Nº 28

UNDERGROUND COAL GASIFICATION FIRST TRIAL IN THE FRAMEWORK OF A COMMUNITY COLLABORATION

CONTRACTS Nº: SF - 369/91 - ES/BE/UK
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TECHNICAL REPORT
JULY 1995 - DECEMBER 1995

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Summary

Underground activities during the period of this report comprised the workover operations on the deviated monitoring well[MW2(ET2)] and the recovery well[RW(ET5)](Phase 1). Completion of the short-radius deviated monitoring well[MW2(ET2)] was conducted by a workover operation in July 1995. The well was surveyed by MWD during drilling to position the well and to confirm the locations at which it crossed the coal seam roof and floor. The completion involved the installation of thermocouples and fibre optics inserted inside 2" coiled tubing.

The installation of liner and partial installation of tubings in recovery well[RW(ET5)] were carried out during September 1995. A good flow path between wells ET4 and ET5 was observed during re-drilling prior to installation of the production liner to the planned depth; the quality of this connection should be a benefit in simplification of the start-up procedure for gasification.

The detailed engineering design of surface plant was completed, including piping, electrical and instrumentation specifications. Civil engineering works were completed in early October. Work on the mechanical/piping contract began in mid-October and a contract for electrical installation was placed in December 1995.

The Data Acquisition/Control Unit was constructed and delivered to site in December. Construction of the Gas Analysis Unit was completed and the unit was undergoing factory acceptance testing at end-December. Plant installed or partially installed on site included cryogenic tanks, pumps and vaporisers, steam boiler, water and foam pumps, instrument air compressors, fire water pumping unit, service water pumping unit, and the gas combustor and flare.

The formulation of data recording and reports on plant operation were addressed, and some of the software to be used for modelling and analysis was written and implemented.

In the supporting programme, T.U. DELFT completed their work on the thermomechanical behaviour of adjacent strata and modelling of the underground gasification process. A meeting will be held in February 1996 for presentation of the results of the work, and to discuss use of the models both for the prediction of process behaviour at El Tremedal and the interpretation of data from the trial.

1. INTRODUCTION

This report is the eighth technical report of the Underground Coal Gasification project being conducted in North Teruel, Spain, with financial support under the EU's THERMIE energy programme.

At the beginning of the period of this report, workover of the vertical monitoring well ET1 was complete and the majority of the detailed design of surface plant had been carried out. The finalisation of the design of only a few items remained at the end of the period of this report.

Workovers of the deviated monitoring well[MW2(ET2)] and the recovery well[RW(ET5)](Phase 1) were conducted. The workovers of wells ET4, ET5(Phase 2) and ET6 remain to be conducted, probable date January - February 1996. The detailed engineering design of the surface plant was completed, and the Gas Analysis and Data Acquisition/Control Units were constructed.

Civil engineering works for the surface plant were completed by NORCONSA in early October. After civil works completion, the installation of the following plant was implemented: cryogenic tanks, pumps and vaporisers, steam boiler, water and foam pumps, instrument air compressors, fire water pumping unit, service water pumping unit, and the gas combustor and flare.

Work on the mechanical/piping contract began by AUXIMET in mid-October with completion foreseen end-February 1996, including commissioning.

2. WORKOVERS AND WELL COMPLETIONS

Unless otherwise stated, all depths given in Section 2 of this report are ***Depths from Ground Level*** *(i.e. from the concrete platform), and all azimuths are* ***Azimuths relative to UTM North****.*

2.1 DEVIATED MONITORING WELL[MW2(ET2)]

2.1.1 Target Objectives - Directional Data

In the initial well plan, the workover operation of well ET2 comprised short-radius drilling at an azimuth along the strike of the seam to meet the line of ET4 in plan at the position of maximum lateral growth of the first CRIP cavity.

The revised location of the first CRIP point(the result of the actual ET4 trajectory achieved and relocation of well ET5) resulted in a revision of the target location of well ET2 along the line of well ET4, with the consequence that the design azimuth of the short-radius trajectory was no longer along the strike of the seam.

The revised target location of ET2 in plan was approx. twenty six metres from ET5 along the trajectory of the injection well ET4, one metre above the floor of the seam(top of limestone), with trajectory inclination equal to the apparent seam dip at the design azimuth. The objectives for the trajectory of the deviated monitoring well[MW2(ET2)] are summarised as follows:

- Target location in plan approx. 26 metres from the position of well ET5 in the seam along the line of injection well ET4
- Target level approx. 1 metre above the floor of the coal seam(top of limestone)
- Target accuracy +/- 2 metres from target X, Y and TVD co-ordinates

- Vertical section — from 528.7 to 536.0 m(MD)
- Kick-Off Point(KOP) — +/- 536 m(Measured Depth)
- First deviated section(side-track) — from 536.0 to 542.0 m(MD)
  Inclination build-up rate — +/- 12.0 degrees / 30 metres
  Inclination at end of section — +/- 2.5 °
  Horizontal displacement from 7" casing shoe at end of section — +/- 0.2 metres
- Second deviated section(build) — from 542.0 to 577.2 m(MD)
  Inclination build-up rate — +/- 81.8 degrees / 30 metres
  Inclination at end of section — +/- 98.5°
  Horizontal displacement from 7" casing shoe at end of section — +/- 24.2 metres
- Third deviated section(hold) — from 577.2 m to 596.8 m(MD)
  Inclination build-up rate — +/- 15.0 degrees / 30 metres
  Inclination at end of section — +/- 108.3°
  Horizontal displacement from 7" casing shoe at end of section — +/- 43.3 metres
- Well azimuth — +/- 302.3° relative to UTM North
  Azimuth range — +/- 2.0°
- Target UTM co-ordinates(Target in plan approx. 26 metres from the position of well ET5 in the coal seam, target level approx. 1 metre above top limestone)

Spud	X: 718587.40	Y: 4532603.00	Z: 659.57(ref. sea level)
7" Casing Shoe	X: 718585.36	Y: 4532608.48	Z: 130.94
Target	X: 718549.04	Y: 4532631.53	Z: 102.30

The planned trajectory of the deviated monitoring well[MW2(ET2)] is shown in Figures 1a, 1b and 1c.

2.1.2 Well Details - Completion Design

Because of the inability to install casing in a short-radius deviated well, the completion design of ET2 was relatively simple, involving the insertion of 2" coiled tubing to TD, the tubing having been pre-installed with a flat pack instrumentation cable comprising 4 thermocouples and 2 fibre optics. The arrangement for anchorage of the instrumentation flat pack to the end of the coiled tubing is shown in Figure 2.

Following tubing installation, the tubing was to be cemented to surface. Fixed hollow blade centralisers were recommended for centralisation of the coiled tubing within the existing 7" casing in order to ensure good cementing.

Coiled tubing is not normally cemented, the usual function of such tubing being the injection of well stimulation materials, with recovery of the tubing after use. The requirement for well ET2 was to cement the tubing in place, and subsequently to cut the tubing above the wellhead, leaving sufficient flat pack outside the tubing to enable connection of the instrumentation to surface plant. This operation required careful planning, involving circumferential cutting of the tubing at the required point, and threading the cut length back over the flat pack.

2.1.3 Drilling Programme, Bits and Fluids

The planned drilling programme(using BAKER HUGHES short-radius drilling equipment) was as follows:

6" vertical drilling to KOP	Rotary(Power Swivel)
6" drilling(side-track section)	4.3/4" AKO DHM/MWD with gyro tool
5.7/8" drilling(build & hold sections)	4.3/4" AKO DHM/MWD with steering tool

Bits

The recommendation of the directional contractor was that short-radius drilling was extremely demanding on bits. Three of each of the following bits were therefore procured for the drilling operations:

6" phase:	SMITH FDG
5.7/8" phase:	REED HP12

Fluids

Water was considered to be adequate for the rotary drilling of cement within the 7" casing.

For the subsequent vertical drilling to KOP, side-track and deviated sections, the Fluids Services contractor decided to use a non-dispersed KCl/polymer mud with additives for clay inhibition, fluid loss control, etc., similar to that used in drilling wells ET4, ET5 and ET6. Target KCl mud properties were:

Density	1.07 kg / l
Yield Point	12 lb / 100 ft^2
Filtrate	10 cm^3 / 30 min API
pH	11

2.1.4 Rig and Service Contractors

The rig selected was an IDECO H35 Trailer rig, with double derrick capacity, 134,000 LB hookload, Triplex pumps, and BOWEN HDS2 Power Swivel.

The main contractors for the operations, services and equipment involved in the realisation of the ET2 workover operations were as follows:

- Drilling(Rig and Crew) — COFOR
  Drill pipe assembly/disassembly — WEATHERFORD(via COFOR)
- Directional Drilling & MWD — BAKER HUGHES INTEQ
- Fluids(Mud) — MILPARK(via COFOR)
  Provision of drilling fluids
  Fluids engineering
- Surveys(Equipment and Crew) — SCIENTIFIC DRILLING
  KEEPER Gyro Tool
  SHAREWELL Steering Tool
- Cementing 2" Coiled Tubing — HALLIBURTON
- Coiled Tubing Supply and Manoeuvre — DOWELL SCHLUMBERGER
  plus centralisers, shoe and hanging device
- Bits — SMITH / REED

2.1.5 Operations

The rig arrived on site 12 July 1995 and drilling operations commenced on 14 July. The operations performed were:

- Drilling(vertical and side-track)	6"	495.6 - 541.0 m	14 Jul. - 16 Jul.
- Drilling(build and hold)	5.7/8"	541.0 - 598.0 m	16 Jul. - 21 Jul.
- Installation of coiled tubing	2"	To 598.0 m	22 Jul.
- Cementing		To TD	22 Jul.

Actual depth/time progress is compared to the pre-spud estimate in Figure 3. Operating time distribution is given in Table I. The total time to complete all operations was 9 days(approx. 5 days greater than anticipated), the additional time being mainly due to inadequate pipe handling tools and frequent rig operations to achieve corrections of trajectory in the final intervals of the well.

2.1.6 Vertical and Side-track Interval 495.6 m - 541.0 m MD, 6" diam.

This phase comprised two sections: a vertical section(495.6 - 535.0 m MD) to KOP, and a side-track section from KOP to the end of the interval.

Water was used for drilling the cement within the existing 7" casing. On reaching the casing shoe at 528.7 m MD, the well was cleaned with a 1.3 m^3 viscous pill and the water replaced by KCl/Polymer mud to be used for all subsequent drilling.

At the end of the vertical section at 535.0 m MD(KOP), the AKO downhole motor and orienting sub assembly was run in hole and the well trajectory was surveyed with a SCIENTIFIC DRILLING TOOLS KEEPER gyro tool. The survey results obtained were very different from a 1994 survey of the well with the same tool, and were subsequently ignored, the reason for the poor agreement being attributed either to a fault in tool performance or drift error. The inability to reproduce the 1994 survey was considered to be totally unsatisfactory, and raised doubts as to the validity of the original 1994 gyro surveys(in 4 wells).

The side-track section(535.0 - 541.0 m MD) was performed with the AKO adjustable bent housing set at 1.85°, oriented via the KEEPER gyro. The objective was to deflect the trajectory from that of the original ET2 drilling for 6 metres to an inclination of 2.5° at the desired azimuth of 302.3° relative to UTM North, in preparation for the subsequent build interval.

At the end of this interval, the final gyro survey was 4.8° inclination, and 326.9° azimuth, both greater than those desired but within the capability of correction via the directional assemblies to be used subsequently.

2.1.7 Build and Hold Interval 541.0 - 598.0 m MD, 5.7/8" diam.

The drilling programme for this interval comprised two sections, using different short radius motor configurations. For the first section to 577.21 m MD, the programme required the use of the short-radius angle build motor with articulation set to achieve a build rate of 81.8°/30 metres, to reach an inclination within the seam equal to 98.5°(approaching the target up-dip inclination of the coal seam). The second section required the articulation of the short-radius angle build motor to be set to achieve a build rate of 15.0° / 30 metres, reaching the target in the plane of the seam at an inclination of 108.3°.

In the actual drilling operation, the total interval was drilled without changing the configuration of the short-radius motor, due to problems which required modification of the designed programme.

Drilling of the interval began with the angle of articulation of the motor set to 0.94° using the gyro tool for directional survey because of the possibility of interference on magnetic tools from the 7" steel casing of the well. At 545.1 m MD, outside the influence of the casing, the gyro tool was substituted by a SHAREWELL magnetic steering tool which in theory was expected to give more accurate survey information. As drilling progressed, azimuth tended to increase, and correcting action was taken to achieve 302° azimuth at 560.0m MD(close to the desired azimuth of 302.3°).

At 565.6 m MD, ROP decreased and a decision was taken to POOH to check for bit balling or wear. On surface, the bit was found to be clean but under gauge, the wear resulting from the high side loads on bit, as predicted by the directional service company. A new bit was installed with 12/32" nozzles to improve cleaning, and drilling resumed.

Between 566 and 567 m MD, the first coal fragments appeared on the shaker screens, indicating that the roof of the seam was approaching. The roof of the coal seam was crossed at 567.6 m MD, approx. 2.5 m higher in TVD than expected from the prognosis.

This difference in the apparent depth of the seam, together with the directional control limitation of the drilling assembly, resulted in the trajectory entering the limestone below the seam(at 574 m MD), after having crossed the coal seam and the clay band at the coal/limestone interface. At 579.9 m MD, with inclination continuing to build, drilling was stopped in order to review the situation and to consider the possibility of a revision to the trajectory which would achieve the objective of locating the final 10 m of the well within the seam, and to reach TD close to the deviated injection well ET4.

At this depth, 579.9 m MD, it was decided to POOH and to survey the well close to well bottom without the motor assembly. The survey at 578.9 m MD was 103.2° inclination(some 1.5 - 2.0° less than that extrapolated to this depth from surveys with the motor assembly installed) and 303.6° azimuth.

On the basis of this information, it was decided to re-define the target 5 m to the south of the initial target(but at the same level) to reduce inclination of the well at TD, and to achieve the benefit of the 2 m increase in seam depth between targets as a result of seam dip. Maintenance of the original target in plan and correction for the difference in seam level observed would have resulted in a trajectory inclination of 146° at TD, outside the safe trajectory limits for the assembly.

Drilling continued with the same articulation setting of the motor(0.94°), with azimuth correction to achieve the revised target, and the clay band at the coal/limestone interface was re-entered at 586.7 m MD. A sharp decrease in ROP at 596.6 m MD marked entry to the sand in the seam roof, and was confirmed by the arrival of sand on the shaker screens some minutes later. Drilling continued to 598.0 m MD in the sand, at which point drilling was terminated in view of the severity of the trajectory already achieved.

The final survey was 126.1° inclination and 283.3° azimuth at 591.0 m MD. Extrapolation to TD gives 136.0° inclination and 261.0° azimuth at 598.0 m MD.

The 2" coiled tubing equipped with a flat pack of thermocouples and fibre optics was installed by DOWELL SCHLUMBERGER. Figure 4 shows the in-seam completion of the well. The fragility of the centralisers prepared by DOWELL resulted in their inability to be used throughout the well, and only a few of them were finally installed(9 centralisers) in the deviated section of the well.

Table II gives the ET2 Workover trajectory based on actual MWD surveys. Figures 5a, 5b and 5c show horizontal and vertical projections of the actual trajectory(based on MWD surveys) compared to target trajectory.

2.1.8 Interpretation and comment on MWD survey data

Surveys during drilling indicated location of the coal seam some 2 - 2.5 metres in TVD higher than expected with the result that the trajectory of the well entered the seam floor. The target location was revised during drilling to reduce maximum inclination of the well at TD on the line of ET4, this requiring an azimuth correction and an approach to the coal seam close to the strike of the seam some 4 - 5 m to the south of the original target. Coiled tubing/ instrumentation was installed and cemented.

Although BAKER HUGHES checked the computation of surveys during the drilling operation, subsequent analysis suggested that the unexpected coal location could be the result of an error in the correction applied to azimuth measurement(measurement realised relative to magnetic North - correction applied for UTM North equal to +4.28°). BAKER HUGHES re-checked the validity of their application of declination/convergence correction in the computation of surveyed azimuths from the raw tool data and confirmed that no error in computation could be detected. If the suspected error is present (correction of -4.28° applied in place of a correction of +4.28°), the implication is that TD of the well is some metres to the east of the line of ET4, probably at the limit of the gasification zone. Figures 6a and 6b show the horizontal and vertical projections of the ET2 workover corrected trajectory in the area of the planned reactors.

Table III gives the comparison of dip azimuths and dip angles obtained by linear regression on two additional sets of top limestone reference points(to be compared with Table X of the previous technical report), and the minimum errors. The first set of points tested is all reference points available(including ET2 workover corrected) with the exception of ET6. The second set of points tested is all reference points available(including ET2 workover corrected). The analysis of the data obtained confirms the excellent correlation existing between the top limestone reference points when ET6 is excluded. The maximum error and the typical error are very similar to the errors obtained in case b of the previous report.

2.2 RECOVERY WELL(PHASE 1) [RW(ET5)]

2.2.1 Well Details - Completion Design

Recovery well[RW(ET5)] was drilled in December 1994 to depth 582.3 m MD and equipped with 9.5/8" casing with casing shoe located at 576.9 m MD, approx. 25 cm below the roof of the coal seam. A cement plug had been set from this level to TD of the well.

The first phase of completion of the well involved the following:

- 8.1/2" drilling of the cement within the 9.5/8" casing, float shoe and cement plug, and continuation to 583.5 m MD, 1.2 m further into the limestone not previously drilled.

- Under-reaming to 15" diameter over approx. the lower half of the coal seam (577.79 - 578.92m).
- Hydraulic connection between wells [RW(ET-5)] and [IW(ET-4)] via injection of water into the latter well.
- Cleaning of the well.
- Introduction of a perforated 7" Inconel liner of 10m length, centralised within the 9.5/8" casing.
- Introduction of 568m of 6.5/8" tubing forming the outer sleeve of the "insulated" production tubing carrying two 3/4" sparge water cooling lines, uncemented.

2.2.2 Rig and Service Contractors

The rig used for the ET5 workover(Phase 1) was the same rig used for the ET2 workover operation in July 1995, which had remained on the UGE site between these jobs to minimise mobilisation costs.

The main contractors for the operations, services and equipment involved in the realisation of the ET2 workover operation were as follows:

• Drilling(Rig and Crew)	COFOR
Drill pipe assembly/disassembly	WEATHERFORD(via COFOR)
• Equipment and operative for	SMITH INTERNATIONAL
Liner setting operation	
Under-reaming	

2.2.3 Operations

The rig was positioned above the well during the period 18-20 September 1995 and workover operations commenced on 21 September. The operations performed were:

- Drilling(cement and formation)	8.1/2"	575.64 - 583.65 m	21 Sept.
- Hydraulic connection test			21 Sept.
- Under-reaming(failed)	15"	To 577.75m	21 Sept.
- Installation of perforated liner	7"	To 583.35m	22 Sept.
- Installation of tubing plus 3/4" sparge pipes	6.5/8"	To 568.78m	23 Sept.

2.2.4 Drilling

The cement and formation were drilled rotary without difficulty using a SMITH MFDGH bit, without nozzles, and with water as the drilling fluid.

2.2.5 Hydraulic Tests

An important element of the ET5 workover was to re-affirm (and if necessary to re-establish) the connection for water flow between wells ET4 and ET5. The same pump previously used for water injection at ET4 during ET5 drilling was again hired from COREIS. The pump allows injection in the range 0-140 LPM at a maximum injection pressure of 50 bar.

Water was injected into the 7" liner of ET4 at a pressure of 12 bar, and a pressure connection to the 9.5/8"-7" annulus was achieved after a period of 15 minutes injection, this showing partial blockage of the hole around the 7" tubing.

Injection pressure in ET4 which had been maintained in the range 9-10 bar (at a flow of 10-12 LPM) prior to drilling the cement in ET5, fell to approx. 1.5 bar when the drilling in ET5 reached the horizon of the coal seam, and water was immediately recovered at ET5. The pressure drop corresponded to the difference in hydrostatic heads in the two wells and, together with a recovered flow at ET5 equal to the injected flow at ET4, indicated excellent flow connection. Table IV shows the pressures and flows during the hydraulic test.

2.2.6 Under-reaming, Installation of 7" Liner, 6.5/8" Tubing and sparge pipes

The under-reaming of the coal was not able to be carried out. Tool availability was limited and the diameter of the tool supplied was too close to the gauge of the hole. The tool was unable to be introduced in the well to the planned depth, the reason postulated being that the arms could not be retracted sufficiently to pass ledges in the coal. After several attempts to insert the tool, it was decided to omit this stage of the workover, and the 7" perforated liner was installed without prior under-reaming. After the 7" liner installation, the well was equipped with a 6.5/8" tubing string. Outside the 6.5/8" tubing string, the 3/4" sparge pipes were clamped. Table V gives the 6.5/8" tubing string components and their respective levels inside the well.

2.3 OTHER WELLS

Although planned for mid-October 1995, the workover operations of the other wells will probably not be carried out until January 1996. The remaining tubings were not received from VALLOUREC until early November, delivery of centralisers/protectors for well completions was awaited at end-December, as was the delivery of special alloy materials for the igniters. The workovers will be carried out using a framework/crane combination rather than a drilling rig.

3. SURFACE PLANT/EQUIPMENT

3.1 DETAILED ENGINEERING

With the exception of minor revisions, the Surface Plant Engineering Design - Phase 2 was completed, including piping, electrical and instrumentation specifications.

3.2 PROCUREMENT/CONSTRUCTION

All main items of surface plant and equipment were ordered. SERELAND was appointed the construction supervision contractor.

Civil Engineering works were completed by NORCONSA in early October. Work on the mechanical/piping contract began by AUXIMET in mid-October with completion foreseen end-February 1996, including commissioning. This date is dependent on the delivery of wellhead manifolds, heat exchangers and let-down valves, expected January 1996 latest, and on special alloy pipe sections and choke valves for product gas lines which are likely to be the latest delivery items.

Although MALBRANQUE choke valves were due for delivery September 1995, body castings were found to be defective on inspection and these components needed to be re-cast, delivery now expected end-February.

The electrical/instrumentation contracts were subject to long delay by SERELAND in preparation of revisions to final drawings/specifications for Invitations to Tender. The Electrical contract(EDASA) began in December; the Instrumentation contract will be placed mid-January 1996.

3.3 PRODUCT GAS ANALYSIS UNIT

In construction of the Gas Analysis Unit, FISHER ROSEMOUNT proved unable to fulfil the order for flow meters(integral orifices) and these were re-ordered from ATELIER POCHET. Factory Acceptance Testing of the Gas Analysis Unit was underway at end-December 1995 with delivery to site expected beginning February 1996.

3.4 DATA ACQUISITION/CONTROL UNIT

The configuration phase of the HONEYWELL Data Analysis/Control Unit was completed and the Unit was delivered to site end-December.

4. PROCESS ANALYSIS AND MODELLING

A contract for the assistance of I.D.G.S. and the UNIVERSITIES OF LIEGE AND LOUVAIN in Process Analysis was placed in July 1995. UGE's three personnel involved in modelling/computing visited I.D.G.S. in September for presentations by, and discussions with, I.D.G.S./University staff on the

software to be transferred to UGE for use during the operational and evaluation phases of the trial.

5. SUPPORTING PROGRAMME

A meeting of the Scientific/Technical Advisory Group was held at UGE Offices on 11 December. Presentations were made on Project Status and Operational Phases of the Trial. Flow parameters and procedures of each operational phase were discussed in detail together with potential problems.

A meeting with T.U. DELFT workers will be held early February 1996 for presentation of the results of their modelling work, and to discuss their use for prediction of behaviour and interpretation of future data from the results.

6. PROJECT DIRECTION

6.1 ADMINISTRATION

Appointment made:
SIMÓN SALA FORMENTO (Assistant - Site Operations) - appointed 1 August 1995.

6.2 PROBLEMS/DIFFICULTIES

Well completions were delayed pending delivery of special component items.

Another important delay resulted from the need to recast product line choke valves being manufactured by MALBRANQUE, defects being observed on inspection. These valves, together with wellhead manifolds, heat exchangers, let-down valves and special alloy pipe sections for product gas lines are expected early 1996. The date of completion of construction and commissioning of the plant will be controlled by the delivery of the outstanding plant items.

6.3 CHANGES IN TECHNICAL STRATEGY

None during the period covered by this report.

6.4 FUTURE WORK

The remaining underground development involves the workover operations on wells ET5 (Phase 2), ET4 and ET6 which are foreseen for January 1996 following the delivery of tubings, liner components and thermocouples. The coiled tubing system for the injection well for channel gasification will be manufactured by DOWELL SCHLUMBERGER.

The instrumentation contract will be placed early in 1996, and construction and commissioning of the remaining surface plant will be completed, followed by the gasification activities.

6.5 EXTENSION OF PROJECT DURATION

CEC gave approval to extend the duration of the contract to 30.09.97.

6.6 EUROPEAN WORKING GROUP

A proposal was made to reconstitute the "European Working Group on UCG", to conduct a programme to disseminate the results of the El Tremedal trial and to formulate a proposal for the second trial in the European UCG programme. An application for CEC aid to this work will be submitted in response to the next invitation to submit projects under the THERMIE "B" scheme.

6.7 CONFERENCES, PUBLICATIONS AND REPORTS

Data Acquisition and Control System - Database Configuration Revision 3, UGE Internal Report 108/IN/95/E, F.Adrián, August 1995.

Data Acquisition and Control System - Advanced Control, UGE Internal Report 115/IN/95/E, F.Adrián, November 1995.

Informe Geólogico de Perforación Sondeo Monitor ET2, UGE Internal Report 119/IN/95/E, C.Barat, October 1995.

Informe Equipamiento del Sondeo Monitor ET1, UGE Internal Report 120/IN/95/E, C.Barat, November 1995.

Informe Operaciones Equipamiento ET5 - Primera Fase, UGE Internal Report 121/IN/95/E, C.Barat, December 1995.

Day		Drilling/ Reaming	Stop/Main-tenance	Mud Prep./ Circulation	Coiled Tubing Setting	Cementing/ W.O.C.	Survey	Trip	Others
1	VERT.		10.00					3.00	11.00
2			15.75	2.00				5.25	1.00
3		5.75	5.50	6.25				6.50	
4	DEVIATED	12.50	2.00				2.75	6.75	
5		1.25		0.50			7.50	14.25	0.50
6		13.75					1.00	9.00	0.25
7		14.50		1.50				8.00	
8		13.25		0.25			1.00	9.50	
9		3.75		0.25	8.50	2.75	0.75	7.00	1.00
Total		64.75	33.25	10.75	8.50	2.75	13.00	69.25	13.75

Table I . ET2 Workover Operating Time Distribution (hours)

Measured Depth related to G.L. (m)	Inclination (deg.)	Azimuth rel. to UTM North (deg.)	True Vertical Depth(*) (m)	East - West Displacement(*) (m)	North - South Displacement(*) (m)
525.00	0.57	333.30	517.29	26.90	-137.95
(7" shoe)528.70	0.55	330.28	520.99	26.88	-137.91
536.00	1.40	312.30	528.29	26.80	-137.82
537.00	1.80	312.60	529.29	26.78	-137.81
539.00	3.00	322.00	531.28	26.72	-137.74
541.00	4.80	326.90	533.28	26.64	-137.63
543.00	7.50	327.90	535.27	26.53	-137.45
545.00	11.20	326.00	537.24	26.35	-137.18
547.00	14.90	318.50	539.19	26.07	-136.83
549.00	19.10	310.50	541.10	25.65	-136.42
551.00	24.10	304.80	542.96	25.07	-135.97
553.00	29.30	303.20	544.74	24.32	-135.47
555.00	35.00	303.30	546.43	23.44	-134.89
557.00	40.90	304.30	548.01	22.42	-134.21
559.00	46.40	303.80	549.45	21.27	-133.44
561.00	51.90	302.90	550.76	20.01	-132.61
563.00	56.20	302.50	551.93	18.65	-131.73
565.00	60.80	299.20	552.98	17.19	-130.86
567.00	65.40	297.70	553.88	15.62	-130.01
(**)567.58	66.73	297.46	554.12	15.15	-129.76
569.00	70.60	297.10	554.63	13.97	-129.16
571.00	78.10	297.80	555.17	12.27	-128.27
573.00	84.30	299.50	555.48	10.54	-127.33
574.00	87.60	300.10	555.55	9.67	-126.83
575.00	90.90	300.70	555.56	8.81	-126.33
577.00	97.40	302.10	555.41	7.11	-125.29
579.00	103.20	303.60	555.06	5.46	-124.22
581.00	108.40	304.30	554.51	3.86	-123.15
583.00	113.00	303.30	553.81	2.31	-122.11
585.00	117.20	300.10	552.96	0.77	-121.16
(**)586.70	119.79	295.66	552.15	-0.55	-120.46
589.00	123.10	289.20	550.95	-2.36	-119.71
591.00	126.10	283.30	549.81	-3.93	-119.25
(**)593.50	129.76	275.54	548.28	-5.87	-118.92
(**)596.62	134.11	265.50	546.19	-8.18	-118.90
(***)598.00	136.00	261.00	545.22	-9.15	-119.01

Table II . ET2 Workover Trajectory based on MWD survey

(*) relative to ET4 spud location
(**) interpolated from adjacent survey
(***) extrapolated to bit

	Case a all points except ET6 (including ET2 workover corrected)	Case b all points (including ET2 workover corrected)
Dip Azimuth rel. to UTM North	180.0°	174.5°
Dip Angle	28.9	28.9
Typical Error	0.40	0.98
Maximum Error	0.50 (ET2 workover nº 1)	1.44 (ET6)

Table III . Dip Azimuths and Dip Angles obtained by Linear Regression on Sets of Top Limestone Reference Points

Date	Time	Injection Pressure 7" liner (bar.)	Annulus Pressure 9 5/8"/7" (bar.)	Flow Rate (LPM)	Accumu-lated Flow (Litres)	Comments
20/9/95	17:37	9,8	12,5	12	846	No activity ET-5
	18:03	10	12,5	12	1151	
	19:00	10	12,5	12	1703	
	19:35	10	12,5	12	2053	
	20:02	10	12,5	10	2314	
	20:34	10,7	13	10	2627	
	21:34	10,7	13	10	3248	
	22:50	10,7	13	10	4018	
	23:48	11	13	10	4636	
21/9/95	00:48	11	14	10,4	5260	
	02:00	11	14	10,6	6025	
	02:51	11	14	10,2	6548	
	03:51	11	14	10,3	7167	
	04:51	11	14	10,5	7800	
	05:52	11	14	9,5	8382	
	06:52	11	14	11,3	9060	
	07:52	11	14	10	9670	
	08:38	11	14	10	10144	
	09:38	11	14	10	10752	
	10:38	11	14	9,6	11389	Start drilling ET-5
	11:13	11,1	14	10	11757	
	11:40	9,2	10	7,6	12087	
	11:50	5,1	8	7,8	12197	
	12:00	5	8	7,6	12305	
	12:15	4,2	5	8,6	12496	
	12:20	0	0	8,1	12550	Drilling cement at seam
	12:30	1,5	0	7,7	12668	horizon
	12:40	1,5	0	7,7	12819	
	13:00	1,5	0	8,2	13065	
	13:30	1,5	0	8,2	13375	
	14:00	0	0	-	13718	End drilling
	14:03	**2**	**0**	**83**	**13775**	)
	14:10	**2**	**0**	**83**	**14342**	) **Pressure**
	14:25	**2**	**0**	**83**	**15595**	) **injection test**
	14:30	**2**	**0**	**83**	**16014**	)
	14:40	1,5	0	10	16306	
	16:00	0	0	10	17212	
	17:00	0	0	10	17915	
	18:00	0	0	10	19022	
	19:12	0	0	10	19986	
	20:00	0	0	10	20605	
	20:22	0	0	9,5	20787	
	21:15	0	0	9	-	

Table IV. Pressures and Flows in Injection Well ET-4 during Hydraulic Test

Nº	Component	Length (m)	Cumulative Length (m)	Depth (m) rel. to G.L.
				568,473
1	INCONEL 625	12,000	12.000	556,473
2	N80	12,225	24,225	544,248
3	N80	11,945	36,170	532,303
4	N80	12,185	48,355	520,118
5	N80	12,445	60,800	507,673
6	N80	11,875	72,675	495,798
7	N80	12,435	85,110	483,363
8	N80	12,485	97,595	470,878
9	N80	11,745	109,340	459,133
10	N80	12,425	121,765	446,708
11	N80	11,455	133,220	435,253
12	N80	12,545	145,765	422,708
13	N80	11,995	157,760	410,713
14	N80	12,745	170,505	397,968
15	N80	12,295	182,800	385,673
16	N80	12,115	194,915	373,558
17	N80	12,595	207,510	360,963
18	N80	11,445	218,955	349,518
19	N80	12,455	231,410	337,063
20	N80	12,245	243,655	324,818
21	N80	11,975	255,630	312,843
22	N80	12,565	268,195	300,278
23	N80	12,255	280,450	288,023
24	N80	11,775	292,225	276,248
25	N80	12,295	304,520	263,953
26	N80	12,165	316,685	251,788
27	N80	12,095	328,780	239,693
28	N80	11,765	340,545	227,928
29	N80	11,795	352,340	216,133
30	N80	11,785	364,125	204,348
31	N80	12,505	376,630	191,843
32	N80	11,675	388,305	180,168
33	N80	12,355	400,660	167,813
34	N80	11,675	412,335	156,138
35	N80	12,475	424,810	143,663
36	N80	12,125	436,935	131,538
37	N80	11,775	448,710	119,763
38	N80	12,135	460,845	107,628
39	N80	11,935	472,780	95,693
40	N80	12,515	485,295	83,178
41	N80	11,825	497,120	71,353
42	N80	11,775	508,895	59,578
43	N80	11,795	520,690	47,783
44	N80	12,035	532,725	35,748
45	N80	12,465	545,190	23,283
46	N80	12,825	558,015	10,458
47	N80	10,770	568,785	-0,312
48	Tubing Hanger	0,408	569,193	-0,720

Table V. Well ET5. Equipment List - 6 5/8" Tubing

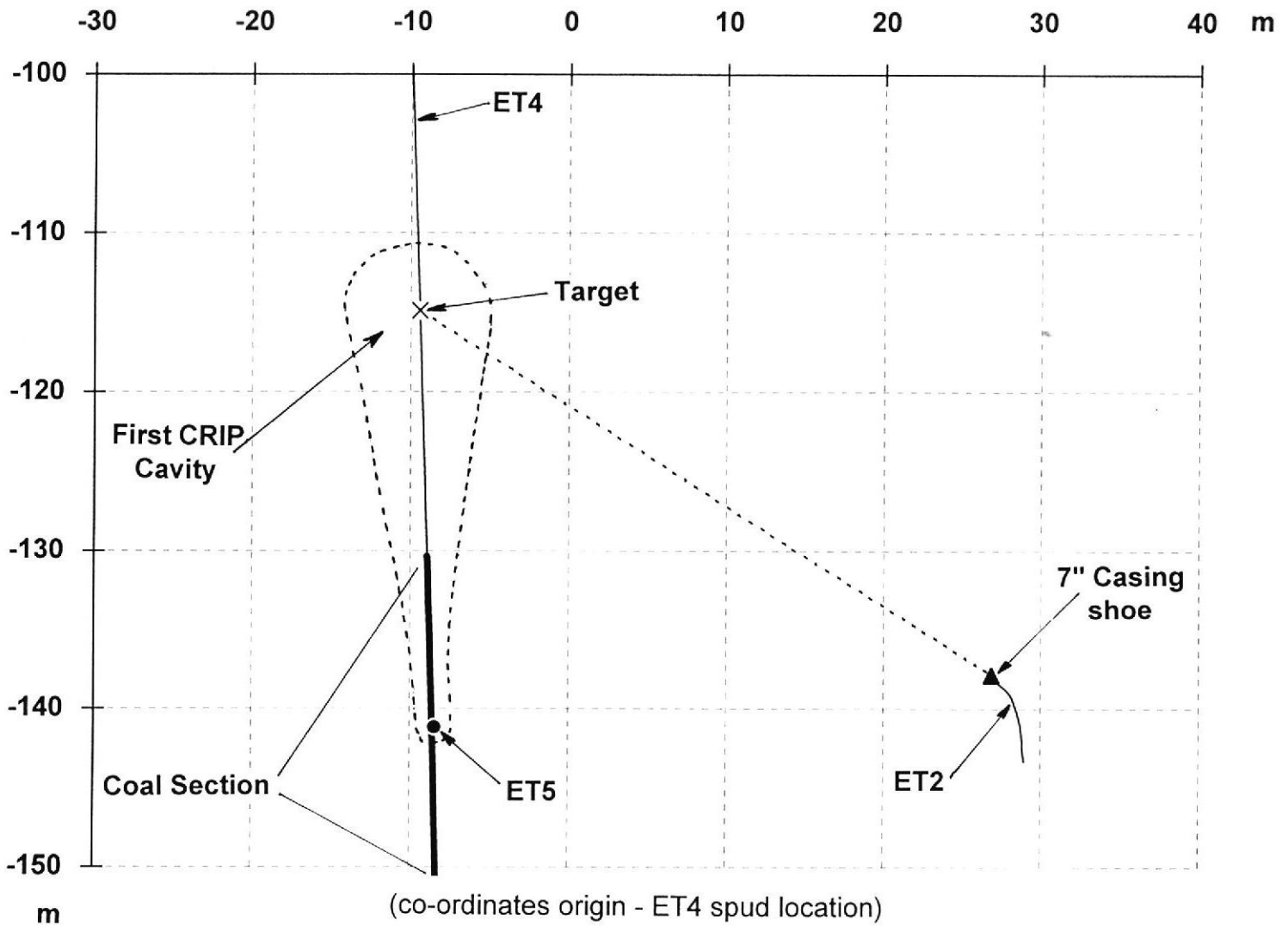


Figure 1a . ET2 Workover Planned Trajectory
(Horizontal Section in Area of first CRIP Reactor)

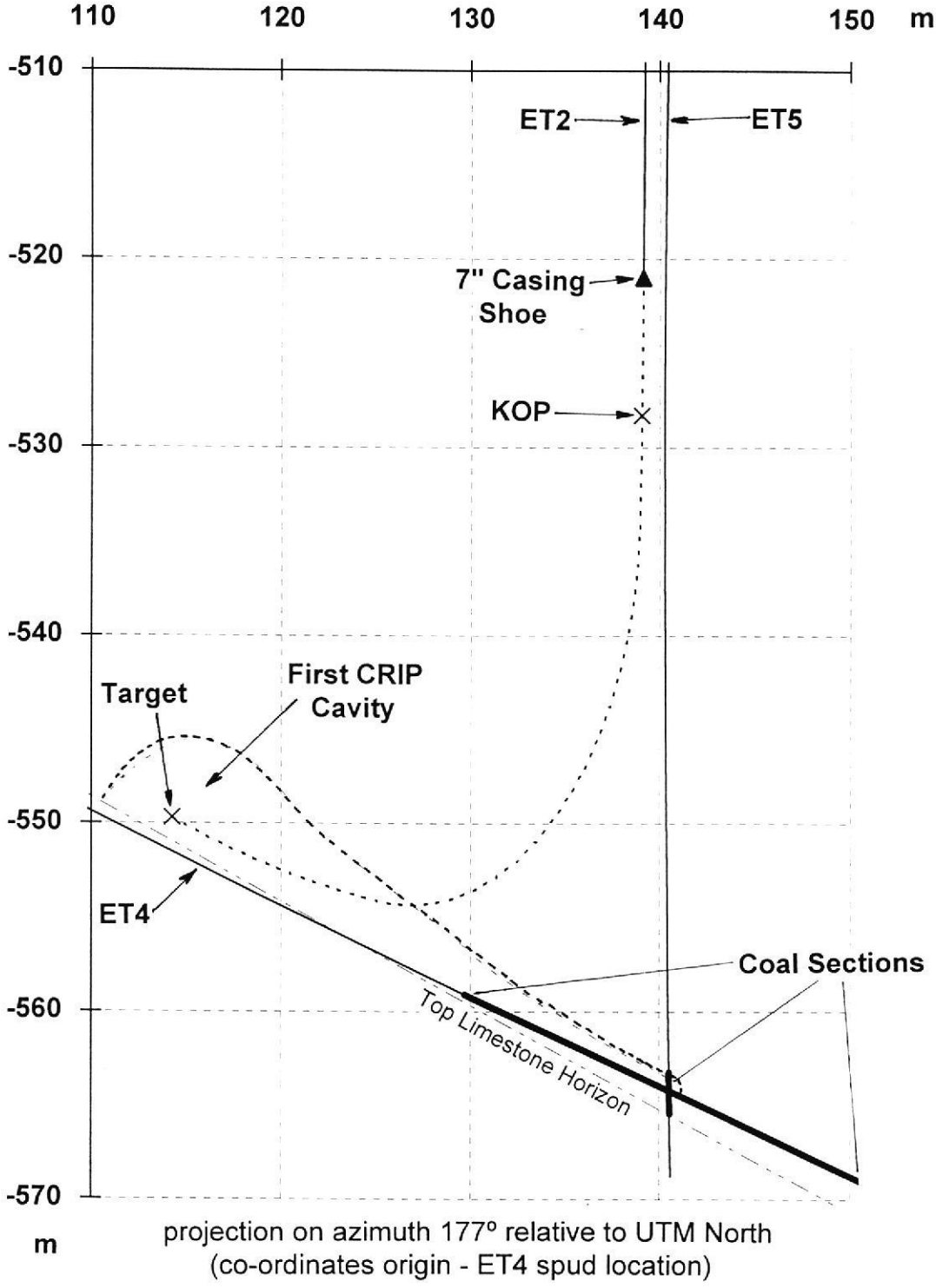


Figure 1b . ET2 Workover Planned Trajectory
(Vertical Section for UCG Representation and Interpretation)

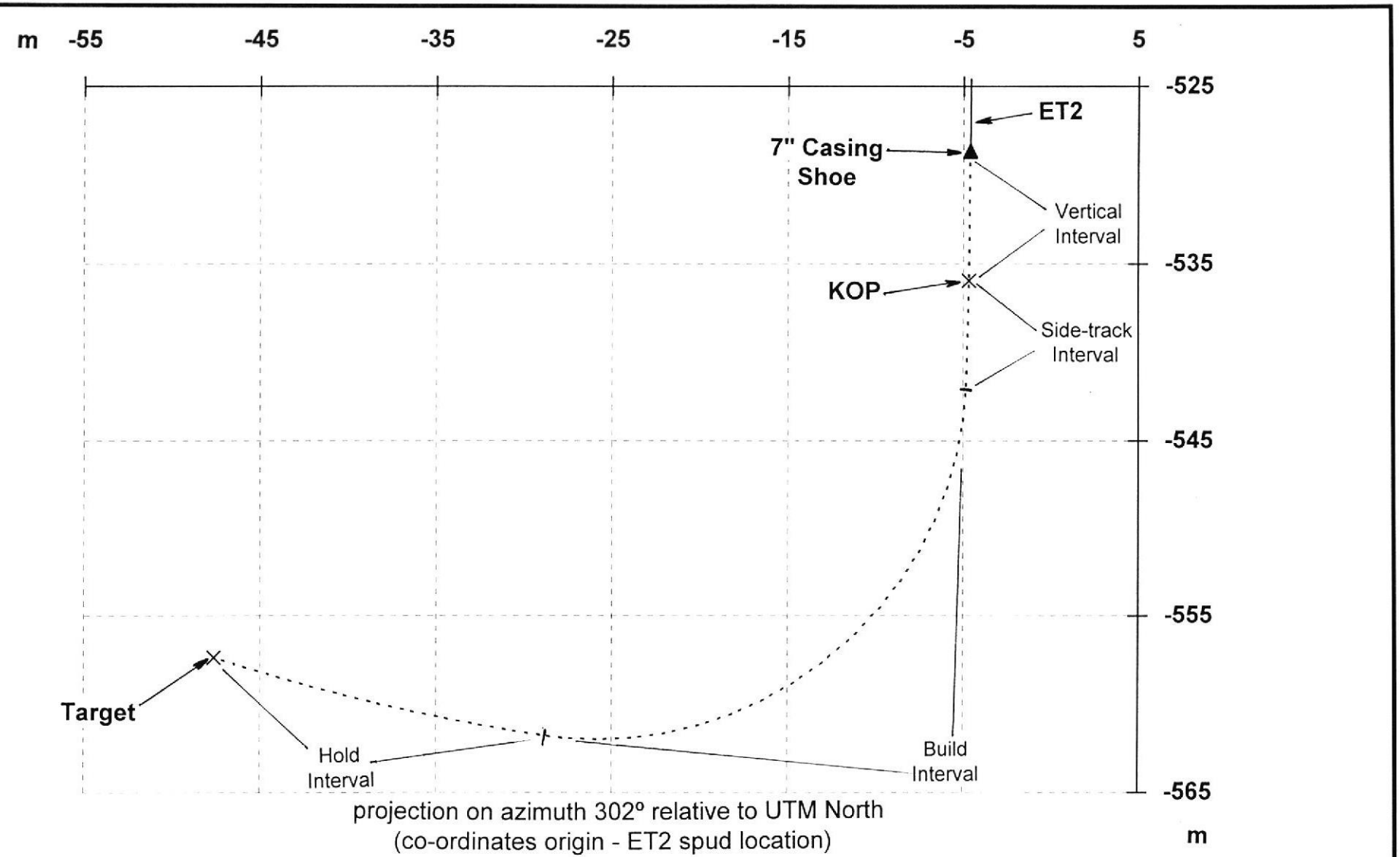


Figure 1c . ET2 Workover Planned Trajectory
(Vertical Section for Drilling Representation)

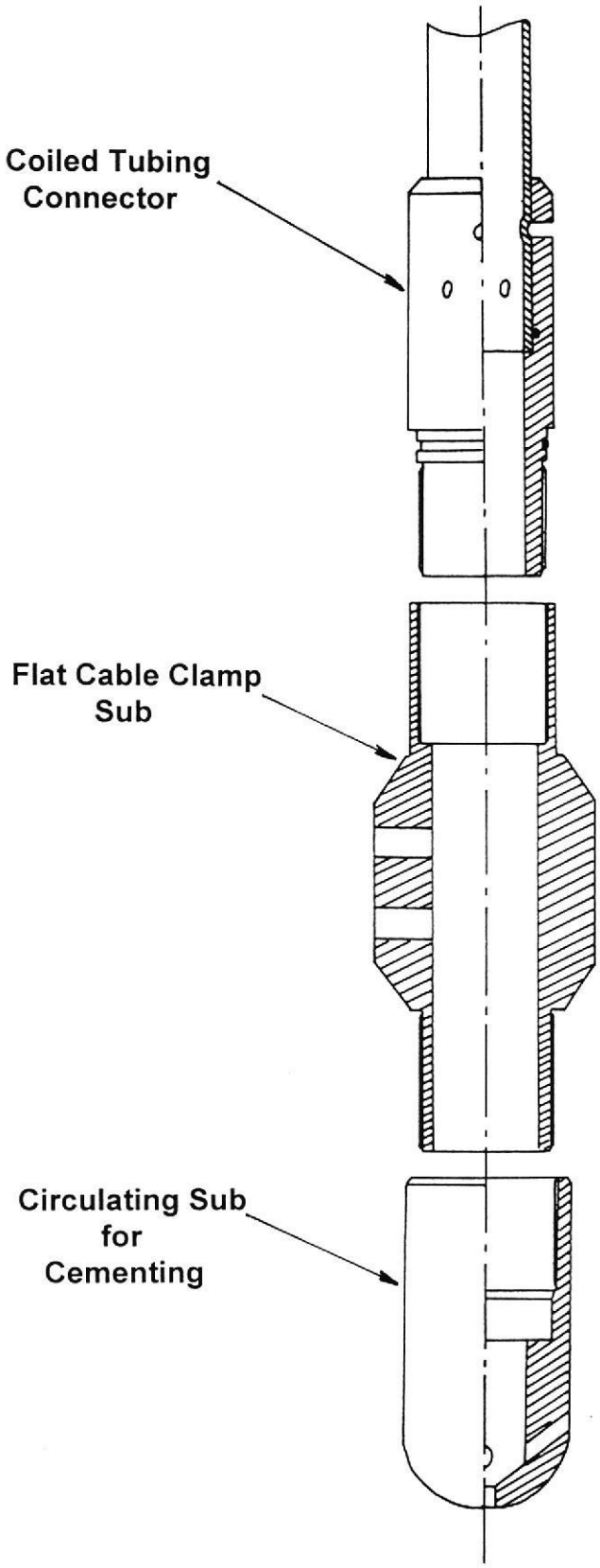


Figure 2 . Arrangement of the Flat Pack Anchorage System connected to the End of the 2" Coiled Tubing

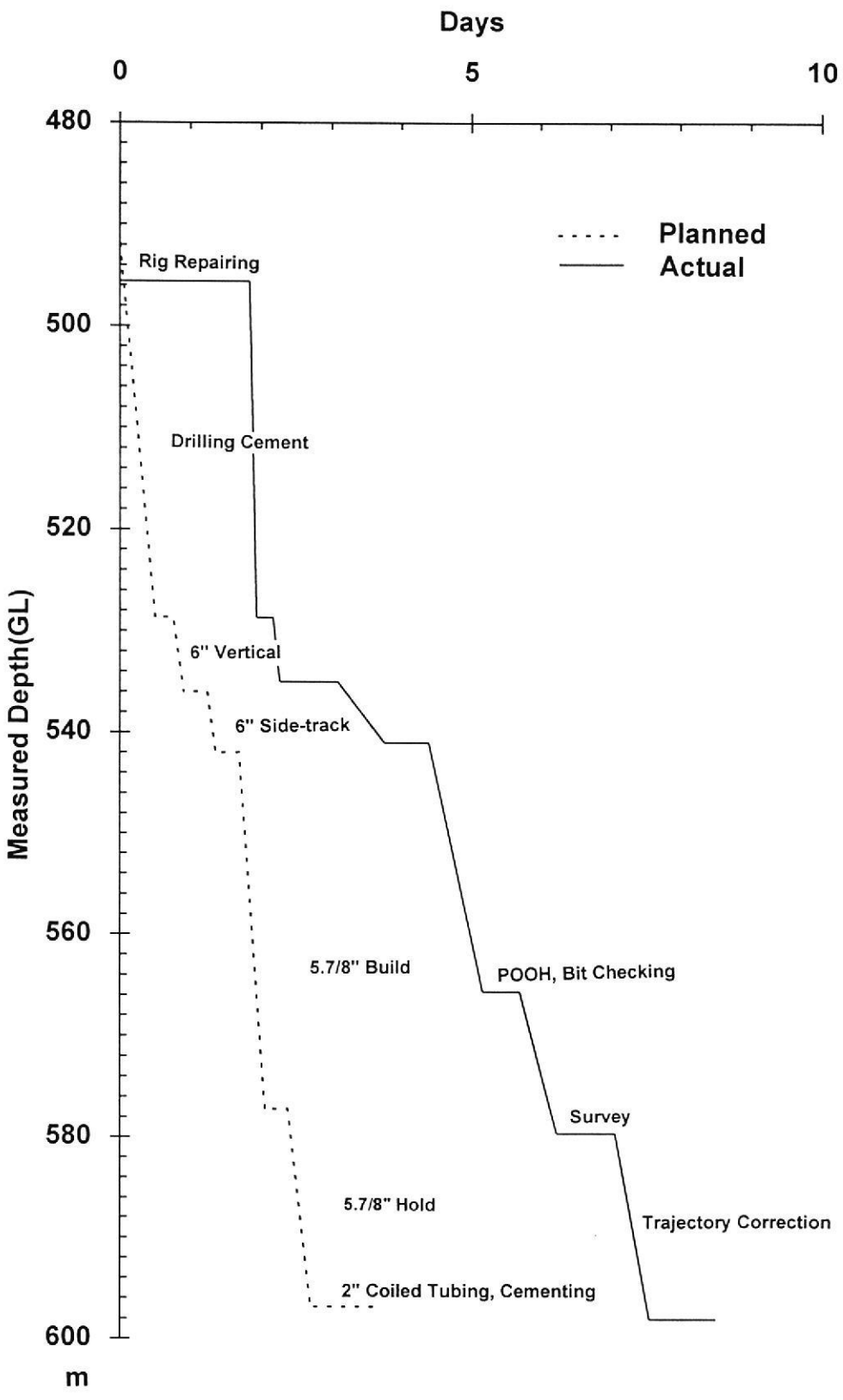
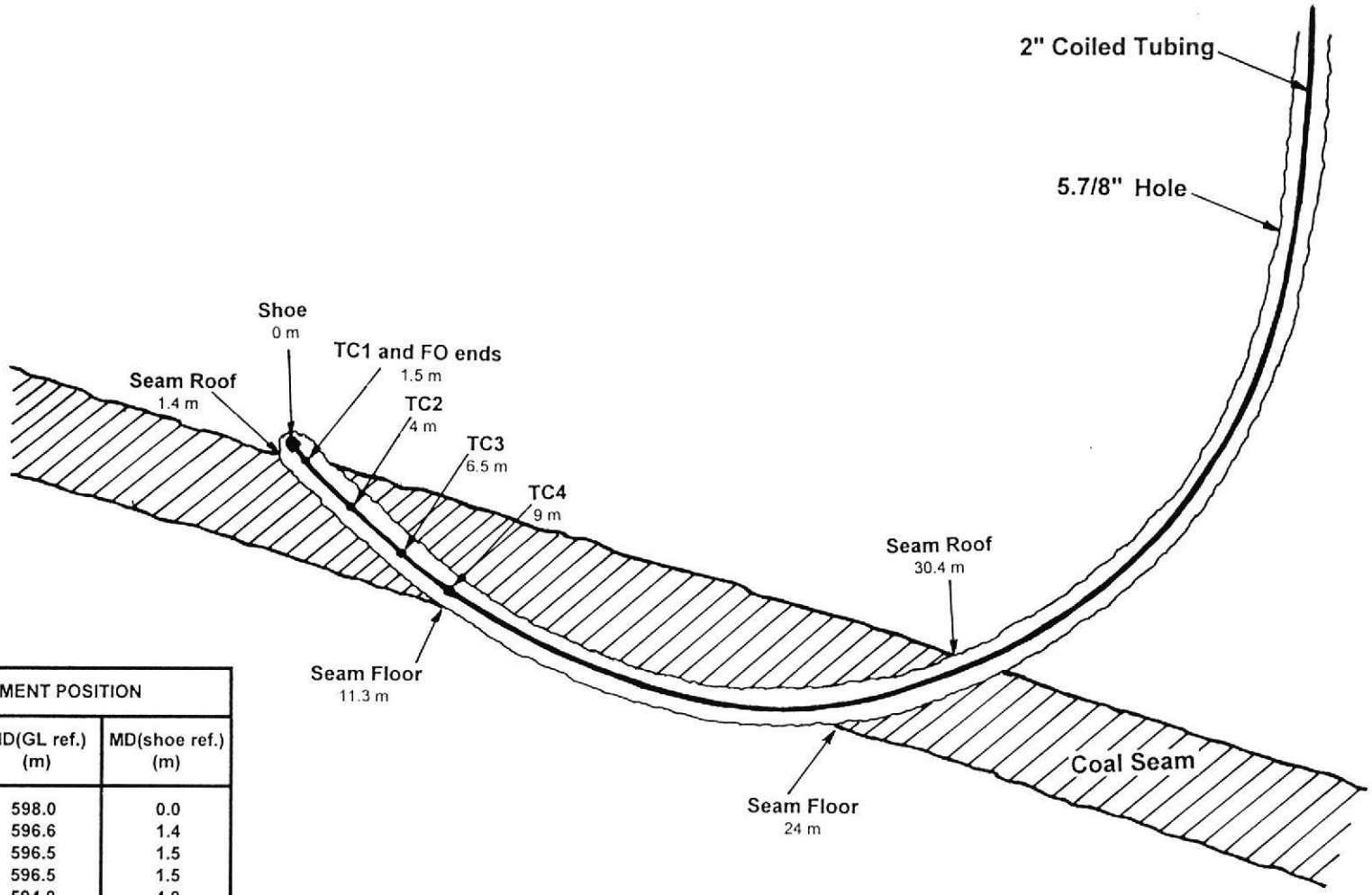


Figure 3 . ET2 Workover Depth/Time Progress compared to Pre-spud Estimate



IN-SEAM EQUIPMENT POSITION		
Equipment/ reference points	MD(GL ref.) (m)	MD(shoe ref.) (m)
2" Coiled Tub. Shoe	598.0	0.0
Seam Roof(2nd Sect.)	596.6	1.4
Fibre Optic Ends	596.5	1.5
Thermocouple nº 1	596.5	1.5
Thermocouple nº 2	594.0	4.0
Thermocouple nº 3	591.5	6.5
Thermocouple nº 4	589.0	9.0
Seam Floor(2nd Sect.)	586.7	11.3
Seam Floor(1st Sect.)	574.0	24.0
Seam Roof(1st Sect.)	567.6	30.4

Figure 4 . ET2 Workover In-seam Completion

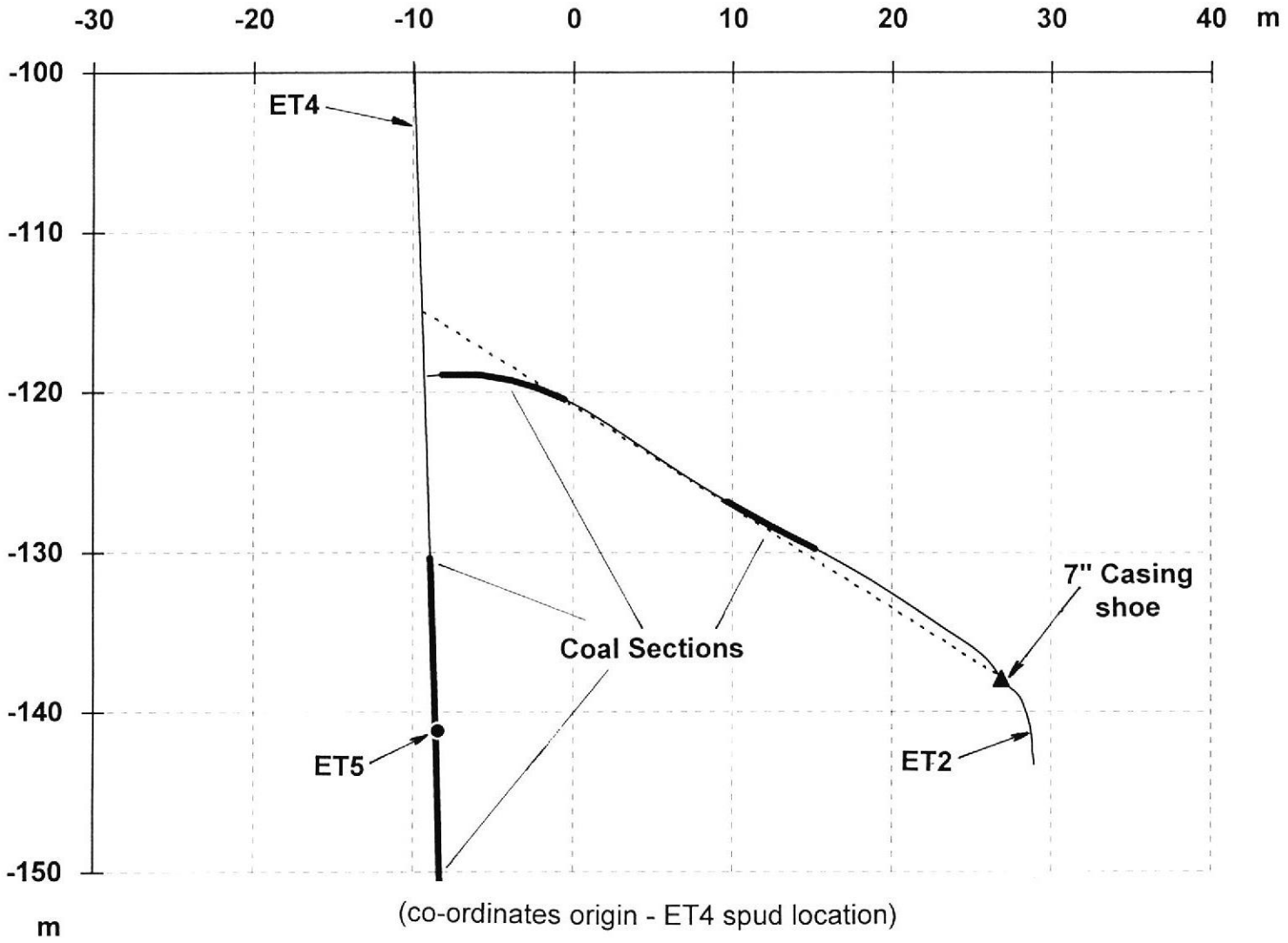


Figure 5a . ET2 Workover Actual Trajectory compared to Planned Trajectory
(Horizontal Section in Area of first CRIP Reactor)

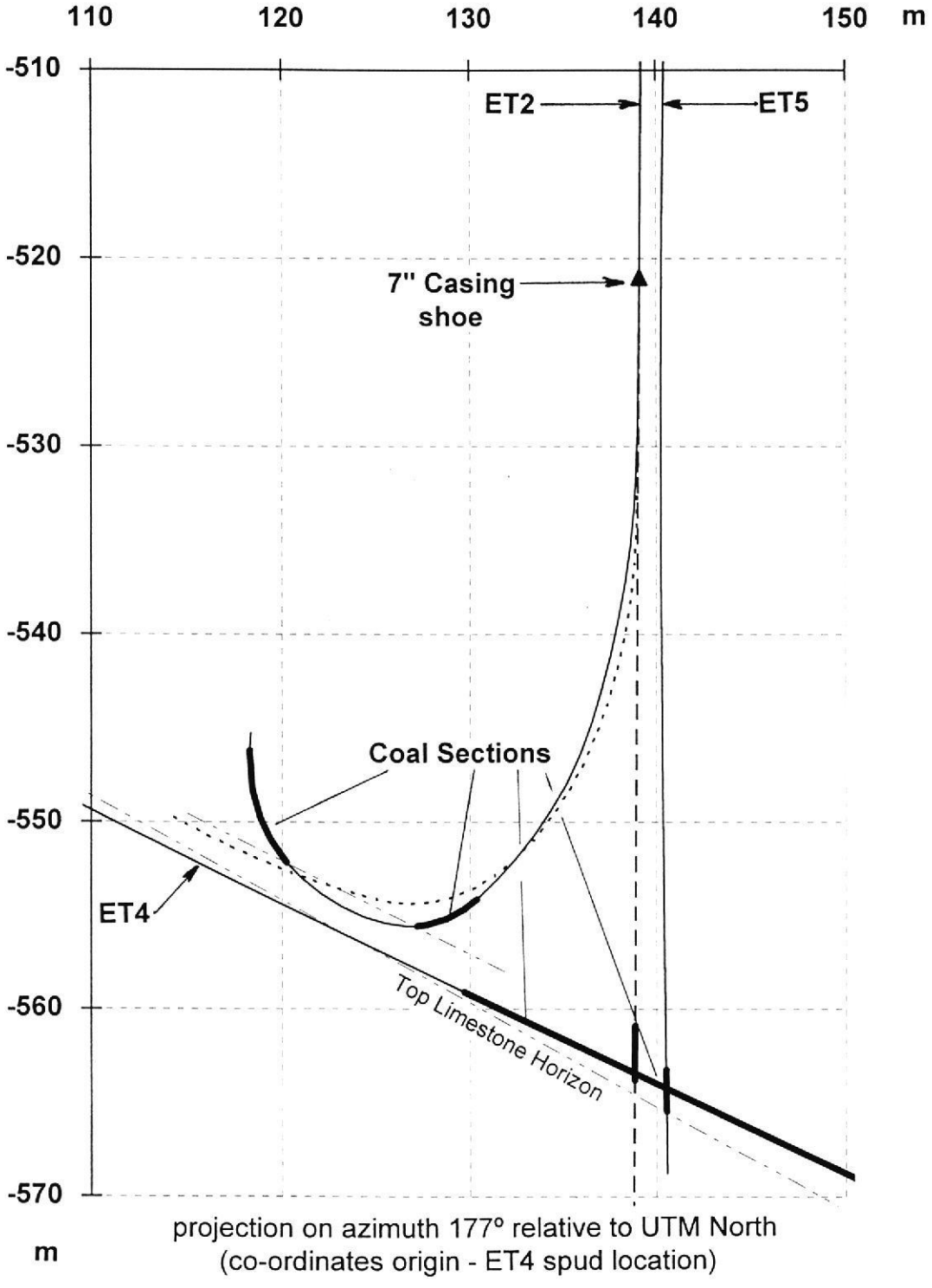


Figure 5b . Comparison of Actual and Planned Trajectories of ET2 Workover (Vertical Section for UCG Representation and Interpretation)

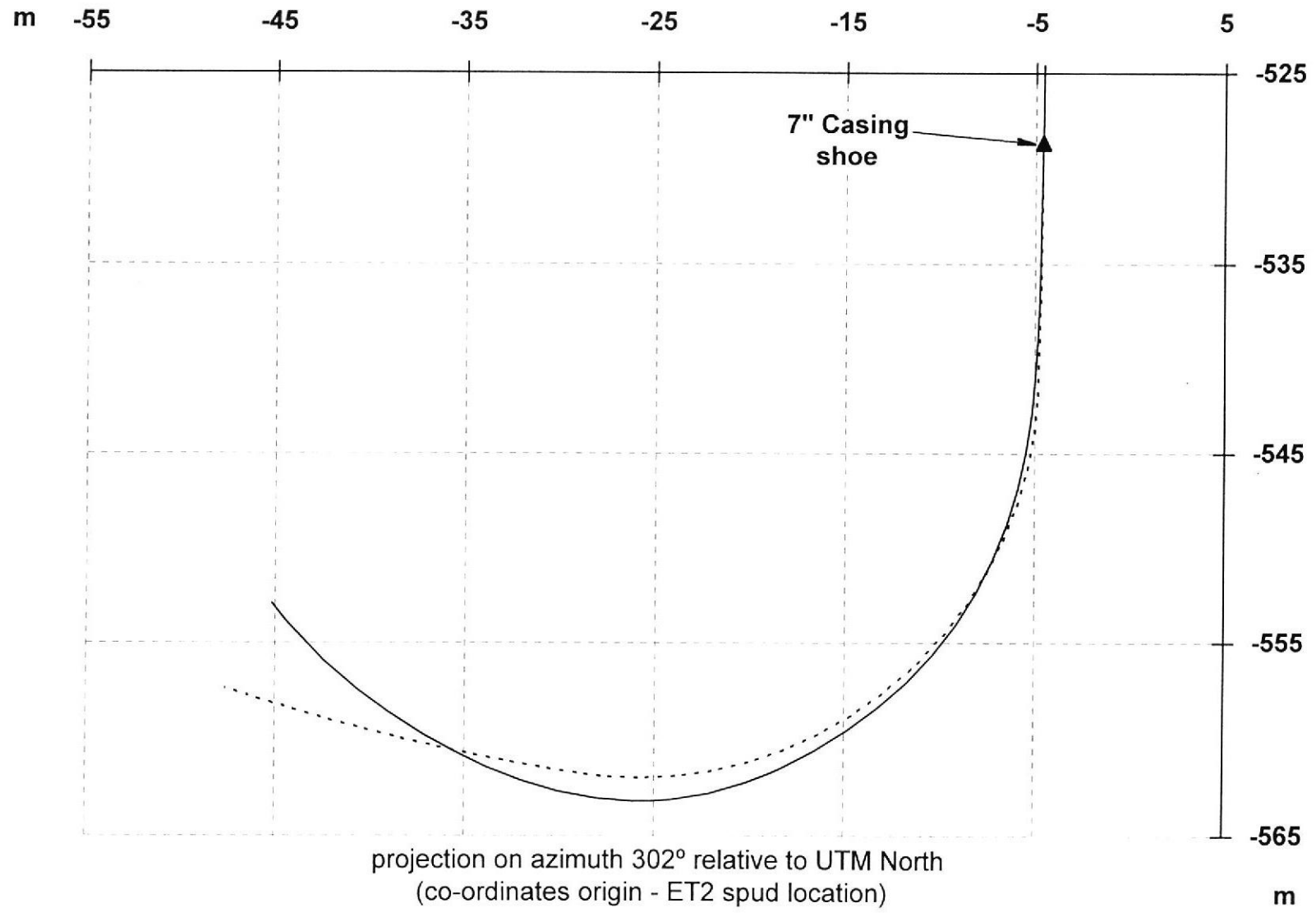


Figure 5c . ET2 Workover Actual Trajectory compared to Planned Trajectory
(Vertical Section for Drilling Representation)

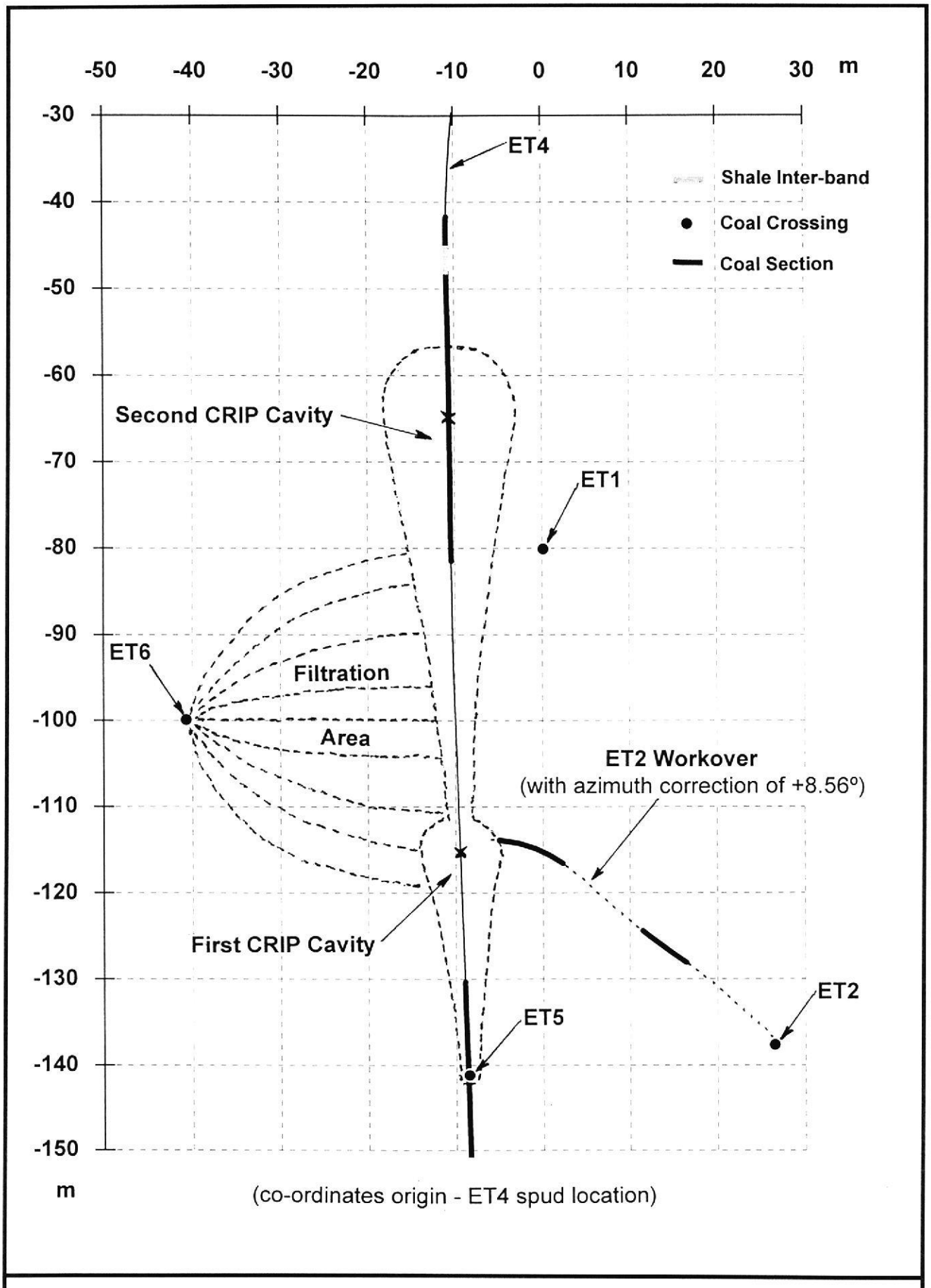


Figure 6a . Reference Well Trajectories and Coal Sections
(Horizontal Section in Area of Planned UCG Reactors)

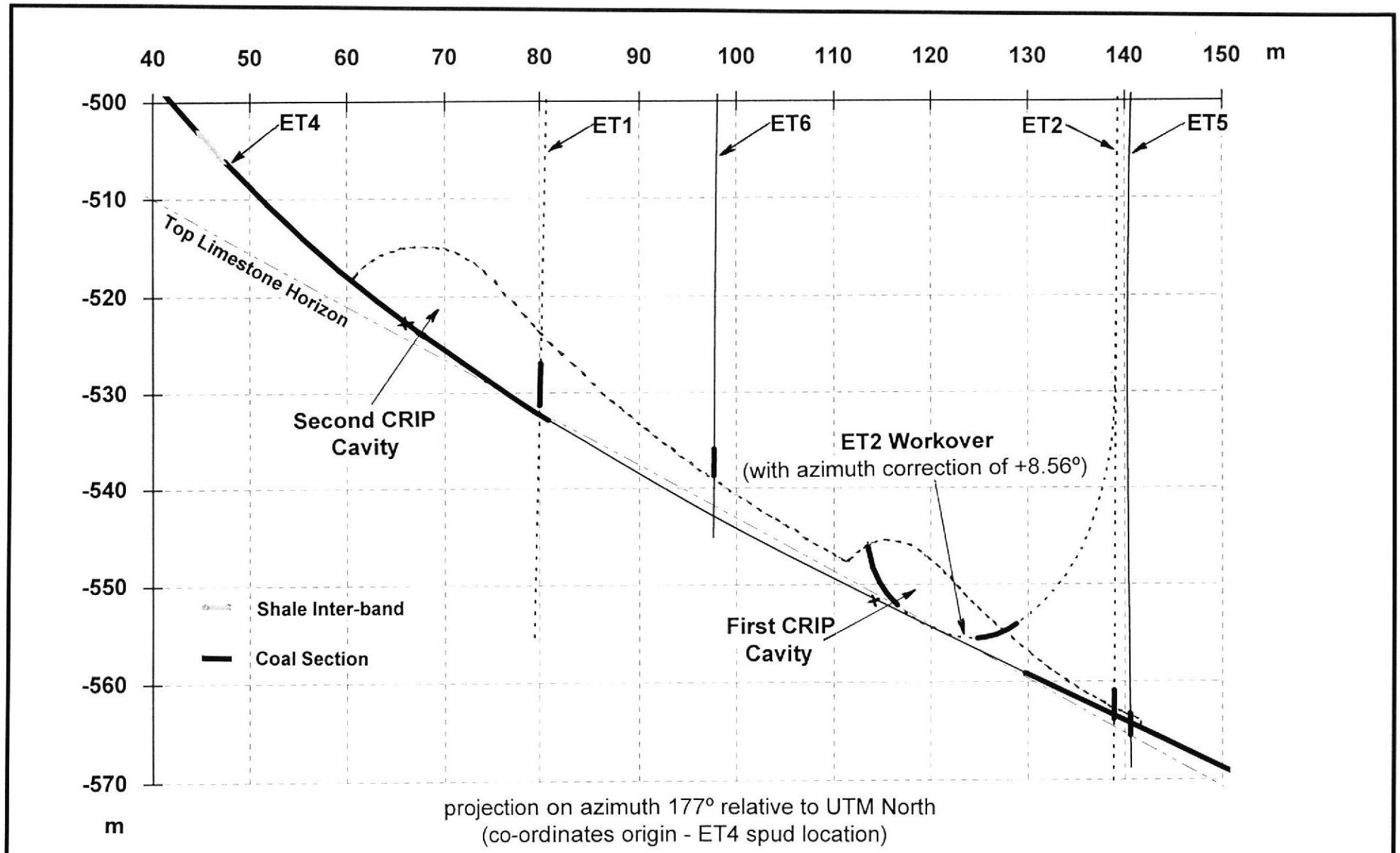


Figure 6b . Reference Well Trajectories and Coal Sections
(Vertical Section in Area of Planned UCG Reactor)