LESS DEBT REPAYMENT	0	0	1,554	4,183	4,685	5,247	5,877	6,582	7,372	5,772	2,113	2,367	2,651	4,014	4,879
LESS FIXED ASSET EXPENDITURE	3,371	35,251	27,633	1,863	0	0	531	0	9,025	9,790	0	856	11,173	3,797	0
NET CASH FLOW (DEFICIT)	1,629	(657)	636	2,080	5,221	6,427	5,310	5,476	6,125	9,251	12,713	11,506	13,554	12,326	12,191
ACC. NET CASH FLOW	1,629	972	1,608	3,688	8,909	15,337	20,647	26,124	32,248	41,500	54,213	65,718	79,272	91,598	103,789
RETAINED EARNINGS	0	117	2,350	3,800	6,135	9,528	14,602	21,413	29,762	39,153	49,264	60,290	72,447	85,406	99,816
% INCOME RETURN ON EQUITY	0	0	9	6	9	14	20	27	33	38	40	44	49	52	58
% CASH FLOW RETURN ON EQUITY	33	(3)	3	8	21	26	21	22	24	37	51	46	54	49	49
NET PRESENT VALUE @ 10%	(3,519)	(22,244)	(21,766)	(20,345)	(17,103)	(13,475)	(10,750)	(8,195)	(5,598)	(2,031)	2,425	6,091	10,017	13,263	16,181

NORCO RESOURCES LTD.
BOWRON RIVER COAL PROJECT
PRO-FORMA INCOME STATEMENT
(ALL AMOUNTS ARE STATED IN THOUSANDS)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
COAL PRODUCTION (TONNES)	881	881	881	881	881	881	881	881	881	881
RESIN PRODUCTION (POUNDS)	0	0	0	0	0	0	0	0	0	0
COAL REVENUES	$207,275	$228,002	$250,803	$275,883	$303,471	$333,818	$367,200	$403,920	$444,312	$488,743
RESIN REVENUES	0	0	0	0	0	0	0	0	0	0
TOTAL REVENUES	207,275	228,002	250,803	275,883	303,471	333,818	367,200	403,920	444,312	488,743
DIRECT COSTS										
LABOR	34,041	37,446	41,190	45,309	49,840	54,824	60,306	66,337	72,971	80,268
MATERIAL & SUPPLY	20,388	22,427	24,670	27,137	29,850	32,835	36,119	39,731	43,704	48,074
FUEL	1,104	1,214	1,336	1,469	1,616	1,778	1,956	2,151	2,367	2,603
RESIN COSTS	0	0	0	0	0	0	0	0	0	0
POWER	3,680	4,048	4,453	4,898	5,388	5,927	6,520	7,172	7,889	8,678
SUPPLY & TRANSPORTATION	75,885	83,473	91,821	101,003	111,103	122,213	134,435	147,878	162,666	178,932
PORT CHARGES	14,721	16,193	17,812	19,593	21,552	23,708	26,078	28,686	31,555	34,710
OTHER	0	0	0	0	0	0	0	0	0	0
	149,819	164,801	181,281	199,409	219,350	241,285	265,414	291,955	321,151	353,266
GROSS PROFIT	57,456	63,201	69,521	76,474	84,121	92,533	101,786	111,965	123,161	135,478
GENERAL & ADMIN EXPENSES										
MANAGEMENT COSTS	4,145	4,560	5,016	5,518	6,069	6,676	7,344	8,078	8,886	9,775
ADMIN EXPENSES	3,680	4,048	4,453	4,898	5,388	5,927	6,520	7,172	7,889	8,678
PRIVATE ROYALTIES	4,083	4,492	4,941	5,435	5,979	6,576	7,234	7,957	8,753	9,629
DEPLETION	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753
DEPRECIATION	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
INTEREST	2,112	3,702	4,851	4,156	3,377	2,506	1,807	1,125	362	0
CONTINGENCY	3,109	3,420	3,762	4,138	4,552	5,007	5,508	6,059	6,665	7,331
	23,884	26,976	29,776	30,898	32,119	33,446	35,166	37,145	39,309	42,165
NET INCOME BEFORE TAXES	33,572	36,226	39,746	45,575	52,002	59,087	66,621	74,820	83,853	93,312
INCOME TAXES										
CURRENT	19,539	19,826	22,767	27,741	32,651	37,662	42,721	48,031	53,742	59,611
DEFFERRED	(2,298)	(1,091)	(2,097)	(3,896)	(5,327)	(6,520)	(7,534)	(8,452)	(9,331)	(10,153)
	17,241	18,735	20,669	23,845	27,324	31,142	35,187	39,579	44,411	49,459
NET INCOME (LOSS)	16,331	17,491	19,076	21,730	24,679	27,945	31,433	35,241	39,442	43,854
ADD NON-CASH CHARGES										
DEPLETION	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753
DEPRECIATION	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
DEFFERRED INCOME TAX	(2,298)	(1,091)	(2,097)	(3,896)	(5,327)	(6,520)	(7,534)	(8,452)	(9,331)	(10,153)
CASH FLOW FROM OPERATIONS	20,786	23,153	23,732	24,588	26,104	28,178	30,653	33,542	36,864	40,454
ADD INCREASE IN EQUITY	0	0	0	0	0	0	0	0	0	0
ADD INCREASE IN DEBT	16,709	13,785	0	0	0	0	0	0	0	0
LESS DEBT REPAYMENT	5,464	5,871	5,791	6,486	7,264	5,825	5,677	6,358	3,021	0
LESS FIXED ASSET EXPENDITURE	16,918	15,899	5,014	0	0	0	0	0	0	0
NET CASH FLOW (DEFICIT)	15,113	15,169	12,927	18,102	18,840	22,353	24,976	27,184	33,844	40,454
ACC. NET CASH FLOW	118,902	134,071	146,998	165,100	183,940	206,294	231,269	258,453	292,297	332,751
RETAINED EARNINGS	116,147	133,638	152,714	174,444	199,123	227,068	258,501	293,742	333,183	377,037
% INCOME RETURN ON EQUITY	65	70	76	87	99	112	126	141	158	175
% CASH FLOW RETURN ON EQUITY	60	61	52	72	75	89	100	109	135	162
NET PRESENT VALUE @ 10%	19,470	22,471	24,796	27,756	30,557	33,577	36,645	39,681	43,117	46,851

NORCO RESOURCES LTD.
BOWRON RIVER COAL PROJECT
PRO-FORMA BALANCE SHEETS
DECEMBER 31
(ALL AMOUNTS ARE STATED IN THOUSANDS)

A S S E T S

	1982	1983	1984	1987	1993
CASH	$1,629	$972	$1,608	$15,337	$65,718
PROPERTY PLANT AND EQUIPMENT	0	24,022	39,509	24,509	14,710
CAPITALIZED EXPLORATION AND DEVELOPMENT EXPENSES	3,371	14,178	24,194	23,438	15,079
	5,000	39,172	65,311	63,283	95,508

L I A B I L I T I E S

	1982	1983	1984	1987	1993
DEFERRED INCOME TAX	0	55	1,835	4,104	(4,518)
CURRENT PORTION OF LONG TERM DEBT	0	1,554	4,183	5,877	2,651
LONG TERM DEBT	0	12,446	31,943	18,774	12,085
	0	14,055	37,961	28,755	10,217

SHAREHOLDERS EQUITY

	1982	1983	1984	1987	1993
SHARE CAPITAL	5,000	25,000	25,000	25,000	25,000
RETAINED EARNINGS(DEFICIT)	0	117	2,350	9,528	60,290
	5,000	25,117	27,350	34,528	85,290
	$5,000	$39,172	$65,311	$63,283	$95,508

APPENDIX V

CASE 2 - DATA AND ASSUMPTIONS, CASH FLOW, BALANCE SHEETS

CASE II

1.0 DATA AND ASSUMPTIONS

Coal Sales Price = $59.00 (Can.) in 1983, $68.15 in 1984.

Resin Sales Price = $4.00/lb in 1985 ($3.00 1982 value).

Resin Extraction and Handling Costs = $0.68/lb in 1985 ($0.51 1982 value).

Resin Content = 1% average in 1,050,000 T.P.A.

Resin Recovery = 7.1%.

All Capital and Operating Costs are escalated @ 10% per annum beginning 1983.

All Sales Prices are escalated @ 10% per annum after last price stated above.

Discount Rate = 10%.

Loan Interest @ 12% is accrued for one year, added to principle and new value is amortized over the next seven years.

Equity Investment = $25,000,000.

Total Loans = $36,000,000.

15% contingency on labour amounts to $1,413,000 by 1984.

1.5% contingency on coal revenue amounts to $1,189,000 by 1984.

Capital cost contingencies amount to $4,523,000 by 1984.

Total contingencies come to $7,125,000 by 1984.

2.0 RESULTS

Total Accumulated Cash Flow	$515,946,000
Net Present Value @ 10%	$87,213,000
Equity Payout (Current Dollars)	1987
Equity Payout (Discount Dollars)	1988

Note: No allowance has been made for reinvestment or interest on cash flow over the life of the project.

NORCO RESOURCES LTD.
BOWRON RIVER COAL PROJECT
PRO-FORMA INCOME STATEMENT
(ALL AMOUNTS ARE STATED IN THOUSANDS)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
COAL PRODUCTION (TONNES)	0	55	497	881	881	881	881	881	881	881	881	881	881	881	881
RESIN PRODUCTION (POUNDS)	0	0	0	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650
COAL REVENUES	$0	$3,245	$33,871	$66,044	$72,649	$79,913	$87,905	$96,695	$106,365	$117,001	$128,701	$141,572	$155,729	$171,302	$188,432
RESIN REVENUES	0	0	0	6,590	7,249	7,974	8,772	9,649	10,614	11,675	12,843	14,127	15,540	17,094	18,803
TOTAL REVENUES	0	3,245	33,871	72,634	79,898	87,888	96,676	106,344	116,979	128,676	141,544	155,698	171,268	188,395	207,235
DIRECT COSTS															
LABOR	0	0	0	10,847	11,931	13,124	14,437	15,881	17,469	19,216	21,137	23,251	25,576	28,133	30,947
MATERIAL & SUPPLY	0	559	5,557	6,496	7,146	7,860	8,647	9,511	10,462	11,509	12,659	13,925	15,318	16,850	18,535
FUEL	0	30	301	352	387	426	468	515	567	623	686	754	829	912	1,004
RESIN COSTS	0	0	0	1,130	1,243	1,367	1,504	1,654	1,820	2,002	2,202	2,422	2,665	2,931	3,224
POWER	0	67	668	1,173	1,290	1,419	1,561	1,717	1,889	2,077	2,285	2,514	2,765	3,041	3,346
SUPPLY & TRANSPORTATION	0	1,248	12,400	24,179	26,597	29,257	32,183	35,401	38,941	42,835	47,118	51,830	57,013	62,715	68,986
PORT CHARGES	0	242	2,405	4,690	5,159	5,675	6,243	6,867	7,554	8,309	9,140	10,054	11,060	12,166	13,382
OTHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	2,146	21,331	48,867	53,754	59,129	65,042	71,546	78,701	86,571	95,228	104,751	115,226	126,748	139,423
GROSS PROFIT	0	1,099	12,540	23,767	26,144	28,759	31,635	34,798	38,278	42,106	46,316	50,948	56,042	61,647	67,811
GENERAL & ADMIN EXPENSES															
MANAGEMENT COSTS	0	300	677	1,321	1,453	1,598	1,758	1,934	2,127	2,340	2,574	2,831	3,115	3,426	3,769
ADMIN EXPENSES	0	61	601	1,173	1,290	1,419	1,561	1,717	1,889	2,077	2,285	2,514	2,765	3,041	3,346
PRIVATE ROYALTIES	0	35	381	743	818	900	990	1,089	1,197	1,317	2,535	2,789	3,068	3,375	3,712
DEPLETION	0	109	989	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753
DEPRECIATION	0	315	2,851	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054
INTEREST	0	0	1,882	4,652	4,150	3,588	2,958	2,253	1,463	1,731	2,306	2,052	1,768	2,716	2,698
CONTINGENCY	0	49	508	991	1,090	1,199	1,319	1,450	1,595	1,755	1,931	2,124	2,336	2,570	2,826
	0	869	7,890	15,686	15,607	15,510	15,392	15,249	15,079	16,027	18,438	19,117	19,858	21,934	23,158
NET INCOME BEFORE TAXES	0	230	4,650	8,081	10,537	13,249	16,243	19,549	23,199	26,078	27,878	31,831	36,184	39,713	44,654
INCOME TAXES															
CURRENT	0	61	667	1,301	1,782	5,226	7,678	10,022	11,733	13,355	15,977	19,281	19,635	23,678	27,452
DEFFERRED	0	53	1,764	2,896	3,651	766	(668)	(1,796)	(1,338)	(924)	(2,232)	(3,133)	(939)	(2,944)	(3,948)
	0	115	2,431	4,197	5,433	5,992	7,010	8,226	10,395	12,430	13,745	16,147	18,696	20,734	23,504
NET INCOME (LOSS)	0	115	2,219	3,884	5,104	7,256	9,232	11,322	12,804	13,648	14,133	15,684	17,488	18,979	21,150
ADD NON-CASH CHARGES															
DEPLETION	0	109	989	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753
DEPRECIATION	0	315	2,851	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054
DEFFERRED INCOME TAX	0	53	1,764	2,896	3,651	766	(668)	(1,796)	(1,338)	(924)	(2,232)	(3,133)	(939)	(2,944)	(3,948)
CASH FLOW FROM OPERATIONS	0	593	7,823	13,587	15,562	14,829	15,371	16,333	18,273	19,531	18,708	19,357	23,356	22,842	24,008
ADD INCREASE IN EQUITY	5,000	20,000	0	0	0	0	0	0	0	0	0	0	0	0	0
ADD INCREASE IN DEBT	0	14,000	22,000	0	0	0	0	0	8,574	9,432	0	0	9,415	3,452	0
LESS DEBT REPAYMENT	0	0	1,554	4,183	4,685	5,247	5,877	6,582	7,372	5,772	2,113	2,367	2,651	4,014	4,879
LESS FIXED ASSET EXPENDITURE	3,371	35,251	28,843	1,863	0	0	531	0	9,025	9,790	0	856	11,173	3,797	0
NET CASH FLOW (DEFICIT)	1,629	(657)	(574)	7,540	10,877	9,582	8,963	9,752	10,451	13,400	16,595	16,134	18,948	18,482	19,129
ACC. NET CASH FLOW	1,629	972	398	7,938	18,815	28,398	37,360	47,112	57,563	70,962	87,557	103,691	122,639	141,121	160,250
RETAINED EARNINGS	0	115	2,335	6,218	11,323	18,579	27,811	39,134	51,938	65,586	79,719	95,403	112,891	131,869	153,019
% INCOME RETURN ON EQUITY	0	0	9	16	20	29	37	45	51	55	57	63	70	76	85
% CASH FLOW RETURN ON EQUITY	33	(3)	(2)	30	44	38	36	39	42	54	66	65	76	74	77
NET PRESENT VALUE @ 10%	(3,519)	(22,244)	(22,675)	(17,525)	(10,771)	(5,362)	(763)	3,786	8,219	13,384	19,201	24,342	29,830	34,697	39,276

NORCO RESOURCES LTD.
BOWRON RIVER COAL PROJECT
PRO-FORMA INCOME STATEMENT
(ALL AMOUNTS ARE STATED IN THOUSANDS)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
COAL PRODUCTION (TONNES)	881	881	881	881	881	881	881	881	881	881
RESIN PRODUCTION (POUNDS)	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650
COAL REVENUES	$207,275	$228,002	$250,803	$275,883	$303,471	$333,818	$367,200	$403,920	$444,312	$488,743
RESIN REVENUES	20,683	22,752	25,027	27,529	30,282	33,311	36,642	40,306	44,336	48,770
TOTAL REVENUES	227,958	250,754	275,829	303,412	333,753	367,129	403,842	444,226	488,648	537,513
DIRECT COSTS										
LABOR---	34,041	37,446	41,190	45,309	49,840	54,824	60,306	66,337	72,971	80,268
MATERIAL & SUPPLY	20,388	22,427	24,670	27,137	29,850	32,835	36,119	39,731	43,704	48,074
FUEL	1,104	1,214	1,336	1,469	1,616	1,778	1,956	2,151	2,367	2,603
RESIN COSTS	3,546	3,901	4,291	4,720	5,192	5,712	6,283	6,911	7,602	8,362
POWER	3,680	4,048	4,453	4,898	5,388	5,927	6,520	7,172	7,889	8,678
SUPPLY & TRANSPORTATION	75,885	83,473	91,821	101,003	111,103	122,213	134,435	147,878	162,666	178,932
PORT CHARGES	14,721	16,193	17,812	19,593	21,552	23,708	26,078	28,686	31,555	34,710
OTHER	0	0	0	0	0	0	0	0	0	0
	153,366	168,702	185,572	204,130	224,543	246,997	271,697	298,866	328,753	361,628
GROSS PROFIT	74,593	82,052	90,257	99,283	109,211	120,132	132,145	145,360	159,896	175,885
GENERAL & ADMIN EXPENSES										
MANAGEMENT COSTS	4,145	4,560	5,016	5,518	6,069	6,676	7,344	8,078	8,886	9,775
ADMIN EXPENSES	3,680	4,048	4,453	4,898	5,388	5,927	6,520	7,172	7,889	8,678
PRIVATE ROYALTIES	4,083	4,492	4,941	5,435	5,979	6,576	7,234	7,957	8,753	9,629
DEPLETION	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753
DEPRECIATION	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054
INTEREST	2,112	3,702	4,851	4,156	3,377	2,506	1,807	1,125	362	0
CONTINGENCY	3,109	3,420	3,762	4,138	4,552	5,007	5,508	6,059	6,665	7,331
	23,937	27,029	29,829	30,952	32,172	33,499	35,219	37,198	39,362	42,219
NET INCOME BEFORE TAXES	50,655	55,023	60,428	68,331	77,039	86,633	96,926	108,161	120,534	133,666
INCOME TAXES										
CURRENT	28,921	30,054	33,950	39,992	46,090	52,417	58,931	65,846	73,327	81,146
DEFFERRED	(2,099)	(842)	(1,801)	(3,553)	(4,938)	(6,081)	(7,043)	(7,905)	(8,723)	(9,479)
	26,822	29,212	32,149	36,439	41,152	46,336	51,888	57,942	64,604	71,667
NET INCOME (LOSS)	23,833	25,810	28,279	31,892	35,886	40,296	45,038	50,219	55,929	61,999
ADD NON-CASH CHARGES										
DEPLETION	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753
DEPRECIATION	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054	5,054
DEFFERRED INCOME TAX	(2,099)	(842)	(1,801)	(3,553)	(4,938)	(6,081)	(7,043)	(7,905)	(8,723)	(9,479)
CASH FLOW FROM OPERATIONS	28,541	31,776	33,284	35,146	37,756	41,022	44,802	49,122	54,013	59,327
ADD INCREASE IN EQUITY	0	0	0	0	0	0	0	0	0	0
ADD INCREASE IN DEBT	16,709	13,785	0	0	0	0	0	0	0	0
LESS DEBT REPAYMENT	5,464	5,871	5,791	6,486	7,264	5,825	5,677	6,358	3,021	0
LESS FIXED ASSET EXPENDITURE	16,918	15,899	5,014	0	0	0	0	0	0	0
NET CASH FLOW (DEFICIT)	22,868	23,791	22,479	28,660	30,491	35,197	39,125	42,764	50,993	59,327
ACC. NET CASH FLOW	183,118	206,909	229,389	258,049	288,540	323,738	362,863	405,626	456,619	515,946
RETAINED EARNINGS	176,852	202,662	230,941	262,834	298,720	339,016	384,054	434,274	490,203	552,202
% INCOME RETURN ON EQUITY	95	103	113	128	144	161	180	201	224	248
% CASH FLOW RETURN ON EQUITY	91	95	90	115	122	141	156	171	204	237
NET PRESENT VALUE @ 10%	44,253	48,960	53,003	57,689	62,222	66,978	71,784	76,560	81,737	87,213

NORCO RESOURCES LTD.
BOWRON RIVER COAL PROJECT
PRO-FORMA BALANCE SHEETS
DECEMBER 31
(ALL AMOUNTS ARE STATED IN THOUSANDS)

ASSETS

	1982	1983	1984	1987	1993
CASH	$1,629	$972	$398	$28,398	$103,691
PROPERTY PLANT AND EQUIPMENT	0	24,019	40,685	25,525	15,406
CAPITALIZED EXPLORATION AND DEVELOPMENT EXPENSES	3,371	14,178	24,194	23,438	15,079
	5,000	39,168	65,277	77,360	134,176

LIABILITIES

	1982	1983	1984	1987	1993
DEFERRED INCOME TAX	0	53	1,817	9,130	(962)
CURRENT PORTION OF LONG TERM DEBT	0	1,554	4,183	5,877	2,651
LONG TERM DEBT	0	12,446	31,943	18,774	12,085
	0	14,053	37,943	33,781	13,773

SHAREHOLDERS EQUITY

	1982	1983	1984	1987	1993
SHARE CAPITAL	5,000	25,000	25,000	25,000	25,000
RETAINED EARNINGS(DEFICIT)	0	115	2,335	18,579	95,403
	5,000	25,115	27,335	43,579	120,403
	$5,000	$39,168	$65,277	$77,360	$134,176