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November 25, 1986

Project No. : 1800
Corres. No. : Boyd-US-238

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Attention: Mr. John R. Morgan
Chief, Power Division
Office of Energy
and Environment

Mr. Ghulam Murtaza Ilias
Chief Engineer, Coal
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Subject: Response to Donor Agency Comments
Volumes 9A/9B: Coal Mine Feasibility

Dear Sirs:

Following are our responses relative to formal comments made by prospective donor agencies relative to their review of BOYD's Coal Mine Feasibility and Master Mine Plan Report Volumes 9A/9B. A review of specific comments indicates that responding members of the donor agencies have not properly interpreted the BOYD reports and, in some cases, simply do not support the objective of the project.

For purposes of this letter, we have reviewed comments and reorganized them by mine component. Refer to Telex E&E/Lakhra/T-1298/4/86 (consolidation of donor agency comments).

## 1.0 Surface Mine Plan

### 1.1 Equipment Availability/Utilization

Comment: For surface mining World Bank thinks that overall machine availability and utilization (used by BOYD) are too high and will actually reach a net figure ten (10) percentage points less or 50% for draglines and 46% for shovels.

BOYD: pp. 6-7, 7-20, 7-21, Appendix C series; Volume 9A:

As compared with typical U.S. standards, BOYD has lowered equipment availability by a factor of 20 to 25 percent to reflect the introduction into Pakistan of (a) an advanced mining technology, (b) new equipment types, and (c) increased equipment size. It is strongly emphasized that securing the services of an experienced international mining company is essential to the success of the project. A phased buildup in operating efficiency is incorporated into the development plan, as well as comprehensive training in equipment operation and maintenance. Procurement of spare parts for the draglines, shovels, etc., is provided by an extensive parts inventory (warehouse). This will preclude prolonged shutdown of any major unit due to unavailability of repair parts.

It is our opinion that an average expatriate mine manager can achieve the performance outlined in Volume 9A. This is also supported by discussions with several of the prequalified expatriate firms who indicate they are planning significantly higher production rates. WB's opinion seems to be biased by their

experience in India (at the same time discounting the superior performance of Costain in Jordan). Based on our knowledge of draglines operating in India, we offer the following comments:

* Operating draglines in India are smaller capacity (bucket size 4 to 30 cubic meters) than those proposed for Lakhra, and many are of Russian manufacture. U.S. manufactured machines operating in India are 20 years or more old. Most newer units are Ransomes Rapier Ltd., U.K., and are 24 cubic meter size (six new machines ordered in 1983-1985).

* Overburden conditions in India are characterized as medium hard to hard (estimated dragline bucket fill factor is about 80%). We anticipate relatively easy digging conditions at Lakhra although blasting will be required (estimated dragline bucket fill factor is 90%).

* Idle time is quite high at Indian coal mines; draglines operate approximately 300 out of scheduled 365 days/year.

* Many mines are government operations. We are not sure if any Indian coal mines have responsible expatriate mining companies involved in their operation.

1.2 Equipment Summary (p. 7-20, Volume 9A)

Comment: Discrepancy noted between equipment summary table on p. 7-20 and Appendix G-1, Appendix G-2.

BOYD: With the exception of four utility service front-end loaders (i.e., total number of front-end loaders is nine), p. 7-20 is correct. Figures shown on Appendix G series under the column "No. of Units" are incorrect in some cases, but capital estimates in the cost detail are correctly shown.

1.3 Selection of Surface Mining

Comment: Provide summary statement which insures that the reader understands the positive impact of surface mining by discussing the tonnes lost, value of tonnes lost, and reduction in

generation capacity if all-underground mining is used. WAPDA specifically requested the following, quote: JTB should defend very strongly the adoption of surface mining vis-a-vis deep mining, particularly with reference to conservation of reserves.

BOYD - pp. 6-2, 6-3, Volume 9A: Rationale used in selection of the predominantly all surface mine approach is shown. We have also included a similar discussion in our draft of Volume 1: Executive Summary.

1.4 Reduction of Highwalls by Prestripping

Comment: Provide more discussion detailing how the height of highwalls will be reduced to minimize bank failure by shovel/truck prestripping.

BOYD - Prestripping Sequence, Surface Mine Plan, Volume 9A, Exhibit 4F, Volume 9B: The prestripping sequence text should be read while reviewing Exhibit 4F to better understand the series of benches constructed during overburden removal. By reducing the height of overburden to be moved by the dragline (by prestripping), coupled with the absence of ground water, the probability of large scale highwall instability is likewise reduced.

1.5 Multiple Seam Mining by Surface Methods

Comment: Provide discussion on how multiple seam surface mining is actually accomplished with references to where such mining is currently done.

BOYD: Multiple seam surface mining is proposed for the Lakhra Coal Project and is explained in detail in the Surface Mine Plan (pp. 7-1 through 7-17), Volume 9A, but should be read while reviewing Exhibits 4A-1 through 4F, Volume 9B, in order to better understand the mining sequence.

Multiple seam surface mining is a common occurrence throughout the world, including the United States, Canada, Australia, Phillippines, South Africa, Colombia, etc.

## 2.0 Underground Mine Plan

### 2.1 Operating Schedule

Comment: WAPDA believes and is supported by USAID that the number of operating days, 262 days per year for underground mining, are too low as not as much time will be lost to spontaneous combustion as shown, and the decrease in efficiency during religious holidays is too high.

BOYD: The mines are scheduled to operate 298 days per year (only Fridays and holidays are not scheduled). The effective days of full production are assigned at 262 per year; the equivalent of 36 days of full production is assigned as lost due to mine fires and other factors beyond the control of the mine operator (weather, electrical outage, etc.). Based on numerous visits to existing mines at Lakhra and experience with mining in general, it is our professional judgement that the 262-day parameter is reasonable. There are no reliable statistics available to document historical performance. To achieve the assigned schedule will require a substantial improvement in current practices, including the establishment of a permanent labor force.

2.2 Comment: WAPDA and USAID - Believe the decrease in efficiency during religious holidays is too high.

BOYD - p. 8-19, Volume 9A: During the 23 scheduled operating days during Ramadan (month-long Moslem religious observance which includes fasting from all food and liquids during daylight hours), the production efficiency is decreased to the equivalent of 15 full production days. This is a reduction of 35%.

Lacking reliable statistics on productivity to compare normal work periods to lignite production during the 30-day Ramadan observance, we relied on information (opinions) gathered from discussions with existing mine operators in the Lakhra area. Three factors must be considered: (1) work environment (hot and humid), (2) physical requirement of the job (hard manual work), and (3) religious attitude of the predominantly Pathan labor force. We believe the assigned efficiency reduction is warranted and reasonable.

2.3 Comment: WB thinks that underground mine labor productivity is too high and will reach 50-60 percent of the 2.6 tonnes per manday suggested by BOYD because more manpower will be required than that shown. USAID supports BOYD productivity figures.

BOYD - p. 8-27a, sheet 3 of 3, Schedule B-2, Volume 9A: Effective ROM Tonnes/Manday, D+1 through D+19 average is 2.47.

It is important to define the basis of the calculation; the effective productivity is defined as ROM tonnage produced divided by estimated manshifts directly worked at the mine. Pakistan practice is to compensate all company employees by salary plus

allowances. In Volume 9A we have assumed all payroll employees receive a monthly salary (i.e., they are paid for all days, including absenteeism). Secondly, personnel assigned to the common facilities and infrastructure are also needed to operate the total mining operation. If the productivity calculation is adjusted to reflect total payroll and an allocation of common facility/infrastructure personnel, then average productivity is estimated at 1.4 ROM tonnes per manday.

Although the projected productivity is significantly higher than existing mines, we believe it is reasonable and achievable based on proposed improvements in ventilation, introduction of mechanized mining, and stabilization of the work force.

2.4 Comment: Mining Approach - World Bank has reservations on the following underground mining points which BOYD should consider and discuss BOYD approach as needed to clearly support JTB position:

(a) Two compartment slope entry developments will pose many construction problems. Considering the weak strata conditions. It is doubtful whether the slope roof and wall could be supported with 10 CM shotcrete. Designer should consider two separate entries.

(b) The ventilation shaft will also be divided into two compartments, for intake and return airways. This is not safe practice for lignite mines.

(c) The recommended ventilation pressure 150 MM. W. G. is too high for lignite pillars which are only 16-17 M wide. There is danger of "breathing" across the pillar.

(d) The longwall districts are 1,000 M long. Average daily retreat is 3.33 M or in other words, the district life will be 12 months or more. The high propensity of lignite to spontaneous combustion may not permit such a long district life.

(e) The average production of the mine is 1,200 tonnes per day or 400 tonnes per shift. It is not economical to install long lines of belt conveyors for such a production rate of low quality material. Conventional rope haulage with mine cars will be a cheaper alternative.

(f) The use of diesel equipment in the development entry is restricted in many counties. The ventilation problems in the entries become very acute even when the diesel equipments are maintained in the best condition.

(g) The main conveyor underground is located in the return air. In the event of any fire at a longwall face carbon monoxide in the air will affect the operation. It is better located in the fresh air.

BOYD: The proposed Lakhra Upgrade approach incorporates limited introduction of Western technology to permit the development of a more efficient operation. Following discussions with WB mining staff on May 28, 1986 (to review our preliminary alternative mine design draft report), BOYD examined the WB concerns and revised our underground mine plan where we believe warranted. There appears to be a basic difference in the point of reference used to compare the Lakhra Upgrade plan. WB would seem to be relying on existing mines in India. This background is very relevant when assessing general problems encountered in underground lignite mining but does not address some of the current proven mining practices and technology. Based on inspections of thirteen (13) existing lignite mines operating at Lakhra and our extensive experience with current underground mining technology, BOYD has developed the proposed Lakhra Upgrade concept.

Following are our point-by-point responses:

A. <u>p. 8-5, Volume 9A</u>:

Access to the underground workings is by an incline (slope), measuring 4.27 x 4.27 meters, with an arched roof. The incline is driven at 10° or a 17.6% gradient.

Preliminary design of the underground mine openings reflects Western construction practices and increased investment to ensure long-term stability. The incline coping (approximately 30 meters long) is reinforced concrete, and the exposed surfaces, walls, and roof throughout the remaining length are coated with a 10 cm thickness of shotcrete. Where traversed, sand zones are sealed with brick walls or other retaining construction material. The incline has two sections (upper/lower) to accommodate a 91 cm wide belt conveyor in the upper deck and a roadway in the bottom section for the Diesel rubber-tired vehicles to transport personnel, machinery, and supplies. The incline also serves as a fresh air intake. Timber and steel columns are used to support the incline deck and provide lateral wall support. Where warranted, rock bolts and/or steel support sets are used (see Exhibit 5C of Volume 9B).

During our inspection program of the existing Lakhra underground mines, routine observations were made of the natural rock conditions in existing inclines. Except where loose sand zones were encountered, the rock strata were competent and the opening was essentially self-supporting. Our preliminary

construction plans are intended to be cost-effective, while providing long life openings. Shotcrete is used to seal the natural rock strata from exposure to weathering, and supplemental structural support is planned where weak strata are encountered. We anticipate no greater stability problems with the proposed two-compartment incline opening than one would encounter with a nonpartitioned incline.

B. pp. 8-6 and 8-7, Volume 9A:

The initial shaft is the primary return. Detail of the four (4) shafts shows No. 1-2-4 are returns and No. 3 is used as an intake. See Exhibit 5A, Volume 9B.

All shafts are clearly designated for use as either an intake or return; no two-compartment shafts are shown in the Volumes 9A/9B reports. WB comment does not apply to BOYD underground mine plan (Volumes 9A/9B).

C. pp. 8-11 and 8-12, Volume 9A; Exhibits 5C, 5D; Volume 9B:

The estimated maximum (most critical) ventilation requirement is 3,684 cubic meters/minute at 11.4 cm water gage. Exhibits 5C and 5D clearly show the proposed main entry ventilation system, two (2) intake and two (2) return entries, separated by a neutral (conveyor belt) entry.

As shown on Exhibit 5F (ventilation diagram), Volume 9B, maximum air pressure occurs at the shaft bottom and decreases as it approaches the working faces. The BOYD ventilation plan places a neutral entry between the intake and return entries; this is designed to minimize any high differential pressure across the pillars between the intake and return airways.

D. pp. 8-7 through 8-10; Volume 9A:

The longwall panel length is 900 meters maximum and will be mined in approximately 10 months. Each longwall panel will be sealed to restrict air circulation after mining. Each group of three panels will be permanently sealed from the remaining mine. It is BOYD's opinion that adequate mine ventilation will dissipate heat associated with oxidation, reducing the potential of spontaneous combustion.

We share WB's concern on the risk of spontaneous combustion and necessity to minimize exposure. Continuous advancement of the longwall panel (3 shifts/day) will expedite mining. Longer panels are highly desirable to maximize production efficiency and concentrate the number of working areas. The proposed underground demonstration mine will provide site-specific operating data to confirm design parameters or modify present plans.

E. pp. 8-13, 8-14, 8-26; Volume 9A:

The underground belt conveyor system is capable of handling 450 tonnes per hour. A 91 cm wide belt is required to accommodate lignite lump size. Conveyor system components are standardized to provide operating efficiency and minimize parts inventory. Average daily tonnage to be transported is 1,338 mine mouth ROM tonnes (reduced to 1,278 tonnes after handpicking).

Once coal is placed on the longwall panel face chain conveyor, it is transported uninterrupted to the surface. Operationally, it would be much more difficult to interrupt the coal flow to stage load mine railcars. In our initial investigations, we considered

underground rail haulage and concluded it was less attractive (than conveyor haulage) due to entry opening restrictions (limited clearance and small car capacity), increased labor and operating requirements, and resulting mix of haulage systems. The proposed conveyor belt system has excess capacity to accommodate higher levels of mechanization if warranted.

F. p. 8-7; Volume 9A:

A 2.0 tonne capacity diesel scooptram is used to load, haul, and dump lignite at the working faces of the developing entries.

As compared to alternative electrical powered face haulage units, we selected diesel-fueled scoops because they offer better maneuverability in the restricted entry openings, proven technology, and multiple uses (does not require a second piece of equipment to load lignite). Diesel equipment is used in many underground mines worldwide, including diesel locomotives used for underground haulage at PMDC's Makarwal coal mine in North West Frontier Province (Pakistan). Under the proposed ventilation system, diesel exhaust should be adequately diffused to maintain acceptable levels.

G. p. 8-7, Exhibits 5C, 5D; Volume 9A/9B

The 91 cm wide coal haulage belt conveyor is in the middle neutral entry with stoppings in the adjacent cut-throughs on both sides. See Exhibits 5C and 5D for a supporting illustration of belt entry isolation.

## 2.5 Single Seam Development

Comment: Also, greater emphasis should be given to technically defending the selection of single seam mining for underground operations, clearly identifying why multiple seam underground mining in the designated area is not recommended.

BOYD - p. 4-4, Volume 9A. Criteria for underground mineability include:

(1) 1.0 m minimum thickness (to provide adequate equipment and labor operating height, while avoiding the need to mine large quantities of roof and floor rock).

(2) 3.66 m maximum height (safety precaution and practical limit of operating equipment and labor).

(3) geologic exclusion - all areas having sandstone within one meter of the mine roof (experience at Lakhra has shown sandstone roof areas are unstable and the Chief Inspectorate of Mines Annual Report indicates gases may be associated with sand zones).

(4) 15 m minimum vertical interval between mineable seams (in order to avoid pressure transfer through underground mine pillars into the overlying and underlying strata. An adequate thickness of in situ rock strata is required to protect overlying/underlying mine workings. Structurally, the majority of sedimentary strata at Lakhra are generally characterized/classified as relatively weak. The 15 m criteria is based on BOYD experience in multiple seam extraction using modern methods.

Although questioned by the existing Pakistani mining companies, the ability to conduct multiple seam mining was not evident during our inspections of the existing Lakhra mines. Although more than one seam was being mined on some leases, they were not being extracted in the same area. Discussions at Faiz Mines indicated that attempts to multiple seam mine both No. 1 seam and the overlying No. 2 seam were unsuccessful. It should

also be pointed out that projected mining recovery under the proposed BOYD plan is 50%, versus approximately 15% to 25% for existing mines at Lakhra.

## 3.0 General Project

### 3.1 Expatriate Personnel

Comment: Review the need for long-term presence of expatriate personnel.

BOYD: The number of expatriate personnel is summarized on page 11-3, Volume 9A, which shows a gradual reduction during the life of the mine project. The need for long-term expatriate personnel is qualified in Staff Recruitment (pages 11-2 through 11-4), Implementation Section, Volume 9A. The ability to reduce expatriate personnel below the level stated will depend on:

* the successful development of Pakistani management,
* the policies of the parent expatriate mining company, and
* the final mine management agreement and plans of the mining company.

### 3.2 Infrastructure Capital Cost

Comment: BOYD is requested to review their consultant's work from the viewpoint that the colony standards may be too high for Pakistan.

BOYD: The proposed colony standards closely follow standards set by WAPDA (see Pages 10-3 and 10-4, Volume 9A, and Exhibit 6C, Volume 9B). The colony was designed to be

self-supportive (because of Lakhra's remote location) providing sufficient services to attract and retain above average skilled labor to the area. The colony constructed by WAPDA at Guddu would be similar to the proposed Lakhra colony but less elaborate in proportion to colony population.

3.3 Miscellaneous

3.3.1 Strip Ratio Map - Composite Seams

Comment: A surface geology map should be included in Volume 9B.

BOYD: All significant surface geological features are shown on Exhibits 2A and 2B. Included on these maps are:

(a) Indicated faults

(b) Indicated lineaments (based on Landsat interpretation)

(c) Outcrop of the Laki Limestone (bottom contact separating the overlying Laki Limestone member and underlying Laki Laterite).

(d) Overburden cov r lines (to No. 2 Seam)

To further define the subsurface geology a series of cross sections are also included (Exhibit No. 7 series).

3.3.4 Boundary Lines

Comment: Although the boundary line of the BOYD study area shown on Exhibits 2A and 2B, for example, may not exactly match the PMDC lease boundary, it will be accepted as is. Proper boundaries will be established in the mining RFP through use of lease corner coordinates to be provided by WAPDA.

BOYD: WAPDA has provided new PMDC lease boundaries and subsequent reports are correct.

3.3.5 Exhibit 4C

Comment: On Exhibit 4C of Volume 9B, add clarifying statement as to absence of truck/shovel operation on section views.

BOYD: Shovel/truck operation is designated as mobile equipment on this exhibit. Exhibit titles are reversed on 4C and 4D and have been corrected.

3.3.6 Quality Exhibits

Comment: Review Exhibits 3B, 3D and 3F and add statement to legend whether data is as received or dry basis.

BOYD: Data shown is dry basis and has been corrected.

3.3.7 Specific Gravity of Lignite

Comment: WB has questioned the 1.42 specific gravity of lignite used in tonnage computation as being too high. BOYD was to review this part of their report to ensure text reflects discussions at Washington review meeting.

BOYD: This was reviewed with WB staff members at the technical review sessions and resolved that the BOYD assigned specific gravity is based on site-specific laboratory test data and is reasonable for the anticipated moisture levels.

We believe the preceding responses clarify the comments received from the various donor agencies. Some of the parameters used in Volumes 9A/9B represent BOYD's professional judgement. We acknowledge other parties may have other opinions, but believe Volumes 9A/9B findings are reasonable.

Respectfully submitted,

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By:

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