

THE 2003 BP ANNUAL AWARD ENTRY FORM

1. Brief Title of Entry: **In Salah Gas (BP & Sonatrach(SH)) Field Development**
2. Name of Company Seeking Award: **Bechtel – Pipeline & Offshore Global Business Unit**
3. Tick if you are a Member: **MEMBER** Or **ASSOCIATE MEMBER**
4. Summary of entry: **The In Salah Gas Field Development in Algeria, went through a number of phases to optimise design and construction execution with the object of improving HSE standards and reduce the capital cost and operating cost of the development. At the completion of the FEED phase BP sought to further optimise this by the having other contractors participate and bring where possible new ideas. This resulted in some 319 potential cost reduction items covering aspects such as commercial environment, project management, design and construction of the Process Facilities, Pipelines, Flowlines, Production drilling, and Infrastructure. A significant number of these were selected for implementation on the project. This included 35 items for the pipeline scope.**

This entry focuses on the Pipelines Scope of work and in particular the cost reduction aspects as selected by BP for implementation prior to the commencement of the EPC execution phase, and the actual results of these during the EPC phase.

The most significant areas addressed here are:

- Revised Route Selection
- Increased field weld production by use of new technology
- Updating of Algerian pipeline code and practices (design and quality control aspects)
- Contracting Philosophy
- Improved HSE standards

5. Signed on Behalf of Company:



6. Name and Position in Company **Jacques Laurijssen, Principle Vice President-**
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This entry form and any attachment thereto has to be received in Gent no later than July 1st 2003, addressed to:

**The Executive Director
International Pipeline & Offshore Contractors Association
University of Gent
Piternieuwstraat 41
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BELGIUM**

BECHTEL DETAILED DESCRIPTION OF ENTRY

The items submitted for IPLOCA's consideration have been selected on the basis that they are the more unusual or greater impacting to the execution of In Salah Gas (ISG) pipelines (600 km of 48", 38" & 24" located in Saharan desert of Algeria) as compared to previous pipelines in Algeria, and have been tracked for actual costs against those estimated.

1. Revised Route Selection:

The FEED phase of the project envisaged the 48 inch diameter - 460 km export pipeline as a virtual straight route from the Krechba Central Processing Facility (CPU) to Sonatrach's National Centre of Gas Distribution at Hassi R'Mel through a hilly sand dune area of approximately 120 km, also known as the "Sea of Sand" the highest of which are approximately 40-50 meters. The cost reduction studies performed during November 1999 through March 2000, included a further examination/survey of this area to assess the optimum routing cost trade-offs between material cost and construction costs in terms of right of way preparation (sand removal), construction access roads, sub soil rock content, schedule aspects and associated indirect costs for personnel accommodation in this remote area.

The study showed that an alternative route was possible without much additional pipe material cost, to skirt the highest dune areas, but getting into more very hard rock areas. This reduced the sand dunes to cross from 120 km to 70 km, and only increased the pipeline length by 8 km. Since Bechtel already owned 3 Trencor 1860 rock ditching machines and a further 2 machines were on order to tackle the high content of rock encountered, the risk factor in additional rock ditch was less, as well as the work effort when compared to that involved in removing sand dunes. It was estimated (allowing for risk in unknown sub soils in the dunes) that the construction cost could be reduced in the order of \$ 20 to \$ 30 million dollars.

This alternative routing was accepted by ISG (BP/SH) and a detailed survey and cost estimate prepared for the inclusion in the EPC fixed lump sum price.

Various methodologies for sand dune removal were explored some quite innovative, however their unproven track record, resulted in implementing a 20 bulldozer and 14 backhoe sand equipment spread to tackle the dunes.

In hindsight after having traversed the selected route, and assuming a similar sub soil pattern the actual net cost saving was in the order of \$ 14 million. Although subsequent Right of Way maintenance was substantially higher than originally estimated due to the affect of winds during the construction period, but this was at Bechtel's risk.

The cost reduction effect and higher quality product of utilising the Trencor trenchers in this terrain has not been highlighted, as this is as per previous projects executed in Algeria by Bechtel.

2. Increased Welding production by use of new technology

In recent projects Bechtel applied the CRC-Evans P200 field welding system with a pipe gang based on 11 stations to obtain high production rates i.e. an overall average of 2.5 km per day (110 joints per day), and the capability to produce 200 joints a day. In the design stage studies were performed to evaluate the latest available mechanised welding systems. Two that had some field application experience were Serimer & CRC-Evans P600 systems. After commercial and service record criteria CRC-Evans P600 double bug system was chosen in combination with the P 200. This envisaged that at the same production rates, the pipe gang could be reduced to 7 welding stations. This reduction, in the order of \$ 2 million dollars in direct costs, was included in the fixed price lump sum.

Due to further development of the P 600 double bug system by CRC, the expected performance was not reached during the first two months of production welding. Production in this period remained for the period around the 80 joints per day. Together with CRC, various parameters and software adjustments were made to the system, resulting in better quality welds but never achieved the rates expected. In view of the lack of production and its affects on indirect costs and schedule it was decided to increase the number of welding stations to 11, utilising both CRC systems. However, the combined system did improve the weld repair rate and was significantly better than on previous projects. Mechanised welding produced averages of 5% against 3% on the ISG pipeline system, this mitigated the cost increases incurred by Bechtel and no predicted savings were achieved on this activity.

3. Updating of Algerian pipeline code and practices (design and quality control aspects) Three notable developments which contributed significantly to modernising standards

yet reducing cost, are:

- The Algerian codes have strict restrictions in various design and construction execution methods. One of these was the mandatory spacing distance of 20 km for section block valves. In November 1999 discussions commenced with the Algerian Authority in revising the restrictive spacing requirements, if fully successful, in changing the rules this would have reduced the capital cost by approx \$ 12 million dollars.

In 2001 the authority agreed to modify the code and granted an increased spacing to 40 km, resulting in an actual cost reduction to ISG of \$ 6.4 million dollars.

- The development envisaged a co-operative program with Authorities certification/ inspection activities commencing a detailed training program for inspection of the Algerian pipe mills and construction inspection. The QC team acting on ISG's behalf, as well as certifying the Bechtel inspection team for their fieldwork, saved the manpower cost of a three layered inspection organisations, i.e. Bechtel's, ISG, and subsequently the National Authority. This delivered in the order of \$ 1 million dollars, as well as soft benefits for all parties concerned.

- Mechanised UT for all field welding inspection was also an early topic of discussion. BP's approval was achieved early in the project, and through many presentations and field trials introduced to Sonatrach and the Algerian Certifying Authority, and finally accepted as the standard inspection method on the ISG pipeline, and will be included in the next revision of the Algerian codes. Although there were no direct commercial gains in the utilisation of these new inspection tools, it did reduce the HSE risks inherent in other (x-ray) inspection methods, assist-welding progress by the real time examination, and also contributed to the reduction of the overall project weld repair rate to 2.5% a level never achieved before. The combination of the modified CRC P 600 and the MUT inspection contributed to approximately \$ 0.5 million dollars of savings.

4. Contracting Philosophy

This is a difficult area to summarise. Although the ISG pipeline work was competitively bid for engineering and procurement and construction on a unit rate basis, this developed into a full fixed price lump sum bid for EPC execution via an "open book approach" this was accomplished in parallel to the development of the engineering and procurement activities. Saving contractors normal turn key bid costs, and customer's evaluation of these, as well as the detrimental effect of delay in time to reach first gas. Thus the customer and contractor reduce their overall direct and associated costs. Author is not privy to customer's cost savings and effects of timely the first gas data, however the contractor's internal bidding costs saved is in the order of \$ 1.5 million dollars for such a large field development. The soft or intangible cost benefits of developing the work together and obtaining a good understanding of the specifications and methodologies greatly reduce risk and contingency. So in the pre-EPC lump sum stage a risk-sharing scheme was adopted to share an agreed contingency of \$ 5 million dollars on both the ISG and Bechtel side. Due to delays incurred in the concession agreements negotiations between BP and Sonatrach and the conditions this imposed, this resulted in modifying the risk pattern and finally resulted in a contract amendment which if Bechtel completed early (a reflection of reduced actual risk level encountered) it would credit ISG with \$ 3.2 million dollars. Humorously referred to by some as a "Reverse Bonus" for contractor's early completion! Upon writing of this report the project is ahead of schedule and thus ISG will probably receive 75% of this credit by the time the IPLOCA 2003 convention is held.

5. Improved HSE standards

Bechtel underwrites the OSHA standards and targets "Zero" accidents. However, in remote and different social cultural environments this is a lot harder to achieve. Suffice to say that in the early nineties and until the start of the ISG pipeline, similar projects executed by Bechtel on a direct hire basis in Algeria suffered too many fatalities (in the order of 5 to 10 persons per project). This project had NONE and a truthful LTI or day away from work rate of 0.19 and by the end of the project we expect this to be done to 0.16. Numerous ways of achieving this improvement were fully led and supported and audited by BP, the gains mainly achieved in prevention of road accidents, and removing the risk of fatal injuries when accidents occur. The cost increase is insignificant compared to the personal distress, and consequential costs of accidents.