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

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TECHNICAL REPORT
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Managers

A. BAILEY (DIRECTOR)

A. OBIS (DEPUTY DIRECTOR - OPERATIONS)

M. MOSTADE (DEPUTY DIRECTOR - TECHNICAL)

Underground Gasification Europe (UGE), AEIE
Calle Hermanos Nadal, 27 - 1º
44550 Alcorisa (Teruel), Spain

CONTENTS

Summary

Underground activities during the period of this report comprised the workover operations on recovery well [RW(ET5)] (Phase 2), and injection wells [IW1(ET4)] and [IW2(ET6)]. An important defect was revealed in the design of the small tubing strings in these wells during installation, and the necessary modifications resulted in delay.

The major activity during the period of this report was the construction of surface plant. Although the plant was largely complete at end-June 1996, piping construction (AUXIMET) was the cause of serious delay due to omissions and errors in procurement by the contractor, deficiencies in welding resources and capability, and uncertainties in installation procedures for special alloy components. At the end of this report period, surface plant completion awaited the delivery of replacements for sub-specification gate valves previously installed in product gas lines and failed on test, and a solution to achieve pressure-tight connections of small valves in wellhead/manifold lines.

A contract for the installation of instrumentation was placed with DENION CONTROL y SISTEMAS in January 1996. This contract, and the electrical contract (EDASA) were almost complete at end-June 1996, the outstanding work awaiting completion of piping construction.

The Gas Analysis Unit was delivered to site in early-March; final connections to this unit also awaited the completion of piping.

In the supporting programme, a meeting was held with T.U.DELFT in February 1996 for presentation of the results of their modelling work, and discussion of use of the models in relation to the El Tremedal trial. Arrangements were made for transfer of the programmes to UGE.

1. INTRODUCTION

This report is the ninth 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 ET5(Phase 1) had been carried out, but the workovers of ET4, ET6 and ET5(Phase 2) had been delayed due to long delivery times in the procurement of materials. These workovers were planned for February 1996.

Work on the mechanical construction contract (AUXIMET) had begun in mid-October with completion foreseen end-February 1996; the electrical contract (EDASA) began in December 1995.

This report describes progress in both underground and surface construction during the period January-June 1996. Important delays resulted from the

poor performance of the mechanical/piping contractor, deficiencies in his procurement having the consequence that, at end-June 1996, the contract was 4 months late (over initial quoted duration 4.1/2 months) and still not complete.

2. WORKOVERS/WELL COMPLETIONS

2.1 ET5 (PHASE 2), ET4, ET6 WORKOVERS

These workovers comprised the installation of small tubing strings and igniters in recovery well [RW(ET5)], and injection wells [IW1(ET4)] and [IW2(ET6)], and were performed in January 1996 using a framework manufactured by a local fabrication workshop. A defect in coupling design was revealed after installation of the small tubing/igniter in recovery well RW(ET5), and the solution of welding couplings to the tubing during insertion was adopted for the installations in wells ET4 and ET6.

For confidence in the performance of the system, the decision was taken to remove the small tubing previously installed in ET5, and to re-install to the welded configuration. Dismantling the string resulted in damage to the tubing hanger, and this was returned to MALBRANQUE for repair. A re-sized Inconel sealing ring for the repaired hanger and replacement macaroni/instrumentation clamps were manufactured, and the small tubing was re-installed in ET5 in late April 1996.

Tables I to IV are the equipment lists for the 4.1/2" production tubing installed in recovery well[RW(ET5)], and for the 1.66" small tubing strings installed in the three process wells. The small tubing strings include the burners for use in process phases 4, 5 and 8 of the trial - described in UGE's third technical report to CEC covering the period January-June 1993. The configurations of the burners are identical to those used in the previous Thulin (Belgium) UCG trial and are shown in Figures 1 and 2.

3. SURFACE PLANT/EQUIPMENT

3.1 PROCUREMENT

Outstanding plant/equipment was received on site, as follows:

Heat Exchangers	AGUILAR y SALAS	January	1996
Wellhead manifolds	MASA	January	1996
Pressure Let-down valves	ITT	March	1996
Product Gas Gate Valves	AUXIMET	March	1996
Wellhead choke valves	MALBRANQUE	April	1996
Special alloy pipe sections	AUXIMET	May	1996
Product Gas Analysis Unit	DENION	March	1996

The gate valves for the product gas lines supplied by the piping contractor AUXIMET were found to be below specification and, to minimise delay, replacement valves were ordered directly by UGE from MALBRANQUE, expected delivery end-July 1996. The replacement valves have different flange-to-flange dimensions and their installation requires modifications to adjacent piping, with consequent delay to the planned schedule of commissioning and operations phases.

3.2 PIPING/CONSTRUCTION

Mechanical, electrical and instrumentation construction composed the major activities during the period of this report. Progress was made in all three construction areas, although progress with the main mechanical/piping contract (on which progress on other contracts depend) was seriously delayed.

Major failures were experienced in the services provided by the mechanical/ piping contractor AUXIMET. Omissions and failures were discovered in his procurement programme, the most important of these being in orders for some long delivery special alloy components, and in the provision of sub-specification gate valves for product gas lines previously mentioned.

AUXIMET also experienced difficulties in achieving pressure tight connections of 1/2" and 1" valves in manifold/wellhead lines. Investigation of the cause of this problem was in progress at the end of the period of this report, initial assessment suggesting sub-standard NPT threads on Redfluid valves.

An omission by the engineering contractor SERELAND to perform stress analysis of the product gas line was revealed, and led to the need to reconstruct the line for the introduction of an expansion loop.

The company which supplied the steam boiler installation (GEVAL) went into liquidation and negotiations took place with a company who accepted GEVAL's contractual obligations, the most important of these relating to start-up and guarantee provisions.

The Electrical contract (EDASA) was completed with the exception of connections to outstanding elements within the piping contract. The Instrumentation contract was placed with DUMEZ COPISA in February and was also completed with similar exceptions.

The final report on Detailed Engineering Design of the plant was received from the contractor SERELAND, and includes all P&ID's of the plant. An "Operation Manual" was also produced by SERELAND, this simply being an assembly of instructions for operation of the package units, provided by the respective manufacturers and suppliers.

3.3 HAZOP STUDY & COMMISSIONING

A HAZOP (Hazard and Operability) Analysis was commissioned from TECSA IBERICA in May 1996. A preliminary report was received in June which recommended the installation of several additional valves and alarms; decisions on implementation of the recommendations will be taken following receipt of the final HAZOP report, expected early July.
Commissioning of other surface plant began in February with the connection of the electricity transformer, LT board, lighting, and the emergency group. The firewater group and system, and the distribution lines for utility water, propane and instrument air are tested. Commissioning of units will continue in parallel with piping construction.

On-site pre-commissioning of the Data Acquisition and Control System was completed, including its connection via modem link to the computing system in UGE offices.

Although pre-commissioning of package units in advance of piping completion could avoid additional delays via the early identification and repair of faults, safety concerns, such as the presence of propane in lines adjacent to welding operations, are paramount, and the pre-commissioning of all units prior to piping completion is not possible.

Completion of the commissioning of all plant is planned for September 1996, on the basis of no further delay in procurement and construction.

3.4 COILED TUBING

After slow initial progress, a contract was signed with SCHLUMBERGER DOWELL in May 1996 for the engineering, procurement and construction of the coiled tubing unit for injection well[IW1(ET4)].

Engineering of the system was completed, the coiled tubing was constructed, and special components were under manufacture at end-June 1996. DOWELL were informed of the likely delay in start-up of the plant, and completion of the system is expected end-July 1996. Rental costs will be incurred from the date of completion of the unit.

3.5 PRODUCT GAS ANALYSIS UNIT / PARTICLE SAMPLING

The Gas Analysis Unit was delivered to site 6 March 1996. Connections of the unit to process and service lines are installed with the exception of final elements which await the completion of mechanical/piping construction.

T.U.DELFT offered to make available to UGE the particle sampling system which was constructed for, but not used at, Thulin. Since its construction, the

Delft unit had been cannibalised for the use of parts in other projects. After careful assessment, it was decided not to incorporate the unit into the El Tremedal plant; this due to the status of plant construction, and the extent of work required for the unit's incorporation.

Particle sampling will be restricted to the recovery of material at the cyclone/filter stage of gas clean-up for gas analysis.

4. ENVIRONMENTAL MONITORING PROGRAMME

An environmental monitoring programme is in progress to detect possible interactions between the El Tremedal trial and the groundwater hydrology in the area, mainly on the aquifer points in the vicinity.

The environmental programme is detailed in Annex 1 to this report. Monitoring is already in progress of water levels in two wells (Saso and New Tremedal).

5. PROCESS ANALYSIS AND MODELLING

A programme for mass and energy balance analysis was written by UGE and installed on the UGE computer system. A comprehensive manual was produced which describes the concepts within and structure of the programme, together with instructions for users.

The following four programmes were received from I.D.G.S. :

- Simple tracer test interpretation
- Two-box equilibrium model
- Liquid - vapour equilibrium
- Recovery well simulation

Only brief supporting technical documentation accompanied the programmes and neither programmers nor users manuals were available. Comprehensive users manuals for the first three programmes were written by UGE personnel and these programmes were installed on the UGE computer system.

6. SUPPORTING PROGRAMME

A meeting with T.U.DELFT workers was held mid-February 1996 for presentation of the results of their modelling work, and to discuss their use for the interpretation of data from the trial. The work is complete and T.U.DELFT will make available to UGE the computer programmes developed for running at Alcorisa.

7. PROJECT DIRECTION

7.1 AUTHORISATIONS/LEGALISATIONS

An application for the production of foul water during cleaning of the cavity after gasification, and its transport from site, was submitted to the DGA in June, with approval expected September 1996.

Legal authorisation of the propane (LPG) storage system was applied for and received. Legalisation of the propane gas line is awaited. The legalisation of other units such as Boiler, Electrical installation, Cryogenic Plant, Combustor and Flare will be requested following piping completion, together with the relevant construction authorisation.

7.2 ADMINISTRATION

One resignation was received during the period of the report:
ALVARO BLASCO VALENTI (Engineer) - resigned 23 April 1996.

Two appointments were made during the period:
JOSÉ LUIS CONCHELLO BEL (Engineer) - appointed 25 March 1996.
ALFONSO HIDALGO BAU (Engineer) - appointed 26 June 1996.

7.3 PROBLEMS/DIFFICULTIES

Major problems were experienced with the service provided by the mechanical/ piping contractor AUXIMET. Omissions and failures were revealed in his procurement programme, sub-specification components were delivered and installed necessitating subsequent replacement, and pressure tight connections in manifold/wellhead lines could not be achieved.

Delivery of 22 wedge gate valve replacements for sub-specification valves in the product gas lines is expected end-July 1996, with re-installation planned for August. A solution to the inability to achieve pressure tight connections in manifold/ wellhead lines has been requested from the valve/connection manufacturers.

7.4 CHANGES IN TECHNICAL STRATEGY

None during the period covered by this report.

7.5 FUTURE WORK

The remaining work in piping construction comprises the installation of replacement valves in product gas lines and a solution to the small valve

connection problem. Once mechanical construction is complete, final electrical and instrumentation connections can be made, and the coiled tubing unit can be brought onto site and installed on injection well[IW1(ET4)] .

7.6 EUROPEAN WORKING GROUP

A joint proposal (UGE and NOVEM) was submitted to CEC for aid under the EU's THERMIE "B" programme. The objective of the proposal was to reconstitute the "European Working Group on UCG", to conduct dissemination of the results of the El Tremedal trial, and to formulate a proposal for the second trial in the European UCG programme. The total estimated cost of the work was 334,000 ECU over a period of 18 months from 1 May 1996.

An indication that co-financing was necessary was received from CEC, but a consensus on the ability to co-finance was not reached by the proposers.

7.7 CONFERENCES, PUBLICATIONS AND REPORTS

IDGS Programmes - Installation Guide, UGE Internal Report 123/IN/96/E, F. Adrián, February 1996.

Detailed Engineering Design - Phase 2, Final Report (including P&ID's), SERELAND, Contractors Report Nº 78, March 1996.

Inspección Sondeo (New Tremedal), Testificación Geofísica, CGS, Contractors Report Nº 75, April 1996.

Estimation of Thermal Expansion of Production Well, UGE Internal Report 128/IN/96/E, A. Herrer, May 1996

Simplified Mass and Energy Balance, UGE Internal Report 135/IN/96/E, A. Herrer and J.L. Arranz, June 1996.

Tracer Test Interpretation, Numerical Model, UGE Internal Report 133/IN/96/E, A. Herrer, June 1996.

I.D.G.S. Two Box Model, Reference Manual, UGE Internal Report 136/IN/96/E, J.L. Arranz, June 1996.

Liquid - Vapour Equilibria, Calculations Program, UGE Internal Report 134/IN/96/E, F. Adrián, June 1996.

Operations Manual for Package Units, SERELAND, Contractors Report Nº 79, April 1996.

Pre-Hazop Report, TECSA IBERICA, Contractors Report Nº 77, June 1996

ANNEX 1

ENVIRONMENTAL MONITORING PROGRAMME

The objective of the environmental monitoring programme is to detect possible interactions between the UCG test at "El Tremedal" and the groundwater hydrology in the area, mainly on the aquifer points in the vicinity or those currently used as water supply.

The activities will be the following:

Hydrochemical Control. Five aquifer points in the surrounding area will be controlled with different periodicity.

- Alcorisa water supply well
- Foz-Calanda water supply spring
- Foz-Calanda water supply well
- Regatillo spring
- New Tremedal well

The first three points will be sampled by ITGE, the remaining two by UGE.

The following parameters will be sampled: calcium. magnesium, sodium, potassium, bicarbonates, sulphates, chlorides, nitrates, Total Organic Carbon (TOC), phenols, boron, ammonia, pH, alkalinity, Chemical Demand of Oxygen (CDO), conductivity, Total Dissolved Solids (TDS) and CO2 dissolved. From them, pH, alkalinity, conductivity and CO2 dissolved have to be measured "in-situ".

Piezometric Control. Hydraulic potential increment is the most effective indicator of gas migration taking place from the reactor, hence the interest of this activity.

Nevertheless, taking into account the distance between piezometer and reactor, no big changes on the piezometric regime are expected.

Four points will be measured:

- Old Tremedal well
- New Tremedal well
- Saso well
- New Tremedal piezometric well

The monitoring programme comprises the following stages:

- **Control point preparation and completion**
- **Pre-test characterisation**
- **Operation phase**
- **Postburn phase**

CONTROL POINT PREPARATION AND COMPLETION

For piezometric control, limnigraphs will be installed in the Old Tremedal and New Tremedal wells. Sampling at the New Tremedal well may result in an inability to achieve sensible piezometric control because of the low permeability and transmissivity values at this well. If this proves to be the case, then installation of the limnigraph in the Old Tremedal well will be considered, despite its remote location.

Hydrochemical control at the New Tremedal well will be achieved via a fixed submersible pump, displacing three times the well volume prior to each sample.

PRE-TEST CHARACTERISATION

The objective is to characterise the surroundings of the trial site and to establish the initial condition of parameters for subsequent control.

Hydrochemical Control
- Ground water pre-test hydrochemical characterisation (5 samples)

Piezometric Control
- Continuous piezometric control of the limnigraph equipped well, and daily control of the rest of the points selected, measurements starting one month before commencement of the gasification test.

OPERATION PHASE

Estimated duration of this phase is 3- 6 months. Activities foreseen:

Hydrochemical Control
- Weekly in-situ control of pH and conductivity of hydrochemical control points
- Monthly complete hydrochemical control of the points

If an anomaly is detected, the control will be made weekly until disappearance of the anomaly.

Piezometric Control
- Daily (or continuous) control of piezometric net.

POSTBURN PHASE

Will be extended for a five year period from the end of the trial The activities will be:

Hydrochemical Control
- During the first quarter after operations, weekly pH and conductivity control

- Monthly complete analysis of the net during the first quarter, and quarterly until completion of the 5 year period.

Piezometric Control.
- Daily (or continuous) control during the first quarter.
- Monthly control over one year

SITUATION OF THE WATER SAMPLING POINTS

- **New Tremedal well.** A logging campaign was conducted in this well in addition to water fall-off and pumping tests. The well appeared to be in good condition for water sampling from the Albian sand at the roof of the coal seam, although such sampling would render continuous piezometric control impossible due to the low permeability/ transmissivity of the strata (recovery time after pumping is of the order of one week).

- **Alcorisa water supply well.** Sampling at this location will be performed within ITGE's EBRO project.

Nº	Component and Ref. Nº	Length (m)	Depth (m) rel. G.L.
1	HR 160 - a	10,170	576,709
2	HR 160 - b	10,165	566,539
3	HR 160 - c	10,175	556,374
4	Inc 625 - 51	5,429	546,199
5	Inc 625 - 46	5,814	540,770
6	Inc 625 - 48	5,003	534,956
7	Inc 625 - 45	4,753	529,953
8	Inc 625 - 49	5,090	525,200
9	Inc 625 - 47	5,580	520,110
10	Inc 625 - 50	5,468	514,530
11	Inc 625 - 44	5,363	509,062
12	VS 28 - 43	11,367	503,699
13	VS 28 - 41	6,804	492,332
14	VS 28 - 16	12,167	485,528
15	VS 28 - 19	11,129	473,361
16	VS 28 - 18	12,030	462,232
17	VS 28 - 20	11,993	450,202
18	VS 28 - 17	12,206	438,209
19	VS 28 - 21	12,137	426,003
20	VS 28 - 29	12,301	413,866
21	VS 28 - 25	12,001	401,565
22	VS 28 - 26	12,110	389,564
23	VS 28 - 23	11,978	377,454
24	VS 28 - 24	11,981	365,476
25	VS 28 - 27	11,944	353,495
26	VS 28 - 28	12,144	341,551
27	VS 28 - 22	11,963	329,407
28	VS 28 - 30	11,993	317,444
29	VS 28 - 35	12,015	305,451
30	VS 28 - 32	11,906	293,436
31	VS 28 - 34	11,890	281,530
32	VS 28 - 31	12,289	269,640
33	VS 28 - 33	11,826	257,351
34	VS 28 - 38	11,810	245,525
35	VS 28 - 39	11,941	233,715
36	VS 28 - 37	11,633	221,774
37	VS 28 - 40	11,307	210,141
38	VS 28 - 36	12,097	198,834
39	VS 28 - 1	11,488	186,737
40	VS 28 - 5	12,359	175,249
41	VS 28 - 9	11,924	162,890
42	VS 28 - 4	11,208	150,966
43	VS 28 - 3	11,538	139,758
44	VS 28 - 6	11,511	128,220
45	VS 28 - 10	11,785	116,709
46	VS 28 - 7	11,876	104,924

Table I . 4 1/2" Tubing String of ET5
(Depth relative to Ground Level)

Nº	Component and Ref. Nº	Length (m)	Depth (m) rel. G.L.
47	VS 28 - 8	11,698	93,048
48	VS 28 - 13	10,853	81,350
49	VS 28 - 2	11,941	70,497
50	VS 28 - 14	11,911	58,556
51	VS 28 - 15	11,780	46,645
52	VS 28 - 12	12,122	34,865
53	VS 28 - 11	12,063	22,743
54	VS 28 - 42 pin x pin	11,860	10,680
	Hanger		-1,180

Table I (cont.) . 4 1/2" Tubing String of ET5
(Depth relative to Ground Level)

Nº	Component and Ref. Nº	Length (m)	Depth (m) rel. G.L.
1	HR160 - a	9,93	578,86
2	HR160 - b	9,89	568,93
3	HR160 - c	9,91	559,04
4	HG3 - 1	9,81	549,13
5	HG3 - 2	11,04	539,32
6	HG3 - 3	9,94	528,28
7	HG3 - 4	9,64	518,34
8	HG3 - 5	9,61	508,70
9	HG3 - 6	9,84	499,09
10	HG3 - 7	9,20	489,25
11	HG3 - 8	9,48	480,05
12	HG3 - 9	9,23	470,57
13	HG3 - 10	10,87	461,34
14	HG3 - 11	9,31	450,47
15	HG3 - 12	10,82	441,16
16	HG3 - 13	11,04	430,34
17	HG3 - 14	11,19	419,30
18	HG3 - 15	10,50	408,11
19	HG3 - 16	9,28	397,61
20	HG3 - 17	11,04	388,33
21	HG3 - 18	10,98	377,29
22	HG3 - 19	11,01	366,31
23	HG3 - 20	9,59	355,30
24	HG3 - 21	10,17	345,71
25	HG3 - 22	9,86	335,54
26	HG3 - 23	10,08	325,68
27	HG3 - 24	9,56	315,60
28	HG3 - 25	9,78	306,04
29	HG3 - 26	11,15	296,26
30	HG3 - 27	10,27	285,11
31	HG3 - 28	10,51	274,84
32	HG3 - 29	9,38	264,33
33	HG3 - 30	10,42	254,95
34	HG3 - 31	10,76	244,53
35	HG3 - 32	10,35	233,77
36	HG3 - 33	10,36	223,42
37	HG3 - 34	10,57	213,06
38	HG3 - 35	10,61	202,49
39	HG3 - 36	9,26	191,88
40	HG3 - 37	9,18	182,62
41	HG3 - 38	10,60	173,44
42	HG3 - 39	10,16	162,84
43	HG3 - 40	10,95	152,68
44	HG3 - 41	11,00	141,73
45	HG3 - 42	10,64	130,73

Table II . 1.66" Tubing String of ET5
(Depth relative to Ground Level)

Nº	Component and Ref. Nº	Length (m)	Depth (m) rel. G.L.
46	HG3 - 43	9,99	120,09
47	HG3 - 44	11,04	110,10
48	HG3 - 45	10,93	99,06
49	HG3 - 46	10,21	88,13
50	HG3 - 47	10,99	77,92
51	HG3 - 48	10,30	66,93
52	HG3 - 49	10,67	56,63
53	HG3 - 50	11,12	45,96
54	HG3 - 51	10,55	34,84
55	HG3 - 52	9,99	24,29
56	HG3 - 53	8,30	14,30
57	HG3 - 54 pin x pin	7,87	6,00
	Hanger		-1,87

Table II (cont.) . 1.66" Tubing String of ET5
(Depth relative to Ground Level)

Nº	Component and Ref. Nº	Length (m)	Cum. Length (m)
46	TP 316 45	9,96	466,46
47	TP 316 46	10,21	476,67
48	TP 316 52	9,79	486,46
49	TP 316 53	9,97	496,43

Table III (cont.) . 1.66" Tubing String of ET4

Nº	Component and Ref. Nº	Length (m)	Depth (m) rel. G.L.
1	HG 3 - Burner	10,03	544,63
2	TP 316 1	10,81	534,60
3	TP 316 2	10,37	523,79
4	TP 316 3	10,01	513,42
5	TP 316 4	10,15	503,41
6	TP 316 5	10,12	493,26
7	TP 316 6	10,27	483,14
8	TP 316 7	10,92	472,87
9	TP 316 8	10,02	461,95
10	TP 316 9	10,11	451,93
11	TP 316 10	10,29	441,82
12	TP 316 11	10,44	431,53
13	TP 316 12	10,32	421,09
14	TP 316 13	10,34	410,77
15	TP 316 14	11,09	400,43
16	TP 316 15	10,82	389,34
17	TP 316 16	11,22	378,52
18	TP 316 17	11,56	367,30
19	TP 316 18	10,78	355,74
20	TP 316 19	10,89	344,96
21	TP 316 20	10,83	334,07
22	TP 316 21	11,13	323,24
23	TP 316 22	11,23	312,11
24	TP 316 23	10,89	300,88
25	TP 316 24	11,05	289,99
26	TP 316 25	10,63	278,94
27	TP 316 26	10,41	268,31
28	TP 316 27	10,71	257,90
29	TP 316 28	10,42	247,19
30	TP 316 29	10,88	236,77
31	TP 316 30	10,46	225,89
32	TP 316 31	10,29	215,43
33	TP 316 32	10,37	205,14
34	TP 316 33	10,26	194,77
35	TP 316 34	10,26	184,51
36	TP 316 35	10,78	174,25
37	TP 316 36	10,95	163,47
38	TP 316 37	11,09	152,52
39	TP 316 38	10,21	141,43
40	TP 316 39	10,07	131,22
41	TP 316 40	11,36	121,15
42	TP 316 41	10,15	109,79
43	TP 316 42	10,39	99,64
44	TP 316 43	9,91	89,25
45	TP 316 44	11,28	79,34

Table IV . 1.66" Tubing String of ET6

Nº	Component and Ref. Nº	Length (m)	Depth (m) rel. G.L.
46	TP 316 45	11,08	68,06
47	TP 316 46	11,06	56,98
48	TP 316 47	9,97	45,92
49	TP 316 48	9,9	35,95
50	TP 316 51	10,18	26,05
51	TP 316 52	6,28	15,87
52	TP 316 49	10,29	9,59
	Hanger		-0,70

Table IV (cont.). 1.66" Tubing String of ET6

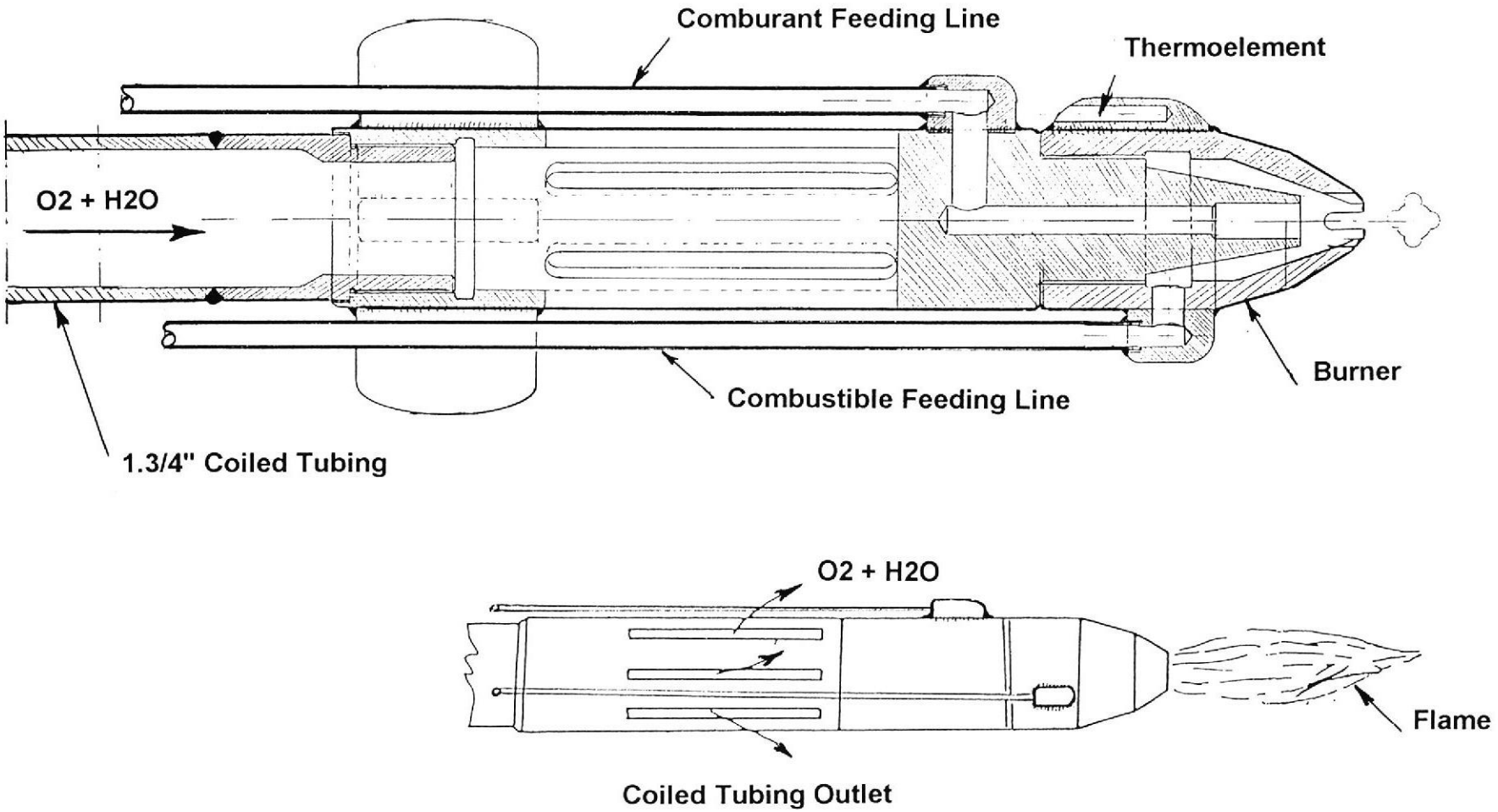

Figure 1 . Injector / Burner for Injection Wells

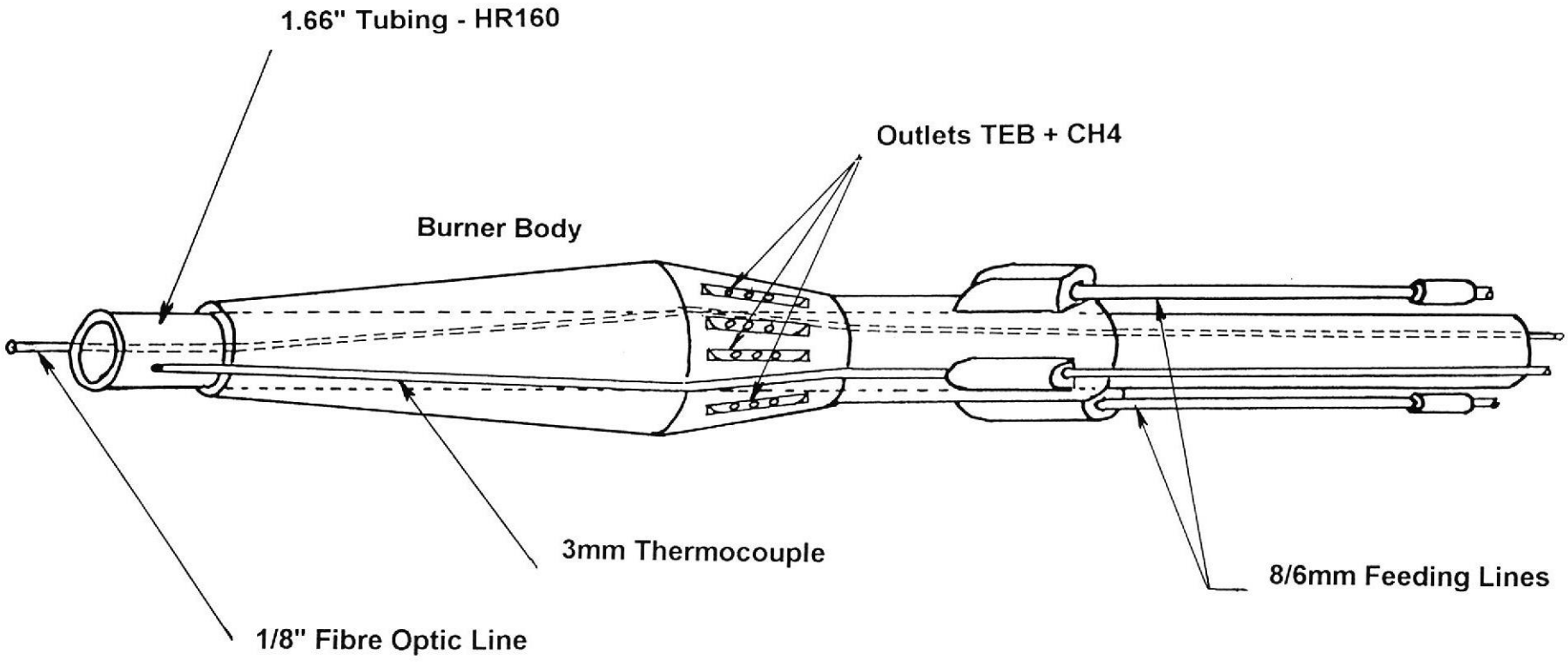

Figure 2 . Burner for Production Well