File

1105 29th December 1959

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

You may have heard about the disappointing results obtained so far at Cousland Well No.6 - i.e. sands which may possibly be the equivalent of the 1580 and 1720 sands of No.1 have proved to be completely non-productive. Drilling is continuing, however, and we shall soon know for certain whether the 1720 sand equivalent has in fact been penetrated. If this proves to be the case and no other productive sands turn up, it will of course be a serious blow, but need not, I believe, necessarily mean the death of your gas storage scheme for the Cousland culmination. I therefore propose to forget this for the moment and to attempt to do something about the questions you raised in your letter dated 17th November.

[illegible] Let us deal with the possible effects on your scheme of first withdrawing natural gas from the reservoir until the pressure falls, as you suggest, to say 100 p.s.i.g. - i.e. well beyond (we hope!) the level that would be reached if the 500 x 10^6 cu.ft. considered by Sunbury were removed initially.

During this withdrawal, which presumably would take place over several years, water would enter the reservoir but the extent of its advance and the effect on the permeability of the sands to gas could not be computed with the required degree of certainty without data provided by laboratory flood pot tests on representative cores, which unfortunately are not forthcoming so far from Cousland 6. Given the right cores it would perhaps take about one month to complete this experimental work. It is certain that movement of gas within the reservoir would be impeded by the presence of invasion water and this of course would affect the injection pressures.

I have made a few rough calculations based on the exercise set out in your letter to give you some idea of compression requirements.

a. Injection

Assuming that both the sands of Well No.1, totalling about 100' in thickness, are employed for storage, and that their characteristics are substantially those described by Sunbury, I calculate that the average reservoir pressure would be up to about 203 p.s.i.a. by say, the week ending 21st September (your graph 2). During that week you would be injecting gas at the average daily rate of 4.65 x 10^6 cu.ft. For a permeability of 25 millidarcies, and using only one well, the pressure required at the sand face would be about 417 p.s.i.a; assuming input via 1500' of 3" tubing the pressure drop through the tubing would be about 50 p.s.i., consequently the pressure required at the well head would be a minimum of 467 p.s.i.a. If however the permeability of the sand had been seriously reduced due to invasion water, say to 2.5 mds, then the pressure at the sand face would have to go up to 1170 p.s.i.a. You would of course gain considerably by using more than one injection well. Using two wells, the pressures required at the sand face would be 327 p.s.i.a. for a permeability of 25 mds and 837 p.s.i.a. for 2.5 mds, and with four wells they would be 272 and 610 respectively; the pressure drops in the tubing would also be much less, e.g. about 18 p.s.i. at the 327 level and only about 4 p.s.i. at the 272 level. The main point emerging from these figures, which are given below in more detail for clarity, is the great importance of the permeability characteristics of the sand.

Gas Input Rate per well Millions of Cu. ft/day	Sand Permeability Millidarcies	Sand Face Press. p.s.i.a.	Press. Drop in Tubing p.s.i.	Required wellhead press. p.s.i.a.
4.65	25	417	51	468
	2.5	1170	18	1188
2.32	25	327	17	344
	2.5	837	6	843
1.16	25	272	4	276
	2.5	610	2	612

b. Withdrawal

Turning now to gas withdrawal from the reservoir, I am afraid that you would be in trouble. For the week ending 15th February (your graph 3), by which time I calculate that the average reservoir pressure would be down to about 145 p.s.i.a., you require an average daily rate of 5.55 x 10^6 cu.ft. Unfortunately the reservoir pressure would have to be about 400 p.s.i.a. to produce that quantity using only 1 well, for a permeability of 25 mds and with the sand face pressure at atmospheric. Even with four wells the pressure would have to be about 200 p.s.i.a. The maximum you could withdraw from any well with the reservoir pressure at 145 p.s.i.a., would be about 850,000 cu.ft./day (i.e. at a permeability of 25 mds and pressure at the sand face atmospheric.)

The above figures, which I need scarcely point out do not take into account the undoubted (but non-calculable) beneficial effects of formation fracturing, serve, I think, to illustrate the need for limiting the initial withdrawal of natural gas from the reservoir if you are to achieve the best possible compromise between the number of wells to be used and compressor requirements. A detailed study of all aspects of the scheme, embracing Glasgow plus Lurgi requirements, would be a major undertaking which I am afraid could not be handled here. Sunbury would perhaps be in a position to do so, but the request would have to be passed on officially via the Gas Council. I estimate that, apart from the laboratory work on the cores, this study would keep a reservoir engineer busy for at least three months!

You have mentioned the d'Arcy accumulation, but unfortunately we have no information about it at all and I cannot therefore make any useful comments. If Cousland turns out to be less satisfactory than we had hoped, then perhaps it could become very important.

Wishing you a Guid New Year' (in the face of the bad news about Cousland!)

Yours sincerely,

A. Laird

cc. Mr. Watson
Mr. Brunstrom
File

AL/JMC

Fib Cousland
Che

PE.951

14th December 1959

T.S. Ricketts, Esq.,
Chief Engineer,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Natural Gas - Cousland

Thank you for your letters dated 27th November and 7th December, also for the information on the metering arrangements at Musselburgh. In all probability we shall install a Connersville meter at Whitby, if this type of meter is acceptable to the Ministry of Fuel and Power.

I note from your October report that the average Cousland gas production was 78,000 cubic feet per day during the month. As you point out, the pressure recorded on 17th November was abnormally low. Could this have been due to a partial blockage in the connections to the deadweight tester?

Many thanks for the delightful Christmas card just received. I would also like to take t is opportunity of wishing you the compliments of the season.

Yours sincerely,

C.M. Adcock

CMA/JMC

Please File
& bring Cousland
Graphs up to date.

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE ~~34331-5~~ CALEDONIAN 2052 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

7th December, 1959.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Notts.

Dear Mr. Adcock,

Natural Gas - Cousland

... I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 30th November, 1959, from which it will be seen that the supply continued uninterrupted during this period.

Yours sincerely,

p T. S. Ricketts

(T.S. Ricketts) RAB.
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - NOVEMBER, 1959

Continuity of Supply .... Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 30th November, 1959.

Volume supplied from Cousland to Musselburgh during the month (Corrected) * .... 2,336,100 cubic feet.

Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester) ....

3rd November - 581 lbs. per square inch

10th November - 580.5 lbs. per square inch

17th November - 577.5 lbs. per square inch

24th November - 580 lbs. per square inch

Number of days on which well was in action during the month .... 30 days

End Nov 30,302,617
2,364,280
32,666,897

Number of days on which well was shut down during the month .... Nil

Note: The fall in pressure on the 17th of November, was thought to be due to a partial blockage in the main pipe or casing. This blockage cleared without treatment on the 20th of November, and the volume of gas supplied to Musselburgh was not affected.

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

H.122 AHC.12.58

Copy

Mr. Laird, Mr., File

From Technical Information Section, Exploration Division, Sunbury.

To Exploration Dept. Records, BP House.

Our Ref. **Your Ref.** **Date**

Subject EXP/56/5717 21st August, 1959.

REPORT NO. KH/PE/101. "A STUDY OF THE FEASIBILITY OF SEASONAL GAS STORAGE IN THE COUSLAND RESERVOIR".

We enclose for your records one copy of Report No. KH/PE/101 "A Study of the Feasibility of Seasonal Gas Storage in the Cousland Reservoir".

Under cover of a memorandum from our Petroleum Engineering Section we have today sent one copy to Chief Petroleum Engineer, for his retention.

L. A. Bassett.

cc: Petroleum Divn., Sunbury (Tech. Inf. Section) (With one copy of report)
Patents, Licensing & Trade Marks Branch { " " " " " }
BP Exploration Co., Eakring { " " " " " }
Files (2)
/DC

7/RKP/MN

BP RESEARCH CENTRE

Chertsey Road, Sunbury-on-Thames, Middlesex

EXPLORATION DIVISION

PETROLEUM ENGINEERING SECTION

Report

KH/PE/101

A STUDY OF THE FEASIBILITY OF SEASONAL GAS STORAGE IN THE COUSLAND RESERVOIR

July 1959

Work by:

K. R. Keep

Approved by:

F. C. Thomas

Report by:

K. R. Keep

Contents

SUMMARY

A study has been made of the feasibility of storing during the summer, for winter use, 1000 million SCF of coal gas in either the upper or in both of the principal gas sands of the Cousland reservoir.

It is concluded that this quantity of gas could be injected in the upper sand only if well head pressures in excess of the specified maximum of 1200 psig could be used. Injecting the gas in both sands could probably be achieved without exceeding 1000 psig. In the latter case it is suggested that the possible loss of gas to the aquifer could be minimised by first producing 500 million SCF of natural gas before using the reservoir as a store.

It is also estimated that there was negligible rise in the gas-water contact as a result of the small production taken from the upper sand during 1958.

NOMENCLATURE

k	=	permeability, darcy
h	=	formation thickness, feet
μ_g	=	gas viscosity, cp
μ_w	=	water viscosity, cp
Q	=	gas production or injection rate, SCF/day
r_b	=	reservoir boundary radius, feet
r_r	=	radius of stabilised zone of flow, feet
r_w	=	well radius, feet
P_e	=	average reservoir pressure, psia
P_w	=	well pressure, psia
P_s	=	standard pressure = 14.7 psia
P_o	=	original reservoir pressure
T	=	formation temperature, ^oR
ϕ	=	formation porosity, fraction
S_g	=	gas saturation, fraction of the pore space
β	=	compressibility of the aquifer, vol/vol/psi
$\bar{Q}$	=	dimensionless production rate
	=	$0.1 \dfrac{Q\, P_s\, \mu}{P_o^2\, k\, h}$
$\bar{\theta}$	=	dimensionless time
	=	$3.16 \dfrac{k\, P_o\, t}{\phi\, \mu\, r_b^2}$
t	=	time, days
V	=	original volume of gas in the reservoir, SCF
Z	=	cumulative water influx, cu ft
$Q(t)$	=	Everdingen and Hurst water influx function, dimensionless
ΔP_j	=	jth change in pressure

A. INTRODUCTION

Following discussions between Petroleum Engineering Department, Eakring, and the Scottish Gas Council, a verbal enquiry was made by Eakring concerning the feasibility of seasonal gas storage in the Cousland reservoir. This report contains the results of calculations on the specific proposals made, which were to inject into a single crestal well 10 million SCF/day of surplus coal gas for 100 days during the summer, and to produce this quantity during two months of the winter. The study of this has entailed calculations of the required injection pressures and the likely effects on the gas-water level. The latter consideration is of importance because it is thought that the reservoir was originally full of natural gas to the spill point, and so a large recession of the gas-water contact might result in the loss of some gas.

So far, only Well No. 1 has been drilled into the formation above the original gas-water contact. This showed that there are two principal gas bearing sands in the structure; one at about 1580' to 1632' B.R.T. and the other at 1720' to 1808' B.R.T. These will be referred to as the upper and lower sands respectively. After a short production test the lower sand produced both water and gas and was plugged back. Commercial production at an average rate of 68,000 SCF/day was taken from the upper sand during 1958. As part of the request for the study the problem was posed of injecting into the upper sand alone, or alternatively, into both sands. It was stipulated that the well head pressure should not exceed 1200 psig.

The information used in the study was taken from a summary of the known reservoir characteristics by R.G.W. Brunstrom (1), and reports on production tests in the Petroleum Engineering Files, Eakring.

B. ORIGINAL VOLUME OF GAS IN PLACE

The rock volumes above the gas-water contacts were determined from the product of the field area from Brunstrom's report and assumed thicknesses of 30' and 70' for the upper and lower sands respectively. These are the approximate thicknesses given on the Geological Log of Well No. 1 when allowance is made for impermeable streaks in the formation.

The rock volumes are as follows:

upper sand = 3.48×10^8 cu ft

lower sand = 8.12×10^8 cu ft

In addition, a curve of rock volume of the combined sands against height above the original gas-water contact was determined from the underground contours on Brunstrom's map, and this is shown in Figure 1. For this it was assumed that the two sands are parallel and that both originally contained gas to the spill points. The original gas-water contacts in the upper and lower sands were 1110 ft S.S. and 1250 ft S.S. respectively.

G.W.L. - Upper Sand
1110' Sub-Sea
G.W.L. - Lower Sand
1237' Sub-Sea.

For determining the original volumes of gas in place the following constants were used:

Average porosity of both sands	= 15%
Average gas saturation of both sands	= 50% of the pore space
Original reservoir pressure of upper sand	= 653 psia — 1067' Sub-Sea.
Original reservoir pressure of lower sand	= 679 psia (original pressure 687 psi gauge at 1205' Sub-Sea)

(The small corrections for temperature and gas deviation factors have been omitted).

The original volumes of gas in place are:

upper sand	=	1.16×10^9 SCF
lower sand	=	2.81×10^9 SCF
total	=	3.97×10^9 SCF

Suppose reduction in one third of volume
= 2.66×10^9 SCF
1.4 producible.
= 53%

C. PERMEABILITY OF THE UPPER SAND

The gas permeability of the upper sand in Well No. 1 has been calculated firstly from short production tests carried out in 1939, and secondly from the decline in well head pressure with time as a result of production taken in 1958. The details of both calculations are given in Appendix I. Taking 30 feet for the net sand thickness, both methods gave an average permeability of approximately 25 md.

It has not been possible to calculate the permeability of the lower sand from 1939 production tests because both water and gas were produced which resulted in a variable and inaccurately known back pressure on the formation. However, the permeability of the lower sand must have been of the same order as the upper sand, and probably slightly higher, because the former gave an initial test production rate of 5.9 million SCF/day, compared with 4 million SCF/day for the latter.

D. GAS CYCLING

In calculating the variations in well head pressure and gas-water level with time the following simplifying assumptions were made:

a. The reservoir can be represented by a circular disc of uniform porosity, permeability and thickness.

b. The injection and production of gas can be represented by a series of steady state solutions.

c. The gas in the reservoir behaves as an ideal gas.

d. In considering injection into both sands they can be lumped together as a single sand with an average original pressure of 680 psia.

The errors caused by these assumptions will almost certainly be much less than errors caused by the uncertainty in the value for the rock permeability. To give some indication of the effect of this variable, calculations of pressures and water movements have been made for a range of permeabilities.

Two methods of achieving the gas cycling requirements have been considered. The first calculations were done for cycling into the reservoir with all the original natural gas left in place. As a result of these it was apparent that a better procedure would be to produce initially 500 million SCF of natural gas before cycling 1000 million SCF of coal gas. In this way the change in reservoir pressure averaged over a number of cycles would be zero, and this would be advantageous in reducing the change in the position of the gas-water contact to a minimum. Calculations pertaining to both methods are described below.

1. Well head pressures

The details of the calculations of the variations in well head pressure with time are given in Appendix II. In all cases described below the calculations are for the 100 days during which the gas is injected, as the chief concern here is the maximum injection pressures encountered by pumps, well head fittings, the local rock formation, etc.

The variations in well head pressure with time for the injection of 10 million SCF/day into the upper sand alone can be seen in Figure 2. This shows that the injection pressure will exceed 1200 psig after about 20 days if no initial production is taken from the reservoir, or after about 70 days if 500 million SCF is first produced. If the permeability of the crestal well is lower than 25 md then even higher injection pressures would be required. Because the required well head pressure is expected to exceed the specified maximum of 1200 psig calculations of water level changes were not carried out for this case. It should be noted, however, that if the specifications concerning the maximum well head pressure, or the total amount of gas, or the number of injection wells were changed then the upper sand could be used for gas storage.

The variations in well head pressure for injection into both sands are shown in Figure 3. From this it is clear that even if the average permeability is as low as 12.5 md, and no natural gas is produced from the reservoir, then the maximum injection pressure will be less than 1200 psig. In the more favourable case where the permeability is about 25 md and 500 million SCF of gas are first produced, the maximum injection pressure is less than 900 psig.

2. Changes in the gas-water level

When gas is injected into a reservoir the resulting increase in boundary pressure tends to drive gas into the aquifer, and when gas is produced the fall in boundary pressure allows water from the aquifer to flow into the reservoir. The volume of water displaced by gas, or the volume of water flowing into the reservoir, can be calculated from the changes in boundary pressure. The details are given in Appendix III. The changes in the position of the gas-water contact are more difficult to calculate, firstly because the displacement efficiencies of gas by water or water by gas are not known for these sands, and secondly because the original gas-water contact was not a sharp interface but was a gradual change in gas saturation over about 25 - 30 feet. Approximate changes in the position of the gas-water contact have been calculated on the assumption that 25% of the pore space is involved in the movement of water on each side of the original gas-water contact. To simplify the water influx calculations it was also assumed that the gas was injected during three months, with each of these periods separated by three months of inactivity.

The results of the calculations for the case where no gas is taken initially from the reservoir (or an insignificant quantity) are summarised in Figure 4. The top of the diagram shows the rate of production or injection against time. Under this is the variation in the increase in boundary pressure with time. The pressure increases to a maximum of about 170 psi above the original value during the injection period. The cumulative flow of water away from the boundary for an aquifer permeability of 25 md extending to 10 times the radius of the reservoir is the solid oscillating line. The dotted line drawn through this solid curve is the water flow calculated for a constant increase in boundary pressure of 170/2 psi, or 85 psi. It appears from this that the general movement of water has responded to the increase in boundary pressure averaged over several injection cycles, and superimposed on this are the smaller variations due to the cyclic changes in boundary pressure. Two other solutions are shown for comparison. These are the general trends for an aquifer of the same size with the permeability reduced to 12.5 md, and for an infinite aquifer of 25 md.

The movement of water can be put into perspective by expressing it as flow of gas out of the reservoir. The flow of 4.5×10^6 cu ft of water is equivalent to a flow of 260 million SCF of gas, or 26% of the total gas injected during a cycle. It is clear from Figure 4 that if the aquifer radius is much larger than 10 times the reservoir radius then much larger proportions of the injected gas might flow out of the reservoir.

The second case studied was a proposed method for reducing the flow of gas from the reservoir by making the change in boundary pressure averaged over several cycles equal to zero. In this way the general trend of the water movement shown in Figure 3 would be removed and there would remain only the small oscillating effect due to the cyclic pressure changes.

The results of the second calculations are summarised in Figure 5. At the top can be seen the injection and production rates. The first is shown as a production of 5 million SCF/day for 100 days, i.e. a total production of 500 million SCF of natural gas, with subsequent cycles at 10 million SCF/day injection, production, and so on, of coal gas. The changes in boundary pressure are shown underneath. The first half cycle lowers the boundary pressure by ~~43.5~~ psi, 85
170 and the following ones, involving increases or decreases in pressure of ~~87~~ psi, oscillate about a mean of zero change. The cumulative influxes of water for several assumed aquifer permeabilities are shown at the bottom of Figure 5. From these it is clear that, although cyclic movements still occur, the general trend has been removed and so the water movements are much smaller. In fact, the flow of water away from the reservoir is reduced from about 4.5×10^6 cu ft to about 0.22×10^6 cu ft for an aquifer permeability of 25 md or, expressed as an equivalent flow of gas, the value is reduced from 26% to about 1% of the gas injected per cycle.

E. PAST WATER INFLUX

During 1958 gas was produced from the upper sand at an average rate of about 68,000 SCF/day. This relatively slow rate lowered the boundary pressure by approximately 1.2 psi/month which resulted in a small flow of water into the reservoir from the aquifer. The water influx calculations are described briefly in Appendix IV, and results for a 30 ft thick aquifer with an average permeability of 25 md are shown in Figure 6. The calculations suggest that the rise in water has been negligible, about 0.2 ft in 14 months, and, as the original gas-water contact is estimated to have been about 60 ft below the lowest perforations in the well, the water is not expected to rise into Well No. 1 in the immediate future.

For two reasons it is considered that little reliance could be put on any extrapolations of the calculated past water influx to predict when the water would reach the lowest perforations. The first has been discussed in relation to water movement during cycling of gas and is concerned with the difficulty of calculating water movements in transition zones. Secondly, the well is very near the edge of the field, and so local pressure gradients may cause larger volumes of water to flow into the reservoir in the neighbourhood of the well (this effect is called water coning).

F. CONCLUSIONS

The general conclusion reached from the study is that gas injection at 10 million SCF/day for 10 days into a single well in the upper sand is likely to require injection pressures in excess of the specified 1200 psig. Injection into the upper and lower sands is more promising because less than 1200 psig would be required to inject the gas, and the possible gas loss to the aquifer could be kept to a very low value by first producing 500 million SCF of natural gas from the reservoir.

After the main calculations had been completed for this study a paper was published by Katz et al (2) which presented similar calculations for a hypothetical reservoir showing how cyclic movements of an aquifer can occur and how these can be reduced by producing some gas from the reservoir before using it as a store. The paper states that the reservoir volume can be kept nearly constant by ensuring that the product (increase in reservoir pressure x days) during injection equals (decrease in reservoir pressure x days) during production. This amounts to the condition discussed in this report that the change in reservoir pressure, averaged over several cycles, should be zero.

The feasibility of storing gas in Cousland obviously depends on the rock characteristics of a central well, and on whether such a well confirms the correctness of Brunstrom's suggestions about the reservoir size. It is thought that the gas in place in the upper sand, as deduced from the well head pressure decline analysis which is described in Appendix II, is in fair agreement with that from volumetric estimates. Little is known, however, about the extent of the lower sand throughout the field, and a crestal well would provide valuable information on this.

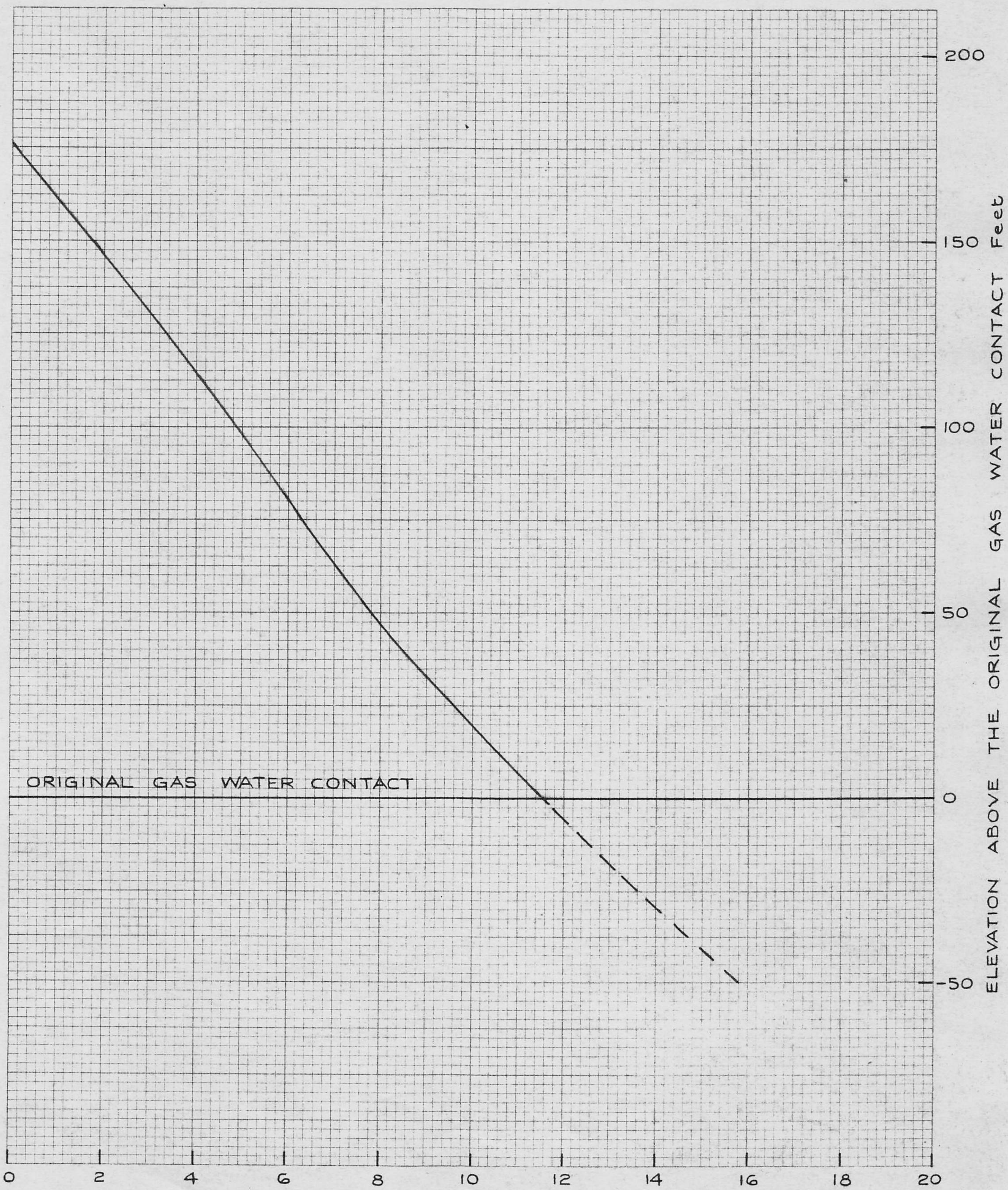
G. REFERENCES

1. R.G.W. Brunstrom: Geological Technical Note GL-RGWB.5-UK-Scotland-1955.

2. D.L. Katz, M.R. Tek and K.H. Coats: Pet. Trans. AIME; 1959, 216, p.18-22 (J. Pet. Tech; Feb. 1959, 11, (2))

SERIAL No.

ROCK VOLUME ELEVATION CURVE FOR COMBINED UPPER AND LOWER SANDS



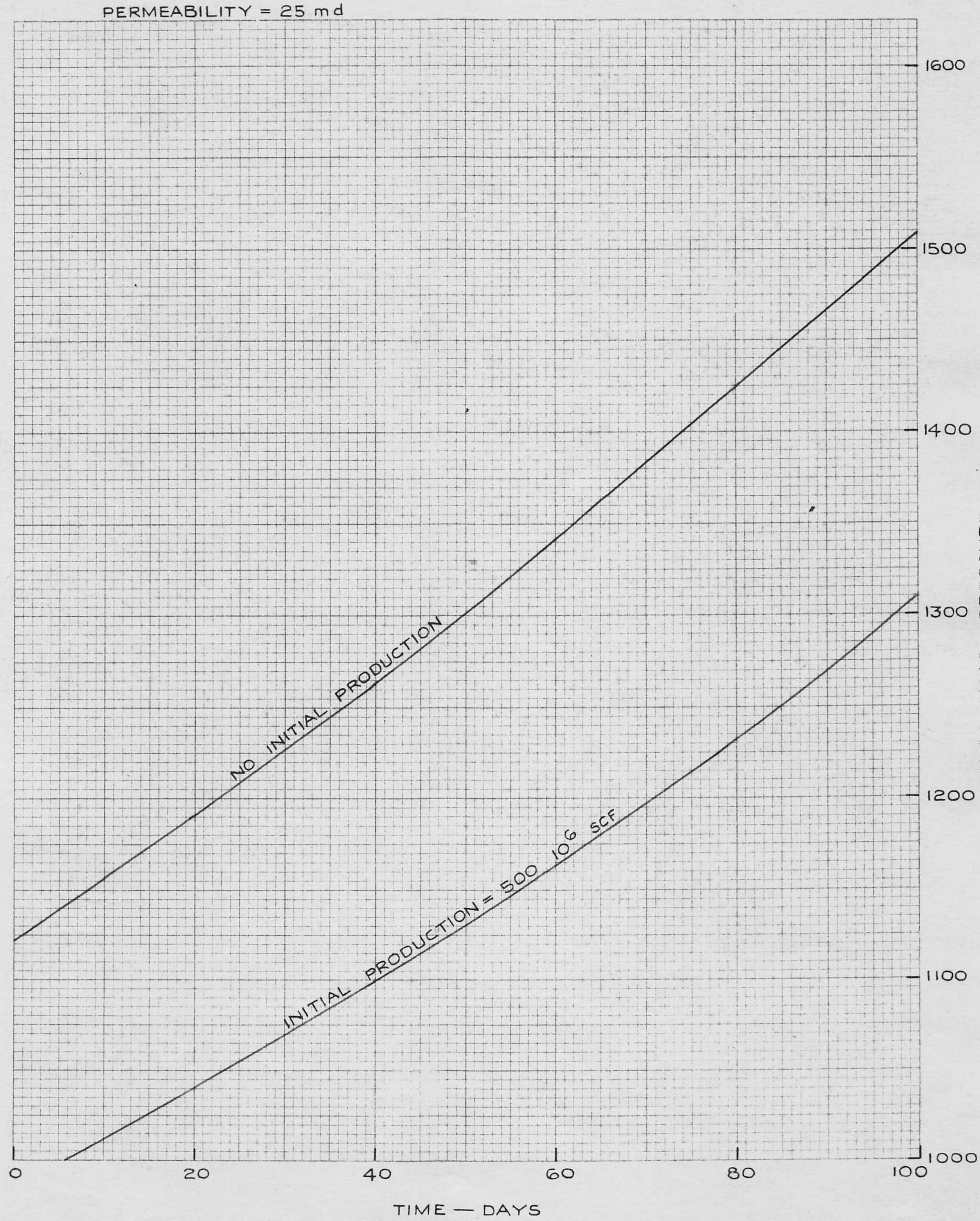
B.P. 1

FIG. 1

P1637

SERIAL No.

VARIATION IN WELL HEAD PRESSURE WITH TIME FOR INJECTION OF 10×10^6 SCF/DAY INTO UPPER SAND



B.P. 1

FIG. 2

SERIAL No.

VARIATION IN WELL HEAD PRESSURE WITH TIME FOR INJECTION OF 10×10^6 SCF / DAY INTO BOTH SANDS

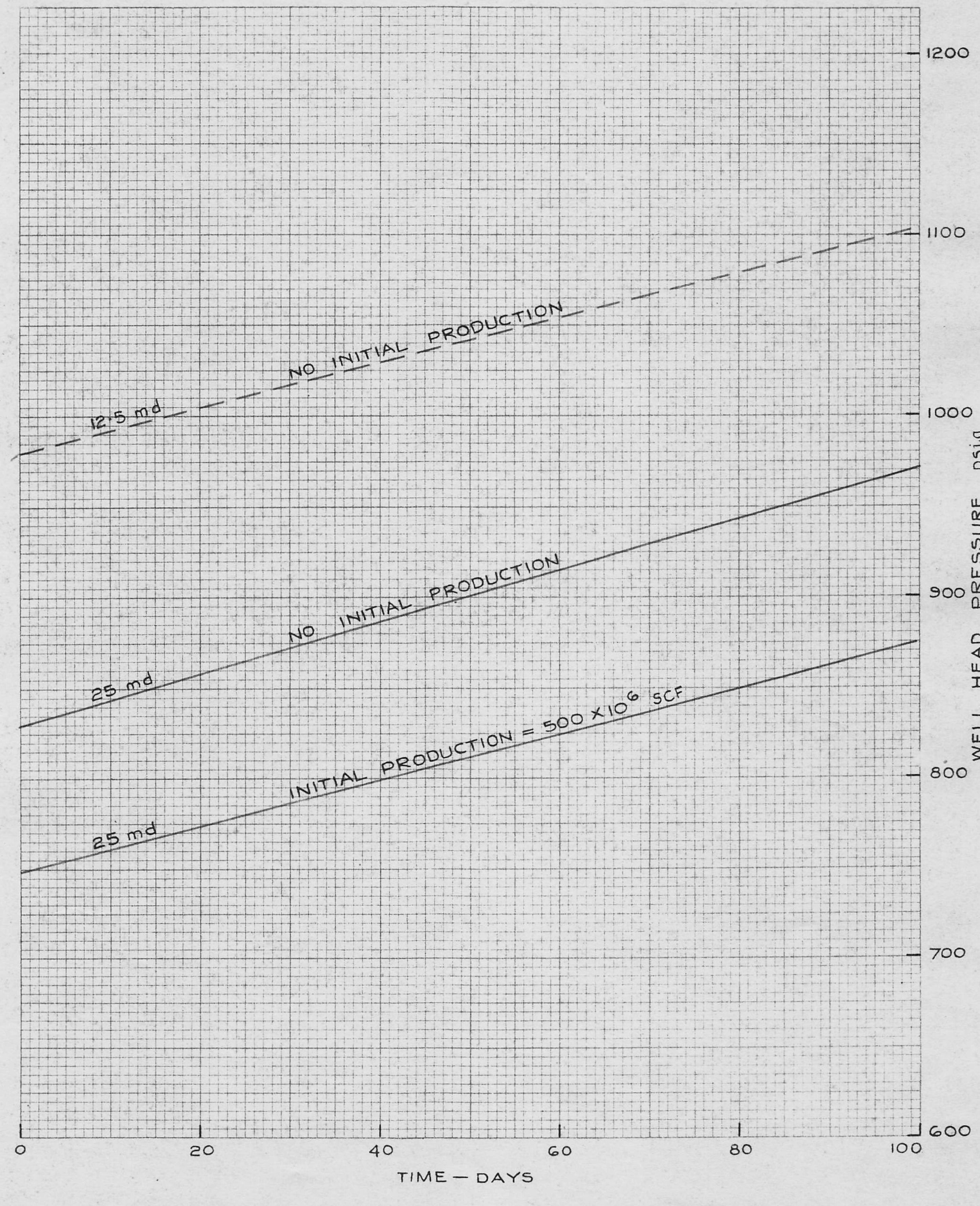


FIG. 3

P1639

SERIAL No.

THE FLOW OF WATER AWAY FROM THE BOUNDARY (OR THE FALL OF THE GAS WATER CONTACT) WITH TIME

CASE: NO INITIAL PRODUCTION FROM THE RESERVOIR
(AQUIFER BOUNDARY RADIUS = 10 × RESERVOIR RADIUS)

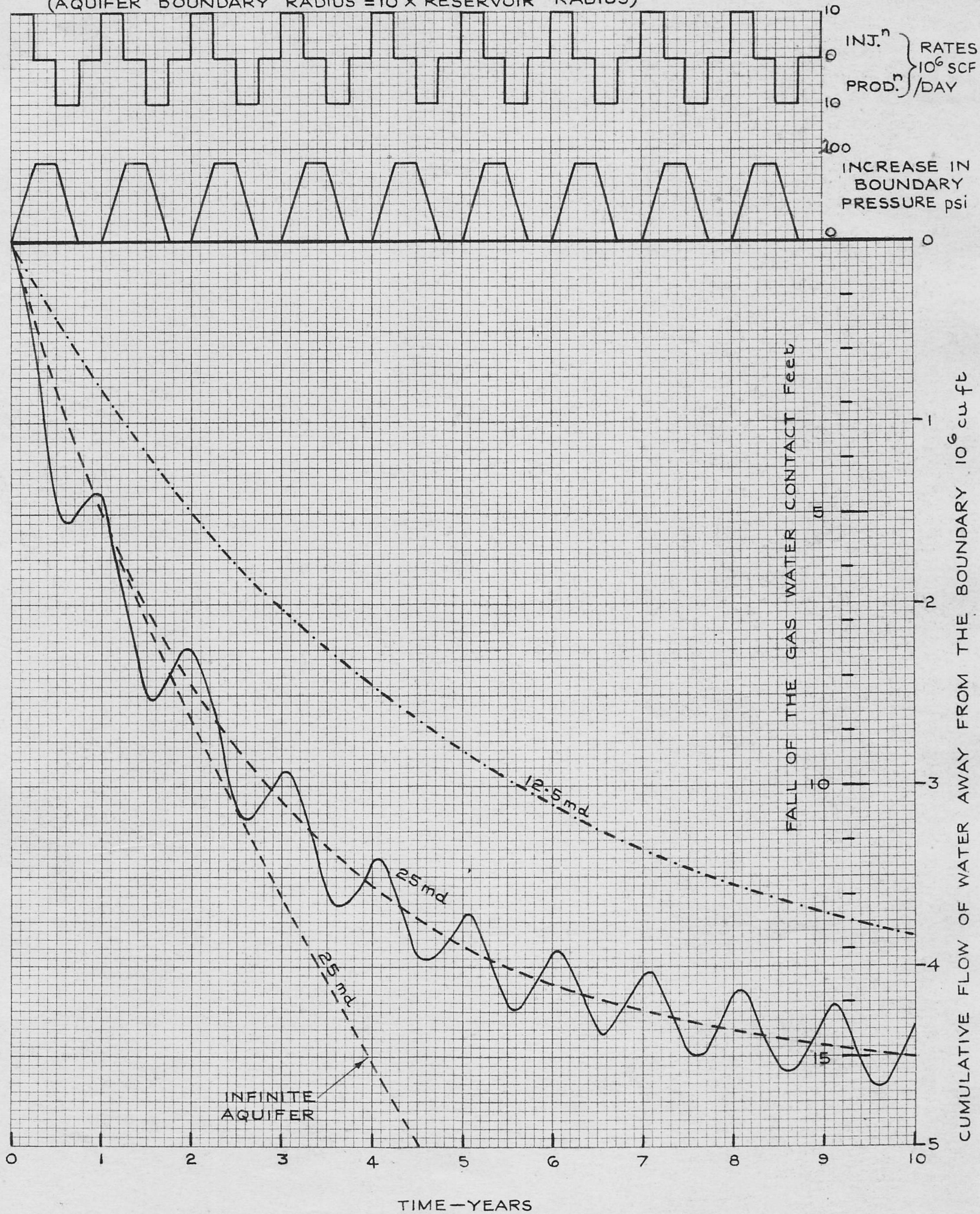


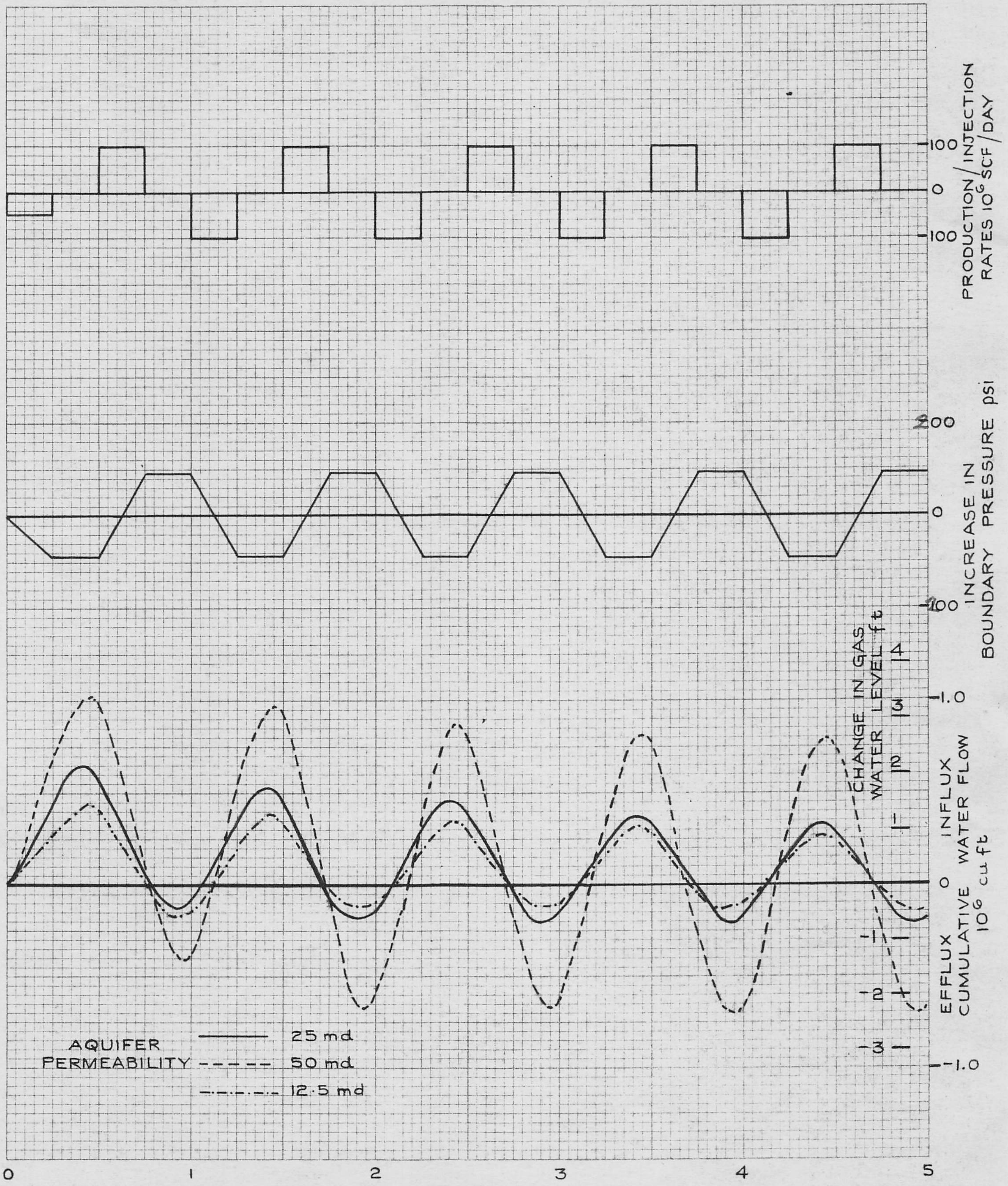
FIG. 4

P1640

SERIAL No.

THE FLOW OF WATER NEAR THE BOUNDARY (OR CHANGE IN THE GAS WATER CONTACT) WITH TIME

CASE: INITIAL PRODUCTION = 500 10^6 SCF OF NATURAL GAS
(AQUIFER BOUNDARY RADIUS = 10 X RESERVOIR RADIUS)



SERIAL No.

PAST WATER INFLUX

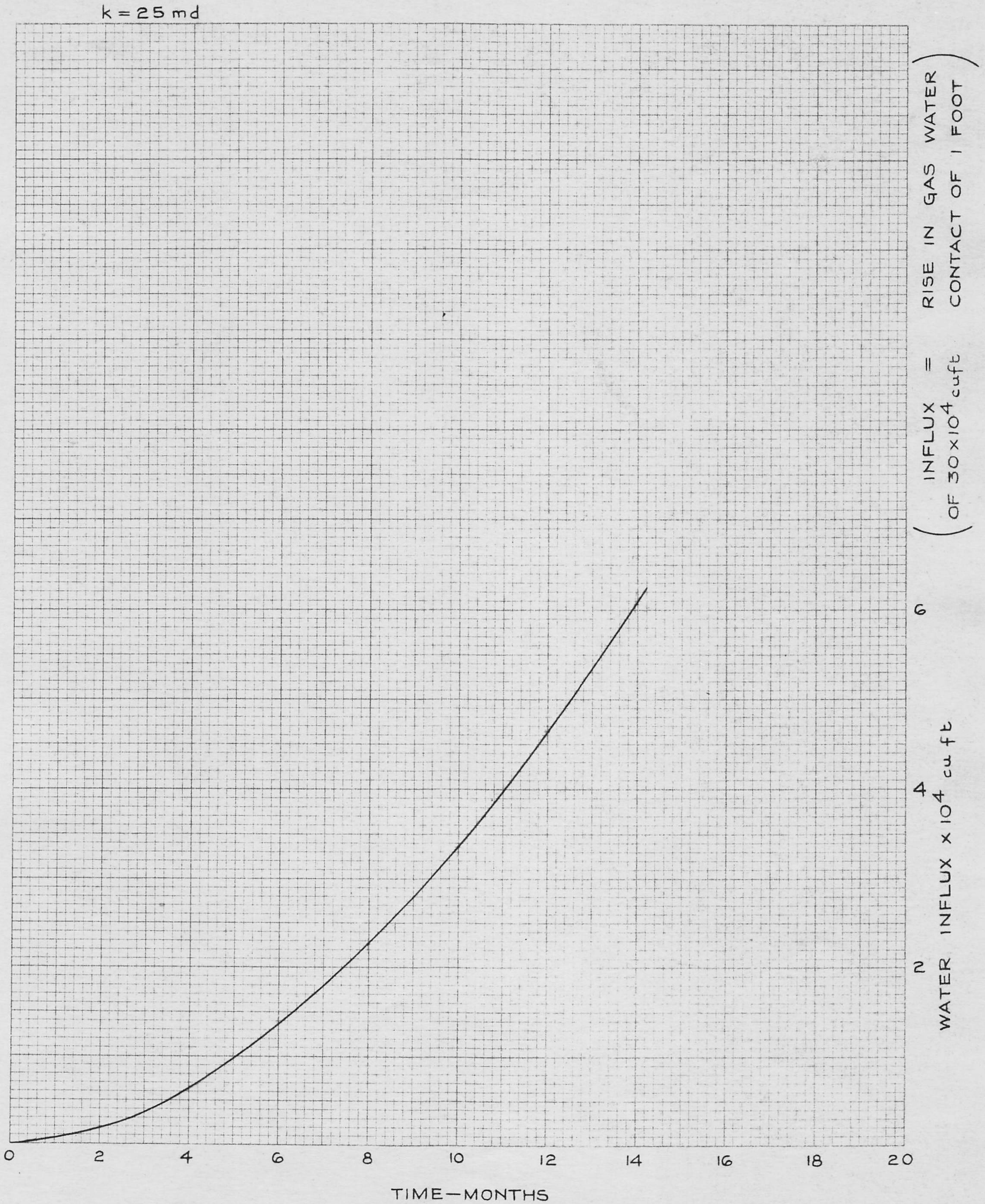


FIG. 6

APPENDIX I

Determination of the Permeability of the Upper Sand

1. From 1939 production tests

The permeability was calculated from the steady state radial flow formula for an ideal gas given below

$$k = \left\{ \frac{\mu \log (r_r/r_w)\ T\ P_s}{1.03\ 10^4\ \cancel{k}\ h} \right\} \left\{ \frac{Q}{(P_e^{\ 2} - P_w^{\ 2})} \right\} \quad \text{darcy} \qquad (1)$$

During the 1939 production tests a series of values of production rate against well head pressure was obtained. Three of these were chosen to obtain $\{Q/(P_e^{\ 2} - P_w^{\ 2})\}$ and the results are tabulated below

Q SCF/day	P_w psig	$Q/(P_e^{\ 2} - P_w^{\ 2})$
$1.05\ 10^6$	598	14.2
$1.03\ 10^6$	595	13.3
$0.98\ 10^6$	597	13.3
	Average	= 13.6

The formula also depends on the value r_r/r_w, where r_r is the radius of a stabilised flow zone. Aronofsky and Jenkins* show how to determine r_r approximately from the known production time, the gas viscosity and the rock permeability. In this case the permeability is the factor being determined so that a trial and error process had to be used. In practice, the value of k can be found with little effort because it depends on $\log(r_r/r_w)$ which is relatively insensitive to small changes in r_r.

The following constants were used

$\mu = 1.2 \times 10^{-2}$ cp

$T = 520^{\circ}R$

---

* Pet. Trans. AIME; 1954, 201, p.149-154

Appendix I (continued)

$$P_s = 14.7 \text{ psia}$$

$$h = 30 \text{ ft}$$

$$\log r_r/r_w = 6.2 \quad (r_r/r_w = 500)$$

From these the permeability is approximately 25 md.

2. From the decline in well head pressure with production during 1958

The decline in well head pressure with time was calculated from the results given in the paper of Aronofsky and Jenkins for a constant rate of flow of gas in a radial system. The formula given below is applicable when $\bar{\theta} > 0.3$ which, for k = 25 md, is about 20 days.

$$P_w/P_o = \left\{(1 - \bar{Q}\,\bar{\theta})^2 - \bar{Q}/2 \log(0.472\, r_b/r_w)\right\}^{\frac{1}{2}} \qquad (2)$$

The well head pressure was determined by subtracting the pressure due to the static head of gas from P_w.

A detailed analysis of Equation (2) shows that for small values of $(\bar{Q}\,\bar{\theta})$ the relation between P_w and time is almost linear. In this range it is easily shown that the slope of the line is sensitive mainly to the boundary radius, while the intercept on the pressure axis at T = 0 is sensitive mainly to permeability. In principle, this enables the two parameters to be determined.

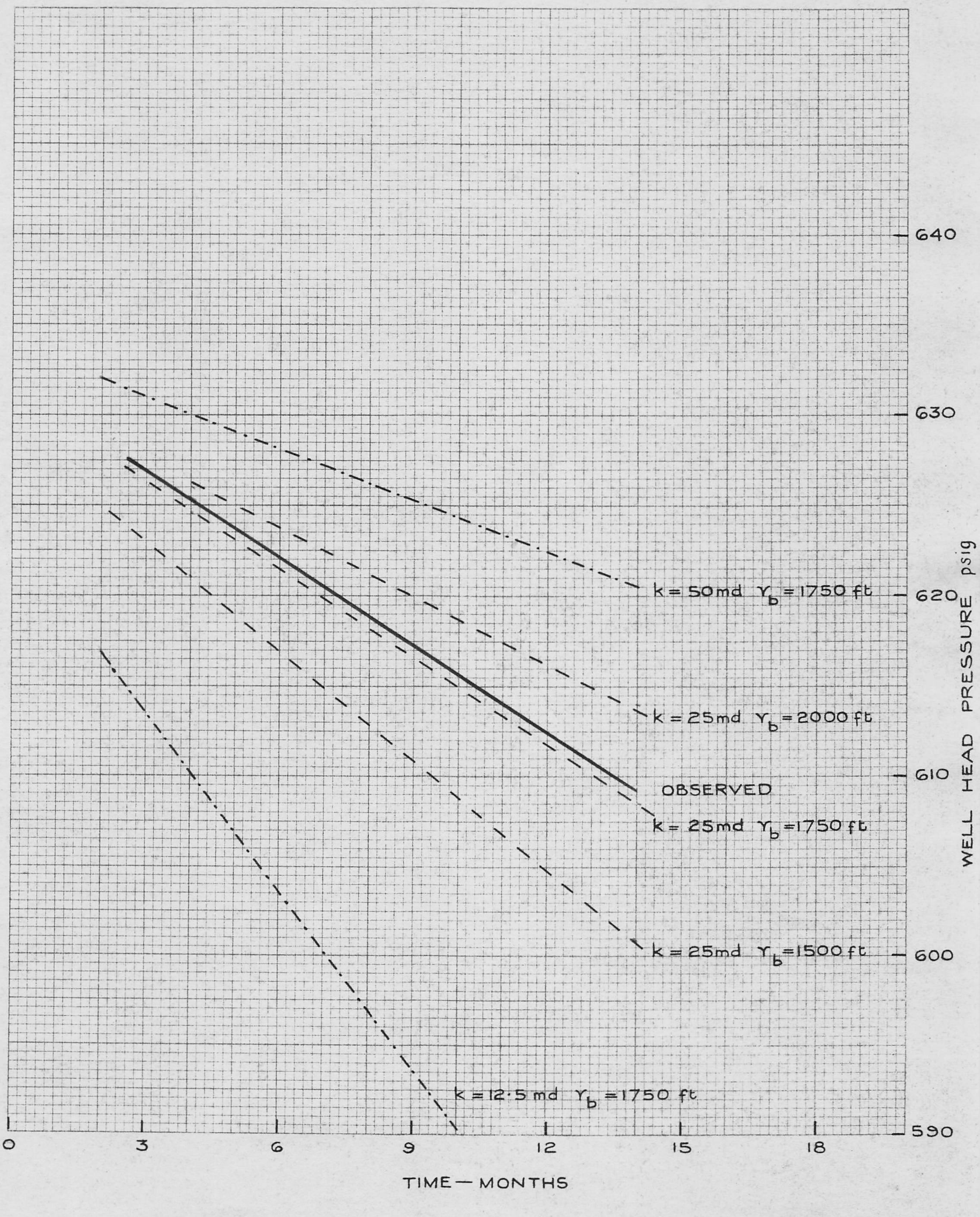
Figure 1 shows the smoothed field results of well head pressures versus time compared with several solutions obtained from Equation (2) for various permeabilities and reservoir radii. It is clear that a pair of constants giving reasonable fit are 25 md for the permeability and 1750 ft for the boundary radius. The latter is in fairly good agreement with the radius of 2000 ft for the circle of equivalent area to the field.

3500

It should be noted that the calculation of permeability from the two types of field results are based on solutions for a well at the centre of a circular reservoir. In fact, Well No. 1 is very near to the reservoir boundary, and so the value for the permeability and the reservoir boundary radius are almost certainly in error, although it is expected that they are of the right order of magnitude.

SERIAL No.

COMPARISON OF OBSERVED AND CALCULATED WELL HEAD PRESSURE DECLINES



APPENDIX II

Calculation of Well Head Pressures during Gas Injection

The variation in well head pressure with time was calculated from the steady state radial flow formula for an ideal gas, and the change in average reservoir pressure with time given in Equations (1) and (2) below

$$P_w^2 = P_e^2 + \frac{Q \mu T P_s \log(r_e/r_w)}{1.03\ 10^4\ k\ h} \tag{1}$$

$$P_e = P_o \left(\frac{Qt + V}{V}\right) \tag{2}$$

The following constants were used in calculations both of injection into the upper sand only, and of injection into the two sands:

$Q = 10^7$ SCF/day   ? 10^6

$\mu = 1.2 \times 10^{-2}$ cp

$T = 520^{\circ}R$

$P_s = 14.7$ psia

$\log(r_e/r_w) = 8.0$

$k = 25$ md

The constants that were used in the separate cases are listed below:

Injection into the upper sand

$h = 30$ ft

No initial natural gas production $P_o = 657$ psia,
$V = 1.16 \times 10^9$ SCF

500 million SCF of natural gas produced initially $P_o = 380$ psia,
$V = 0.66 \times 10^9$ SCF

The results of the calculations are shown in Figure 2 of the report.

Appendix II (continued)

Injection into both sands

$h = 100$ ft

No initial gas production $\quad P_o = 679,$

$V = 3.97 \times 10^9$ SCF

500 million SCF of natural gas produced initially $\quad P_o = 585,$

$V = 3.47 \times 10^9$ SCF

The results of the calculations are shown in Figure 3 of the report.

APPENDIX III

Water Influx Calculations

The volumes of water flowing into or away from the reservoir as a result of pressure changes at the boundary were calculated from the Everdingen and Hurst solutions for a radial flow system.* For this it was assumed that any percentage change in the volume of gas in the reservoir caused the same percentage change in the average reservoir pressure, and further that the change in boundary pressure equalled the change in average reservoir pressure. These assumptions will obviously not be quite true because of the finite time required for a pressure disturbance due to production to travel to the reservoir boundary. For a permeability of 25 md it is estimated that a pressure change takes about 20 days to travel to the boundary. This time is obviously significant when considering production cycles occurring about every 100 days. However, it is expected that the time delays resulting from the transit times of pressure waves will alter the phase of the water influx and have little effect on the absolute magnitude.

Equations (1) and (2) below summarise the method of calculation:

$$Z = 2 \pi \phi h \beta r_b^2 \sum_{j=0}^{j=n-1} \Delta P_j \, Q(t_n - t_j)$$

$$= 1100 \sum_{j=0}^{j=n-1} \Delta P_j \, Q(t_n - t_j) \qquad (1)$$

$$\text{Boundary pressure} = P_e = P_o \left(\frac{Qt + V}{V}\right) \qquad (2)$$

where $V = 3.97 \times 10^9$ SCF

The water influx or efflux results for the case where no natural gas is produced from the reservoir and for the case where 500 million SCF of gas are first produced are shown in Figures 4 and 5 respectively of the report.

The change in the position of the gas-water contact was calculated from the volume of water flowing into or away from the reservoir, from an average value of rock volume per foot taken from Figure 1, and from the assumption that 25% of the pore space is involved in movement of water on each side of the original contact.

---

* Pet. Trans. AIME; 1949, 186, p.305-324

Appendix III (continued)

The calculation is given below:

The change in rock volume with height (near the original gas-water contact) $= 8.0 \times 10^6$ cu ft/foot

$\therefore$ The relation between the volume of water flowing and the change in the gas-water level $= 8.0 \times 10^6 \times 0.15 \times 0.25$ cu ft/foot

$= \underline{0.30 \times 10^6 \text{ cu ft/foot}}$

APPENDIX IV

Analysis of Past Water Influx

The water influx that occurred as a result of the 1958 production was calculated by the same method as described in Appendix III.

The equations used were:

$$Z = 340 \sum_{j=o}^{j=n-1} \Delta P_j \, Q(t_n - t_j) \qquad (1)$$

Boundary pressure $= P_e = P_o \left(\frac{Qt + V}{V}\right)$

where $V = 1.16 \times 10^9$ SCF

and $Q = 6.85 \times 10^4$ SCF/day

The results of the calculations are shown in Figure 6 of the report.

File
Tha

PE.910

13th November 1959

T.S. Ricketts, Esq.,
Chief Engineer,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Natural Gas at Cousland

Many thanks for your recent correspondence, and I apologise for the delay in replying to you. I trust that your discussions with your Mining Consultants are proceeding satisfactorily, and that the problem of subsidence round your working area will be resolved.

I was interested to receive the analysis of the petroleum deposit which you extracted from the water separator. The gas sands are impregnated with a crude oil which is solid at the reservoir temperature. It would appear that a trace of this crude oil is being obtained with the gas production.

Thank you for the copy of your October report for the Cousland gas production, which I note averaged 72,000 cubic feet per day during the month. There is another point on the measurement of the Cousland gas production in which I am interested in relation to the Eskdale project, and I would much appreciate your recommendations.

The Eskdale meter will be located at Whitby and will measure gas at 2 p.s.i. For the Cousland gas production I believe you use a Holmes BM meter, and we are considering using the same type for Eskdale, as it is presumably more accurate than a Connersville meter.

I do not know whether you have incorporated a P.V.T.T. recorder with your B.M. meter. I would be most grateful to you if you would advise me as to the value of such a recorder if you use one, or if you consider that when the gas is measured at 2 p.s.i., the installation of a recorder is not justified.

You will be glad to know that drilling at Cousland well 6 is due to commence this week end, and I feel certain that it will be a most interesting well.

Yours sincerely,

C.M. Adcock

CMA/JMC

F16

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE ~~34331-5~~ CALEDONIAN 2052 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

10th November, 1959.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Notts.

Dear Mr. Adcock,

Cousland Number 1 Natural Gas Well

Our Edinburgh and South-Eastern Division report that during a recent examination of the agglomerator and water collecting vessel, a quantity of deposit was removed. This deposit which was of a bituminous appearance was coated on the inside of the vessels and approximately 1,500 ccs. was scraped off.

A sample of this deposit has been analysed by the British Petroleum Refinery (Grangemouth) Limited, and I append a copy of their analysis for your information.

I trust this information will be of interest to you.

Yours sincerely,

(T.S. Ricketts)
Chief Engineer

RAB/RC.

COPY/

B.P. REFINERY (GRANGEMOUTH) LIMITED

Cousland No. 1 Gas Well

ANALYSIS

Soluble in normal heptane (Probably waxes).	Wt. %	57.2
Soluble in benzine (Asphalts).	"	2.3
Iron (as Fe_2O_3)	"	31.7
Silica (as SiO_2)	"	6.3
Copper		Trace

****

File

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE ~~34331-5~~ CALEDONIAN 2052 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

6th November, 1959.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Notts.

Dear Mr. Adcock,

Natural Gas - Cousland

... I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st October, 1959, from which it will be seen that the supply continued uninterrupted during this period.

Yours sincerely,

p. T. S. Ricketts RB.

(T.S. Ricketts)
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - OCTOBER, 1959

Continuity of Supply	Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 31st October, 1959.
Volume supplied from Cousland to Musselburgh during the month (corrected) *	2,242,640 cubic feet
Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester)	6th October - 583 lbs. per square inch 13th October - 582.5 lbs. per square inch 20th October - 582 lbs. per square inch 27th October - 581.5 lbs. per square inch
Number of days on which well was in action during the month	31 days
Number of days on which well was shut down during the month	Nil

Cum. end Oct. 47,966,517
Nov 2,336,100
end Nov 50,302,617

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

File/cla

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE ~~34331-5~~ CALEDONIAN 2052 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

Friday,
30th October, 1959.

C.M. Adcock, Esquire,
BP Exploration Company Limited,
P.O. Box 1,
Eakring,
Southwell,
Notts.

Dear Mr. Adcock,

Natural gas - Cousland

In the final paragraph of the letter dated 20th October, 1959 signed by Mr. Savile and Mr. Woodbridge, it is suggested that we should ourselves negotiate with Bain Brothers with regard to any measures necessary to support the governor house at Cousland.

I am asking our Solicitor to take this matter up with Bain Brothers and we are also calling in our Mining Consultants, J.W.H. Ross and Company of Glasgow, to advise on the present position so that appropriate steps can be taken to safeguard our equipment.

Yours sincerely,

T Ricketts

(T. S. Ricketts)
Chief Engineer.

DCE/MA

File/
Cha

Exp.117/61

Chief Engineer,
The Scottish Gas Board,
26 Drumsheugh Gardens,
Edinburgh 3.

20th October, 1959.

Dear Sir,

Natural Gas - Cousland.

Mr. Adcock has passed to us your letters of the 6th and 10th October, and his reply to you of the 8th October. We understand you would like further information on our relations with the land owner and Bain Brothers, concerning the Cousland No. 1 well site.

In the first place, we would point out that we have only made arrangements with Stair Estates and Bain Brothers to cover the period of the production test. No permanent agreements have been negotiated to cover any permanent gas production which may be decided upon from the Cousland reservoir. After completion of the No. 6 well, which is to be drilled, it may be possible to know your future intentions concerning production at Cousland, in which case, some permanent arrangements will have to be negotiated with the parties concerned.

Our re-entry into the Cousland No. 1 site for operation of the production test which still continues, was arranged by an exchange of letters with The Stair Estates. These were dated 8th October, 1956, and acknowledged by letter dated 10th October, 1956. The then holders of the Mining Lease, which were the Dalkeith Transport and Storage Company Limited, were informed of our intention to re-open the existing borehole and extract the natural gas, in our letter dated 8th October, 1956. A surface rental is paid to the Estate for the well site enclosing the well head and fittings, and an agreed compensation paid to the farm tenants. We were not asked to negotiate for the aquisition of the auxilary building (Regulator house) site in the confines of the old quarry workings, and we assume that this was arranged directly by the Gas Board.

Cont/...

In 1958, we were informed that Bain Brothers were extending their mining galleries, for extracting limestone for use as a fertilizer, towards No. 1 well, and that their explosive charges and the use of naked lights in the workings, might be dangerous and ignite the well if any of the casing was fractured. The mine workings were surveyed by Messrs. Duff and Geddes, for Bain Brothers, and in their letter to you of the 4th August, 1958, they stated the nearest working face to the borehole was 160 feet. On the 30th July, 1958, we had a meeting with Bain Brothers, and it was decided that the safe distance from the borehole would be at least 150 feet, and Mr. Messer of Bain Brothers, agreed to work not nearer than this distance to the borehole. We replied to Messrs. Duff and Geddes in our letter of the 7th August, 1958, thanking them for the information that the nearest working face in the limestone mine was 160 feet from the borehole, and informing them that it had been decided that the safe distance was 150 feet, and that Bain Brothers had agreed not to work nearer than this distance. This letter was copied to Bain Brothers and yourselves.

In September/October, 1958, Bain Brothers sent us a plan of their workings in the vicinity of the borehole, and a plan of their Mining Concession from the Stair Estates, on which they marked the area of their future development; to which we added the position of the boreholes drilled at Cousland. The area of their future development was all to the north of the old quarry, and did not approach towards No. 1 borehole. The position at Cousland was explained in a letter to the Secretary of the Gas Council dated 31st December, 1958, with a copy of the map showing the boreholes, the mining lease area, and the proposed development area enclosed. Our last letter to Bain Brothers was dated 21st January, 1959, explaining that we were not yet in a position to undertake any further negotiations with them until further results from the production test were apparent, or further measures to evaluate the field had been taken.

We think it best that negotiations for any permanent arrangements, or concerning sterilization of limestone, should await the results of the next well, No. 6, which is soon to be drilled. This well site is outside the mining lease of Bain Brothers. During our negotiations it has never been stated that compensation for sterilization of the limestone should amount to more than loss of profit and royalties to the Estate on the limestone in place.

It would appear that the regulator house is over workings, which may have been made after it had been erected, and that you should negotiate direct with Bain Brothers concerning any measures which you require to make to support it from below.

Yours faithfully,

K.R.G. Savile.

p.p. C.E. Woodbridge.

for BP EXPLORATION COMPANY LIMITED

c.c. Mr. C.M. Adcock/Mr. Acres - Eakring.
Secretary - Gas Council.
Secretary - Scottish Gas Board.

File Cho

Your reference: PE/851

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE ~~34331-5~~ CALEDONIAN 2032 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

19th October, 1959.

C.M. Adcock, Esquire,
BP Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural gas - Cousland

With reference to your letter of 13th October, 1959, we are now assembling information on the use of tetrahydrothiophene as an odorant on the natural gas line at Cousland. I hope to despatch this to you within the next few days.

Yours sincerely,

T. S. Ricketts

(T. S. Ricketts)
Chief Engineer.

DCE/MA

File / [illegible]

Copy

From Mr. C.M. Adcock
Eakring

To Mr. C.E. Woodbridge,
BP House

Our Ref. EXP/1/PE.849 **Your Ref.**

Date 13th October 1959

Subject Mining Subsidence at Cousland

Further to my memorandum dated 8th October, I have received another letter from Mr. Ricketts dated 10th October, enclosing a copy of a letter which the Secretary of the Scottish Gas Board sent to the Secretary of the Gas Council, dated 7th October.

I have had prints made from both these letters which I am forwarding to you herewith. The letters are self-explanatory, and I do not therefore propose to make any further comments.

C.M. Adcock

21st Oct. 1959
phoned Mr. Smith
re Eskdale

ENCL.

CMA/JMC

File/
Chem

PE.851 13th October 1959

T.S.Ricketts, Esq.,
Chief Engineer,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Natural Gas Cousland

Many thanks for your letters dated 6th and 10th October. I have passed on the information contained in your letter dated 10th October to our London Office. Thank you for the copy of your September report for the Cousland gas production, and I note that the average offtake rate was 74,000 cubic feet per day during the 28 days the well was on production during the month.

You are no doubt aware that the North Eastern Gas Board are proposing to pipe Eskdale gas to Whitby for reforming and distribution through their undertaking. I have been preparing a production scheme for this project which will incorporate odorising equipment.

The N.E.G.B. are proposing to use T.H.T. as an odorant at a concentration of $1\frac{1}{4}$ lbs T.H.T. per million cubic feet of gas. As the maximum quantity of gas production would not exceed 30,000 cubic feet per hour, the T.H.T. requirements would be less than 0.0375 lbs per hour. This is of course a very small quantity, and I was wondering how you managed at Cousland, where I believe you are using T.H.T. and must have a very similar problem?

Do you use a diluent for the T.H.T. to provide a manageable quantity of liquid to inject into the Cousland gas? Have you any means of ensuring that the T.H.T. concentration remains unchanged with varying rates of gas flow?

I would be very grateful to you if you would send me particulars of your treatment procedure. This should prove helpful in planning suitable odorising equipment for the N.E.G.B. scheme.

Yours sincerely,

CMA/JMC C.M. Adcock

File Uka

Copy

From	Mr. C.M. Adcock, Eakring	**To**	Mr. C.E. Woodbridge, BP House
Our Ref.	EXP/1/PE.843 **Your Ref.**	**Date**	8th October 1959

Subject Mining Subsidence at Cousland

We are sending you herewith a copy of a letter from Mr. Ricketts, the Chief Engineer of the Scottish Gas Board, dated 6th October 1959 on the subject of Mining Subsidence at Cousland. We are also sending you The Scottish Gas Board's drawing G.34, which shows the area of subsidence in relation to Well 1, and the extent to which the quarry workings have spread to date.

I am also sending you a copy of my reply to Mr. Ricketts. You will note that he is interested in precise information on the agreed area which has been sterilised in the vicinity of Well 1. He is also interested to know whether our agreement with the Stair Estates limits in any way work carried out by the Scottish Gas Board on their governor house. Perhaps you would be good enough to write direct to Mr. Ricketts giving him the information he is requiring.

C.M. Adcock

Encls.

CMA/JMC

PE.844 8th October 1959

T.S. Ricketts, Esq.,
Chief Engineer,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Natural Gas - Cousland

Thank you for your letters dated 22nd September and 6th October, enclosing drawing No.G.34 showing the area of subsidence about 600 feet away from Well 1. The map shows that the subsidence has occurred within the area of the quarry mine workings.

Well 1 is located outside the mined area, and in discussions with Messrs. Bain Brothers which took place in July 1958, it was agreed that the nearest working face in the limestone must be at least 150 feet from the well. (See letter from our London Office to Messrs. Duff and Geddes with a copy to yourself dated 7th August 1958). The negotiation of an agreement concerning the respective interests was also mentioned in this letter, and I will write to our London Office to find out the present position.

Since well 1 is located outside the area to be mined, and the workings are shallow, the occurrence of any subsidence in the future close to the wellhead is not to be expected. The present area of subsidence is therefore in no way related to the safety of the well, and we do not intend at this juncture to arrange for someone to visit Cousland to investigate the matter.

As the governor house is located over the mined area, we concur with your view that there may be some chance of subsidence occurring in its vicinity, and we agree as to the desirability of arranging for some form of permanent underground support. We are enquiring from our London Office whether this matter is in any way governed by agreements with the Stair Estates.

The site for well 6 has been chosen outside the area covered by the mining lease, and there will be no underground workings in its vicinity. We are sending you drawing GEOL/A65/2183 which shows the approximate position of well 6 in relation to well 1. The exact well site is shown on the site plan SP 513, which is also being sent to you herewith. You will note that well 6 has been located some 1800 feet to the east of well 1.

Yours sincerely,

C.M. Adcock

cc. Mr. C.E. Woodbridge, BP House,

CMA/JMC

COPY

The Scottish Gas Board
26, Drumsheugh Gardens
Edinburgh, 3

6th October 1959

C.M. Adcock, Esq.,
BP Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Notts.

Dear Mr. Adcock,

Natural Gas - Cousland

In my letter of 25th September, 1959, I referred to the subsidence which has occurred in the vicinity of the wellhead at Cousland. As promised I now enclose a drawing showing the location of the subsidence in relation to the wellhead. This subsidence has shown itself as a surface hole and at the end away from the wellhead there appears to be a deeper fissure; perhaps this is a shaft of an old working. You will note also that the subsidence is some distance from the wellhead; during our latest visit to the site there were no signs of subsidence closer to the wellhead, although as you will see on the drawing, falls of rock have occurred in this vicinity in the past.

I would be very pleased to have your comments after consideration of the drawing and I shall also be pleased if you will let me know the present position with regard to sterilisation in the immediate area around the wellhead, and if you will confirm whether this ground is in fact sterilised.

We also have in mind the possibility of arranging for some form of permanent underground support below the governor house and I shall be pleased to learn if your negotiations with Stair Estates have included this point, and if so what is the present position?

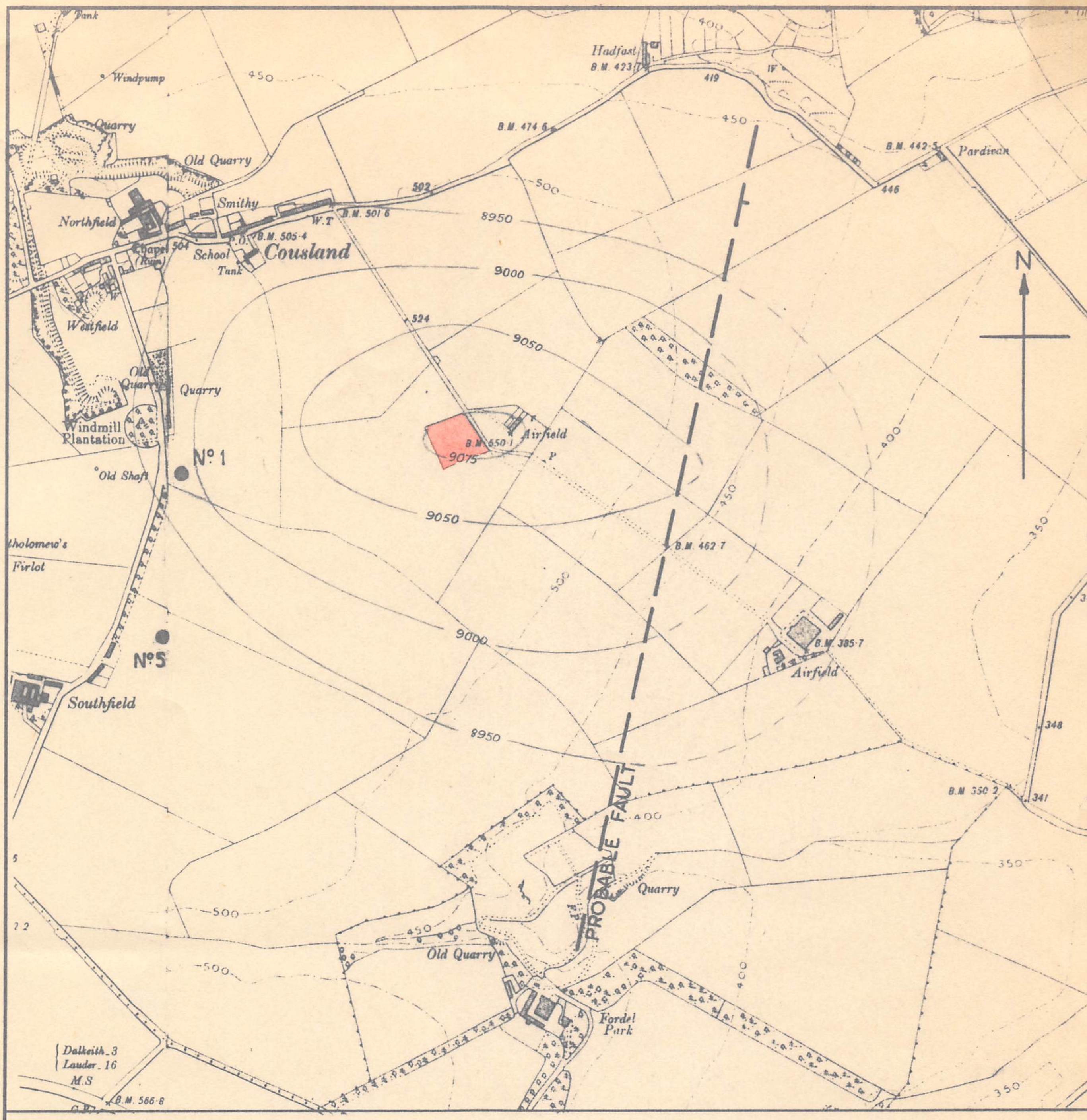
I shall be interested to learn if you intend to visit Cousland to investigate the incident further or, alternatively, whether you will be sending a representative.

I am anxious also as to the position of the borehole which you intend to commence during the next few weeks. Have you ascertained whether the area in which you propose to drill is free from subsidence? I should be obliged if you could send me a drawing showing the exact position of the proposed borehole.

It seems to me that it would be a good plan to obtain a complete picture of old underground workings under the site of the Cousland number 1 and Cousland number 6 wells, and perhaps you would let me have your views on this: I might mention that we have made use of a Mining Consultant in other parts of the Board's Area and we would be very pleased to use his services if you wish.

Yours sincerely,

(T.S. Ricketts)
Chief Engineer.



1000 ft. 0 1000 2000 3000 ft.

Scale: 6inches - 1mile.

THE COUSLAND VILLAGE CULMINATION OF THE D'ARCY COUSLAND ANTICLINE

STRUCTURE CONTOURS ON THE 1582 SAND OF No. 1,

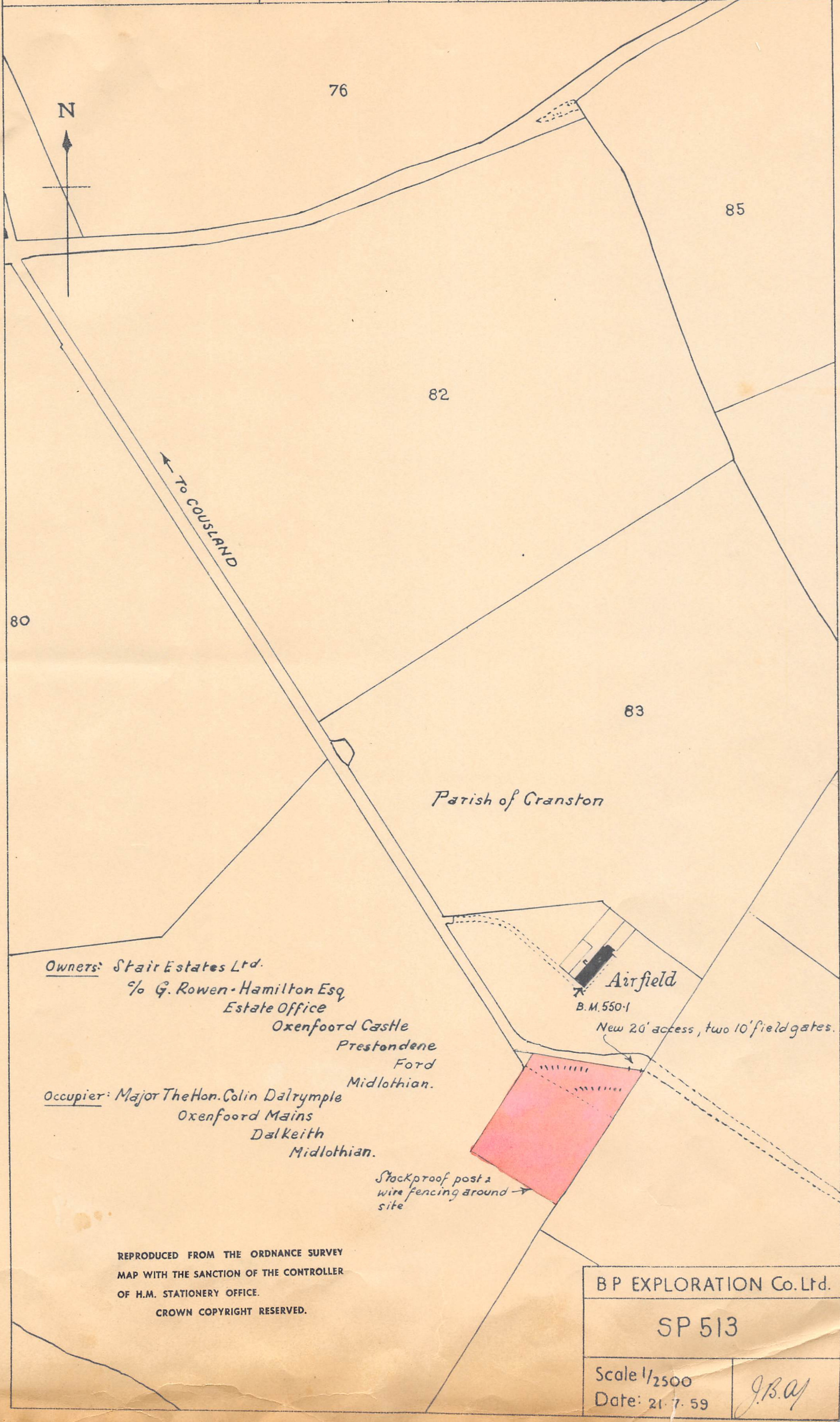
(in feet above a datum 10,000ft. b.s.l.)

-from fig.2 of Tech. Note RGWB.5.

Proposed Site for New Well

BP EXPLORATION CO. LTD.
GEOLOGICAL DIV. EAKRING.
AREA: SCOTLAND.
REF: GEOL/A65/2183
R.G.W. BRUNSTROM | 25.3.59

AREA: COUSLAND	Site Plan for Well No 6	A 205a	Site Area approx 1acre	OS Sheets Edinburghshire. IX.1, IX.5 Haddingtonshire XIV.1, XIV.5



Please File
Che

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

6th October, 1959.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Notts.

Dear Mr. Adcock,

Natural Gas - Cousland

... I enclose a copy of the statement sent to the Gas Council relating to the supply of natural gas from Cousland to Musselburgh during the month ended 30th September, 1959, from which you will note that the supply continued uninterrupted with the exception of a shut down from 9.55 a.m. on the 14th September to 10.35 a.m. on the 16th September, 1959, for the installation of thermometers and a sampling point in the governor house.

Yours sincerely,

p. T.S. Ricketts
(T.S. Ricketts)
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - SEPTEMBER, 1959

Continuity of Supply	Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 30th September, 1959, with the exception of a shut down from 9.55 a.m. on the 14th September to 10.35 a.m. on the 16th September, 1959, for the installation of thermometers and a sampling point in the governor house.
Volume supplied from Cousland to Musselburgh during the month (Corrected) *	2,065,840 cubic feet
Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester)	1st September - 584.5 lbs. per square inch 8th September - 584 lbs. per square inch 16th September - 584 lbs. per square inch 22nd September - 584 lbs. per square inch 29th September - 583.5 lbs. per square inch
Number of days on which well was in action during the month	28 days
Number of days on which well was shut down during the month	2 days

End Sept C

45,723,877
Oct 2,242,640
End Oct. 47,966,517

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

Please File
Chas

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE ~~34331-5~~ TELEGRAMS "SCOTGASBO"
Caledonian 2052

REPLY TO CHIEF ENGINEER

Tuesday,
22nd September,
1959

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Nottingham.

Dear Mr. Adcock,

Thank you for your letter of the 21st of September 1959. It was very good of you to send me a copy of the Paper you read at Milan in October, 1957. I am looking forward to an enjoyable reading of it this evening.

The latest news which I have received this morning concerning Cousland is that there appears to be some slight subsidence about 600 feet away from the wellhead, caused, as far as I can gather, by old shallow mine workings in the vicinity. As soon as I have further particulars I will send you a sketch and no doubt after looking at it you will decide whether or not it warrants a visit.

With kind regards,
Yours sincerely,

T. S. Ricketts.

(T.S. Ricketts)
Chief Engineer

TSR/EWF

Dictated by Mr. Ricketts
and signed in his absence.
EWF.

Please File
Ac

PE.814 21st September 1959

T.S. Ricketts, Esq.,
Chief Engineer,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Natural Gas - Cousland

Many thanks for your letter dated 7th September which I found awaiting me on my return from my holiday. Thank you for the copy of your August report for the Cousland Gas production, and I note that the average offtake rate was 66,000 cubic feet per day during the month.

In case you may be interested I am sending you herewith a copy of the paper I read at Milan in October 1957 on Natural Gas in Britain.

Yours sincerely,

C.M. Adcock

Encl.

CMA/JMC

Please File
Avec

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE ~~34331-5~~ CALEDONIAN 2052 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

7th September, 1959.

C.M. Adcock Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
NOTTINGHAM.

Dear Mr. Adcock,

Natural Gas - Cousland

... I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st August, 1959, from which it will be seen that the supply continued uninterrupted during this period.

Yours sincerely,

T.S. Ricketts

(T.S. Ricketts)
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - AUGUST, 1959

Continuity of Supply	Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 31st August, 1959.
Volume supplied from Cousland to Musselburgh during the month (Corrected) *	2,232,560 cubic feet
Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester)	4th August - 586.5 lbs. per square inch 11th August - 586 lbs. per square inch 18th August - 585.5 lbs. per square inch 25th August - 585 lbs. per square inch
Number of days on which well was in action during the month	31 days
Number of days on which well was shut down during the month	Nil

Cum End Aug 43,658,037
Sept 2,066,840
End Sept 45,725,877

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

File/Ur

PE.775

11th August 1959

T.S. Ricketts, Esq.,
Chief Engineer,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Natural Gas - Cousland

Many thanks for your letter dated 6th August giving details of the electrical heating at Cousland to overcome freezing.

Thank you also for the copy of your July report for the Cousland Gas production. I note that the average offtake rate was 67,000 cubic feet per day during the month.

Yours sincerely,

C.M. Adcock

CMA/JMC

Please complete graphs & file

THE SCOTTISH GAS BOARD
26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE ~~34331-5~~ CALEDONIAN 2052 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

6th August, 1959.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
NOTTINGHAM.

Dear Mr. Adcock,

Natural Gas - Cousland.

I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st July, 1959, from which it will be seen that the supply continued uninterrupted during this period.

Yours sincerely,

T.S. Ricketts.

(T.S. Ricketts)
Chief Engineer.

AB.

RAB/MPL.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - JULY, 1959.

Continuity of Supply..................... Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 31st July, 1959.

Volume supplied from Cousland to Musselburgh during the month (Corrected)*.......................... 2,089,090 cubic feet

31)

67,500

186
229
217
120

Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester)............................

7th July - 588.5 lbs. per square inch
14th July - 588 lbs. per square inch
21st July - 587.5 lbs. per square inch
28th July - 587 lbs. per square inch

Number of days on which well was in action during the month........... 31 days

Number of days on which well was shut down during the month........... Nil

Cum 41,425,477
end July
Aug 2,232,560
end Aug 43,658,037

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

Please file

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE ~~34331-5~~ CALEDONIAN 2052 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

6th August, 1959.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
NOTTINGHAM.

Dear Mr. Adcock,

Natural Gas - Cousland.

Thank you for your letter of 4th August, 1959.

On the Cousland installation there is a tape heater wrapped around the outlet pipe of the water separator. This heater has a maximum rating of 2 kW. In the governor house there are three electrical space heaters each rated at 0.24 kW and a similar heater is installed in the odorizer house. From this you will see that the maximum rating of these heaters is a little above 2,000 units per month but the actual usage is appreciably less. These heaters are not thermostatically controlled.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts)
Chief Engineer.

RAB/MPL.

File / ua

PE.764

4th August 1959

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

<u>Natural Gas - Cousland</u>

Many thanks for your letter dated 22nd July detailing briefly your experience with hydrate formation and the steps you have taken to combat freezing troubles.

I presume that the electrical heaters are strapped to the gas pipe line, and that your consumption of electricity is comparatively small.

Yours sincerely,

C.M. Adcock

CMA/JMC

Please note that our
TELEPHONE
NUMBER is now

Exchange CALEDONIAN........ *Number* 2052/7.....

Name ....THE SCOTTISH GAS BOARD,..............................

Address ....26 Drumsheugh Gardens,..............................

..........................Edinburgh, 3...

EDINBURGH
7 - PM
31 JLY
1959
GT. BRITAIN.D.

OFFICIAL PAID

To C.M. Adcock, Esquire,

BP and Shell Mex Limited,

EAKRING, P.O. BOX 1

SOUTHWELL, Notts.

TELEPHONE

A 3119
Sales Traffic

75606 (8361)

Please file
C.M.

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

Wednesday,
22nd July, 1959

C.M. Adcock, Esquire,
BP Exploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

Natural Gas - Cousland

Further to your letter of the 10th of July, 1959 and our reply of the 13th of July, 1959, we now have pleasure in setting out details of the method of operation of the electric heaters installed at Cousland Governor house.

Freezing of the I.V. regulator valves seems to have occurred from the inauguration of the well; you may recall that a needle valve was fitted to reduce the pressure from 600 pounds per square inch to 400 pounds per square inch in the hope that the gradual step-by-step reduction of pressure would obviate freezing troubles. However, this needle valve itself froze up and therefore in October 1957 electric heaters were fitted and no further trouble seems to have occurred until January, 1959.

Freezing at the wellhead occurred on the 30th of January 1959 and subsequent days, as evidenced by frost formation on the outside of the pipes leaving the 'christmas tree' fitting. Simultaneously with the formation of frost the pressure fell from 600 pounds per square inch to 120 pounds per square inch, although the pressure at the wellhead itself remained constant at 600 pounds per square inch.

When the Bryan Donkin governor burst the electric heaters were not in action as the atmospheric temperature was not considered to be low enough to warrant their use.

Since /

Since the burst, which was considered to be due to a fracture of the cast-iron casing of the governor which was probably weakened by successive formations of frost, the electric heaters have been in continuous operation and no blockages have been reported.

I hope this short account enables you to obtain a picture of the present position but I shall be only too pleased to elaborate on any particular aspect should you so desire.

Yours sincerely,

T T Ricketts

(T.S. Ricketts)
Chief Engineer

TSR/EWF

F.G.
Clo

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

Monday,
13th July, 1959

C.M. Adcock, Esquire,
BP Exploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

Natural Gas - Cousland

Thank you very much for your letter of the 10th of July, 1959: we hope that we have overcome the problem of hydrate formation at our pressure reducing valves, although of course the worst trouble occurs during the winter months and we normally have no trouble during the summer.

I will be very pleased to let you have details of our present arrangements and procedure to overcome hydrate formation and I hope to let you have this information during the course of the next few days.

Yours sincerely,

T.S. Ricketts

(T.S. Ricketts)
Chief Engineer

Dictated by Mr. Ricketts
and signed in his absence

TSR/EWF

File
Chg

PE.733

10th July 1959

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Natural Gas - Cousland

Many thanks for your letter dated 7th July, and for the copy of your June report for the Cousland gas production. I note that the average production rate was 72,000 cubic feet per day during the month.

I am interested to know whether you have finally overcome the problem of hydrate formation at your pressure reducing valves. You have not made any mention of this problem in any of your recent reports, apart from the shut-down you reported in Feburary due to freezing at the wellhead in particularly cold weather.

It is presumed that you still have electric heaters in your control room, but that you would not have them on during the warm weather. Would you advise me to write to Mr. Beavis for details of your present arrangement and procedure to overcome hydrate formation? I can remember the various discussions we had on this subject, but not what was the final outcome of it all.

Yours sincerely,

C.M. Adcock

CMA/JMC

Please complete graphs of File
Cho

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER 7th July, 1959.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

... I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 30th June, 1959, from which it will be seen that the supply continued uninterrupted during this period.

Yours sincerely,

T.S. Ricketts
(T.S. Ricketts)
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - JUNE, 1959

Continuity of Supply	Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 30th June, 1959.
Volume supplied from Cousland to Musselburgh during the month (Corrected)*	2,159,570 cubic feet 72,000
Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester)	2nd June - 591 lbs. per square inch 9th June - 590.5 (Minus) lbs. per square inch 16th June - 590 lbs. per square inch 23rd June - 589 lbs. per square inch 30th June - 588.5 lbs. per square inch
Number of days on which well was in action during the month	30 days
Number of days on which well was shut down during the month	Nil

Cum and June
39,336,387
2089090
41,425,477

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

File
Cha

PE.702 22nd June 1959

T.S. Ricketts, Esq.,
Chief Engineer,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter dated 17th June. I confirm, as requested, that Mr. Laird is handling all gas storage problems, and that I will continue to deal with gas production matters at Cousland, including the keeping of the production records.

Yours sincerely,

C.M. Adcock
Senior Petroleum Engineer U.K.

CMA/JMC

File
MA

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

Wednesday,
17th June, 1959

C.M. Adcock, Esquire,
Senior Petroleum Engineer, U.K.,
BP Exploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

I was very pleased to receive your letter of the 12th of June, 1959; as you say, the target reserves for Cousland may indeed approach 2000 million cubic feet and I look forward to the results to be obtained from the drilling of Cousland Well Number 6.

I am at present investigating a number of alternative schemes for using Cousland as an underground storage; by this I mean that I am examining the economics of pipelines to and from various localities, and I am also bearing in mind that adjacent structures might also increase the capacity of underground storage.

I note that it has been arranged that Mr. Laird shall keep in touch with me on the problems of underground storage of gas and, indeed, I am very grateful for the considerable help and advice he has already given to me on this matter. I interpret your letter as meaning that I shall receive correspondence from Mr. Laird and I will reply to him on the question of underground storage; all other matters concerned with natural gas will continue to be addressed to you: if I am incorrect in this interpretation perhaps you would let me know.

Yours sincerely,

T S Ricketts.

(T.S. Ricketts)
Chief Engineer

TSR/EWF

File
Cla

PE.692 12th June 1959

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Thank you for your letter dated 14th May in which you refer to the drilling of Cousland Well 6. This should prove to be a most interesting well, particularly in view of Mr. Brunstrom's interpretation of the Cousland structure.

On the current performance of Cousland Well 1 it would appear that your target reserves for Cousland of 2000 million cubic feet should be realistic.

I note your renewed interest in the use of Cousland for underground storage of gas, and it has been arranged that Mr. Laird shall keep in touch with you on these problems. He will also be able to supervise whatever work you would wish BP to undertake on your behalf on gas storage matters.

I wish also to acknowledge your letter to Mr. Laird dated 6th June enclosing your Monthly Statement for the Cousland gas production during May. I was interested to note that you had refitted the I.V. Controllers, and I trust that you will now have a period of continuous production.

Yours sincerely,

C.M. Adcock

Senior Petroleum Engineer, U.K.

CMA/JMC

THE SCOTTISH GAS BOARD
26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

6th June, 1959.

A. Laird, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Laird,

Natural Gas - Cousland

I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st May, 1959, from which you will note that I.V. Controllers have now been fitted, and following a 4 hour trial run, draw-off has been continuous since the 19th of May, 1959.

Yours sincerely,

p. T.S. Ricketts.

(T.S. Ricketts)
Chief Engineer

RB.

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - MAY, 1959

Continuity of Supply	Following the failure of the number 1 governor, I.V. controllers have been fitted and the supply was on from 12.30 p.m. to 4.30 p.m. on the 15th May, for a trial run and continuous draw-off restarted at 10.20 a.m. on the 19th May, 1959.
Volume supplied from Cousland to Musselburgh during the month (corrected)*	842,560 cubic feet
Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester)	11th May - 593 (Plus) lbs. per square inch 26th May - 591.5 (Plus) lbs. per square inch
Number of days on which well was in action during the month	13 days
Number of days on which well was shut down during the month	18 days

64,800

cum. end May

37,176,817
2,159,570
39,336,387

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

1050

27th May 1959

Mr. T.S. Ricketts,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Sunbury have now completed their preliminary study of the Cousland gas accumulation, but since it may take some considerable time to prepare the report for issue, I asked them to send me a short note summarising the main points emerging from the study. Herewith a copy which I think will interest you.

Incidentally the reserves and other figures are based on Mr. Brumstroms opinion about the extent of the two main sands (you have read his report in this connection).

When the report is finally issued I will send you a copy.

With kindest regards,

Yours sincerely,

A. Laird

Encl. Sunbury Note on Cousland - Seasonal Storage.

AL/JMC

Your reference: PE.659

File
M

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

14th May, 1959

C.M. Adcock, Esquire,
BP Exploration Company Limited,
Eakring,
P.O. Box 1, Southwell,
Notts.

Dear Mr. Adcock,

Natural Gas - Cousland

Thank you very much for your letter of the 13th of May, 1959: I was very pleased to note that you had returned from Trinidad, and I can quite understand your delight at coming back to English spring-time weather!

During your absence we have given a great deal of thought to Cousland, and as you know it has been decided to drill another well there, this time in a position which is thought to be nearer the crest. I hope that a positive result will be achieved from the drilling of this new well which will enable us to say that the capacity is at least 2,000 million cubic feet: if this is so, then I feel we can safely go ahead with our plans for using Cousland for underground storage purposes.

With best wishes,

Yours sincerely,

T. Ricketts

(T.S. Ricketts)

TSR/EWF

MG

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

6th May, 1959.

A. Laird, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Laird,

Natural Gas - Cousland

I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 30th April, 1959.

You will note from the statement that the supply was off from 11 a.m. on Wednesday, 1st April, to 11 a.m. on Friday, 3rd April, 1959, for the clearing of a partial blockage in the pipeline between the wellhead and the governor installation, and also that the supply was off from 8.30 p.m. on Monday, 6th April, 1959, for the remainder of the month due to bursting of the casing of the first of the two high pressure governors (as mentioned verbally to you). This matter is now under discussion with the manufacturers of the governor (The Bryan-Donkin Company Limited) and arrangements have been made to refit the original I.V. controllers. Provision is to be made for a stream parallel to the I.V. controllers into which redesigned Bryan Donkin governors can be fitted for trial purposes.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts) pp
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - APRIL, 1959

Continuity of Supply .... The supply was off from 11 a.m. on 1st April, to 11 a.m. on 3rd April, 1959, for the clearing of a partial blockage in the pipeline between the wellhead and the governor installation. The supply was also off from 8.30 p.m. on 6th April, 1959, for the remainder of the month due to the bursting of the casing of the first of the two high pressure governors.

Volume supplied from Cousland to Musselburgh during the month (corrected)* .... 286,391 cubic feet

57,200

Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester) .... 3rd April - 590 lbs. per square inch
30th April - 592.5 lbs. per square inch

Number of days on which well was in action during the month .... 5 days

Number of days on which well was shut down during the month .... 25 days

Cum end April
36,334,257
842,560
37,176,817

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

PE.659

13th May 1959

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

<u>Natural Gas - Cousland</u>

Mr. Laird has passed on to me your letter to him dated 6th May, enclosing your monthly statement for the Cousland gas production.

I was sorry to learn that you have had a shut-down occasioned by the failure of your Bryan-Donkin regulator. However, I was interested to note that during this period the wellhead pressure rose 2.5 p.s.i.

I returned from Trinidad on 19th April, and I have found it very pleasant to come back to a delightful English Spring.

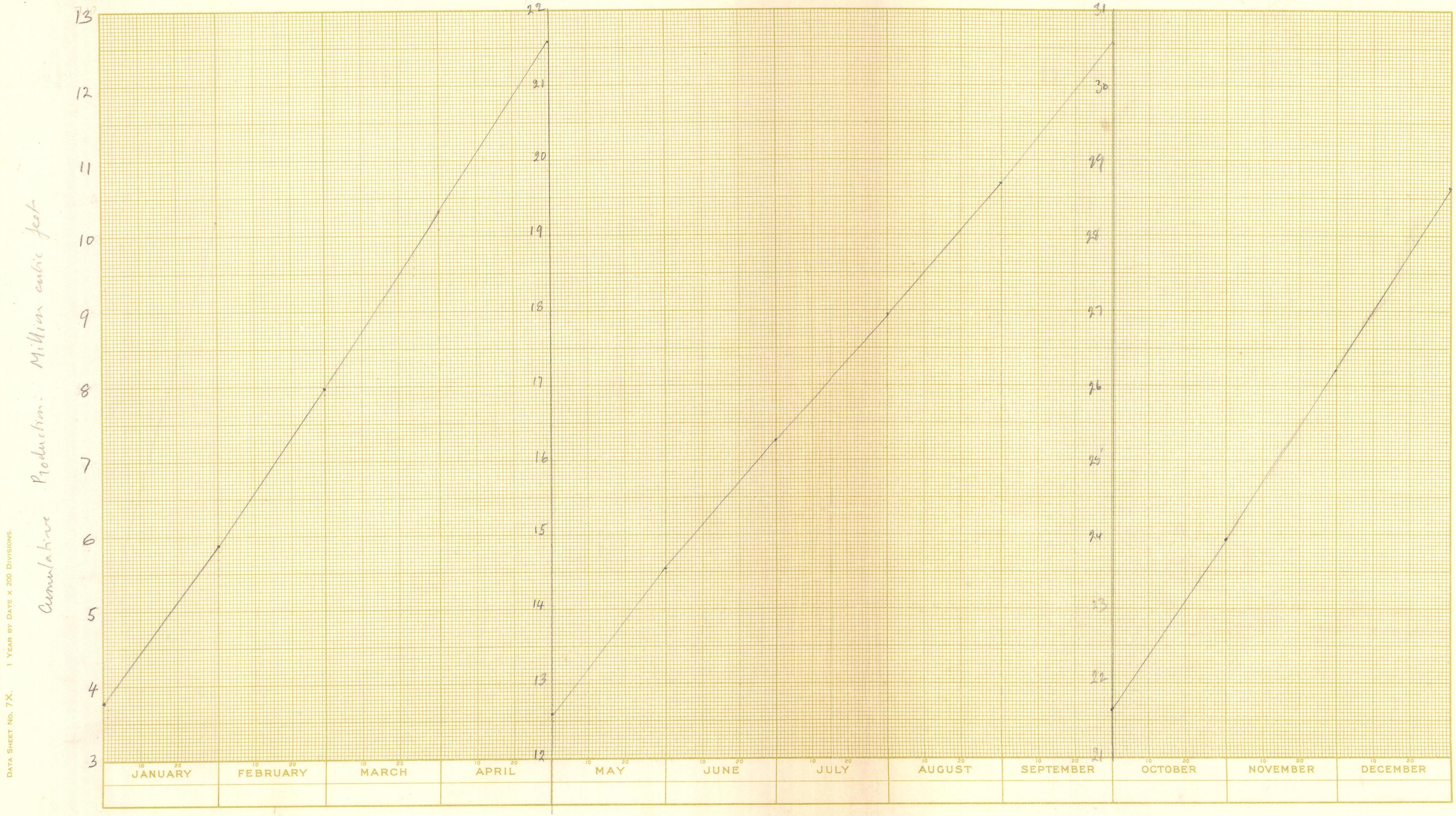
Yours sincerely,

C.M. Adcock

CMA/JMC

COUSLAND

1958



1958

PE.622

8th April 1959

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter of the 3rd instant, and for the copy of your March report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was 84,400 cubic feet per day during March.

Yours sincerely,

A. Laird

JMC

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

3rd April, 1959.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st March, 1959, from which it will be seen that the supply continued uninterrupted during this period.

Yours sincerely,

p. T.S. Ricketts.

(T.S. Ricketts)
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - MARCH, 1959

Continuity of Supply	Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 31st March, 1959.
Volume supplied from Cousland to Musselburgh during the month (corrected)*	2,615,890 cubic feet 84,400
Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester)	3rd March - 591 (Plus) lbs. per square inch 10th March - 590.5 lbs. per square inch 17th March - 590.0 lbs. per square inch
Number of days on which well was in action during the month	31 days
Number of days on which well was shut down during the month	Nil

Cum end March.
36,047,866
286,391
36,334,257

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

PE.603

11th March 1959

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter of the 9th instant, and for the copy of your February report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was 83,100 cubic feet per day during February.

Yours sincerely,

A. Laird

JMJ

Ward

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

9th March, 1959.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 28th February, 1959.

You will note that there were stoppages of $1\frac{1}{2}$ hours on Saturday, 14th February, and 2 hours on Tuesday, 17th February, 1959, for the clearing of a wellhead pipe. This was necessary because the very cold weather caused freezing of the condensate in the offtake branches at the wellhead, as shown on the appended sketch. A reduction in pressure resulted and on one occasion, the pressure fell to 120 pounds per square inch.

It should be noted that full well pressure was maintained at the top of the christmas tree and that no blockage occurred in the well bore. No further reductions in pressure have occurred since this time, due, no doubt to milder ambient conditions.

Yours sincerely,

T Ricketts

(T.S. Ricketts)
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - FEBRUARY, 1959

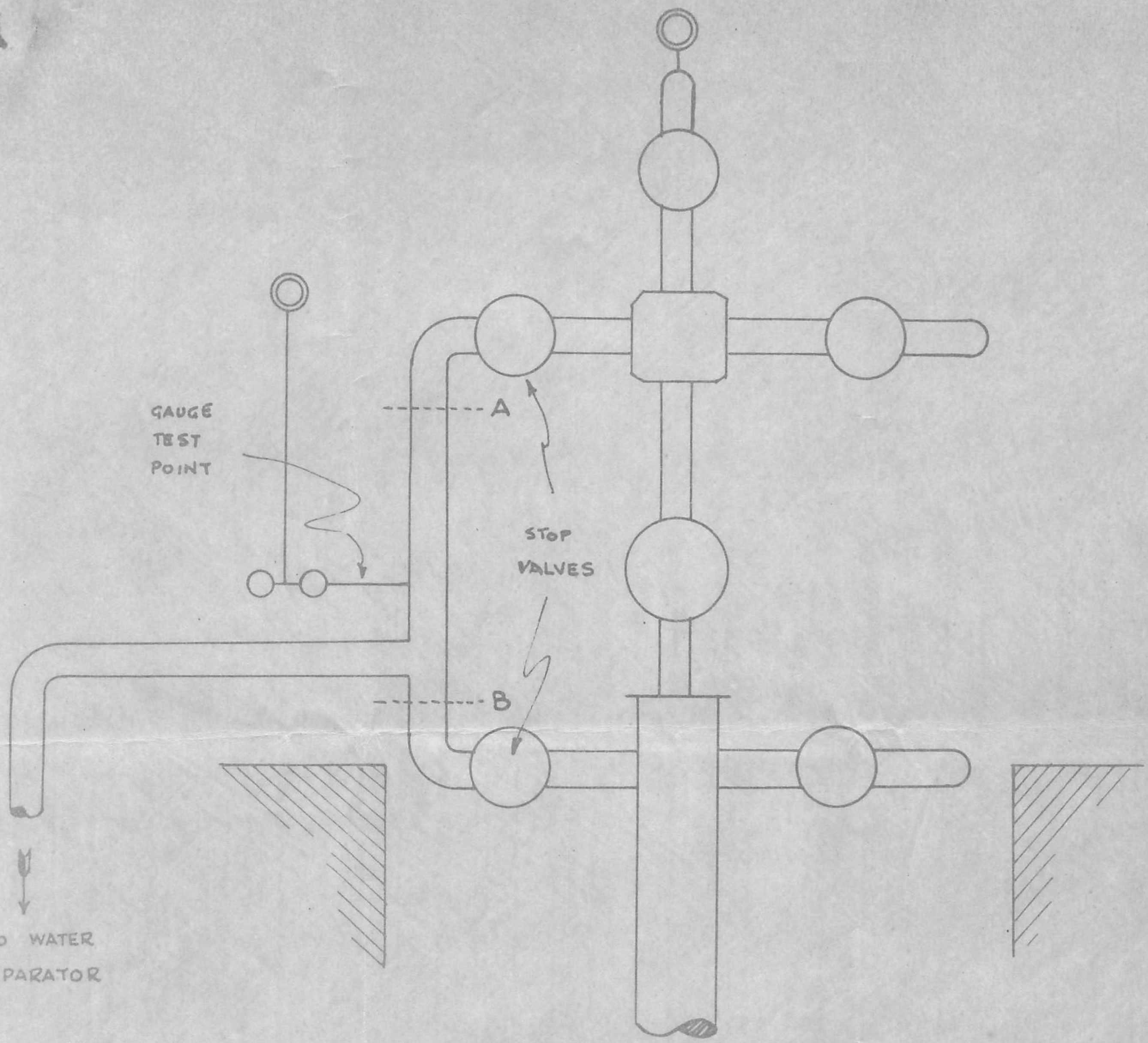
Continuity of Supply	Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 28th February, 1959.
Volume supplied from Cousland to Musselburgh during the month (corrected)*	28 2,326,320 cubic feet 83.100
Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester)	3rd February - 592.5 (Plus) lbs. per square inch 17th February - 591.5 (Plus) lbs. per square inch 24th February - 591.5 lbs. per square inch
Number of days on which well was in action during the month	28 days
Number of days on which well was shut down during the month	Nil

Cum end Feb.
33,431,976
2,615,890
36,047,866

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

Supply off on Saturday, 14th February, from 10 a.m. to 11.30 a.m. for clearing of pipe from the wellhead.

Supply off on Tuesday, 17th February, from 10 a.m. to 12 noon for clearing of pipe from the wellhead.



FREEZING OCCURRED
BETWEEN POINTS A and B

NATURAL GAS WELL ~ COUSLAND
CHRISTMAS TREE CONNECTIONS ~

THE CHIEF ENGINEERS DEPARTMENT,
THE SCOTTISH GAS BOARD,
26 DRUMSHEUGH GARDENS,
EDINBURGH. 3.

9th MARCH. 1959

l

M

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

14th February, 1959

M/ A. Laird, Esquire,
PB Exploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Notts.

Dear Mr. Laird,

Your telephone message of yesterday was passed on to me and I am enclosing the copy of the report by R.G.W. Brunstrom on natural gas which you left with me at our last meeting.

I am very grateful indeed to you for lending me this copy; it has proved very valuable indeed.

When I was in London yesterday I met Mr. Johnson, the Coal Officer of the Gas Council and had a long talk with him on the possibilities of the use of the Cousland well for underground gas storage purposes: he told me that the Gas Council had, in conjunction with BP Exploration Company Limited, been giving considerable thought to this matter during recent weeks, and he suggested that I should defer my proposed visit to you at Eakring until the Gas Council had had an opportunity to finalise their thoughts on the matter.

I am very anxious to see Cousland used for underground gas storage purposes, but I think it would be advisable in view of Mr. Johnson's comments, to defer my visit to Eakring for the present.

Yours sincerely,

T.S. Ricketts

(T.S. Ricketts)
Chief Engineer

TSR/EWF

Telephone
National 1200.

Britannic House,
Finsbury Circus,
London, E.C.2.

12th February, 1959

Dear Sandy,

Many thanks for the 1958 Royalty Statement for Cousland, which I received today.

Best wishes,

Yours sincerely,

Basil Parker

A. Laird, Esq.,
BP Exploration Co. Ltd.,
P.O. Box 1,
Southwell,
Notts.

1034

11th February 1959

Dear Basil,

Last year Mr. Adcock sent the Royalty Statement for Cousland to Mr. Matthews and I presume you will require a similar document for 1958.

Enclosed herewith.

Yours sincerely,

A. Laird

B.M. Eager, Esq.,
Exploration Department,
Britannic House.

AL/JMJ

BP EXPLORATION COMPANY LIMITED

LICENCE A 205

COUSLAND

Statement of Natural Gas Production - 1st January 1958 to 31st December 1958 (Inclusive)

		Cubic feet at 30 inches Mercury and 60 degrees Fahrenheit
Natural Gas Won and Saved		
	January	2,107,850
	February	2,098,540
	March	2,358,150
	April	2,260,870
	May	1,950,080
	June	1,732,010
	July	1,681,650
	August	1,726,140
	September	1,971,460
	October	2,281,290
	November	2,271,910
	December	2,435,560
NATURAL GAS LIABLE TO ROYALTY		24,875,510

11th February 1959
JMJ

PE. 585

9th February 1959

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter of the 6th instant, and for the copy of your January report for the Cousland gas production, including the we lhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was 79,500 cubic feet per day during January.

Yours sincerely,

A. Laird

JMJ

Rc

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

6th February, 1959.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

... I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st January, 1959, from which it will be seen that the supply continued uninterrupted during this period.

Yours sincerely,

p. T.S. Ricketts.

(T.S. Ricketts)
Chief Engineer ab.

RAB/RC.

m

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

PE. 586

REPORT ON GAS PRODUCTION - JANUARY, 1959

Continuity of Supply .... Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 31st January, 1959.

Volume supplied from Cousland to Musselburgh during the month (corrected)* .... 2,464,400 cubic feet 79,500

Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester) ....

12th January - 594 (Plus) lbs. per square inch
20th January - 594 lbs. per square inch
27th January - 593 (Plus) lbs. per square inch

Number of days on which well was in action during the month .... 31 days

Number of days on which well was shut down during the month .... Nil

Cum ed Jan
31,105,656
2326,320
Ed Feb 33431,976

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

PE.560 12th January 1959

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter of the 8th instant, and for the copy of your December report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was 78,600 cubic feet per day during December.

Yours sincerely,

A. Laird

JMJ

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

8th January, 1959.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st December, 1958, from which it will be seen that the supply continued uninterrupted during this period.

Yours sincerely,

p. T.S. Ricketts.

(T.S. Ricketts)
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - DECEMBER, 1958

Continuity of Supply .... Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 31st December, 1958.

Volume supplied from Cousland to Musselburgh during month (corrected)* .... 2,435,560 cubic feet

18,560

Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester) ...

10th December - 596.5 lbs. per square inch
22nd December - 596.0 lbs. per square inch
31st December - 595 (Plus) lbs. per square inch

Number of days on which well was in action during the month .... 31 days

Number of days on which well was shut down during the month .... Nil

Cum end Dec

28,641,256
2,464,400
31,105,656

Ed

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

PE.539

10th December 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter of the 8th instant, and for the copy of your November report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was 75,700 cubic feet per day during November.

Yours sincerely,

A. Laird

JMJ

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

8th December, 1958.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 30th November, 1958.

The supply continued uninterrupted during this period, but the intake was reduced from the 11th to the 13th November, 1958.

Yours sincerely,

p T.S. Ricketts

(T.S. Ricketts)
Chief Engineer

RAB.

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - NOVEMBER, 1958

Continuity of Supply .... Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 30th November, 1958. During the period 3 p.m. Tuesday, 11th November, to 4 p.m. Thursday, 13th November, 1958, the intake was reduced to allow the fitting of a new orifice in the natural gas governor at the Musselburgh works.

Volume supplied from Cousland to Musselburgh during the month (corrected)* .... 2,271,910 cubic feet   15,700

Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester) ....

- 6th November - 599.0 lbs. per square inch
- 18th November - 598 (minus) lbs. per square inch
- 27th November - 597.0 lbs. per square inch

Number of days on which well was in action during the month .... 30 days

Number of days on which well was shut down during the month .... Nil

Cum incl Nov. 26,205,696
2435,560
28,641,256

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

1011 27th November 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh, 3.

Dear Mr. Ricketts,

Many thanks for your letter dated 24.11.58.

I confirm that I will call on you at your office at 11.0 a.m. on Wednesday 3rd December 1958.

Yours sincerely,

A. Laird

AL/JMJ

Your reference: 1006

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

24th November, 1958

A. Laird, Esquire,
PB Exploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Notts.

Dear Mr. Laird,

Thank you very much for your letter of the 21st of November, 1958 from which I note that Mr. Adcock is in Trinidad but that you have taken over from him and would be pleased to visit Edinburgh for a preliminary talk with me on the question of underground gas storage.

I am glad that the first week in December would suit you for a meeting in Edinburgh, and perhaps you would care to call at my office at about 11 a.m. on Wednesday, the 3rd of December, 1958. I look forward to seeing you then.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts)
Chief Engineer

TSR/EWF

1006

21st Novembe 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh, 3.

Dear Mr. Ricketts,

Your letter dated 14.11.58, addressed to Mr. Adcock, has been passed on to me for reply.

About five weeks ago Adcock left for a six months tour of duty in Trinidad and I have taken over temporarily. I am reasonably familiar with the past work on Cousland and would certainly be very pleased to deputise for him and visit Edinburgh for a preliminary talk with you on this question of gas storage which I appreciate is rapidly becoming very important. As regards timing, the first week in December would suit me quite well and I could perhaps travel to Edinburgh on Tuesday 2nd December and call on you the next day.

Yours sincerely,

A. Laird

AL/JMJ

Scottish Gas Pan...
File.

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

14th December, 1958

C.M. Adcock, Esquire,
BP Exploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

As you know from the reports which have been passed to you the supply of natural gas from Cousland is still proceeding smoothly, and we are looking round for ways and means of using the gas at a faster rate than hitherto. From the reports, I see that the pressure in the Well is falling very slowly and the chances of obtaining a fair volume of gas from the well before it is exhausted seem very good.

I am now thinking of the steps which will be necessary to store gas underground when the Well becomes exhausted, and in this connection I would be very glad to have a chat with you. I am wondering whether it would be possible for you to come to Edinburgh and talk over this matter with me. As you also know arrangements are being made to commence drilling at the Salsburgh well near Glasgow at the end of this year or early next year, and the whole question of underground storage is one that is very important to us at the present time.

Perhaps you will letme know whether you think you can manage to visit Edinburgh during the next few weeks.

Yours sincerely,

T S Ricketts

(T.S. Ricketts)
Chief Engineer

TSR/EWF

PE.523 14th November 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter of the 12th instant, and for the copy of your October report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was 74,000 cubic feet per day during October.

Yours sincerely,

A. Laird

JMJ

llu/

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

12th November, 1958.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st October, 1958.

Yours sincerely,

p. T.S. Ricketts.

(T.S. Ricketts)
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - OCTOBER, 1958

Continuity of Supply	Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 31st October, 1958.
Volume supplied from Cousland to Musselburgh during month (corrected)*	2,281,290 cubic feet
Pressure at wellhead during the month (to nearest 0.5 pounds per square inch by deadweight pressure tester)	7th October - 601.0 lbs. per square inch 24th October - 599.5 lbs. per square inch
Number of days on which well was in action during the month	31 days
Number of days on which well was shut down during the month	Nil

74.000

cin ed Oct 23,933,786
2271,910
Ed Noo 26 205,696

* Corrected to 30 inches of Mercury and 60° Fahrenheit.

Cousland File

13th October, 1958.

Dear Miss Brookes,

We thank you for your letter of 14th September requesting certain information concerning the production of petroleum and natural gas in the United Kingdom for the Statistical Year-book of the World Power Conference.

You will note that all the gas wells capable of production are shut in, apart from Cousland No. 1 which has been producing to Musselburgh since the end of October 1957.

The figures for the number of wells are, of course, cumulative ones, and the number of wells drilled in any one year can be determined by subtraction.

This confirms our telephone conversation of today's date.

Yours sincerely,

R. J MILWARD.

Miss E.M. Brookes,
Ministry of Power,
Petroleum Division,
Thames House South,
Millbank, S.W.1.

Encl.

cc: Mr. C.M. Adcock.

PE.489

9th October 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter of the 6th instant, and for the copy of your September report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was 66,000 cubic feet per day during September.

Yours sincerely,

C.M. Adcock

CMA/JMJ

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

6th October, 1958.

C.M. Adcock, Esquire,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
NOTTINGHAM.

Dear Mr. Adcock,

Natural Gas - Cousland

I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 30th September, 1958, from which it will be seen that the supply continued uninterrupted during this period.

Yours sincerely,

For T.S. Ricketts

(T.S. Ricketts)
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - SEPTEMBER, 1958.

Continuity of Supply	Gas was supplied uninterrupted from Cousland to Musselburgh during the period from 1st to 30th September, 1958.
Volume supplied from Cousland to Musselburgh during the month (corrected)*	1,971,460 cubic feet. 651
Pressure at wellhead during the month (to the nearest 0.5 pound per square inch by deadweight pressure tester)	5th September - 602.5 lbs. per square inch 12th September - 602.0 lbs. per square inch 18th September - 601.5 lbs. per square inch 25th September - 601.0 lbs. per square inch
Number of days on which well was in action during the month	30 days
Number of days on which the well was shut down during the month	Nil

21,652,496
2281,290
End Oct 23,933,786

* corrected to 30 inches of mercury and 60° Fahrenheit.

1+2

PE.466

9th October

~~11th September~~ 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts, September

6th

Many thanks for your letter of the ~~8th~~ instant, and for the copy of your ~~August~~ report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was ~~56,000~~ cubic feet per day during ~~August.~~

66,000 September.

Yours sincerely,

C.M. Adcock

CMA/JMJ

THE SCOTTISH GAS BOARD
26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

8th September, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

I enclose a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st August, 1958. On two occasions during the period, the supply was interrupted, the reasons for the interruptions being given in the report.

Yours sincerely,

T. S. Ricketts
(T.S. Ricketts)
Chief Engineer

JMB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - AUGUST, 1958

Continuity of Supply	Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 31st August, 1958, except from 10 a.m. to 1 p.m. on the 6th of August, when it was necessary to shut down the system to repair a leaking welded joint on the drain/water level gauge connection at the water separator also from 9 a.m. on the 12th August to 11 a.m. on the 14th August for the internal inspection of governors.
Volume supplied from Cousland to Musselburgh during month (corrected)*	1,726,140 cubic feet.
Pressure at wellhead during the month (to the nearest 0.5 lb. per square inch by deadweight pressure tester)	7th August - 603.5 lbs. per square inch 15th August - 603.5 lbs. per square inch 28th August - 603.0 lbs. per square inch
Number of days on which well was in action during the month	28 days
Number of days on which well was shut down during the month	3 days

56,000

19.6

19,681,036
1,971,460

$\frac{1}{1,726} = 0.58$ p.s.i. per M. ft3

21,652,496

* Corrected to 30 inches of Mercury and 60° Farenheit.

PE.435

11th Sept.
~~8th August~~ 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

1 + 2
Chg

Dear Mr. Ricketts,

Many thanks for your letter of the ~~6th~~ 8th instant, and for the copy of your ~~July~~ August report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was ~~54,000~~ 56,000 cubic feet per day during ~~July~~ August.

Yours sincerely,

C.M.Adcock

CMA/JMJ

Gas Council

Note on visit to Cousland 30th July, 1958.

With the assistance of Mr. Keddie, General Mining Manager of Scottish Oils Ltd., and Mr. Gloag, of the Scottish S.E. Gas Board, the underground mine workings of Messers. Bain Brothers at Cousland were inspected. They are driving their main gallery (20 feet wide) straight towards the well, and many additional galleries are also planned in this general direction. The Cousland No. 1 well is situated almost at the centre of the area of their operations, and of the area in which the mineral rights have been leased to them by The Stair Estates Ltd. A survey of this area is being made, and we have been promised a copy of the survey (N.B. they have since established that the nearest workings are only 160 feet from the well). A safe area was considered by Mr. Keddie as 150 feet from the well, due to the fissured nature of the limestone. Shots of 1¾ lbs. of gelignite are used to blast the centre of the limestone, which is consequently widened out top and bottom. The limestone mined is 8 ft. thick with 2 tons per cubic yard, of which 75% is extracted. It is milled and sold to merchants at 26/3d. per ton, or 31/3d. per ton direct as a fertilizer with 93% lime content. The royalty paid to Stair Estates is 10d. a ton. It was calculated that a pillar of 150 feet around the well would immobilize 31,300 tons.

Subsequently a meeting was held in the Oxenfoord Estate Office, Ford (not far from Cousland), of The Stair Estates Ltd. with the factor, Mr. G. Rowan Hamilton, and Mr. Thomas Messer, a partner with Bain Brothers. Mr. Messer agreed that, until such time as we can work out a permanent agreement upon which also depended a permanent agreement with The Stair Estates for leasing the well site in the event of a permanent production scheme, he would not work within a safe distance of 150 ft. from the borehole. He was not so much concerned with any compensation as not to be disturbed in his business, or suffer any interruption of his supplies with consequent loss of customers. A loss of profit and royalty as compensation was mentioned by the factor. This could, no doubt, be settled as value in situ.

Any agreement reached will have a bearing on the development of the field, and the conclusion of an agreement with Stair Estates on the right of entry for permanent production. The Scottish Gas Board are at present thinking of a plan to drill another well close to No. 1, and exhaust the reservoir rapidly for eventual use as underground storage (the legal ownership of which is not clear).

Eakring are requested to supply a plan with logs of other wells drilled in the area, and details of the casing with specifications. When all these are assembled sometime in September, it is hoped to consider making a further offer to Mr. Messer (who is on holiday during August), when it might be possible to reduce the safety area in view of the small amounts of explosive used. Meantime the position, which must seriously affect any future plans for Cousland, has been fully explained to Mr. Brewer, Secretary of the Gas Council, who will in turn notify the Scottish Gas Board.

(Sgd.) R.J. MILWARD.

p.p. C.E. Woodbridge.

20th August, 1958.

c.c. Mr. W.H. Dowling
Mr. A.F. Matthews
Mr. Watson)
Mr. Adcock ✓) Eakring.

25th July, 1958.

Dear Mr. Ricketts,

<u>Cousland - Natural Gas</u>

I shall be visiting Edinburgh on Wednesday and Thursday next week to see Messrs. Bain Brothers and the factor of The Stair Estates, in order to open negotiations for the settlement of our working rights as Licence Holders over the Cousland No. 1 well site. I have already made arrangements for meeting these people. Mr. Barrett of our Legal Department has been in communication with Mr. Ramsay, and has advised him of my visit, and that I intend to call upon him.

I will discuss with Bain Brothers the question of the survey they were undertaking of their workings, as if we can come to an agreement it will not be necessary to send a representative.

Yours sincerely,

C. E. WOODBRIDGE

C.E. Woodbridge.

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
EDINBURGH 3.

c.c. Mr. Adcock, Eakring.

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

6th August, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

I am now enclosing a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st July, 1958. The item referred to under "continuity of supply" involved the installation of an excess-pressure safety cut-off valve in the wellhead governor house by Scottish Oils Limited. This valve was included in the original design and is not a recent amendment to the wellhead governor house pipework.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts)
Chief Engineer

RAB/RC.

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - JULY, 1958

Continuity of Supply	Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 31st July, 1958, except from 10 a.m. to 3 p.m. on the 22nd of July for the installation of a safety cut-off valve.
Volume supplied from Cousland to Musselburgh during month (corrected)*	1,681,650 cubic feet. 54,000

The intake of natural gas was at a reduced rate during the local "Trades Holiday" period of the 5th to 19th July.

Pressure at wellhead during the month (to nearest 0.5 lb. per square inch by deadweight pressure tester)	14th July - 604.5 lbs. per square inch 24th July - 604.0 lbs. per square inch 31st July - 604.0 lbs. per square inch
Number of days on which well was in action during the month	31 days
Number of days on which well was shut down during the month	Nil

17,954,896
1,726,140
19,681,036

$\frac{0.5}{1.68}$ =
0.3 lbs per M ft3

* Corrected to 30 Inches Mercury and 60° Fahrenheit.

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

5th August, 1958.

C.M. Adcock, Esquire,
BP Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Notts.

Dear Mr. Adcock,

Cousland - Natural Gas

I enclose a copy of a letter which I have received from Messrs. Duff and Geddes, the Civil Engineers who have been dealing with the survey of the limestone workings at Cousland. I have written to Mr. C.E. Woodbridge at Britannic House informing him of this development and I have asked him if he could arrange for the necessary information to be provided.

Yours sincerely,

T.S. Ricketts

(T.S. Ricketts)
Chief Engineer

JMB/RC.

DUFF AND GEDDES.
Chartered Civil and Structural Engineers
and Mining Engineers
D. Kerr Duff. F.R.S.E. M.I.C.E. M.I.W.E. M.I.Struct.E.

Associated Consultants
Sir J.D. Ramsay. Bt. M.V.O. F.R.I.C.S. A.R.S.M.
Dr. J.E. Richey. M.C. F.R.S. F.G.S.
Telephone Cal. 5821

JDR/JBJ

21 Young Street.
Edinburgh, 2. 4th August 1958.

The Scottish Gas Board,
26/27 Drumsheugh Gardens,
EDINBURGH.

Dear Sirs,

Cousland Limestone Mine
Nunnery Quarry

We beg to inform you that as a result of the recent survey carried out by ourselves at the above Quarry, it appears that the nearest working face to the Gas borehole is 160 feet. There are two headings approximately this distance from the borehole.

We are writing Messrs. Bain Brothers, the Lessees of the Limestone, asking them to furnish us with an approximate figure for the monthly advance of these faces.

We would be obliged if your Engineers would indicate to us the size of the pillar which they think should be left round the borehole.

Yours faithfully,

J. D. Ramsay

For DUFF and GEDDES.

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

1 copy please CMA

11th July, 1958.

C.M. Adcock, Esq.,
BP Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Notts.

Dear Mr. Adcock,

Cousland - Natural Gas

Thank you for your letter of 7th July, 1958 referring further to the position regarding the quarrying operations in the vicinity of Cousland.

I asked Mr. Cox yesterday to endeavour to find out definitely the date on which the surveyor employed by Bain Brothers will be visiting the site to carry out his survey. Unfortunately, however, Bain Brothers cannot yet give us a definite date and have said that they may be able to give us notice only about three days prior to the visit. I have asked the Edinburgh and South-Eastern Division to keep very closely in touch with Bain Brothers in this matter and we will telephone you as soon as we have further information.

Yours sincerely,

T. S. Ricketts

(T. S. Ricketts)
Chief Engineer.

DCE/MA

45

H 2
Ug

PE.417

~~10th July 1958~~
8th Aug.

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter of the ~~7th~~ 6th instant, and for the copy of your ~~June~~ July report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was ~~60,000~~ 54,000 cubic feet per day during ~~June~~ July.

Yours sincerely,

C.M.Adcock

CMA/JMJ

THE SCOTTISH GAS BOARD
26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

7th July, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

I am now enclosing a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 30th June, 1958. The alteration referred to in the note of "continuity of supply" involved the replacing of the two existing I.V. pressure controllers by two pressure controllers designed and built by the Bryan Donkin Company Limited, in order to try out this design. There is no change in the working conditions.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts)
CHIEF ENGINEER pp

RAB/AH

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - JUNE, 1958

Continuity of Supply	Gas was supplied uninterrupted from Cousland to Musselburgh during the period 1st to 30th June, 1958 except from 10 a.m. on the 12th of June, 1958 to 11 a.m. on the 13th of June, 1958 in order that alterations could be undertaken to the governor.
Volume supplied from Cousland to Musselburgh during month (corrected)*	1,732,010 cubic feet 60,000
Pressure at wellhead during month (to nearest 0.5 lb. per square inch by deadweight pressure tester)	2nd June - 605.0 lbs. per square inch 9th June - 605.0 lbs. per square inch 16th June - 605.0 lbs. per square inch 24th June - 604.5 lbs. per square inch 15.93
Number of days on which well was in action during month	29 days
Number of days on which well was shut down during month	1 day

16,273,246
1,681,650
17,954,896

$\frac{1 \text{ lb}}{1.73} = 0.58$ lb per M ft³

* Corrected to 30 Inches Mercury and 60° Fahrenheit.

PE.414 7th July 1958

Dear Alistair,

Many thanks for your letter of the 3rd instant giving details of the progress of the Cousland negotiations. I consider that the proposal to avail ourselves of the good offices of Scottish Oils is an excellent one. The Scottish Gas Board found Scottish Oils most helpful when the wellhead plant was being installed under their supervision.

I have to-day received from the Scottish Gas Board drawing No.383/25A showing the relation of the underground workings to the surface structures at Cousland, which I am forwarding on to you. It gives a clear picture of the present position and future proposals, and should be helpful to our representative when considering Cousland matters.

Copies of my correspondence with the Scottish Gas Board are attached herewith.

Yours sincerely,

C.M. Adcock

A.F. Matthews, Esq.,
Exploration Dept.,
Britannic House.

CMA/JMJ

Telephone
National 1200.

Britannic House,
Finsbury Circus,
London, E.C.2.

3rd July, 1958.

Dear Milton,

Thank you for your letter PE.394 of the 23rd June forwarding a letter from the Scottish Gas Board's Solicitor of 19th June.

Our Legal Department have now spoken to the Solicitor to the Scottish Gas Board. They told him that our intention was to approach the mineral lessees with a view to obtaining their agreement to restrict their workings beyond a fixed "safety boundary", and that we would probably be prepared to pay them something by way of compensation - since otherwise we might have difficulty in obtaining the consent of the freeholders to our continuing to use the bore hole. We would, however, first need to clear this approach with the Gas Council, who were indemnifying us under the terms of the Gas Council Agreement. Meanwhile we were writing at once to Bain Brothers to warn them of the dangers of working in the vicinity of the bore hole.

Ramsey agreed with the above course and that the approach should be made by BP (with the assistance of the Scottish Gas Board) rather than by the Gas Board alone. For his part Ramsay was himself in contact with the Solicitors to the Stairs Estates, and was ascertaining the facts as to the exact standing of the various parties etc. and the terms of the Mineral Lease.

We have now received provisional approval of the Gas Council to proceeding on this basis subject, of course, to their agreement of the amount of any compensation which it may be decided eventually that it is necessary to pay.

The way is, therefore, now open to a visit by our representative to Scotland to open negotiations both for settlement of this minor problem and the renewal of working rights with the Stair Estates in a manner which will enable long-term commercial production of the gas to be undertaken. I discussed this with Mr. Watson on 1st July and he requested me that in view of the heavy pressure on your section at the moment, the negotiation ~~is to~~ be undertaken from here. We shall accordingly shortly be sending a representative, availing ourselves of the good offices of Scottish Oils.

We will keep you informed.

Yours sincerely,

Alistair Macleod Matthews

M. Adcock, Esq.,
BP Exploration Co. Ltd.,
EAKRING.

PE.413 7th July 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letters dated 30th June and 4th July. Thank you also for your drawing No.383/25A showing the relation of the underground workings to the surface structures at Cousland, as at 19th June 1958.

This drawing gives a clear picture of the quarrying which has taken place, and of the future development programmed. I am forwarding it to our London Office to give our representative an opportunity of studying it before he visits the site, and negotiations are opened both with Bain Brothers and the Stair Estates.

We are also hoping that Scottish Oils will be able to look after our interests; and this arrangement will provide you with a local contact, which I am sure you will find as convenient in the future as you have done in the past.

Yours sincerely,

C.M.Adcock

CMA/JMJ

1 Copy
[illegible]

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

4th July, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

With further reference to our recent correspondence regarding the underground workings by Bain Brothers, the quarrying firm working at Cousland, I am now enclosing a copy of a drawing prepared by the Edinburgh and South-Eastern Division to show the extent of the workings at 19th June, 1958. This drawing may be of some assistance to your representative when he visits the site this month.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts) pp [illegible]
CHIEF ENGINEER

DCE/AH

1 copy please

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

Your reference: PE.404 30th June, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

1 copy to Mr. Woodbridge.

Dear Mr. Adcock,

Cousland Natural Gas

Thank you for your letter of 27th June, 1958, from which I was very pleased to see that you are arranging for a representative to be present when the consultant employed by Bain Brothers is carrying out his survey in the vicinity of Cousland. I have informed Mr. Beavis, that you have made this arrangement and have asked him to let me know as soon as he has found out when the survey is likely to begin. We shall, of course, keep you informed about all developments in this connection.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts) pp
CHIEF ENGINEER

DCE/AH

PE.404

27th June 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh, 3.

Dear Mr. Ricketts,

Thank you for your letter dated 25th June and for the information that Messrs. Bain Brothers have arranged to carry out a mine survey in the vicinity of Cousland, early in July.

I have spoken to our Mr. C.E. Woodbridge at Britannic House, who, as you know, has been in communication with Messrs. Bain Brothers; and he agrees that we should also arrange for our representative to be present during the mine survey, in accordance with your suggestion.

If you will let me know as soon as possible when the Survey is likely to commence, I will pass this information on to Mr. Woodbridge, so that he can make his own arrangements.

Yours sincerely,

C.M. Adcock

cc. Mr. C.E. Woodbridge,
Britannic House.

CMA/JMJ

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

1 Copy
Chs

25th June, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Cousland Natural Gas

I have now heard from Mr. Beavis that the quarrying firm of Bain Brothers have arranged for their surveyors to carry out a mine survey in the vicinity of Cousland early in July, 1958. They have agreed that a member of our staff can attend during the survey, but it occurred to me also that you might wish either to be present yourself or to send a representative.

I have asked Mr. Beavis to let me know as soon as he hears that the survey is likely to commence.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts) pp
CHIEF ENGINEER

DCE/AH

24th June, 1958.

Dear Mr. Watson,

Cousland No. 1

With reference to a letter addressed to Mr. Adcock by the Scottish Gas Board dated 28th May, 1958, requesting full particulars of the agreement with Stair Estates, and which letter was forwarded by you under cover of your letter to Mr. Lowson of 30th May, will you please note that we have spoken to the Scottish Gas Board, and are taking up the matter with the Gas Council, as they are concerned with any expenses which we incur whilst acting on their behalf as licensees.

In the meantime, we have written to Bain Brothers, who we understand are the firm carrying out quarrying operations in the vicinity of the Cousland No. 1 Borehole, to warn them that they should cease operations within an area which would be dangerous or likely to cause an explosion, accident or damage to the production scheme, pending further talks which we shall arrange, owing to our responsibility as licence holders, after we have spoken to the Gas Council.

Yours sincerely,

C. E. WOODBRIDGE

W.M. Watson, Esq.,
BP Exploration Co. Ltd.,
P.O. Box 1,
Southwell,
Notts.

c.c. Mr. Adcock.

PE.394 23rd June 1958

My dear Alistair,

I believe you were away when I forwarded to London the letter I received from The Scottish Gas Board's Solicitor dated 28th May.

Apparently there has been no communication with the Scottish Gas Board's Solicitor, for I have to-day received another letter from him. As you are handling the legal position at Cousland I am forwarding this letter to you straight away, unanswered; and I trust that you will acknowledge it and deal with the matter raised.

Yours sincerely,

C.M.Adcock

A.F. Matthews, Esq.,
Exploration Dept.
Britannic House.

CMA/JMJ

PE.391

20th June 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Thank you for your letter of the 17th instant, together with enclosures, which I am forwarding to our London Office for their attention.

Yours sincerely,

C.E. Woodbridge
BP. Expl. Co. Lᵈ. C.M.Adcock

CMA/JMJ

1+ Copy

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

17th June, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Cousland Natural Gas

For your information I am enclosing a copy of a letter just received from Edinburgh and South-Eastern Division, together with a copy of a letter from Bain Brothers, Cousland Lime Works. From these letters you will note that Bain Brothers are intending shortly to recommence working in the region of the Cousland natural gas well and that they anticipate that they will come within 140 feet of the bore.

With reference to the final sentence in the letter from Edinburgh and South-Eastern Division, I have asked the Board's Solicitor to get in touch with your legal people again so that we can be informed of the legal position at Cousland as soon as possible.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts) pp
CHIEF ENGINEER

DCE/AH

1 copy please
Cha

PE.362 21st May 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh, 3.

Dear Mr. Ricketts,

Further to our telephone conversation yesterday, I confirm that it is our considered opinion that it would be most dangerous for the quarrying operations to proceed any nearer to the Cousland Well 1 bore hole than the 100' already reached.

The danger is of course that earth movements, resulting from the firing of explosives etc, will cause the casing to split, and hence the escape of gas at 600 lbs pressure. This could be most dangerous in the quarry itself, where men's lives would be endangered, owing to the double risk of fire and explosion.

We began drilling the well on 5th September 1937, and to the best of our knowledge and belief the quarry was disused in those days. In fact, we used the quarry to burn off the gas when we tested the well. However, we did have an agreement with the Stair Estates, and we are looking into the particulars of this agreement.

I trust that this is the information you are requiring.

Yours sincerely,

C.M.Adcock

CMA/JMJ

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

Your ref: PE.376 9th June, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

Thank you for your letter of 5th June, 1958 letting me have your comments on the implications of observations made so far in connection with the removal of natural gas from the well at Cousland. I appreciate from your remarks, that it is difficult for you to give a definite estimate of the reserve at this stage. I shall be very pleased, however, to hear from you if your views are at any time changed by the conditions revealed by our future reports.

Thanking you again for your continued help in this matter,

Kind regards,

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts) pp
CHIEF ENGINEER

DCE/AH

417
~~PE.382~~

1+1
Ch.9

10th July 1958
~~9th June 1958~~

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

June

~~Many~~ thanks for your letter of the 7th instant, and for the copy of your ~~May~~ report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was ~~63,000~~ cubic feet per day during ~~May~~.

60,000 June.

Yours sincerely,

C.M.Adcock

CMA/JMJ

THE SCOTTISH GAS BOARD
26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

7th June, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

I am now enclosing a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st May, 1958.

Yours sincerely,

T. S. Ricketts.

(T.S. Ricketts)
CHIEF ENGINEER

RAB/AH

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - MAY, 1958

Continuity of Supply	Gas was supplied from Cousland to Musselburgh during the period 1st to 31st May, 1958. There were no stoppages during the month.
Volume supplied from Cousland to Musselburgh during month (corrected)*	1,950,080 cubic feet = 63,000
	/31
Pressure at wellhead during month (to nearest 0.5 lb. per square inch by deadweight pressure tester)	5th May - 606.5 lbs. per square inch 12th May - 606 + lbs. per square inch 20th May - 606.0 lbs. per square inch 26th May - 605.5 + lbs. per square inch
Number of days on which well was in action during month ...	31 days 14.25
Number of days on which well was shut down during month ...	None

* Corrected to 30 inches Mercury and 60° Fahrenheit.

$\frac{16}{1.95}$ = 0.51 lb. per M ft3

14,541,236
1,732,010
16,273,246

PE.376 5th June 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter dated 2nd June, in which you ask whether it is possible to form any conclusions as to the extent of the gas reserves to be obtained from Cousland Well No.1, as a result of the data obtained since the well was put on production in October 1957.

I have not yet received a copy of your May report, but I presume that the cumulative gas production to-date is about 15 million cubic feet. The production tests have gone so far very much as anticipated, in that there has been no reservoir water production, and that the pressure decline has been about 1 p.s.i. for every million cubic feet of gas production.

If there is no change in the well performance, and you continue to draw off gas at the present rate until the wellhead pressure had dropped to 100 p.s.i., then some 500 million cubic feet of gas would have been obtained. You are now producing at a rate of approximately 27 million cubic feet per year, and the gas supply from Well No.1 should therefore last about 20 years.

However, it must be borne in mind that this estimate is based on the rather small production of 15 million cubic feet. It is probable that the pressure decline will diminish in due course; and the ultimate production from Well No.1 could still greatly exceed the gas reserves which can so far be envisaged.

I am sorry I cannot be more definite, but I trust that this general appraisal of the Cousland position will be of assistance to you.

Yours sincerely,

C.M.Adcock

CMA/JMJ

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

2nd June, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottinghamshire.

Dear Mr. Adcock,

Natural Gas - Cousland

As you are aware, there has been a continuous usage of natural gas from the well at Cousland since October, 1957. I would be interested to learn if, from the data submitted since that time, you have been able to come to any new conclusions regarding the extent of the reserve and the possible life of the well. You will appreciate that we would be particularly interested to obtain some idea of the extent of the reserve at Cousland as soon as possible.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts)
CHIEF ENGINEER pp

DCE/AH

1+2/Chas

PE.343

9th June
~~8th May~~ 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter of the ~~6th~~ 7th instant, and for the copy of your ~~April~~ May report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was ~~75,000~~ 63,000 cubic feet per day during ~~April~~ May.

Yours sincerely,

C.M.Adcock

CMA/JMJ

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

6th May, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham

Dear Mr. Adcock,

... As arranged, I am enclosing a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 30th April, 1958.

The only unusual item is that on four occasions the supply of gas from the well was partially reduced due to hydrate formation.

Yours sincerely,

T. S. Ricketts

(T. S. Ricketts) [initials]
Chief Engineer.

JMB/MA

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - APRIL, 1958

Continuity of Supply .... Gas was supplied from Cousland to Musselburgh during the period 1st to 30th April, 1958. The supply of gas from the well was reduced due to hydrate formation on the following occasions:

1) From 9 p.m. on 4th April 1958 to 1 p.m. on 5th April 1958,
2) From 9 a.m. on 11th April 1958 to 1 p.m. on 13th April 1958,
3) From 4 a.m. to 12 noon on 24th April 1958, and
4) From 5 a.m. to 11 a.m. on 25th April 1958.

Volume supplied from Cousland to Musselburgh during month (corrected)* .... 2,260,870 cubic feet — 75,000

Pressure at wellhead during month (to nearest 0.5 lb. per square inch by deadweight pressure tester) ....

6th April - 608.0 lbs. per square inch

13th April - 608.0 lbs. per square inch

20th April - 606.5 lbs. per square inch

27th April - 606.5 lbs. per square inch

↑ 12:4

Number of days on which well was in action during month .... 30 days

Number of days on which well was shut down during month .... None (but see remark under heading "Continuity of Supply")

* Corrected to 30 inches Mercury and 60° Fahrenheit.

12,591,156
1,950,080
14,541,236

$\frac{2\text{lb}}{2.26}$ = 0.9 lbs per million ft³

1+2 / Cla

PE.323 9th April 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3

Dear Mr. Ricketts, April

Many thanks for your letter of the ~~7th~~ 6th instant, and for the copy of your ~~March~~ report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester.

I note that the average rate of gas offtake from the well was ~~76,000~~ 75,000 cubic feet per day during ~~March~~ April.

Yours sincerely,

C.M.Adcock

CMA/JMJ

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

~~REPLY TO SECRETARY~~

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

7th April, 1958.

Dear Mr. Adcock,

As arranged, I am enclosing a copy of our latest return to the Gas Council with reference to the supply of natural gas from Cousland to Musselburgh during the month ended 31st March, 1958.

The only unusual feature of the statement this month is the minor interruption of supply between the hours of 5 p.m. and 9 p.m. on Saturday 22nd March, 1958, due to hydrate formation; there has been no recurrence of this.

Yours sincerely,

T.S. Ricketts

(T.S. Ricketts)
CHIEF ENGINEER pp

DCE/AH

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - MARCH, 1958

Continuity of Supply	Gas was supplied from Cousland to Musselburgh during the period 1st to 31st March, 1958. There were minor interruptions of gas supply between the hours of 5 p.m. and 9 p.m. on Saturday 22nd March, 1958 due to hydrate formation.
Volume supplied from Cousland to Musselburgh during month (corrected)*	2,358,150 cubic feet 76,000
Pressure at wellhead during month (to nearest 0.5 lb. per square inch by deadweight pressure tester)	3rd March - 610.5 lbs. per square inch
	10th March - 610.0 lbs. per square inch
	17th March - 609.0 lbs. per square inch
	24th March - 608.5 lbs. per square inch 9.78
Number of days on which well was in action during month ...	31 days
Number of days on which well was shut down during month ...	None (but see remark under heading "Continuity of Supply")

10,330,286
2,260,870
12,591,156

* Corrected to 30 inches Mercury and 60° Fahrenheit.

2

PE.293

10th March 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter of the 6th inst, and for the copy of your February report for the Cousland gas production, including the wellhead pressures taken with the deadweight tester. You are now obtaining consistent results for the wellhead pressures, which will be required eventually for an assessment of the performance of this reservoir.

I was interested to note that you have stepped up the average rate of gas offtake from the well to 75,000 cubic feet per day.

Yours sincerely,

C.M.Adcock

CMA/JMJ

THE SCOTTISH GAS BOARD
26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

6th March, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

In accordance with our standing arrangement, I am now enclosing a copy of the report which we have sent to the Gas Council referring to natural gas taken from the well at Cousland in February.

You will note that we are now incorporating the results of the weekly pressure tests taken with the deadweight tester, including the latest reading on the 3rd March, 1958.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts)
CHIEF ENGINEER

DCE/AH

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - FEBRUARY, 1958

Continuity of Supply	Gas was supplied from Cousland to Musselburgh daily during the period 1st to 28th February, 1958. During the month there have been no enforced stoppages of gas supply for any reason.
Volume supplied from Cousland to Musselburgh during month (corrected)*	2,098,540 cubic feet
Pressure at wellhead during month (to nearest 0.5 lb. per square inch by deadweight pressure tester)	10th, 17th and 24th February - 611.5 lbs. per square inch 3rd March - 610.5 lbs. per square inch
Number of days on which well was in action during month ...	28 days
Number of days on which well was shut down during month ...	None

75,000

8 2 M.C.F

7,972,136
2,358,150
10,330,286

* Corrected to 30 inches Mercury and 60° Fahrenheit.

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

Your ref: PE.276

22nd February, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Cousland Natural Gas

Thank you very much for your letter of 18th February, 1958. We appreciate the assistance given by your Mr. Kirby to our Edinburgh and South-Eastern Division when he visited Edinburgh on 13th February, 1958 to demonstrate the method of measuring wellhead gas pressures by means of the deadweight tester. It is of particular interest to know that there has been a pressure drop of 8.8 pounds per square inch since 11th November, 1956 and that this is equivalent to a rate of about 1.3 pounds per square inch per million cubic feet of gas.

With reference to your suggestion that the wellhead pressure should be checked with the deadweight tester not less than twice monthly, I have asked our Edinburgh and South-Eastern Division to arrange for weekly tests to be carried out until further notice. The dates of measurement and the pressures recorded will be included in our monthly returns of gas production to enable a close watch to be kept on any changes of pressure which may occur.

I have now confirmed with Edinburgh and South-Eastern Division that a second 2-pounds per square inch weight has been order from the Barnet Instrument Company Limited.

With thanks again for your advice and interest in the Cousland project.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts) pp
CHIEF ENGINEER

DCE/AH

PE.276

18th February 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

6.8 M.C.F

Dear Mr. Ricketts,

Many thanks for your letters dated 6th and 11th February. In accordance with our arrangement, Mr. Kirby demonstrated to Mr. Cairns on Thursday 13th February the method of measuring wellhead gas pressures accurately by means of the deadweight tester. The wellhead pressure recorded last Thursday 13th Feb. was 611.6 p.s.i.g.

In the Cousland report, dated 1st January 1957, it was shown that, at production rates around 100,000 cubic feet per day, there was no detectable difference between the following pressure and the closed-in pressure (See Table on page 9).

The closed-in pressure measured on 11th November 1956 was 620.4 p.s.i.g. (page7). There has been in consequence a pressure drop of 8.8 p.s.i. during the current production period. The Musselburgh meter reading on 13th February was 6,751,000 cubic feet. It will be noted that the current pressure decline rate is approximately 1.3 p.s.i. per million cubic feet of gas

It would be convenient if you would arrange to measure the wellhead pressure by deadweight tester not less than twice monthly; and if you would report these pressures, together with the dates of measurement, when you submit to us your monthly returns for the gas production. This will permit a closer study to be made of any changes which may occur in the pressure decline rate.

Mr. Kirby mentioned that you had only received one 2 p.s.i. weight for the Barnet deadweight tester. In my letter dated 31st October 1957, I stated that two 2 p.s.i. weights should be ordered. It is evident that the sum of the smallest weights must add up to 5 p.s.i., and the second 2 p.s.i. weight is definitely required.

I was pleased to learn that you have overcome the gas hydrate problem by wrapping the gas inlet pipe to the control room with an Electrothermal Armoured Heating cord, which you have lagged to conserve the heat, and to ensure its transfer to the gas stream.

Yours sincerely,

THE SCOTTISH GAS BOARD EDINBURGH AND SOUTH-EASTERN DIVISION

DATE 1/2/58.	COAL GAS			NATURAL GAS				MIXED GAS							
TIME	METER READING	HOURLY MAKE	C.V.	METER READING	HOURLY INTAKE	C.V.	PRESSURE	METER READING	HOURLY THRO'PUT	C.V. IN HOLDER	C.V. OUT HOLDER	STOCK NO.1.HOLDER	STOCK NO.2.HOLDER	H_2S	REMARKS
6.0a.m.		26630	415	61070	2870	915	4¼LBS.	707800	29500	480	460				
7.0		27060	410	64010	2940	915	"	737800	30,000	470	460				
8.0		26570	390	66940	2930	915	"	767300	29500	440	455				
9.0		27540	400	70100	3160	915	"	798000	30700	460	460				
10.0		26440	400	72860	2760	915	"	827800	29200	450	460				
11.0		27460	390	75800	2940	915	"	858200	30400	452	460				
12.0		27450	395	78850	3050	915	"	888700	30510	440	450				
1.0p.m.		26100	390	81750	2900	915.	"	917300	29000	445	450				
2.0		27000	400	84750	3000	920	"	947700	30,000	460	450				
3.0		26870	400	87680	2930	925		977500	29800	462	452				
4.0															
5.0															
6.0															
7.0															
8.0															
9.0															
10.0															
11.0															
12.0															
1.0a.m.															
2.0															
3.0															
4.0															
5.0															
6.0.															

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

11th February, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas - Cousland

I was sorry that I was not available when you telephoned this morning but I understand from Mr. Elgin that you suggested that Mr. Kirby of your firm should visit Cousland on Thursday 13th February, 1958, in order to demonstrate the use of the deadweight pressure testing equipment. As you know, it has been confirmed with our Edinburgh and South-Eastern Division that Mr. K.F. Cairns and his assistant will be available on that day.

As requested, Edinburgh and South-Eastern Division have booked a single room at the North British Station Hotel for the nights of Wednesday 12th and Thursday 13th February, 1958, and arrangements will be made to collect Mr. Kirby by car from the hotel at 9.30 a.m. on Thursday.

As Mr. Elgin informed you, Mr. Cairns confirmed that a supply of oil had been sent to us with the deadweight pressure testing equipment, and the weights supplied included small weights for fine determinations. The pressure hose has not yet been delivered but we understood from you that Mr. Kirby will be bringing a suitable hose with him.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts) pp
CHIEF ENGINEER

DCE/AH

Mr. Cairns — Wednesday in Transport in N.B. 9.30 am.

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

6th February, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

As arranged, I am enclosing a copy of the statement giving the Gas Council information on the operation of the natural gas well at Cousland during the month ended 31st January, 1958.

With regard to the wellhead pressure, you will note that this has been recorded as 620 lbs. per square inch gauge. The actual reading on the gauge is still 630 lbs. per square inch, but since my letter of 22nd January, 1958, I have been informed by our Edinburgh and South-Eastern Division that a further check test by Scottish Oils Limited showed a gauge error of 10 lbs. per square inch. This question of wellhead pressure will, of course, be cleared up as soon as we can carry out tests with the dead-weight tester. This instrument has now been delivered but we are still awaiting delivery of the special flexible connection for use with it. It has been promised within a few days, however, and I shall let you know immediately a successful check has been made.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts) pp
CHIEF ENGINEER

DCE/AH

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - JANUARY, 1958

Continuity of Supply	Gas was supplied from Cousland to Musselburgh daily during the period 1st to 31st January, 1958. During the month there have been no enforced stoppages of gas supply for any reason.
Volume supplied from Cousland to Musselburgh during month (corrected)*	2,107,850 cubic feet
	68,000 ft³/day
Pressure at wellhead at end of month	620 lbs. per square inch
Number of days on which well was in action during month ...	31 days
Number of days on which well was shut down during month ...	None

5,873,596
2,098,540
7,972,136

* Corrected to 30 inches Mercury and 60 degrees Fahrenheit

MR. A.F. MATTHEWS.

ARTICLE IN 'NATURE' WRITTEN BY STAFF OF SCOTTISH GAS BOARD

In 'Nature' for December 28th, 1957, pp.1444/45 an article appeared entitled "Natural Gas in Scotland" written by T.S. Ricketts and D.C.Elgin, Chief Engineer and Technical Officer respectively of the Scottish Gas Board. As the article contained some obvious geological errors, and we had not been informed about its impending publication, enquiries were made at Eakring, where it was discovered that BP had not been consulted at all.

The article contains both major and minor errors of fact which ought not to be perpetuated in a serious scientific journal of Nature's type, and a correcting note should be printed. Clearly if we were to do this without consulting with the Gas Council it would result in a serious impairment of relations. I therefore suggest that the Gas Council itself should be asked to publish the corrections, and in asking them to do so we should tactfully point out the unwisdom of any technical staff anywhere publishing data collected by others without asking the collectors to check the draft; also, as a matter of courtesy, they should have asked BP's permission before publishing its unpublished data.

The published article's major error is to be grossly unfair to the Geological Survey who, of course, did the essential surface mapping on which knowledge of the Cousland anticline is based.

The errors are listed on the attached sheet, the important ones being marked by an asterisk.

(Sgd.) N. L. FALCON

24th January, 1958.

c.c. Mr.Dowling
Mr.Lowson
Mr.Dickie
Mr.Doyle (General Dept.)
Senior Geologist, Eakring.
Mr.Adcock (Eakring) ✓

Encl:

1. The Cousland anticline is a well known feature on the geological maps published by H.M. Survey and has been known for a very long time; it was not discovered by D'Arcy Exploration Co. Ltd. (now known as BP Exploration Co. Ltd.). It was first tested shortly after World War I, during a Government inspired search for petroleum, near D'Arcy Farm (no connection with D'Arcy Exploration Co.) when a small amount of oil and gas was proved.

2. Most of the present sub-surface knowledge of the Cousland anticline was obtained by test drillings by D'Arcy Exploration Co. and the Anglo-American Oil Co. during the period 1937/39. It was at this time that the gas accumulation now being used by the Scottish Gas Board was discovered by D.E.C. The contribution of the well sunk in 1954 by BP Exploration Co. for the Gas Council was to define the limits of the gas accumulation on its south side.

3. The anticline runs north and south, not east and west, although the local crest maximum with the gas in it may have an east-west long axis.

4. The statement that the gas is "trapped within the sandstone strata which are in communication with the Cousland anticline" is meaningless to a geologist. The sandstones in which the gas occurs are an integral part of the Cousland anticline.

5. The main two gas sands proved in Cousland well 1. are 1582' - 1632' and 1720' - 1806' (not 1760' - 1806').
Both sands are subdivided into leaves.

6. The gas/water level in well 1. for the 1582' - 1632' sand is put at 1675' below the rotary table of the well from which measurements were made, not about 1700'.

7. The sand face reservoir pressure, i.e. at 1582' is 660 p.s.i.a., not 620 p.s.i.g.; the closed-in wellhead pressure (636 p.s.i.a.) is 621 p.s.i.g.

8. Water production was obtained when the 1720' - 1806' sand was produced, but has not so far been obtained during production tests of the 1582' - 1632' sand.

9. The original perforation in 1939 at Cousland was with 164 - ½" steel bullets. I have never heard of a copper shot.

10. The maximum production rate recorded during production tests on November 1956 was 3.56 million cubic feet per day at a calculated bottom hole pressure of 391 p.s.i.a., the back pressure production graph indicating an open flow potential of 4.5 million cubic feet per day. The figures of 4 million c.f.p.d. and 415 lb./sq.in. for bottom hole pressure are generalisations.

24.1.58.

27th January 1958

My dear Alistair,

As agreed with you, I am forwarding to you two copies of the Royalty Statement covering the production of natural gas at Cousland during the year 1957.

I have no record of the exact day in October when gas first reached the Musselburgh meter, but it was about the middle of the month, and before the official opening date on 28th October. The throughput quantities were then very small as the Edinburgh Division of the Scottish Gas Board experienced mechanical difficulties in the operation of their pressure regulators, and pipe line blockage due to Hydrate formation.

These difficulties have now been overcome, and for the purposes of the Royalty Statement I have taken the starting date as 1st October 1957. The Scottish Gas Board's returns give the productions in cubic feet at 30 inches mercury and 60 degrees Fahrenheit, in conformity with Statutory requirements; and I have tabulated these productions on a monthly basis for the last quarter of 1957.

I trust this gives you the information you are requiring.

Yours sincerely,

C.M.Adcock

A.F. Matthews, Esq.,
Exploration Department,
Britannic House.

CMA/JMJ

File (Cousland)
A65

MR. A.F. MATTHEWS.

ARTICLE IN 'NATURE' WRITTEN BY STAFF OF SCOTTISH GAS BOARD

In 'Nature' for December 28th, 1957, pp.1444/45 an article appeared entitled "Natural Gas in Scotland" written by T.S. Ricketts and D.C.Elgin, Chief Engineer and Technical Officer respectively of the Scottish Gas Board. As the article contained some obvious geological errors, and we had not been informed about its impending publication, enquiries were made at Eakring, where it was discovered that BP had not been consulted at all.

The article contains both major and minor errors of fact which ought not to be perpetuated in a serious scientific journal of Nature's type, and a correcting note should be printed. Clearly if we were to do this without consulting with the Gas Council it would result in a serious impairment of relations. I therefore suggest that the Gas Council itself should be asked to publish the corrections, and in asking them to do so we should tactfully point out the unwisdom of any technical staff anywhere publishing data collected by others without asking the collectors to check the draft; also, as a matter of courtesy, they should have asked BP's permission before publishing its unpublished data.

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The errors are listed on the attached sheet, the important ones being marked by an asterisk.

(Sgd.) N. L. FALCON

24th January, 1958.

c.c. Mr.Dowling
Mr.Lowson
Mr.Dickie
Mr.Doyle (General Dept.)
Senior Geologist, Eakring. ✓
Mr.Adcock (Eakring)

Encl:

1. The Cousland anticline is a well known feature on the geological maps published by H.M. Survey and has been known for a very long time; it
* was not discovered by D'Arcy Exploration Co. Ltd. (now known as BP Exploration Co. Ltd.). It was first tested shortly after World War I, during a Government inspired search for petroleum, near D'Arcy Farm (no connection with D'Arcy Exploration Co.) when a small amount of oil and gas was proved.

2. Most of the present sub-surface knowledge of the Cousland anticline was obtained by test drillings by D'Arcy Exploration Co. and the Anglo-American Oil Co. during the period 1937/39. It was at this time that the gas accumulation now being used by the Scottish Gas Board was discovered by D.E.C. The contribution of the well sunk in 1954 by BP Exploration Co. for the Gas Council was to define the limits of the gas accumulation on its south side.

3. The anticline runs north and south, not east and west, although the local
* crest maximum with the gas in it may have an east-west long axis.

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6. The gas/water level in well 1. for the 1582' - 1632' sand is put at 1675' below the rotary table of the well from which measurements were made, not about 1700'.

7. The sand face reservoir pressure, i.e. at 1582' is 660 p.s.i.a., not 620 p.s.i.g.; the closed-in wellhead pressure (636 p.s.i.a.) is 621 p.s.i.g.

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9. The original perforation in 1939 at Cousland was with 164 - ½" steel bullets. I have never heard of a copper shot.

10. The maximum production rate recorded during production tests in November 1956 was 3.56 million cubic feet per day at a calculated bottom hole pressure of 391 p.s.i.a., the back pressure production graph indicating an open flow potential of 4.5 million cubic feet per day. The figures of 4 million c.f.p.d. and 415 lb./sq.in. for bottom hole pressure are generalisations.

<u>24.1.58.</u>

BP EXPLORATION COMPANY LIMITED

LICENCE A 205

COUSLAND

Statement of Natural Gas production - 1st October 1957 to 31st December 1957 inclusive

	Cubic feet at 30 inches Mercury and 60 degrees Fahrenheit
Natural Gas won & saved	
October	219,175
November	1,582,307
December	1,964,264
NATURAL GAS LIABLE TO ROYALTY	3,765,746

3,765,746
2,107,850
5,873,596

Royalty 2d per 1000 cubic feet i.e. circa £ 31-7-0

27th January 1958
CMA/JMJ

THE SCOTTISH GAS BOARD
26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

Your ref: PE/237

22nd January, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

With reference to the second paragraph of your letter of 21st January, 1958 and to our previous correspondence, I now confirm that the difference between the gas production given for the Cousland natural gas well for the year ended 31st December, 1957, and the sum of the productions for the months of November and December, 1957 represented the production during the month of October, 1957 which was 219,175 cubic feet at 30 inches of mercury and 60° Fahrenheit.

I had intended to submit this information after the position regarding the pressure at the Cousland wellhead had been clarified. In this connection I have been informed today that the pressure gauge, which has recently been showing a reading of 630 lbs. per square inch, has been tested by Scottish Oils Limited and found to have an error of 5 lbs. per square inch. The gauge is to be refitted at Cousland tomorrow, and we will keep it under careful observation.

You will, of course, appreciate that with the close calibration of this gauge it is difficult to take readings within 5 lbs. per square inch. We appreciate that the deadweight tester is essential for accurate reading and I asked our Edinburgh and South-Eastern Division to write to their suppliers to press delivery.

Yours sincerely,

T Ricketts

(T.S. Ricketts)
CHIEF ENGINEER

DCE/AH

PE.237

21st January 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letters dated 14th and 16th January, and I was interested to learn that you are having a discussion with the Geological Survey on the Valleyfield Colliery district.

With regard to the production of Cousland natural gas, we have to submit our Royalty Statement to the Ministry by the end of this month; and I am requiring your confirmation that the October production was 219,175 cubic feet at 30 inches of mercury and 60 degrees Fahrenheit. I trust that you will be able to let me have this information very shortly.

Yours sincerely,

C.M.Adcock

CMA/JMJ

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

16th January, 1958.

C.M. Adcock, Esquire,
BP Ecploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

I am writing with reference to your letter of 31st December and my subsequent telephone conversation with you concerning the monthly details of Cousland gas production.

As I explained to you, the monthly production figures are transmitted to your London office via the Gas Council, this being in accordance with our instructions from the Gas Council, and I quite thought that you would be obtaining the figures from your London office. However, I am only too anxious to see that you are supplied with these figures and I am therefore arranging for a copy of the monthly production figures to be sent direct to you at the same time as they are sent to the Gas Council.

I hope you will let me know if there is any further information you may require.

With regard to the possibility of natural gas or firedamp from the area in the vicinity of Valleyfield Colliery, I have written to the Assistant Director of the Geological Survey of Great Britain and, whilst he does not anticipate that he can supply me with very much information, I have nevertheless arranged to meet him next Tuesday, 21st January. I am also arranging to meet Mr. MacGregor, the Divisional Geologist of the Scottish Division of the National Coal Board in respect of the same matter.

I will keep you informed of any information which I may obtain from either of these sources.

Yours sincerely,

T S Ricketts

(T. S. Ricketts)
Chief Engineer

TSR/EWF/MA

Your reference: PE.228

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

14th January, 1958

C.M. Adcock, Esquire,
BP Exploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

Natural Gas at Cousland

Thank you for your letter of 13th January 1958. I am looking into the matters which you have raised, and I will be letting you have further particulars as soon as possible.

With regard to the delivery of the deadweight tester equipment, I will certainly try to expedite this. Thank you for your helpful remarks in this connection.

Yours sincerely,

T S Ricketts.

(T.S. Ricketts)
Chief Engineer.

TSR/EWF

PE.228 13th January 1958

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Thank you for the details of the Cousland Gas production. There is just one point I would like you to confirm. The sum of the November & December Gas production is 3,546,571 cubic feet at 30 inches of mercury and 60 degrees Fahrenheit. This is less than the annual production by 219, 175 cubic feet. I presume this offtake occurred during October 1957, but I would like your confirmation of this matter.

The wellhead pressure you have recorded of 630 p.s.i.g. for November and December seems to be rather high. You will remember that the maximum corrected pressure we recorded was 621 p.s.i.g. at the wellhead. It is unlikely that the pressure has risen, and I would suspect that this is a gauge error. Can you check this pressure against another gauge?

If you can expedite the delivery of the deadweight tester equipment, you will find this of real value in obtaining accurate pressures. If you will let me know as soon as you receive it, I will make arrangements to show you how to use this instrument on the well.

Yours sincerely,

C.M.Adcock

CMA/JMJ

Copy

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - NOVEMBER, 1957

Continuity of Supply	Gas was supplied from Cousland to Musselburgh daily during the period 1st to 30th November, 1957. On a few occasions hydrate formation resulted in total or partial blockage at the Cousland governor installation.
Volume supplied from Cousland to Musselburgh during month (corrected)*	1,582,307 cubic feet 52,000
Pressure at wellhead at end of month	630 lbs. per square inch 625 corrected gauge
Number of days on which well was in action during month ...	30 days
Number of days on which well was shut down during month ...	None

*Corrected to 30 inches Mercury and 60 degrees Fahrenheit

Copy

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

REPORT ON GAS PRODUCTION - DECEMBER, 1957

Continuity of Supply	Gas was supplied from Cousland to Musselburgh daily during the period 1st to 31st December, 1957. On one occasion hydrate formation resulted in total or partial blockage at the Cousland governor installation for a period of approximately one hour.
Volume supplied from Cousland to Musselburgh during month (corrected)*	1,964,264 cubic feet 63,000
Pressure at wellhead at end of month	630 lbs. per square inch 625 corrected gauge
Number of days on which well was in action during month ...	31 days
Number of days on which well was shut down during month ...	None

*Corrected to 30 inches Mercury and 60 degrees Fahrenheit

Copy

THE SCOTTISH GAS BOARD

NATURAL GAS SUPPLIED FROM COUSLAND TO MUSSELBURGH

ANNUAL REPORT ON GAS PRODUCTION 1957

Continuity of Supply	During the number of days on which the well has been in production there have been a few occasions on which hydrate formation has resulted in total or partial blockage at Cousland governor installation.
Volume supplied from Cousland to Musselburgh during year (corrected)*	3,765,746 cubic feet
Pressure at wellhead at 31st December, 1957	630 lbs. per square inch 625 corrected gauge
Number of days on which well was in action during year (including preliminary period)	72 days
Number of days on which well was shut down during year	None

*Corrected to 30 inches Mercury and 60 degrees Fahrenheit

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

7th January, 1958.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell,
Notts.

Dear Mr. Adcock,

I refer to your letter of 31st December, 1957 addressed to Mr. T.S. Ricketts, Chief Engineer, The Scottish Gas Board, and have to inform you that Mr. Ricketts is at present away from the office and will not return until Thursday 9th January, 1958.

In his absence, however, I am enclosing copies of the November and December reports on the natural gas supplied from Cousland to Musselburgh. You will notice from these reports that there has not been any change recorded in the wellhead pressure up to the present time.

Yours sincerely,

John M. Brown

(J.M. Brown)
PRODUCTION ENGINEERING ASSISTANT

JMB/AH

TELEPHONE
NATIONAL 1200.

D.O. 287

BEAUFORT HOUSE,
GRAVEL LANE,
LONDON, E.1.

9th January, 1958.

7000 cubic feet natural gas equivalent to one ton high grade deep-mined coal.

C.M. Adcock, Esq.,
Eakring.

Dear Milton,

Confirming our telephone conversation this morning I enclose a copy of "Nature" dated December 28th, containing, on page 1444, an article by Ricketts and Elgin on "Natural Gas in Scotland". Falcon is anxious to write to Ricketts and correct a number of inaccuracies with the suggestion that he should have the corrections suitably published in "Nature". I have gone over the article and marked some of the inaccuracies additional to those marked by Falcon, but I am afraid I have not all the data here to check the figures quoted by Ricketts.

I should be very glad if you would look through the article and let me have it back as soon as possible, with a note of any errors that you detect and suggestions for re-wording any inaccurate statements.

Yours sincerely,

Kelso Dickie

R.K. Dickie

Enc. Magazine "Nature"
dated 28.12.57.

odorant

T.H.T. Tetrahydrothiophene
(C_4H_8S)

13th January 1958

R.K. Dickie, Esq.,
Beaufort House,
Gravel Lane
London.

Dear Kelso,

Thank you for your letter dated 9th January, and I am sorry I could not send my comments on Ricketts' paper to you on Friday, but I was rather busy with routine work.

I have confined my remarks to the P.E. aspect of the paper; and it will be noted that one's main criticism is of a lack of precision by the Authors in their writing.

I am also returning to you herewith the copy of Nature you forwarded to me. It you wish to include the revised data in amended sections of the article, then you will probably find that the wording requires a few alterations to make it fit the paragraphs in question.

Yours sincerely,

C.M.Adcock

Encl.

CMA/JMJ

Natural Gas In Scotland

Comments on article by T.S. Ricketts &
D.C. Elgin in Nature, Dec. 28th 1957

1. The main two gas sands, in Cousland well 1 are:-
1582' -1632' and 1720' - 1806'
Both sands are subdivided into leaves.

2. The gas/water level in well 1 for the 1582' -1632' sand is put at 1675' below the R.T.

3. The area of the Cousland gas field is put at between 100 and 200 acres. This is thought to be a better method of expressing this concept than referring to a gas field diameter of 2500 feet.

4. The sand face reservoir pressure, i.e. at 1582' is 660 p.s.i.a. Whereas the closed-in wellhead pressure is 636 p.s.i.a., i.e. 621 p.s.i.g.

5. Water production was obtained when the 1720' - 1806' sand was produced, but has not so far been obtained during production tests of the 1582' - 1632' sand.

6. The original perforation in 1939 at Cousland was with 164 - $\frac{3}{8}$" steel bullets. I have never heard of a copper shot.

7. The maximum production rate recorded during the November 1956 production tests was 3.56 million cubic feet per day at a calculated bottom hole pressure of 391 p.s.i.a. The back pressure production graph indicated an open flow potential of 4.5 million cubic feet per day.

The data given in items 4, 5, 6 and 7 have been abstracted from my Cousland report dated 1st January 1957 - The figures given in the paper of 4 million and 415 p.s.i. appear to be generalisations, which are approximately correct.

13th January 1958

CMA/JMJ

PE.211

31st December 1957

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh, 3.

Dear Mr. Ricketts,

Many thanks for your letter dated 6th December. I was glad to learn that we were able to be of assistance to you on the question of the production of Methane at Valleyfield. Have you been able to take up this matter with the Assistant Director of the Geological Survey at Edinburgh?

I was hoping that we would have received by now details of the Cousland gas production for November. Perhaps you will forward this information with the December figures. I shall be also most interested to know if you have been able to record any changes in the wellhead pressure; and if so, I would appreciate it if you would send particulars of these measurements, with dates, and cumulative gas productions at each date.

With all best wishes for the New Year,

Yours sincerely,

C.M.Adcock

phoned Mr. Smith
8th Jan: 1958

CMA/JMJ

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

6th December, 1957

C.M. Adcock, Esquire,
BP Exploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

Thank you very much for your letter of 19th December 1957.

With regard to the Cousland gas production for November, this will be sent off to you in the course of the next day or two.

The information which you have given to me in regard to the 8-inch borehole near Valleyfield is very helpful and I think I will take your advice and discuss the geological problems with the Assistant Director of the Geological Survey at Edinburgh. If anything of interest develops I will write to you giving you details.

Yours sincerely,

T S Ricketts

(T.S. Ricketts)
Chief Engineer

TSR/EWF

PE.169 5th December 1957

Your Ref: TSR/EWF

T.S.Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh, 3.

Dear Mr. Ricketts,

Thank you for your letter dated 2nd December, and I was glad to learn that the Cousland gas is now flowing smoothly down the pipe line. This suggests that you have overcome your hydrate problem, which is good news. I trust that you will be forwarding to us shortly details of the Cousland gas production for November, and the recorded wellhead pressures. As you know, this information will be required when you come to consider the advisability of installing reforming plant, so that you can handle an increased production of Cousland gas.

With regard to the Methane which is being produced from an 8" borehole about 1 mile ahead of the Valleyfield Colliery workings, we have not sufficient data to be able to give you an appraisal of the possibilities of this reservoir. We know that a Methane drainage scheme is being worked for the 5' and diamond coals in the Valleyfield Colliery, and that the production of gas is reputed to be 1½ million cubic feet per day. We would have thought that the production from this borehole might have been tied-in with the Methane drainage scheme.

I understand from our Geological Department that the borehole would be located in the Limestone Coal Group, i.e. about 2000' above the level of the Cousland gas sands; and that it is situated on the flank of a coal field basin, with very little knowledge of the type of trap which might exist to contain the gas.

If the borehole is cased, some indication of the usefulness of the gas supply to you could be obtained by closing the well in at surface and measuring the closed-in-pressure. The well should then be produced through a meter, so that the production can be measured; and, subsequently the closed-in pressure is again determined to ascertain the pressure decline for a given production.

The value of the well for gas storage could not be ascertained without more detailed geological data, e.g. as to the type of reservoir from which the gas is being obtained, whether it is say sandstone or limestone, the extent of the reservoir beds, and the nature of the closure. We suggest that you might profitably discuss the geological problems with the Assistant Director of the Geological Survey at 15, South Park, Edinburgh.

Yours sincerely,

C.M.Adcock

CMA/JMJ

PE.161

Your Ref: TSR/EWF

26th November 1957

T.S.Ricketts, Esq;
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Many thanks for your letter dated 1st November. I was interested to hear that Mr. Cox was proposing to wrap the 2" inlet pipe with pyrotenax cable, at a point just outside the building, to avoid flameproofing complications.

I hope this arrangement is proving satisfactory in overcoming whatever hydrate formation tendency still exists; and that there is now a smooth and uninterrupted flow of gas to Musselburgh.

During my last visit to Edinburgh I did not make arrangements with you about reporting to us the quantities of Cousland gas produced, and also of reservoir water, if any, during each month, for our records. We require also to know the wellhead pressure, on a given day, say the 1st of each month, as accurately as possible. We know this will not be easy to do until you can measure it by means of a deadweight tester. It will be necessary to have all this information for any future appraisal of the Cousland structure, and we trust that you will be able to arrange for the routine forwarding of this data for each calendar month.

Yours sincerely,

C.M.Adcock

CMA/JMJ

Mr Adcock

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5   TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

2nd December, 1957.

C.M. Adcock, Esquire,
BP Exploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

Methane (fire-damp) ex Valleyfield

I have recently been in touch with the National Coal Board concerning a supply of methane (fire-damp) from the Valleyfield Colliery which is situated about 6 miles from Dunfermline in the County of Fife.

During our negotiations it was reported that a borehole some 8-inches in diameter had been sunk into the ground about a mile ahead of the coal workings for the purpose of proving the coal measures. From this borehole there issued a stream of methane at a fairly high pressure (no measurement was made of the actual pressure) and an analysis showed that the purity was some 95 per cent. The methane has been flowing from this borehole for the last 6 months and is still keeping up its rate and is being blown to waste.

Valleyfield Colliery
1½ million cubic feet per day.
ca. 2200'
5' of diamond coals.

The underground mine workings around Valleyfield are very gassy and I am wondering whether there is any possibility that the earth formation is similar to that at Cousland, namely a possible hiding place for natural gas or future underground storage.

Limestone Coal Group c. 2000' above level of Cousland gas sands.

Methane drainage scheme

From your extensive knowledge of the earth structure in this part of the world you may be able to give me an indication whether or not this is relevant. On the other hand it may be that owing to your official capacity you feel that you are not able to discuss this particular matter. If so, I would appreciate /

P.S.K.

of a Coal Field Basin

Str. flank, ... [illegible] ... of a [illegible]

Assistant Director
Geological Survey
15 South Park Edinburgh

C.M. Adcock, Esq. 2nd December, 1957

appreciate it very much if you would be kind enough to let me have the name of a geologist with whom I could consult on this matter.

With regard to the Cousland well, the gas is still issuing quite happily but at a very modest rate owing to our inability to take greater quantities at present. After a month or two, however, we shall be able to decide whether it is worth while putting in plant (possibly a reformer) to take the gas at a higher rate.

With kind regards,

Yours sincerely,

T S Ricketts.

(T.S. Ricketts)
Chief Engineer

TSR/EWF

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

1st November, 1957

C.M. Adcock, Esquire,
BP Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

Thank you very much for your letter of the 31st October 1957 in which you gave very interesting and helpful information.

I was sorry I was not in the office when you telephoned. I have, however, ascertained from Mr. Cox this morning that the flow of natural gas carried on quite satisfactorily from the time you left it on Monday afternoon until approximately 11 a.m. yesterday (Thursday) when icing up of the needle valve occurred. An adjustment was then made to the needle valve by opening it and closing it back to its original position and since then the natural gas has flown satisfactorily and is again flowing happily this morning.

Mr. Cox is arranging to wrap the 2-inch inlet pipe with pyrotenax cable at a point just outside the building in order to avoid flameproofing complications.

I have passed on to Mr. Cox the information which you gave concerning the purchase of a deadweight tester and a high-pressure flexible hose.

I will keep you informed of the progress of the project and I hope we shall be able to report that, with your assistance, we have been able to overcome the freezing trouble.

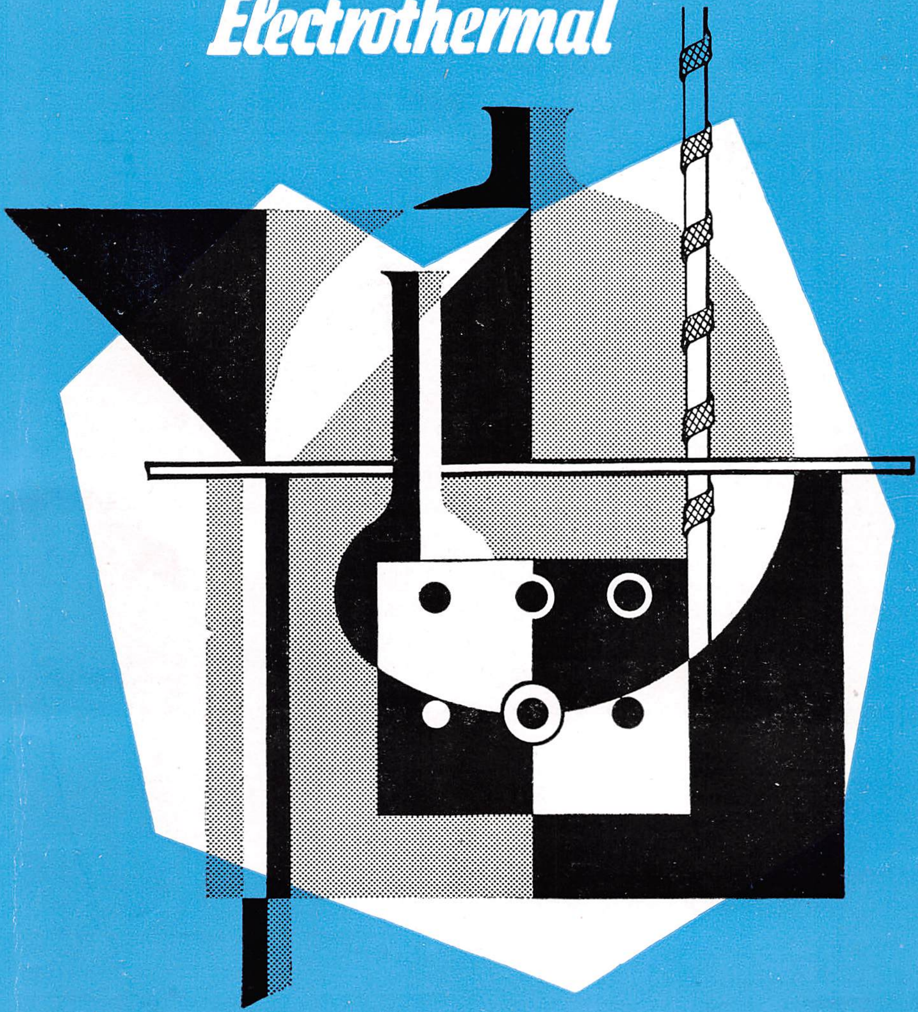
Yours sincerely,

T S Ricketts

(T.S. Ricketts)
Chief Engineer

TSR/EWF

Electrothermal



LABORATORY HEATING EQUIPMENT

GENERAL INTRODUCTION

Electrothermal Laboratory Heating Equipment has been developed in close co-operation between electrical engineers and scientists, to provide safe, efficient and economical methods of heating vessels and surfaces generally.

Carefully designed and manufactured under exacting conditions, the equipment, which is fully guaranteed, renders years of satisfactory service. A selection of items from the Electrothermal range, is described in this leaflet.

Series 'M'

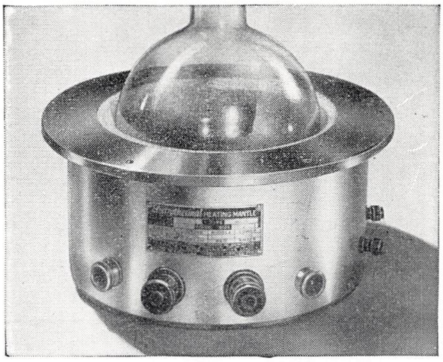
This series of Heating Mantles comes in a rigid aluminium housing with a pilot lamp in each circuit. The heating element is covered by flexible and elastic knitted glass fabric which is capable of accepting flasks of wide tolerance. Available from 50 ml. to 200 litre flask capacity and for beakers, conical flasks, funnels and Buchner funnels of any size. Temperatures up to 750°C. with a choice of surface area wattages are available. Thermocouples are built-in to 1,000 ml. size mantles and above.

Series 'MV'

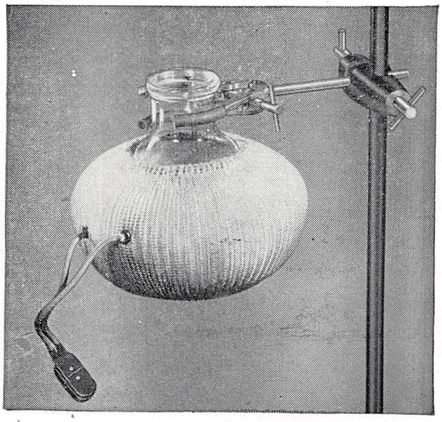
The Multimantle, an aluminium housed universal heating mantle capable of accommodating a large variety of flasks or funnels in one heater, is truly a multi-purpose heating mantle. It is available with or without built-in temperature control, in the following capacity ranges : 50 to 500 ml., 50 to 2,000 ml., 500 to 6,000 ml., 2,000 to 12,000 ml., and 5,000 to 22,000 ml.

Series 'MJ'

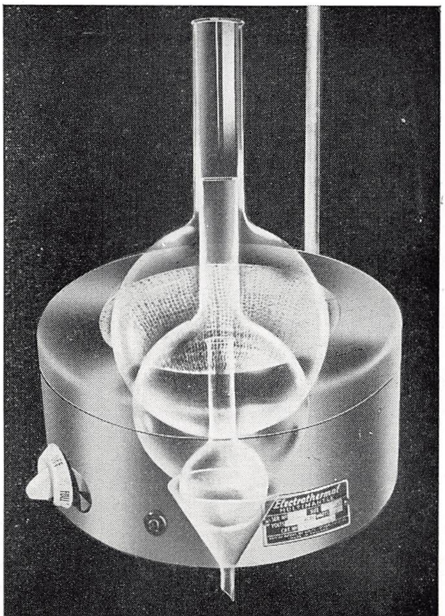
This light, all-flexible Heating Mantle, for round or flat bottom flasks, is of glass knitted construction. Its unique elastic neck opening allows this model to be snugly fitted to flasks with single or multiple necks. Available for flask capacities up to 10,000 ml. Special designs with side or bottom outlets can be supplied.



Series 'M'



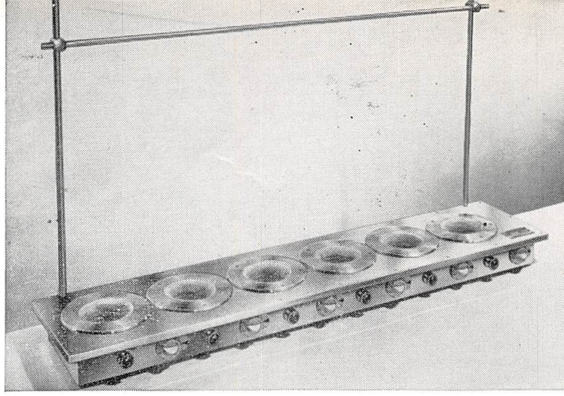
Series 'MJ'



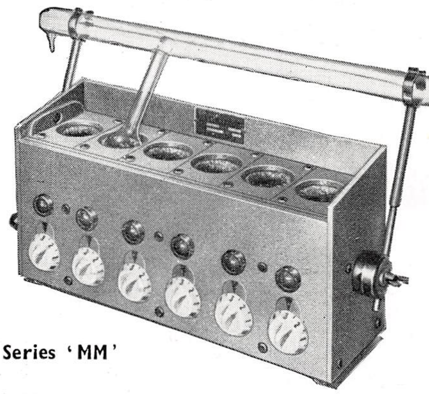
Series 'MV'

Series 'ME' 'MM' 'MQ'

Electrothermal Heating Mantles, using flexible and elastic knitted glass fabric incorporating elements, provide the heat in this range of extraction and distillation apparatus and Kjeldahl and Micro-Kjeldahl digestion units. Even distribution of heat, accurate temperature control, a minimum amount of attention and an immunity from fire and explosion risk hitherto unknown, makes this series of apparatus indispensable in research and test laboratories. Capacities from 18 ml. to 1,000 ml. for flasks or beakers, with or without built-in controls.



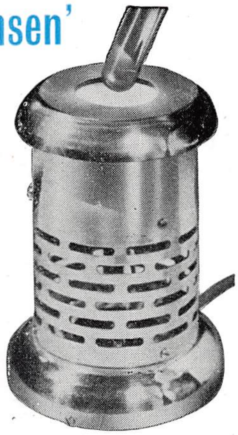
Series 'ME'

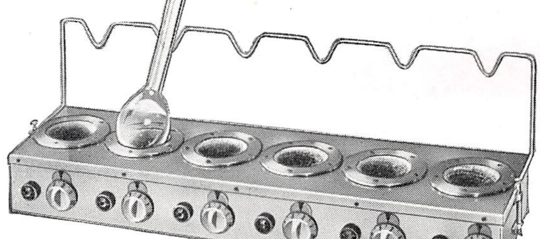


Series 'MM'

Series 'BA'
Electrothermal 'Bunsen'

This new heating apparatus is indispensable in every laboratory, even where a gas supply is normally available. It combines the advantages of the gas burner with cleanliness in operation and ease of control associated with electric heating. It can be used for most routine work which is normally carried out by the gas burner.



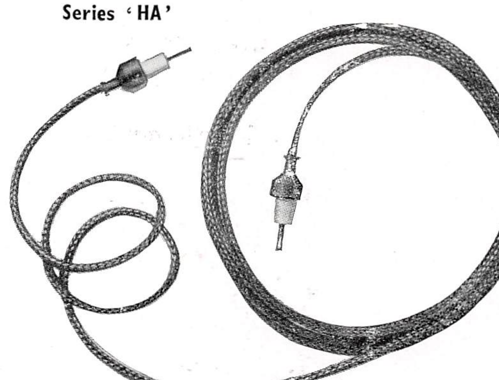


Series 'MQ'

Series 'HT'

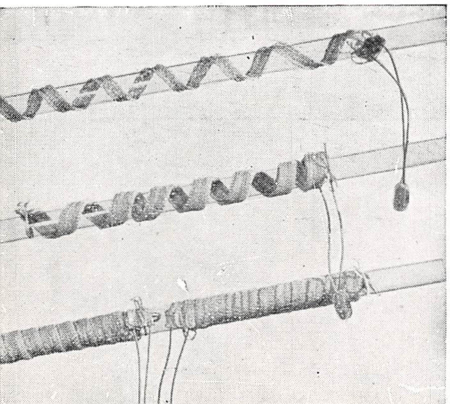
A safe, convenient and efficient surface heater for use wherever heat is required in production processes and in the laboratory. These tapes consist of one or more bands of resistance wire, separated and bordered by bands of high temperature resisting glass fibre yarn. They are supplied in various lengths and widths, insulated on both sides. Also available insulated on one side, and uninsulated, allowing observation. Standard surface loading is $2\frac{1}{2}$ watts/in.^{2} (0.4 watts/cm.^{2}). Special tapes including alternative make-up can be made to specification up to 8 watts/in.^{2} (1.25 watts/cm.^{2}).

Series 'HA'



Series 'HA'

The Electrothermal Armoured Heater consists of resistance wire suitably insulated and enclosed in a braided armour sheath. It is ideal in circumstances where a high rate of heat transfer is required, and may be applied directly to glass or metal vessels or pipes, and can be lagged. Two types in various lengths are available, to attain 450°C. and 800°C. respectively. Surface loadings of 30 watts/in^2. (4.65 watts/cm.^{2}) can be achieved.



Series 'HT'

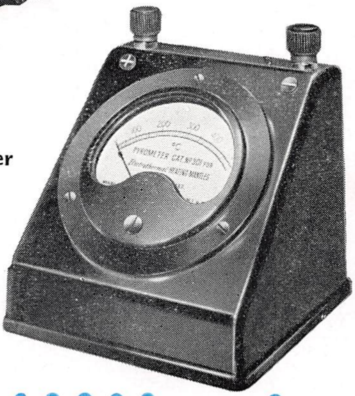
MC 201 Energy Regulator

Control Gear

Energy Regulators, Auto-Transformers and Pyrometers are available for the accurate control of Electrothermal heating equipment. Cat. No. MC.201 is an energy regulator which operates by automatically switching on and off the energy input on a time basis. It is not affected by voltage variations up to 15%. Cat. No. MC.202 is an Auto-Transformer supplying infinitely variable output from 0 to 15% above input voltage. Other control gear for coarse and fine regulation of temperature and control equipment for D.C. can be supplied as required. Indicating Pyrometer Cat. No. MP.301, as illustrated, is one of a range of temperature measuring instruments available. Suitable control gear can be recommended for each application.

MC 202 Auto-Transformer

GENERAL INFORMATION: Electrothermal Heating Equipment is available in many standard and special forms for use in the laboratory. In addition to this, a range of heating equipment is manufactured for industrial use.



MP 301 Pyrometer

Electrothermal provides Heat for Science and Industry

Separate publications giving full details of Electrothermal products are available on request.

Electrothermal heating equipment is covered by the following patents:

Canada	498946	Gt. Britain	630173, 668163	Switzerland	
Denmark	77964		722221, 721491		273730, 292723
Germany	867263, 892207	Holland	74969	U.S.A.	2643324, 2670620

(Others pending)

Regd. Design: Gt. Britain 875606

ELECTROTHERMAL ENGINEERING LIMITED

270 Neville Road, London E.7. Telephone: **GRAngewood 0055/7**

SUPPLIED BY:—

R. W. JENNINGS & Co.,
9a/11 Fisher Gate,
Nottingham.

PUBLICATION NO. 268/1

PRINTED IN ENGLAND

PE.133 31st October 1957

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh, 3.

Dear Mr. Ricketts,

I telephoned you yesterday afternoon to enquire how the flow of Cousland gas was progressing, but you were not available; and so I spoke to Mr. Elgin, who assured me that as far as he knew, the flow to Musselburgh was continuing in a satisfactory manner.

You will remember that when I spoke to you on Monday, I said that we had restricted the gas flow at the needle valve to reduce the pressure drop from 620 p.s.i. in a more gradual manner, with a view to eliminating the conditions under which Methane hydrates form.

This control appears to be perfectly satisfactory, for when I visted Cousland on Tuesday morning, the gas flow was very steady, the pressure on the downstream side of the needle valve being 250 p.s.i., after the first I.V. controller 120 p.s.i., after the second I.V. controller 18 p.s.i., and after the Bryan Donkin regulator 3 p.s.i. The room temperature was around 50°F. Should the pressure after the Bryan Donkin regulator fall below 3 p.s.i; it will be necessary to open up the 2" needle valve the smallest possible fraction of a turn. This must not be overdone of course, otherwise the whole of the pressure drop will be transferred to the first I.V. regulator, and Methane hydrate formation will once more be obtained.

It is thought that if the foregoing operating conditions can be maintained, it may only be necessary to use supplemental heating during a short period of the year, under severe cold weather conditions. The simplest arrangement, and the maximum economy of heat input, could be obtained at little cost, by wrapping the 2" inlet pipe in the building before it reaches the 2" needle valve, with some form of electrical heater, such as pyrotenax cable, which has a loading of about 70 watts per foot run. An alternative heating cord is made by Electrothermal Engineering Ltd., which has a loading of 20 to 30 watts per square inch of surface. It would seem that a heating capacity of about half to one kilowatt should be sufficient to maintain the temperature of the gas above the point of hydrate formation, if pressure reduction is carried out in a gradual manner, during the severest of weather.

Another point I mentioned to Mr. Cox is the importance of recording accurate wellhead pressures at fairly frequent intervals, which can be related to the gas offtake from the well. Pressure gauges cannot be relied on for these measurements; and the best arrangement is to measure the wellhead pressure directly with a deadweight tester. I promised to send you particulars of the equipment you would require for this work, and to show you the procedure to be adoped when measuring these pressures, as soon as you had received your own instrument.

We have found the Barnet instrument, a practical, compact, and accurate dedweight tester. It is manufactured by Barnet Instruments Ltd., of Bath Place, Barnet, Hertfordshire. We would recommend to you the type 1086, which is combined low and high pressure model, and costs approximately £100. The low pressure range is from 1 to 400 p.s.i., and the high pressure range from 200 to 4000 p.s.i. You will find the low pressure range convenient for calibrating periodically the gauges you have on the downstream sections of your pressure controllers. On the high pressure range, the smallest weight is equivalent to 10 p.s.i. It is therefore essential that you request the manufacturers to make you some smaller weights, so that you can measure the wellhead pressure to 0.5 p.s.i. I would suggest that you ask them for one 5 p.s.i. weight, two 2 p.s.i. weights, one 1 p.s.i. weight, and one ½ p.s.i. weight, all these weights for use on the high pressure range.

To connect the deadweight tester to the well you will require a length of high pressure flexible hose. We have found the hose made by the British Ermeto Corporation Ltd., of Beacon Works, Hargrave Road, Maidenhead, Berks, very satisfactory for this purpose. I suggest that you order one ½" bore hose (1 1/16" o.d.) ten feet long. The single wire braid, reference WH2/1, will stand a maximum working pressure of 2000 p.s.i. which is more than sufficient for your requirements. This hose is required to be fitted with the standard ⅜" nominal bore standpipe ends, reference DD. To be able to connect the hose both to the gauge fitting on the well and to the deadweight tester, you will require the hose to be assembled complete with ⅜" nominal bore x ½" B.S.P. steel stud couplings.

Yours sincerely,

C.M.Adcock

CMA/JMJ

Memorandum

From	LONDON	**To**	EAKRING
Our Ref.	JRE/CAB **Your Ref.**	**Date**	25th October, 1957.
Subject	COUSLAND - GAS METER		

In accordance with the telephoned request from Mr. Adcock on 17th October, 1957, we now enclose one copy of the correspondence exchanged with the Ministry of Power on the subject of metering arrangements for royalty purposes at Cousland.

A further copy is being transmitted to the Scottish Gas Board via the Secretary of the Gas Council.

A P Fallbeus

Encs.

The Secretary,
The Ministry of Power,
Petroleum Division,
Thames House South,
Millbank,
LONDON, S.W.1.

18th September, 1957.

Dear Sir,

We refer you to our letter of the 10th September, 1957, concerning our proposed arrangement for a prolonged production test of the natural gas reservoir at Cousland in our licence area Number 205.

We have to inform you that a Holmes BM gas Meter has been installed to measure the quantity of gas produced during the proposed test. The meter is situated at the end of the pipeline from Cousland at the Musselburgh Gas Works of the Scottish Gas Board. We attach a descriptive catalogue.

In accordance with Clause 22 of the relevant prospecting licence, we now write to enquire whether this method of measuring the natural gas won and saved meets with the approval of the Minister.

Yours faithfully,
For BP EXPLORATION COMPANY LIMITED

(Sgd) J.R. ENGLAND

Enc

MINISTRY OF POWER

Petroleum Division
Thames House South
Millbank,
LONDON, S.W.1.

PD 811/17/45

23rd September, 1957

Sir,

I am directed by the Minister of Power to reply to your letter of 18th September seeking his approval under the terms of your licence No. A.205 for a meter to measure the quantity of gas taken from the Cousland natural gas reservoir.

The Minister hereby approves the use of a Holmes BM gas meter subject to you confirming that it has been examined and stamped at the manufacturer's works and to him being informed of its serial number.

I am, Sir,
Your obedient Servant,

(Sgd) J. SIMPSON

BPEXPCO

J. Simpson, Esq.,
The Ministry of Power,
Petroleum Division,
Thames House South,
Millbank,
LONDON, S.W.1.

25th September, 1957

Dear Sir,

We refer to your letter PD 811/17/45 dated 23rd September, 1957.

We confirm that the Holmes BM gas meter which is to be used at the Musselburgh Gas Works to measure the quantity of gas taken from the Cousland Natural Gas Reservoir, has been examined and tested by the manufacturer, W.C. Holmes and Company and also proved and stamped by The Ministry. The meter is numbered 2703, Type No. 40.

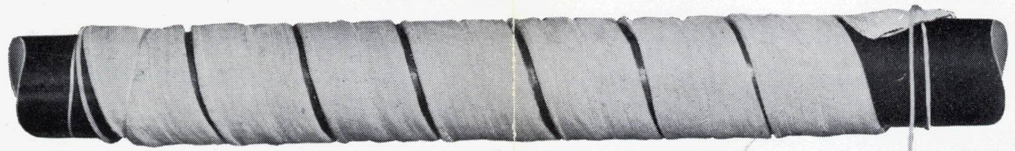
We note that the Minister has approved the use of the meter.

Yours faithfully,
for BP EXPLORATION COMPANY LIMITED

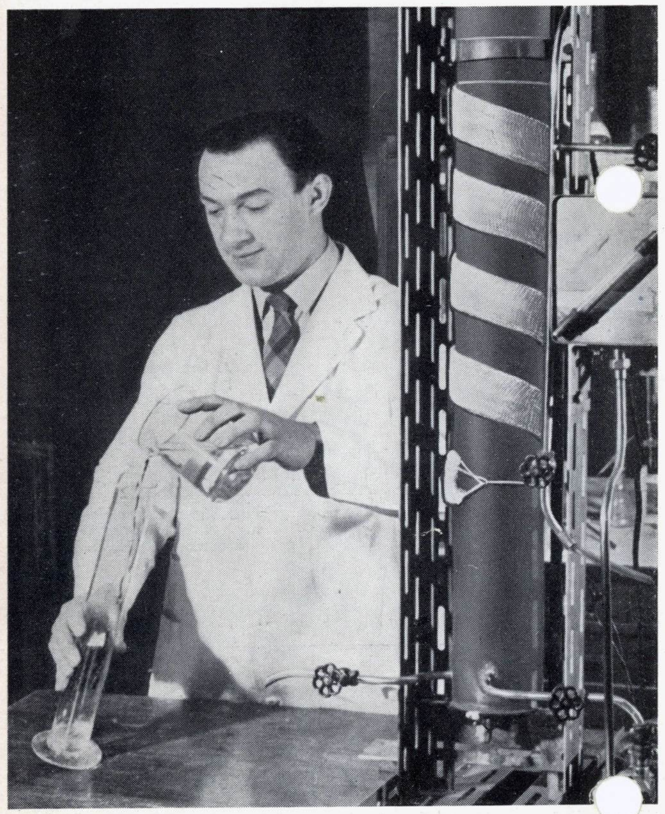
(Sgd.) J.R. ENGLAND

c.c. F.G. Brewer, Esq.,
Gas Council

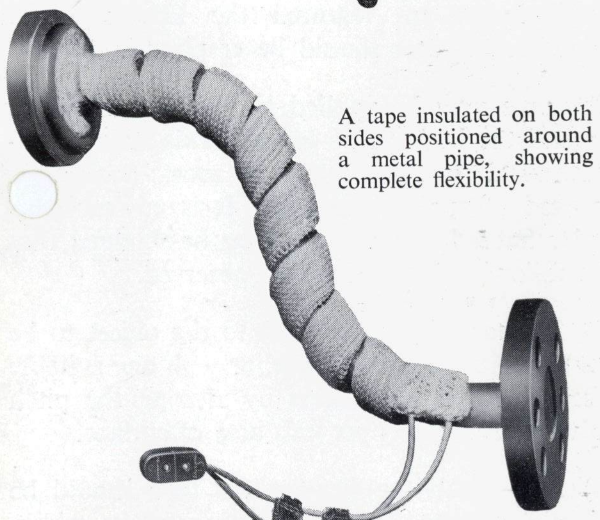
/CB



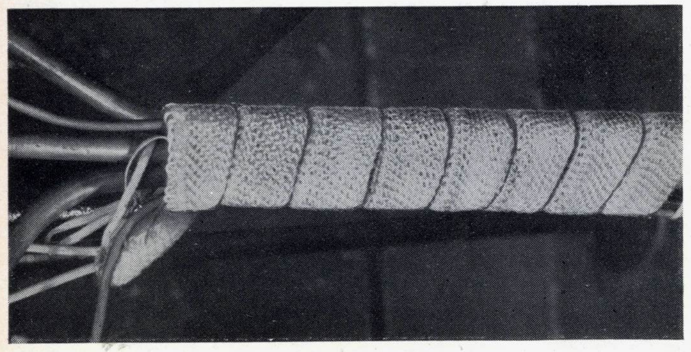
A typical application of a heating tape wrapped around a straight length of tubing.



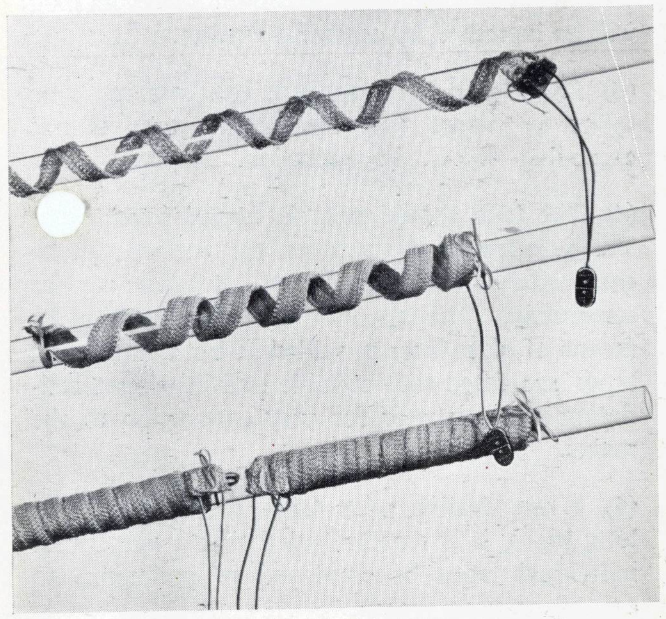
A heating tape used on an experimental copper counter-flow ring-packed column, running at elevated temperatures.



A tape insulated on both sides positioned around a metal pipe, showing complete flexibility.



Reactivating an experimental charcoal trap by a heating tape.



The upper tube carries an uninsulated tape, the middle tube a tape insulated on one side, and the lower tube tapes insulated on both sides.

PRICE LIST AND SPECIFICATION OF ELECTROTHERMAL HEATING TAPES

	Cat. No.	Length (approx.)		Width (approx.)		Approx. watts	Max. Current Amps.		Price £ s. d.
		ins.	cm.	ins.	mm.		230v.	115v.	
Uninsulated	HT101	36	90	1″	25	100	0.8	1.6	1 10 0
	HT102	48	125	2½″	64	250	1.5	3.0	1 17 6
	HT103	60	150	3″	76	450	2.3	4.6	2 12 6
	HT104	72	180	3½″	89	500	2.6	5.2	3 0 0
Insulated on one side	HT201	36	90	1″	25	100	0.8	1.6	1 15 0
	HT202	48	125	2½″	64	250	1.5	3.0	2 7 6
	HT203	60	150	3″	76	450	2.3	4 6	3 5 0
	HT204	72	180	3½″	89	500	2.6	5.2	3 12 6
Insulated on both sides	HT301	36	90	1″	25	100	0.8	1.6	2 7 6
	HT302	48	125	2½″	64	250	1.5	3.0	2 17 6
	HT303	60	150	3″	76	450	2.3	4.6	4 5 0
	HT304	72	180	3½″	89	500	2.6	5.2	4 [illegible]
	HT340	24	60	½″	12.7	36	0.25	0.5	1 5 0
	HT341	48	125	½″	12.7	72	0.5	1.0	1 17 6
	HT342	72	180	½″	12.7	108	0.75	1.5	2 7 6
	HT343	96	250	½″	12.7	144	1.0	2.0	3 0 0
	HT344	300	765	½″	12.7	—	0.5	1.0	8 0 0
	HT345	600	1530	½″	12.7	—	0.5	1.0	12 10 0
	HT350	24	60	1″	25	72	0.5	1.0	1 12 6
	HT351	48	125	1″	25	144	1.0	2.0	2 12 6
	HT352	72	180	1″	25	216	1.25	2 5	3 10 0
	HT353	96	250	1″	25	288	1.5	3.0	4 2 6
	HT354	300	765	1″	25	—	0.75	1.5	10 10 0
	HT355	600	1530	1″	25	—	0.75	1.5	16 5 0
	HT360	24	60	2″	70	120	0.75	1.5	2 2 6
	HT361	48	125	2″	70	240	1.5	3.0	2 17 6
	HT362	72	180	2″	70	360	2.0	4.0	4 2 6
	HT363	96	250	2″	70	480	2.5	5.0	4 17 6
	HT370	24	60	3½″	90	210	1.25	2.5	2 17 6
	HT371	48	125	3½″	90	420	2.5	4.20	3 15 0
	HT372	72	180	3½″	90	630	3.75	7.5	4 12 6
	HT373	96	250	3½″	90	840	5.0	10.0	6 0 0

Average loading of above Heating Tapes is 2½ watts/sq. in.

ENERGY REGULATORS FOR AC

Cat. No.	Description	Input Volts	Output Volts	Output Amps		V.A.	Price £ s. d.
				Rated	Max.		
MC201	Energy Controller	100/130 200/250	100/130 200/250	8 6	10 8	1,300 2 000	2 15 0
MC202	Auto Transformer	230	0-270	2	2 5	580	15 10 0
MC203	Auto Transformer	110	0-135	5	7.5	860	12 0 0

Suitable control gear can be supplied for D.C.

PLEASE STATE VOLTAGE WHEN ORDERING

SUPPLIED BY

GRIFFIN & TATLOCK LTD
KEMBLE STREET, KINGSWAY, LONDON, W.C.2
GLASGOW, C2, EDINBURGH 1, MANCHESTER 4
BIRMINGHAM 3: STANDLEY BELCHER & MASON, LTD.

Publication No. 236

A SAFE ECONOMICAL EFFICIENT SURFACE HEATER

For use wherever heat is required in production processes and in the laboratory. Available in three types, uninsulated, insulated on one side, and insulated on both sides. The only heating tape suitable for the ideal heating of double curvature surfaces.

Electrothermal Engineering Ltd.

270, NEVILLE ROAD, LONDON, E.7. Telephone Grangewood 0055/7

ELECTROTHERMAL HEATING TAPES

Considerable research into the difficulties associated with the heating of pipes, valves, transfer lines, and fractionating columns, resulted in the unique design of Electrothermal flexible and elastic heating tapes. These tapes consist of one or more fabric bands of resistance wire separated and bordered by bands of high temperature resisting glass fibre yarn. The width and length of the various tapes are carefully determined by the current carrying capacity of the resistance wire. The surface loading of standard heating tapes has been arranged approximately at $2\frac{1}{2}$ watts per sq. in. (0.4 watts/cm.^{2}) area of tape. This wattage concentration enables temperatures of 400°C. and over to be reached inside a glass tube of 2 mm. wall thickness. Other surface loadings up to 8 watts/sq. in. (1.25 watts/cm.^{2}) are available.

Three principal designs are available :—

UNINSULATED

1 In this construction the current carrying resistance wires are in direct contact with the surface to be heated. (It is important for care to be taken to prevent overlapping and accidental contact.) As it is possible to look through this tape it will be of the greatest value in research work when wound on a transparent surface, but heat losses will be more pronounced than with construction (3). Tests have been carried out on fractionating columns and temperatures between 35°—120°C. were maintained for indefinite periods of time. Draughts did not cause a fluctuation of more than 2°C.

INSULATED ON ONE SIDE

2 This tape is just as simply applied, with direct contact between the resistance wire and the surface to be heated as in construction (1) but heat losses to atmosphere are greatly reduced by the addition of a layer of knitted glass yarn on one side. The tape should not be wound onto itself and care must be taken as in construction (1) to wind it directly onto insulating surfaces only.

INSULATED ON BOTH SIDES

3 This tape is constructed of two insulation layers of knitted glass yarn with the current carrying bands in the centre. The tape can be safely wound onto metal, thus making it especially suitable for heating steel tubes, valves, nozzles and other conducting surfaces. Heat losses to atmosphere are minimised.

Special tapes in either constructions 1, 2 or 3 can be made available in any length, and width. Wattage loadings up to 8 watts/sq. in. (1.25 watts/cm.^{2}) have been supplied.

Heating tapes are suitable for operation at controlled temperatures of up to 450°C. For maintaining constant temperatures suitable energy regulators can be supplied. Where higher temperatures are required the Electrothermal Armoured Heater should be employed.

The tape may be applied by simply winding it around the body to be heated. This makes Electrothermal heating tapes a most convenient method of surface heating. It is advisable, in order that full operating efficiency be obtained, that the following instructions be observed.

(1) The tape can be applied to the object to be heated with edges adjoining, or with any suitable pitch. Thus it is possible by altering the pitch to vary the loading per unit area of surface.

(2) Before each application the tape should be slightly stretched in the direction of its width. Moderate tension should then be used when winding the tape into position. The loading will be increased by excessive tension.

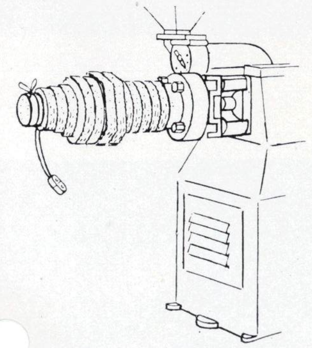
(3) Lagging may be applied, but care must be taken to ensure that the heating tape is not exceeding 450°C. in operation.

(4) The tape should not be wound overlapped. The position of the tape on the surface can be easily altered and frequently will not even require unwinding. The tape can be held in position by means of glass laces provided at both ends. All tapes are fitted with suitable lead-in wires terminating in a connector for easy connection to the mains.

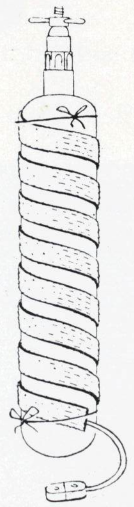
(5) When dealing with large surfaces such as long pipes, it is recommended that a number of individual tapes be employed in preference to one of excessive length.

Patents applied for.

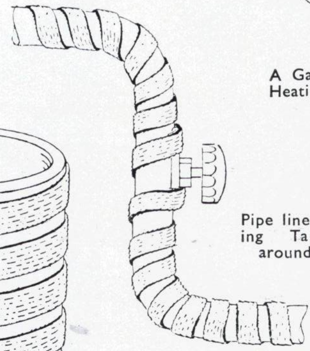
A few examples of how Electrothermal Heating Tapes can be used



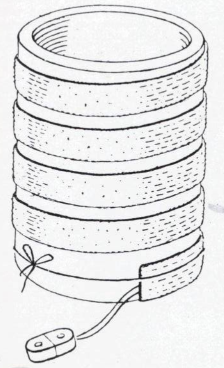
…eating Tape used in conjunction with an injection moulding machine.



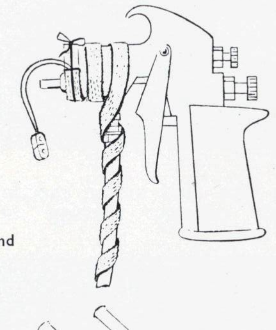
A Gas Bottle with Heating Tape in position.



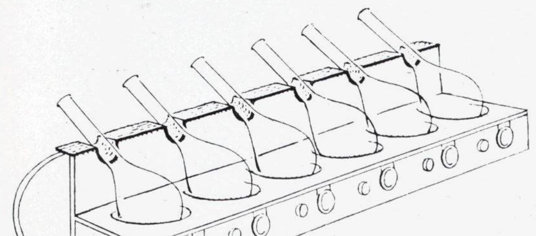
Pipe line showing Heating Tape positioned around a stop-cock.



…trating an application cylindrical vessels.



Heating Tape wound round spray gun.



Kjeldahl Unit with Heating Tape in position to prevent condensation inside necks of flasks

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO SECRETARY

15th October, 1957

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Britannic House,
Finsbury Circus,
London, E.C.2.

Dear Mr. Adcock,

Sir Harold Smith, K.B.E., D.L., Chairman of the Gas Council, is visiting Scotland on Monday, the 28th October 1957, in order to inaugurate the supply of natural gas from the well at Cousland, Midlothian. The gas will be mixed with the town's gas made at the Musselburgh gas works, and distributed to Musselburgh, Cockenzie and Port Seton, Prestonpans and Tranent. The communities in these places will thus become the first in Britain to make commercial use of natural gas, and The Scottish Gas Board will be the first of the twelve Area Boards in Britain to benefit from the search for natural gas sponsored by the Gas Council which has been carried out in conjunction with your Company in various parts of the United Kingdom.

To mark the occasion the Board are planning a visit to the well-head at Cousland and to the gas works at Musselburgh, followed by a luncheon in the Caledonian Hotel, Edinburgh.

I am writing now in the hope that you will be able to join the Chairman of the Board either for the whole visit and the luncheon, or at some point in the proceedings most convenient to you.

The supply will be inaugurated by Sir Harold Smith at the well-head at Cousland at 10.30 a.m. on Monday, the 28th October, 1957. A party will leave the Headquarters of The Scottish Gas Board, 26 Drumsheugh Gardens, Edinburgh 3, at 10 a.m. and transport will be available should you wish to join us there. Should you wish to go to Cousland direct, I attach a sketch map for your convenience.

After the ceremony at Cousland, the party will go to the gas works at Musselburgh, where light refreshments will be served at 11.30 a.m. The party will then go on to Edinburgh, assembling in the Caledonian Hotel at 12.30 p.m. for luncheon.

I /

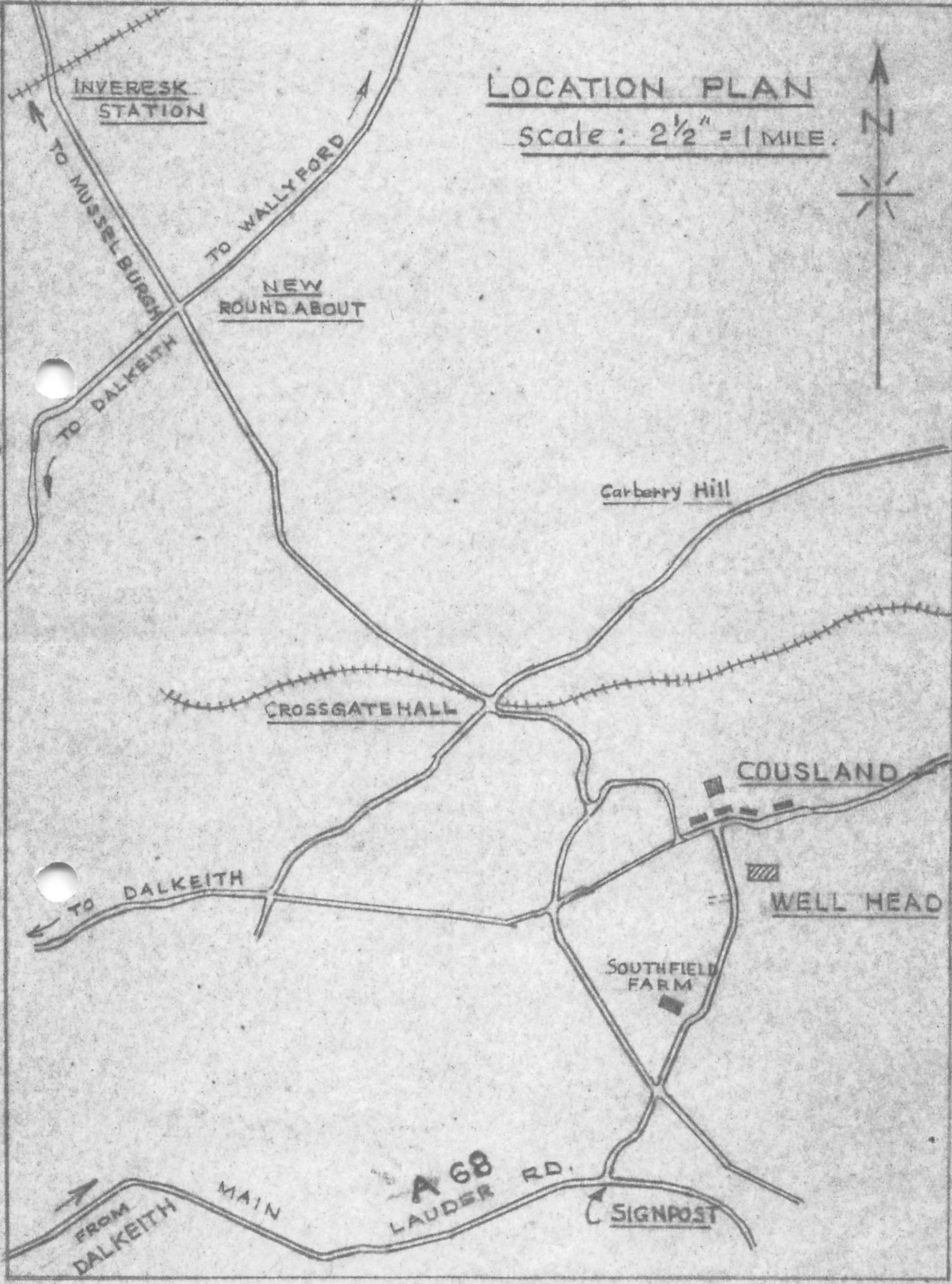
C.M. Adcock, Esq. (continued) 15th October, 1957

I very much hope that you will be able to be with us on this occasion in spite of somewhat short notice. Whilst the work at Cousland, as you will be aware, has been proceeding for some considerable time, unavoidable delays have occurred through mechanical troubles. These, however, have now been overcome, and it is felt desirable on the grounds of economy to bring the supply into operation at the earliest possible moment.

Yours sincerely,

Secretary

RD/EM



LOCATION PLAN
Scale: 2½" = 1 MILE.
N
INVERESK STATION
TO MUSSELBURGH
TO WALLYFORD
NEW ROUND ABOUT
TO DALKEITH
Carberry Hill
CROSSGATEHALL
COUSLAND
WELL HEAD
TO DALKEITH
SOUTHFIELD FARM
A 68
FROM DALKEITH
MAIN
LAUDER RD.
SIGNPOST

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

11th October, 1957

C.M. Adcock, Esquire,
BP Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

Pressure Reducing Valve

Thank you for your letter of 29th October 1957. I am very pleased that you agree to the suggestion that a prototype Bryan Donkin regulator be installed on the natural gas supply from Cousland. We will now get in touch with Bryan Donkin and ask them to forward this regulator; I understand that delivery period will be approximately one month.

Yours sincerely,

T.S. Ricketts

(T.S. Ricketts)
Chief Engineer

TSR/EWF

PE.119 9th October 1957

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh, 3.

Dear Mr. Ricketts,

Cousland : Pressure Reducing Valves

A copy of your letter, dated 28th September, to our London Office, has been forwarded to us on the subject of the Cousland Pressure Reducing Valves. When I was speaking over the telephone to Mr. Elgin yesterday I understood that you may wish to replace the two I.V. pressure controllers by a new type Bryan Donkin regulator.

It is agreed that it would be advantageous to be able to test out the prototype pressure regulator at Cousland; and we can see no objections to this proposal. There would of course be no interference with the wellhead equipment owing to the production plant being located away from the well. This is convenient, as it will enable you to make whenever necessary, adjustments to your production plant indicated by practical operating experience.

Mr. Elgin also mentioned that you hope to be producing Cousland gas to Musselburgh by early next week; and I trust that this may be the beginning of a prolonged production test.

Yours sincerely,

C.M.Adcock

cc. Mr. A.F. Matthews.
Exploration Dept.

CMA/JMJ

10th September 1957

My dear Alistair,

After our telephone conversation yesterday afternoon I phoned Mr. Elgin of the Scottish Gas Board, and I found out that so far no natural gas has reached Musselburgh, as trouble had been experienced with one of the high pressure regulators. The pipe line to Musselburgh has been purged; and, at this Gas Works, a Holmes 'BM' Gas Meter has been installed for the measurement of Cousland gas.

I am sending you an old catalogue giving details of the operation of the 'BM' meter, which complies with the 'Sales of Gas Act' and is sealed by the Board of Trade Meter Inspectors. I believe the meter is equipped to record volumes at S.T.P., but I do not know the details of the recorder. Presumably this meter will have to satisfy the Ministry that it will be acceptable for Royalty Measurements.

With regard to the Tuxford Sidings, the two Royalty Tanks were calibrated in August by Messrs. Caleb Brett & Son Ltd. For your information I am sending you copies of the calibration sheets; and, before we commission these tanks, we will require to know whether these calibrations are acceptable to the Ministry, or whether they wish to arrange for check calibrations.

Yours sincerely,

A.F. Matthews, Esq.,
Exploration Department,
Britannic House.

Encls.

CMA/JMJ

Mr. Bevis Wednesday 21st

Hay

Your Ref: PE.31

40 for 3-45

Phoned Mr. Elgin 16th August

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH. 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

S.O. Buxbaum 34 & 35

Mr. Greenhorn

2/1

Caledonian Hotel

phoned Mr. Roth

7th May, 1957

C.M. Adcock, Esq.,
BP Exploration Company Limited,
Eakring, P.O. Box 1,
Southwell, Notts.

Mackay

Cairns

Mr. Elgin

Dear Mr. Adcock,

Underground storage of gas at Cousland

Thank you for your letter of 3rd May 1957 giving me information concerning the possible use of the Cousland No.1 Well for underground storage. Your remarks are reassuring and I assume that even if water penetrates into the reservoir rock no particular damage will result since the admission of town gas to the Well at a suitable pressure will force this water out again, thus allowing us to use the rock quite satisfactorily.

We would not increase the well pressure above the existing pressure of 600 lbs. per square inch, and in fact, I would be more inclined to consider the limits of pressure as 100 to 200 lbs. per square inch for storage purposes. This range of pressure might give us all the storage we require, but this of course will be a matter for calculation at a later period.

Thank you once again for your very helpful letter.

Yours sincerely,

T. Ricketts

Holmes BM meter

(T.S. Ricketts)
Chief Engineer

TSR/EWF

PE.31

3rd May, 1957

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Underground storage of gas at Cousland

Thank you for your letter dated 30th April enquiring as to the possibility of using Cousland Well 1 for underground gas storage. I wrote a report on this subject dated 20th December 1954, which was forwarded to the Gas Council.

The extent of a natural water drive at Cousland, particularly in the 1582' - 1632' sand, is not known. However, the ingress of edge-water into the reservoir rock is of no particular significance from the standpoint of the underground storage of gas. The build-up of the gas stored will bring about a recession of whatever water encroachment may have taken place.

There would be more cause for concern if gas were to be injected into the reservoir without first of all drawing off at least an equal quantity of natural gas. From geological considerations it would appear that the closure in the Cousland dome is rather more than 100'; and that the reservoir may be nearly completely filled with gas to the "spill-point". Hence, gas injection into the reservoir without some prior depletion, might result in the loss of gas reserves.

Otherwise, it is immaterial at whatever wellhead pressure gas injection into the reservoir is commenced. I suggested an injection pressure of twice the wellhead pressure; but this would of course be governed by the rate at which you intended to inject gas back into the formation.

You might have also in view the possibility of injecting gas into the reservoir concurrently with drawing natural gas production from it. This would be quite practicable with an injection well on the crest of the structure.

Please do not hesitate to write again if I can be of further assistance. I am also wondering how the Cousland production scheme is progressing; how far you are on with the installation of the wellhead plant; and whether you have now completed your pipeline to Musselburgh.

Yours sincerely,

C.M.Adcock

CMA/JMJ

THE SCOTTISH GAS BOARD
26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

3 copies

30th April, 1957

C.M. Adcock, Esq.,
BP Exploration Company Limited,
Eakring,
Southwell, Notts.

Dear Mr. Adcock,

Natural Gas from Cousland

I have given some thought to the extent to which it will be possible to use the Cousland No.1 Well in the future as a means of underground gas storage. It seems to me that as we remove the natural gas the pressure in the well will fall and there will come a time when the water level will penetrate into the porous strata and thus spoil future prospects for pumping gas back into the well again. The difficulty is to decide when this point is reached; for example, when the pressure in the well has dropped to 300 lbs. per square inch will the water commence to penetrate into the porous strata or will this not happen until a much lower pressure is reached?

I wonder whether it would be possible for you, with your knowledge of the Cousland well, to give me your opinion as to the prospects of using the well in the future as a means of underground gas storage, and also whether you could give me an indication of the extent to which we should reduce the pressure in the well.

Yours sincerely,

T S Ricketts.

(T.S. Ricketts)
Chief Engineer

TSR/EWF

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

3rd April 1957.

C. M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
Post Office Box 1,
SOUTHWELL,
Notts.

14

Dear Mr. Adcock,

Natural Gas at Cousland

I thank you for your letter of the 1st April 1957 enclosing a second copy of Technical Notes 334/57 on the gamma ray survey at Cousland Well No. 1.

Yours sincerely,

T. S. Ricketts

T. S. RICKETTS p.p.
Chief Engineer

ROE/EWG

4240

1st April 1957

T.S. Ricketts Esq.,
The Scottish Gas Board,
26 Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Natural gas at Cousland

I thank you for your letter dated 25th March, and I have pleasure in sending you herewith a second copy of Technical Note 334/57 on the gamma ray survey at Cousland Well 1, in accordance with your request.

Yours sincerely,

C.M. Adcock

CMA/EMH

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

Your Ref. P.E.8 25th March 1957.

C. M. Adcock, Esq.,
B.P. Exploration Limited,
P.O. Box 1,
Eakring,
SOUTHWELL,
Notts.

Dear Mr. Adcock,

Natural Gas at Cousland

I thank you for your letter of the 20th March 1957 enclosing a technical note giving the results of the Gamma ray surveys obtained at Cousland Well No.1.

I thank you for this most interesting report and would be greatly obliged if you could arrange to send me one additional copy which I can then pass on to the Edinburgh Division of the Scottish Gas Board for their information.

Yours sincerely,

T.S. Ricketts pp. [signature]

T. S. RICKETTS
Chief Engineer

ROE/EWG

PE.11

22nd March 1957.

W.Y.Robb, Esq.,
Scottish Oils Ltd.,
Middleton Hall,
Uphall,
Broxburn,
West Lothian.

Dear Mr. Robb,

Natural Gas at Cousland

Thank you for your letter of 18th March and copy of the minutes of your meeting with the Scottish Gas Board. I have only a few very general comments to make on the Cousland Gas development scheme.

1. Distance between wellhead and separator.

This distance can of course be varied to suit local circumstances. I suggested an arbitrary figure of 50' to allow room for working on the well if necessary without interfering with the separator and ancillary equipment. You could of course come somewhat closer if necessary, but probably 40' should be regarded as a minimum distance.

4. Boundary fences for wellhead equipment.

As you point out this must depend largely on the local topography. The well itself is of course 100' from the roadway, this distance being governed by the Petroleum Act. Your suggestion of 75' being a safe distance for the rest of the equipment should be quite satisfactory. Otherwise the fencing can be as close to the wellhead etc., as is found convenient. If it should ever prove necessary to carry out a workover on the well, part of the fencing would have to be removed whilst this job is being undertaken.

5. Hydrate knock-out drum.

I agree that the hydrate knock-out drum is an unimportant item. If much trouble were to be experienced from hydrate formation it would be probably better to install a bottom hole flow regulator in the tubing itself so that the gas expansion can take place at the bottom of the well. The gas would then be warmed by the natural heat in the reservoir, which would prevent the formation of hydrates.

With regard to item 5 of the minutes of your meeting with the Scottish Gas Board I would not say that it is necessary to maintain a liquid seal in the bottom tank of the separator. The outlet is after all through two $\frac{1}{2}$" valves; and there is nothing detrimental in blowing out a small quantity of gas when the separator is drained of any fluid accumulation.

Yours sincerely,

C.M.Adcock

CMA/JMJ

P.E.8

20th March 1957

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Natural Gas at Cousland

Thank you for your letter dated 19th February. Mr. Robb, of BP Grangemouth, telephoned me last week; and I understand that you have had a meeting with him to make arrangements for the installation of the Cousland wellhead plant. I am sure you will find this procedure very satisfactory, especially as it will enable you to keep in constant touch with the progress of the work.

I am sending you herewith a technical note giving the results of the Gamma ray surveys obtained at Cousland Well No.1. I must apologise for the delay in sending it to you, but this was due to an oversight on my part. If you require additional copies of the Kirklington Hall report I can no doubt make arrangements to send them to you.

Yours sincerely,

C.M.Adcock.

CMA/JMJ

S.O { Mr. Robb / Mr. Greenhorn / Mr. Hay }

Mr. Elgin H.O.
Mr. Emmony H.O.
Mr. Cairns Edin.
Mr. McCallum Edin.

Thurs 7th March.

4137.

8th March, 1957.

Dr. G. Smith,
Messrs. Scottish Oils Ltd.,
Middleton Hall,
Uphall,
Broxburn,
West Lothian,

Dear Dr. Smith,

Gas Production Scheme for
Cousland Well No. 1.

In connection with our telephone conversation this morning, we are sending you a copy of Refineries and Technical Dept. Engineering Division memorandum reference RFD/215 dated 6th March. We are also forwarding to you quotations from various manufacturers for the required control valves.

We thank you for undertaking the procurement and installation of the wellhead plant on our behalf. I understand that Mr. Robb has been in touch with the Scottish Gas Board; and I hope that the scheme will now go forward as planned.

Yours sincerely,

C. M. ADCOCK.

CMA/EEK.

Copy

From REFINERIES & TECHNICAL DEPT.
ENGINEERING DIVISION

To BP EXPLORATION CO. LTD.
EAKRING
ATTN: MR. C.M. ADCOCK

Our Ref. RFD/215 **Your Ref.** PRO/1/3770 **Date** 6th March 1957

Subject PRODUCTION SCHEME FOR COUSLAND NO.1 WELL

Mr. Robb, of BP Grangemouth, recently visited London Office, and intimated that the majority of items detailed in our B.M.1205 could be obtained ex-stock, the exception being the valves listed on Sheet 5 of the B.M.

Accordingly, at Mr. Dickie's request, we asked our Stores Division to issue tentative enquiries, and have pleasure in enclosing the quotations received from various manufacturers in response to these.

We understand that there will be no difficulty as regards the wedge gate valves on Mark Nos. 90, 94 and 95 which can be met from bulk stocks. The position with the remaining items appears to be:-

Mark No.	Suggested Supplies	Delivery Promise
92	Tress Eng. Co.	June 1957
98) 99)	I.V. Pressure Controllers Ltd.	2/3 weeks
101	Fisher Governor Co.	18/20 weeks
103	Deurance & Co. Ltd.	4 months

It would thus appear that the material can be made available sometime in June, providing Orders are placed without delay, with the exception of the Safety Shut-off Valve, Mark No.101. In view of the urgency of commissioning the line we suggest that it would be perfectly safe to fit a flanged spool in the first instance, leaving sufficient room to accommodate this valve when it is delivered.

G.A. Varley

c.c. Mr. R.K. Dickie
Mr. W. Robb, BP Grangemouth

/PS

TELEPHONE · PERivale 6424
TELEGRAMS · CROSBY WESPHONE LONDON

CROSBY VALVE & ENGINEERING Co LTD

CROSBY WORKS, EALING ROAD

WEMBLEY

MIDDLESEX

OUR REF ED/BL. YOUR REF M.A.12/RFD/215/Tentative.

B.P. Trading Limited.,
Stores Division,
Beaufort House,
Gravel Lane,
LONDON E.1.

19th February, 1957

Dear Sirs,

We thank you for your enquiry of the 18th inst. and we have pleasure in quoting as follows :-

Item 103.

2 - 2" inlet x H x 3" outlet Crosby Style JO-35A Full Lift Nozzle Type Relief Valves, having cast steel body and bonnet with plain closed top with screwed cap over the adjusting bolt, inlet connection flanged A.S.A. 300 lbs R.F. outlet connection flanged A.S.A. 150 lbs. R.F. Provided with stainless steel full length nozzle and disc, stainless steel guide, guide rings etc. carbon steel spring, Valve set at 35 psig, at a temperature you would specify not exceeding 450°F.

Price. £57. 0s. 0d. each
(fifty seven pounds.)

With regard to delivery, we would require six months from receipt of instructions in which to complete the above item.

As usual our terms to you are less 2½% monthly account, packing and delivery f.o.b. British Port would be charged 5% extra.

All products are tested and inspected during and on completion of manufacture by ourselves and, in addition, your Inspector may witness a standard final test should you so desire. If special or additional tests are required, we reserve the right to charge an extra.

Continued/.......

CROSBY

B.P. Trading Limited.,   19th February, 1957

The prices quoted are based on the costs of material, labour etc. ruling at the date of this tender, and if between that date and the termination of the work variations either by rise or fall shall occur in these costs, then we reserve the right to amend the quoted price to provide for these variations.

Trusting you will find our offer acceptable.

We are,

Yours faithfully,
CROSBY VALVE & ENGINEERING CO. LTD.,

Contracts Engineering.

THE TRESS ENGINEERING COMPANY, LTD

30A, SACKVILLE STREET
LONDON, W.1

REGISTERED OFFICE: RIVERSIDE WORKS, NEWBURN, NEWCASTLE UPON TYNE. 5

MA/12/RFD/215.Tentative.
WBC/BD/TE. 82257/L.57270. 20th February, 1957.

Messrs. BP Trading Limited,
Stores Division,
Beaufort House,
Gravel Lane,
London, E.1.

Dear Sirs,

We duly received your valued enquiry of the 18th instant covered by your above reference and have pleasure in giving you herewith our offer, which we trust will meet with your requirements:-

<u>Item 92.</u>

1 off 2" <u>'Tress' Figure No. 1002.</u> (Drop Forged Steel Needle Type Globe Valve
600 lb Drop Forged Steel Globe Valves, union bonnet, screwed gland, loose disc, inside screw rising stem, 11½-13% chrome stainless steel trim. Ends screwed API 600 Series.
<u>DELIVERY:</u> June, 1957.

<u>Price each £10. 6. 6d.</u>

(Ten pounds six shillings and sixpence).

The price quoted above includes for delivery f.o.b. London/ Liverpool or equal with packing extra at cost.

<u>TERMS:</u> 2% cash seven days.

Assuring you of our continued attention at all times,

We are, dear Sirs,

Yours faithfully,
For and on behalf of,
THE TRESS ENGINEERING COMPANY LIMITED.
for W.B. Creasser
W.B. CREASSER. PJ

Scottish Oils – Gas Production Scheme.

Item No.	Suppliers & Description.
92	Triangle Valve Co. Lo. P.O. Box No. 38, Lamberhead Green Wigan, Lancs. 2" - Triangle No. 5042, drop forged steel needle valve. price £ 9-6-9 Ref: commercial sales/WTS/BG/E.3833. or Newman Hender & Co. Lo., Woodchester, Stroud, Glos. 2" - No 1556N - forged steel globe valve - Needle point type price £11-1-1 Ref. ~~MA. 12 / REF / 215 / Tentative~~. DJ/GB/35410
103	Dewrance & Co. Lo., Great Dover St. London. S.E.1. 2" x 3" No. 1906 Jc Dewrance consolidated cast carbon steel safety relief valve. Orifice area 1.287 sq: in. set pressure 35 p.s.i.g. cost £74 Ref: ~~#~~ BSB/BCL/AB.
92	The Tress Engineering Co. 30a Sackville St. London. W.1. Tress Fig. No. 1002 Drop forged steel needle type globe valve. price £10. 6-9 Ref. WBC/BD/TE. 82257/L.57220
103	Crosby Valve & Engineering Co. Lo. Wembley. 2" inlet x H x 3" outlet Crosby style 70-35A Lift Nozzle type relief valve. £57. Ref: ED/BL.
101	Fisher Governor Co. Lo. Airport Works, Maidstone Rd: Rochester, Kent. 2" cast iron safety shut-off ~~valve~~. regulator. price £87-14-0 Ref: R 2522
98 & 99	I.V. Pressure Controllers Lo. 683. London Rd, Isleworth. Middx. Valve 'FLOWMASTER 3' - drawing # CU.427/1 price £ 79-10-0 @. - similar to H-5 Ref: JAS/AF.

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

19th February, 1957.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
P.O. Box 1,
Southwell,
Nottingham.

Dear Mr. Adcock,

Natural Gas at Cousland

I acknowledge your letter of 14th February, 1957 enclosing three copies of your drawing number 1205 showing your latest proposals for the layout of equipment following the wellhead at Cousland, together with three copies of a schedule of materials.

These are now receiving consideration, and I shall be writing to you with comprehensive comments as soon as possible.

Yours sincerely,

T. S. Ricketts
(T.S. Ricketts) pp
CHIEF ENGINEER

DCE/AH

14th February, 1957

T.S.Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Production Scheme for Cousland Well No.1

Further to my letter dated 4th February I have now received from our Development Engineering Branch the working drawing and bill of materials for the Cousland production scheme.

You will note from their drawing No.1205 that the following slight modifications have been made to the scheme:-

(a) The lower half of the impact baffle plate is provided with slits in place of the proposed perforations. This is to facilitate the gravitational flow of water to the bottom of the vessel.

(b) The agglomerator has been designed in the form of a stainless steel wire mattress, which should provide better mist extraction than the proposed perforated plate.

(c) A needle valve has been substituted for the flow bean to provide ready adjustment of the pressure drop on the upstream of the reducing valves.

(d) A by-pass has been provided round the reducing valves to allow for manual control when the latter require maintenance.

(e) In accordance with Eakring's memo. PRO/1 dated 4th January the vessels will be fashioned from 12" line pipe in lieu of the casing originally proposed.

We are hoping to be able to make arrangements with Messrs Scottish Oils Ltd., for them to undertake the procurement, fabrication, and erection of the complete installation. Our tentative approximate estimate for the cost at this stage is £1400, which we will be able to confirm or otherwise amend after talking the scheme over with Messrs Scottish Oils Ltd.

At your request we are sending you three copies of drawing No.1205 and the accompanying bill of materials.

Yours sincerely,

C.M.Adcock

Mr. Robb

14th February, 1957

Dr. G. Smith,
Scottish Oils Ltd.,
Middleton Hall,
Uphall,
Broxburn,
West Lothian,

Dear Dr. Smith,

Gas Production Scheme for Cousland Well No.1

In connection with our telephone conversation this morning, it would be of considerable assistance to us if you could undertake the installation of the wellhead plant required for the Cousland gas production scheme, on behalf of the Scottish Gas Board.

The scheme has been engineered by the Development Engineering Branch in consultation with the Scottish Gas Board. Drawing No.1205 attached shows the details of the scheme. It will be noted that the plant consists essentially of a water separator made out of 12" line pipe, together with an agreed arrangement of pressure reducing and control valves before the gas is delivered to the Gas Board's pipe line to Musselburgh. We are also sending you the Bill of Material required for this scheme to drawing No 1205

A copy of the London memorandum RFD/215 is also attached, from which it is seen that their estimate for the total cost is £1400 of which £850 is direct material and £550 fabrication and erection costs.

If you should require any further information, I shall be pleased to do my best to give it to you; but I hope that I have sent you everything you require for you to be able to decide whether you will be able to carry out this work on our behalf, which will be very much appreciated.

Yours sincerely,

C.M.Adcock.

Copy

1 copy

From DEVELOPMENT ENGINEERING BR: ENGINEERING DIVISION
To MANAGER RESERVOIR ENG., DRILLING FLUIDS & PRODUCTION BRANCH

Our Ref. RFD/215 **Your Ref.** **Date** 6th February 1957

Subject GAS PRODUCTION SCHEME FOR COUSLAND NO.1 WELL

With reference to your memo. Ref. PRO/15/6194 dated 28th November, we attach six prints plus Bills of Material of Drawing No. 1205 showing the development of the scheme prepared at Eakring for the supply of gas from Cousland No.1 Well via the Gas Board's 4" pipeline to Musselburgh.

In general the details of the scheme have been closely adhered to with the following slight modifications which we believe will result in more satisfactory operation.

(a) The lower half of the impact baffle plate is provided with slits in place of the proposed perforations. This is to facilitate the gravitational flow of water to the bottom of the vessel.

(b) The agglomerator has been designed in the form of a stainless steel wire mattress, which should provide better mist extraction than the proposed perforated plate.

(c) A needle valve has been substituted for the flow bean to provide ready adjustment of the pressure drop on the upstream of the reducing valves.

(d) A by-pass has been provided round the reducing valves to allow for manual control when the latter require maintenance.

(e) In accordance with Eakring's memo. PRO/1 dated 4th January the vessels will be fashioned from 12" line pipe in lieu of the casing originally proposed.

/.....

We estimate that the total cost will be approximately £1,400 of which £850 will be Direct Material and £550 fabrication and erection costs. This price excludes the building to house the control gear which is, we understand, being provided by the Gas Board.

In view of the location of the well we suggest that you might consider asking BP Grangemouth to undertake the procurement, fabrication and erection of the complete installation, for which the majority of materials might well be obtainable from Refinery stocks.

We note from Eakring's memo. PRO/1 dated 28th December that the Gas Board are making provision to heat the building housing the control gear, if found necessary to avoid freezing. This installation will, of course, have to be carefully checked from the safety angle and, if gas is used, would probably be in the form of a remote fired hot water system.

<u>H.W. Tombs</u>

/PS

EXP/1/3967

4th February 1957

T.S. Ricketts Esq.,
The Scottish Gas Board,
26 Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Production scheme for Cousland No.1 well

Thank you for your letter dated 25th January, and I have passed on to our Engineering Branch in London the details of the "Pakistan" governor.

As requested I am sending you a further two copies of our drawing No. BM/655a. With regard to the report on the production tests I did not have any spare copies; and so I arranged for prints to be taken from our own copy. I think you will agree that the results are as clear as the usual carbon copy, and I trust that you will consider the printing satisfactory. I am sending you two of these printed copies, so that you will now have three copies in all, which is in line with your present request for such information to be submitted to you in triplicate.

Yours sincerely,

C.M. Adcock

CMA/EMH

Copy

From BP EXPLORATION CO.LTD.,
EAKRING.

To CHIEF DEVELOPMENT ENGINEER (MR. TOMBS), ENGINEERING DEVELOPMENT BRANCH, REFINERIES DIVISION.

Our Ref. EXP/1/3935

Your Ref.

Date 29th January 1957.

Subject PRODUCTION SCHEME FOR COUSLAND NO.1 WELL.

I am sending you herewith a copy of a letter from the Scottish Gas Board dated 25th January giving the details of the "Pakistan" governor which you are requiring for incorporation in the general arrangement drawing of the Cousland production scheme.

You will note that the Scottish Gas Board has requested that all drawings, etc. which are sent to them in the future to be in triplicate.

C. M. ADCOCK.

c.c. Manager,
Reservoir Engineering
Drilling Fluids & Production Branch.

CMA/EEK.

3 copies
C M.A. (?)

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

25th January, 1957.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Britannic House,
Finsbury Circus,
London E.C.2.

Dear Mr. Adcock,

Production Scheme for Cousland No.1 Well

I was pleased to note from your letter of 24th January, 1957 that you have arranged with your engineering department that the 4-inch blow off valve will be included in the equipment you will be supplying for incorporation in the connections from the wellhead at Cousland.

I have heard today from our Edinburgh Division that the "Pakistan" governor which we will be supplying will be fitted with 2-inch diameter flanges to British Standard Table E, this being the standard size of flange for the capacity we require. The length to this governor will be 15-inches between the flange faces. The 2-inch diameter pipe will therefore continue to the inlet of the "Pakistan" governor, and we will be fitting a 2-inch diameter to 4-inch diameter taper piece immediately following the governor. I trust that this information will be of assistance.

You will recall that with your letter of 4th January, 1957 you enclosed a copy of the report you prepared following the production tests at Cousland on 11th and 12th November, 1956. The information contained in this report will be of considerable interest to our Edinburgh Division and it would be most helpful if you can let me have a further copy. I also intend to let Edinburgh Division have a copy of your drawing number BM.655/a which was enclosed with your letter of 27th December, 1956. I wonder if you could spare two further prints of this drawing? I would like also if you could arrange for me to have three copies of any future drawings or reports referring to the Cousland scheme so that these can be distributed here as necessary.

Yours sincerely,

T. S. Ricketts

(T.S. Ricketts)
CHIEF ENGINEER pp

DCE/AH

EXP/1/3922.

24th January 1957.

T. S. Ricketts, Esq.,
The Scottish Gas Board,
26 Drumsheugh Gardens,
Edinburgh, 3.

Dear Mr. Ricketts,

Production Scheme for Cousland No.1 Well.

Thank you for your letter of the 10th instant, and I have passed on to our Engineering Branch your request that we should also provide the 4" blow off valve.

I understand that good progress is being made in the preparation of the Cousland production scheme, and I have been asked for the details of the connections to your 4" governor. If you will kindly send me these particulars I will pass them on to our Development Section for incorporation in the drawing.

Yours sincerely,

C. M. ADCOCK.

CMA/EEK.

H.120 C.1.40

HW. TOMBS

Copy

From BP EXPLORATION CO. LTD., EAKRING.

To CHIEF DEVELOPMENT ENGINEER (MR. TOMBS) ENGINEERING DEVELOPMENT BRANCH REFINERIES DIVISION.

Our Ref. EXP/1/3874 **Your Ref.** **Date** 16th January 1957

Subject PRODUCTION SCHEME FOR COUSLAND NO. 1 WELL

I am sending you herewith for your information a copy of the Scottish Gas Board's letter dated 10th January 1957.

You will note that they confirm requiring us to install the plant which we are purchasing on their behalf. If Messrs. Scottish Oils Ltd. are manufacturing the separator it would be most convenient if they could also undertake the installation of the wellhead equipment.

The Scottish Gas Board have also asked us to supply the 4" diameter blow-off valve in addition to the 2" diameter blow-off valve. Both these valves will be presumably of similar design.

C.M. Adcock

c.c. Manager,
Reservoir Engineering,
Drilling Fluids and Production Branch.

CMA/EMH

KIRKLINGTON HALL TECHNICAL NOTE

Petroleum Engineering Section

Borehole Survey of Cousland Well No. 1,

7.11.56.

TN.334/57.
17th January, 1957.

1. Introduction.

(a) General.

Cousland Well No. 1 was drilled as part of the British Isles exploration programme by the then D'Arcy Exploration Company over the period 5.9.37 - 12.9.38, to a total depth of 2917'. The bit stuck on bottom at 2917' and drillpipe was backed off at 2086', a cement plug being placed on top of the fish. $8\frac{3}{4}$" casing was cemented to surface, the shoe being at 2057'.

A number of packer tests was made during the drilling period, and several horizons were tested after casing had been run. Details of these tests are given in Section 2 below. Following the last of these tests the producing horizon was plugged off and the well was closed in, as there was no immediate demand for the gas which was proved on test. In November 1956, the well was re-opened and the plug was cleaned out to 1660'.

The casing was then perforated over the interval 1575'-1605'.

(b) Operational.

Logging conditions were as shown on the heading to the attached chart.

2. Packer and Production Tests.

(a) Packer Tests.

The following packer tests had been made:-

1188'-1209'	produced	at	the	rate	of	15,000-20,000 cu.ft. gas per day.					
1248'-1275'	"	"	"	"	"	30,000 cu.ft. gas per day.					
1582'-1632'	"	"	"	"		4,000,000	"	"	"	"	"
1724'-1806'	"	"	"	"		5,900,000	"	"	"	"	"
2094'-2122'	"	"	"	"		150,000	"	"	"	"	"

(b) Production Tests.

After $8\frac{3}{4}$" casing had been run, the following production tests were made, each interval being perforated with $4 \times \frac{3}{8}$" shots/ft.

(i) 1760'-1806', 17.4.39-24.4.39.

Initial C.I.P. = 659 p.s.i.

Initial production 13 x 10^6 cu.ft. gas per day, declining after three days to 7 x 10^6 cu.ft. per day. Water production increased from 17,000 to 22,000 galls. per day. Total production 35 x 10^6 cu. ft. gas and 75,000 galls. water.

9.5.39-15.5.39.

C.I.P. = 552 p.s.i.
Water free production rate = 70,000 cu.ft. per day.
13.8.39. C.I.P.= 594 p.s.i.
Plugged back to 1740'.

(ii) 1720'-1735', 10.9.39.

C.I.P. = 593 p.s.i.
Well flowed at rate of 800,000 cu.ft. gas per day, then shut in.

(iii) 1582'-1613', 1622'-1630' and 1720'-1735'.

These intervals were tested simultaneously.

3.11.39.

C.I.P. = 587 p.s.i. Gas/water level approx. 1708'.

30.11.39.

Well closed in after flowing total of 30 x 10^6 cu.ft. gas. Following this, well flowed at restricted rate of 1 x 10^6 cu.ft. gas per day. Flowing pressure fell from 580 p.s.i. to 550 p.s.i.

31.12.39.

C.I.P. = 590 p.s.i. Gas/water level approx. 1708'.

The perforated intervals were then plugged off. The hole filled with heavy mud and closed in. The well was re-opened in November, 1956, and the cement plug was cleaned out to 1660'. The interval 1575'-1605' was perforated.

(iv) 1575'-1605'.

Tests indicated that the well will flow at a rate of approximately 3 x 10^6 cu.ft. gas per day.

3. Discussion of Results.

(a) Qualitative.

The gamma ray log delineates the formation boundaries very clearly. The interpretation shown on the chart has been prepared on the basis of the geological log, with which the gamma ray log is generally in good agreement.

The chart also shows the correlation with Cousland Well No. 5. Well No. 1 is structurally some 90'-130' higher than Well No. 5.

It will be seen that the sandstone which has recently been perforated in Well No. 1 is comparatively poorly developed in Well No. 5, being broken by clearly marked shale beds.

(b) Quantitative.

Shale factors have been calculated for a number of corresponding horizons in the two wells. A summary of the method of estimating shale factors is given in the Appendix to this Technical Note.

Whilst we cannot estimate how accurately the shale factors represent the percentage of shale actually present in any given sandstone, we believe that they do give a fairly reliable indication of the relative "shaliness" of the various intervals considered, and hence a comparison of the permeabilities of corresponding zones.

Well No. 1.				Well No. 5.			
$D_{min.}$ = 2.8 divisions. $D_{max.}$ = 10.0 " $D_{max.} - D_{min.}$ = 7.2 "				$D_{min.}$ = 1.5 divisions. $D_{max.}$ = 7.0 " $D_{max.} - D_{min.}$ = 5.5 "			
Interval	Deflexion (D)	$D-D_{min.}$	Shale Factor	Corresponding Interval	Deflexion (D)	$D-D_{min.}$	Shale Factor
920'- 950'	4.1	1.3	18	1040'-1065'	3.6	2.1	38
958'- 988'	4.6	1.8	25	1070'-1095'	3.8	2.3	42
1180'-1195'	4.6	1.8	25	1287'-1295'	4.5	3.0	55
1238'-1270'	2.8	0	0	1343'-1368'	1.8	0.3	5
1422'-1444'	3.6	0.8	11	1510'-1530'	1.8	0.3	5
1575'-1604'	3.4	0.6	8	(1690'-1700'	2.3	0.8	15
				(1710'-1720'	1.8	0.3	5
1608'-1633'	3.4	0.6	8	1725'-1752'	1.9	0.4	7

The data given above show that the majority of sandstones are considerably more shaly in Well No. 5 than in Well No. 1. In all cases the shale factors have been calculated for the cleanest parts of the intervals quoted.

4. Conclusions.

There is good gamma ray correlation between the two wells.

Estimates of shale factors indicate that sandstones in Well No. 5 are in most cases appreciably more shaly than in Well No. 1.

P. J. Tracy.

TN.334/57,
17th January, 1957,
/MW.

APPENDIX

Calculation of Shale Factors from Gamma Ray Logs.

1. Determine the point at which radio-activity is a minimum. Let the deflexion at this point be $D_{min.}$.

2. Determine the average deflexion given by shales, ignoring thin marine bands showing exceptionally high radio-activity. Let this average shale deflexion be $D_{max.}$.

3. In the cleanest portion of any sand, the deflexion will have some value, say, D.

4. The shale factor is calculated thus:-

$$S.F. = \frac{D - D_{min.}}{D_{max.} - D_{min.}} \times 100.$$

Note.: The deflexion may be measured in either counts per second or scale divisions. In the estimates given above, scale divisions have been used. On the log of Cousland Well No. 1, $D_{min.}$ (2.8 scale divisions) occurs at 1256', and the average shale deflexion is 10 scale divisions.

This method, together with some of its difficulties and limitations, is discussed more fully in Section IIIb of Report No. KH/PE/13, "Gamma Ray Survey of the Wingfield Flags at Eakring and Duke's Wood," by F. H. Mann and D. Hoyte, June, 1951.

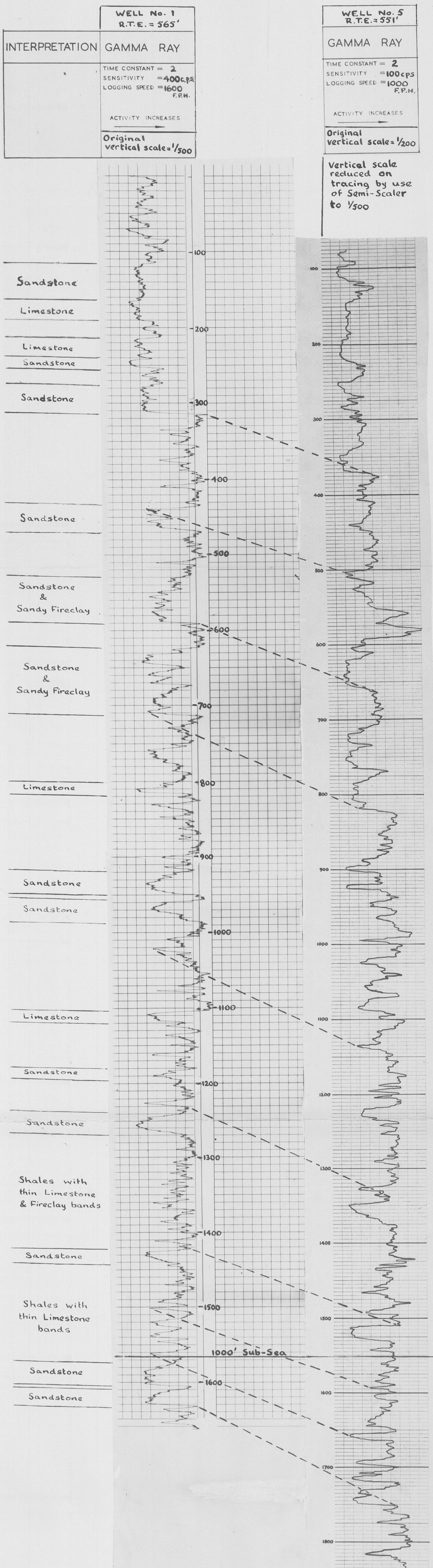
TN.334/57.
17th January, 1957.

LOCATION :- COUSLAND

WELL No. 1

DATE 7th Nov. 56

SHOWING CORRELATION WITH COUSLAND WELL No. 5



3 copies please

Chq

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

Your ref: RPO/1

REPLY TO CHIEF ENGINEER

10th January, 1957.

royalty 2d per 1000 ft^3

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Britannic House,
Finsbury Circus,
London E.C.2.

Dear Mr. Adcock,

Natural Gas at Cousland

I have now received your letter of 4th January, 1957 enclosing a copy of your report of the production tests carried out at Cousland on 11th and 12th November, 1956 after Number 1 Well was brought back into production. This is, of course, of great interest to us and I shall circulate it as necessary.

I have noted from your letter that your engineering branch are now planning the wellhead equipment on our behalf. I confirm that we will require you to assemble the equipment which you are purchasing for us, and it will therefore be in order if you complete the production scheme up to the point where our 4-inch diameter pipe line will commence.

I should point out at this stage that the 4-inch diameter equipment to be fitted by us includes a blow off valve of similar design to the blow off valve in the 2-inch diameter section to be installed by you. We are presuming that you will be arranging to provide the 4-inch diameter blow off valve as well as the 2-inch diameter blow off valve, but we shall arrange to fit the former along with our governor and other equipment.

We now look forward to receiving your working drawing showing the general arrangement of the equipment, together with the dimensions of the flanges, and other details.

Yours sincerely,

T.S. Ricketts

(T.S. Ricketts)
CHIEF ENGINEER

DCE/AH

Copy

From BP EXPLORATION CO.LTD.,
EAKRING.

To VIA EXPLORATION RECORDS.
Manager, Reservoir Engineering
Drilling Fluids & Production
Branch.

Our Ref. PRO/1

Your Ref.

Date 4th January 1957.

Subject

PRODUCTION SCHEME FOR COUSLAND NO. 1 WELL.

As requested we are forwarding to you two copies of the completion report on the bringing in of Cousland No. 1 well, and the carrying out of production tests on 11th and 12th November 1956.

We have forwarded a third copy to the Scottish Gas Board at Edingburgh, for their information and retention.

C. M. ADCOCK.

CMA/EEK.

PRO/1.

4th January 1957.

T. S. Ricketts, Esq.,
The Scottish Gas Board,
26 Drumsheugh Gardens,
Edinburgh, 3.

Dear Mr. Rickets,

PRODUCTION SCHEME FOR COUSLAND NO.1 WELL.

Thank you for your letter dated 28th December which crossed with my letter to you dated 27th December. Yesterday I visited our Engineering Development Branch at Beaufort House, London, to discuss the details of the production scheme for No. 1 well.

Our Engineering Branch are now planning the scheme on the assumption that all the production plant will be located about 100' away from the wellhead. We presume that you will require us to assemble the equipment which we will be purchasing on your behalf: in which case we will complete the production scheme to the commencement of your 4" pipe line. Details of the flanges, etc. will be shown on the general arrangement drawing which we will be sending you in due course.

I am forwarding to you a copy of the report giving the details of the production tests we carried out on 11th and 12th November 1956 after bringing in the well.

Yours sincerely,

C. M. ADCOCK.

CMA/EEK.

C.11.46

Copy

From	BP EXPLORATION CO.LTD. E A KRING.	**To**	CHIEF DEVELOPMENT ENGINEER (Mr.Tombs) ENGINEERING DEPT. BRANCH, REFINERIES DIVISION.
Our Ref. PRO/1	**Your Ref.**	**Date**	4th January 1957.

Subject PRODUCTION SCHEME FOR COUSLAND No.1 WELL.

Further to our discussion at Beaufort House yesterday, we confirm that we have not got in stock the required flanges for the 11.3/4" casing.

We agree therefore with your suggestion that the water separator should be fabricated from 12" line pipe. It would also be most convenient if Messrs. Scottish Oils Ltd. will undertake to make this separator.

As requested, we are forwarding to you a copy of the Scottish Gas Board's letter dated 28th December 1956. We are taking up the matter of the assembly of the wellhead plant at Cousland with the Scottish Gas Board; but we presume that we shall be required to connect in the equipment up to the Gas Board's 4" pipe line.

C. M. ADCOCK.

c.c. Manager,
Reservoir Engineering,
Drilling Fluids & Production Branch.

CMA/EEK.

I + Copy please

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

28th December, 1956.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Britannic House,
Finsbury Circus,
London E.C.2.

Dear Mr. Adcock,

Natural Gas from Cousland

Further to our extremely useful discussion on the details of the proposed wellhead gas control installation at Cousland, I wonder if your colleagues on the mechanical engineering side can give us an indication of the size and drilling of the flanges on the high pressure regulators and other equipment which you are to supply.

I would like to take this opportunity to thank you for giving us the benefit of your experience, both at our recent meeting and on several occasions previously.

With all good wishes,

Yours sincerely,

T. S. Ricketts
(T.S. Ricketts) pp DCE
CHIEF ENGINEER

DCE/AH

Your Ref: CMA/EMH

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

29th December, 1956

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

Cousland No.1 Well

Thank you very much for your letter of 27th December 1956 and for the copy of the amended drawing B.M.655A which you enclosed, showing the safety precautions to be taken on the wellhead installation. At first glance it appears to be just what we require, but if after studying the drawing in detail we find any further points we wish to raise we will contact you again by letter.

Yours sincerely,

T S Ricketts

(T.S. Ricketts)
Chief Engineer

TSR/EWF

C.11.46

Copy

From BP EXPLORATION CO.LTD., EAKRING.

To ENGINEERING DEVELOPMENT BRANCH. REFINERIES DIVISION. (ATTENTION: MR. R.G.GRANT.)

Our Ref. PRO/1. **Your Ref.** **Date** 28th December 1956.

Subject PRODUCTION SCHEME FOR COUSLAND NO. 1 WELL.

At Mr. Dickie's request we are sending you our estimate for the cost of fabricating the high pressure mist extractor and water separator. It will be noted that we have only an approximate cost for the flanges for the 11.3/4" casing. At an average cost of circa £20 each these flanges are the most expensive part of the separator.

It is proposed to use slip-on flanges for welding to the casing, and blank matching flanges. The top section of the separator should be flanged at each end to give access to the impact baffle plate and to the agglomerator plate. One end of the bottom section of the separator should also be flanged for cleaning purposes.

There is thus little scope for saving on the flanged ends of the separator. The details of the cost estimate for the complete separator are as follows:-

Quantity.	Description.	Unit Cost.	Total Cost.
24'	11.3/4" casing	21/9d.per ft.	£26
8	4 slip-on & 4 blank flanges for 11.3/4" casing	circa £20	£160
2	H.P.drain cocks. Suggest Klinger type AB-22 - 3/8" bore F/S (forged steel)	£5.10.0.	£11
1	Forged steel Reflex gauge. Suggest Klinger type K Model VII	£10	£10
2	Connecting tubes for Reflex gauge	£1	£2
1 pair	Klinger cocks type AB-18 KD forged steel for 600 p.s.i. working pressure	£21	£21
1	Drain cock for Reflex gauge	£3	£3
	Cost of fabrication of separator	-	£27
	TOTAL COST.		£260

It will be noted that thisprice does not include the concrete supports for the separator; nor does it include the 2" inlet and outlet valves, and the separator bye-pass.

It is suggested that in your general arrangement drawing you indicate that the separator and pressure control equipment be sited 100' away from the wellhead. This will allow space for workover operations, such as running Otis equipment etc. It is believed that the Scottish Gas Board is planning to locate all the pressure control equipment in a small building, which can be gas heated if necessary to avoid freezing conditions affecting the operation of the instruments in use.

C. M. ADCOCK.

c.c. Manager,
Reservoir Engineering,
Drilling Fluids & Production Branch.

CMA/EEK.

Copy

From	BP EXPLORATION CO. LTD., EAKRING.	**To**	ENGINEERING DEVELOPMENT BRANCH, REFINERIES DIVISION. (ATTENTION OF MR. R.C. GRANT)
Our Ref.	PRO/1/3770 **Your Ref.**	**Date**	27th December 1956

Subject PRODUCTION SCHEME FOR COUSLAND NO. 1 WELL

Further to our telephone conversation this morning we are sending you a copy of our drawing No. BM 655 A showing the safety precautions which the Scottish Gas Board decided should be taken to protect their 4" pipeline from the 600 p.s.i. wellhead pressure.

A covering note discussing these points is attached to the drawing. We are also sending you herewith one of Messrs. I.V. Controllers Ltd. catalogues, for you to decide whether you consider that the pressure regulators suggested are the most suitable type for the work required of them.

C.M. Adcock.

c.c. Manager, Reservoir Engineering
Drilling Fluids and Production Branch.

CMA/EMH

3771

27th December 1956

T.S. Ricketts Esq.,
The Scottish Gas Board,
26 Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Production Scheme for Cousland No.1 Well

Further to our meeting in Edinburgh last week, I have now had drawing No. BM 655 amended to show the safety precautions, which, it was decided should be taken to protect the 4" main pipeline from the 600 p.s.i. well-head pressure.

I am sending you a copy of our amended drawing No. BM 655 A herewith together with a covering note on the points discussed. I have sent this information on to our Engineering Branch in London for them to prepare the working drawing, and to cost the complete production scheme to your 4" main pipe line.

Yours sincerely,

C.M. Adcock

CMA/EMH

COUSLAND NO. 1 WELL.

GAS PRODUCTION SCHEME.

Revision of scheme as a result of a meeting with the Scottish Gas Board on 20th December 1956.

The diagrammatic sketch BM 655 A shows the amended arrangement for the proposed gas production scheme. This proposal was arrived at after a discussion with Messrs. Ricketts, Cox, Elgin and Cairns at the Scottish Gas Board's Office in Edinburgh on 20th December 1956.

The discussion centred around the safety precautions to be taken to prevent the possibility of the full wellhead pressure of 600 p.s.i. being transmitted to the 50 p.s.i. cast iron main pipe line to Musselburgh.

The following points were agreed:-

(1) Fit a by-pass line across the high pressure water separator.

(2) Install the Flow Bean on the high pressure side of the pressure controller. The throughput of the flow bean would then be circa 2000 cubic feet per day at the wellhead pressure instead of 100,000 cubic feet per day at atmospheric pressure.

(3) Fit two high pressure regulators instead of only one. It is thought that two of the type H5 controllers made by Messrs. I.V. Pressure Controllers Ltd. would be suitable for this work. The regulators to be connected in series; and the first controller to reduce the pressure from 600 p.s.i. to 100 p.s.i., and the second controller to reduce the pressure from 100 p.s.i. to 25 p.s.i.

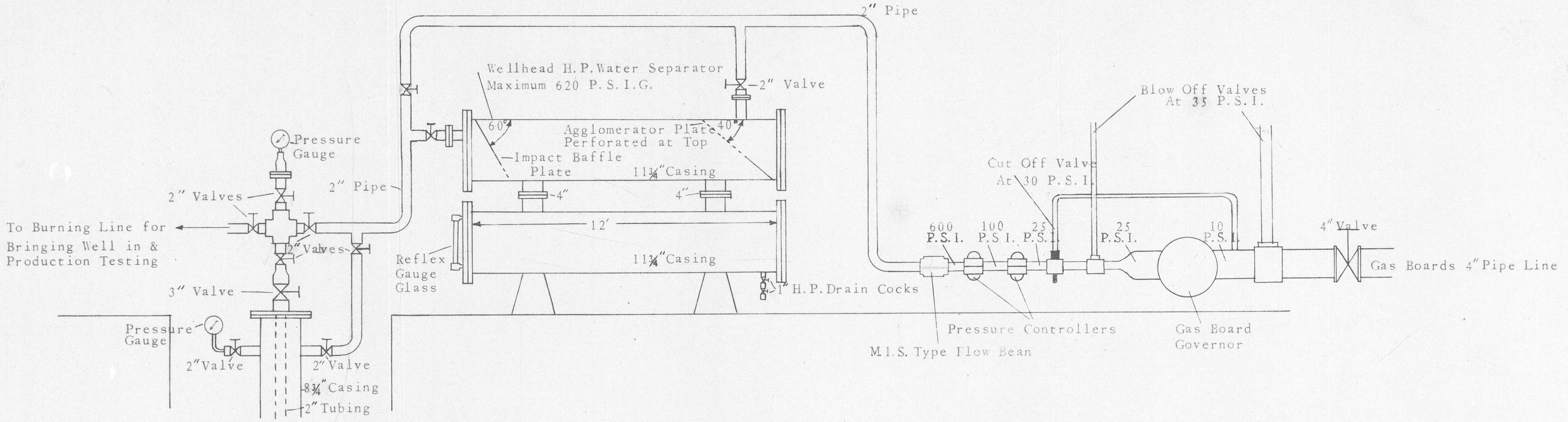
(4) The Gas Board's governor is connected into the 4" pipeline, and will be set to reduce the pressure from 25 p.s.i. to 10 p.s.i. It is required to fit a shut-off valve controlled by the pressure on the downstream side of the Gas Board's governor. If the pressure in the 4" line rises to 30 p.s.i. then the cut off valve will close.

(5) In addition to the shut-off valve, a safety release valve is required between the shut-off valve and the Gas Board's governor. This is to be set to blow off at 35 p.s.i. In consequence, it will only come into operation after failure of the other control mechanisms.

(6) The Gas Board will supply all instruments and fittings for the 4" pipe line. It will be noted that it is proposed to install a second safety release valve after the Gas Board's governor. Again this would blow off at 35 p.s.i., and would only come into operation after the failure of all the other pressure controllers.

It is pointed out that it is planned for the pipeline to be completed by May 1957; and all equipment should be available for installation by this date.

Eakring
27.12.56
CMA/EMH



BP EXPLORATION CO. LTD., EAKRING NOTTS.

COUSLAND NO. 1 WELL

DIAGRAMMATIC ARRGT. OF WELLHEAD PLANT
FOR GAS OFFTAKE TO GAS BOARDS' PIPE LINE

Scale : Diagrammatic
Date : 22.11.56

BM. 655/a

Mr Adcock

3687

7th December 1956

The Manager,
The North British Hotel,
Edinburgh,
Scotland.

Dear Sir,

Confirming our telephone conversation today please reserve single accommodation for Mr. C.M. Adcock on 19th and 20th December 1956.

Yours faithfully,
For BP EXPLORATION CO.LTD.,

Kal

For Manager,
(U.K. DRILLING & PRODUCTION)

KRL/EMH

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO CHIEF ENGINEER

5th December, 1956.

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1,
Southwell, Notts.

Dear Mr. Adcock,

Production Scheme for Cousland No.1 Well

Thank you for your letter of 3rd December 1956. I confirm that Thursday, 20th December, 1956 will be a suitable date for our meeting.

I also confirm that the meeting will be held at 10.30 a.m. in my office at 26 Drumsheugh Gardens.

I look forward to seeing you.

Yours sincerely,

T. S. Ricketts.

(T.S. Ricketts)
Chief Engineer.

Dictated by Mr. Ricketts
and signed in his absence. GW.

3657

3rd December 1956

T.S. Ricketts Esq.,
The Scottish Gas Board,
26 Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Production scheme for Cousland No. 1 Well

Thank you for your letter dated 29th November suggesting a meeting in Edinburgh on 19th or 20th December.

May we make Thursday 20th December a firm appointment? This date should be quite convenient. If by any chance I cannot manage it I will let you know straight away.

I propose travelling to Edinburgh on the Wednesday. Will you be holding the meeting on the Thursday in your office at 10.30 a.m. as was the case when I visited you at the beginning of this year?

Yours sincerely,

C.M. Adcock.

CMA/EMH

THE SCOTTISH GAS BOARD
26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"
REPLY TO CHIEF ENGINEER

29th November, 1956

C.M. Adcock, Esq.,
B.P. Exploration Company Limited,
Eakring,
P.O. Box 1, Southwell, Notts.

Dear Mr. Adcock,

Production Scheme for Cousland No.1 Well

Thank you for your letter of 26th November, 1956 referring to the above matter.

It was very good of you to send me the detailed notes on the gas production scheme for No.1 Well and I look forward to receiving from you, in due course, details of the recent production tests. In the meantime the information you have provided will be sufficient for our immediate needs.

With regard to the date of our proposed meeting, I wonder if Wednesday 19th or Thursday 20th December would be suitable? Perhaps you would be good enough to let me know if either of these dates would be convenient.

Yours sincerely,

T. Ricketts

(T.S. Ricketts)
Chief Engineer

TSR/EWF

OTIS ENGINEERING CORPORATION

MANUFACTURERS OF PRESSURE CONTROL EQUIPMENT

6612 DENTON DRIVE — ENGINEERING OTIS CORPORATION — P. O. BOX 7206

DALLAS 9, TEXAS

December 13, 1956

B. P. Exploration Company Limited
P. O. Box 1
Southwell, Notts.
England

RECEIVED
EAKRING
20DEC1956

Attention: Mr. C. M. Adcock

Re: Your Reference No. 3631
Our Quotation No. 1394

Gentlemen:

This is to acknowledge your letter of November 27, 1956, regarding Otis Removable Bottom Hole Regulators. As requested in your letter, we have quoted Items 1 through 6 as the necessary equipment for running and pulling operations of any Otis Wire Line Subsurface control equipment. You will note under Item 7, we have quoted you an Otis Wire Line Stuffing Box packed for .072" wire. We have found the wire in question to be very satisfactory in working to depths of 9,000-10,000 Ft. and on most wire line operations. On depths below 10,000 Ft. we highly recommend the .082" wire line. It is our understanding that the above equipment would be used at approximately 1,600 Ft., and the .072" should, therefore, be very adequate to handle any proposed operations. In your fourth paragraph you asked the question as to whether the Type B Mandrel Assembly required the Type H Running Tool and the Type RB Pulling Tool. This deduction was correct, and we have, therefore, quoted you under Items 12 and 13 the prices on this equipment.

In paragraph five you have requested our advise on the regulator as opposed to the bottom hole choke. After considering your specifications, we feel that the bottom hole regulator is the correct equipment to be used due to your variation of flowing rates. The bottom hole choke would prevent freezing but would hold you to a constant rate of flow unless this choke were pulled and a different size bean inserted and then rerun. Whereas, the bottom hole regulator will allow you to variable flow rate without any adjustment other than the one adjustment prior to running the regulator.

In your last paragraph you ask us to clarify the difference between the Type S and Type J Landing Nipples and Mandrel assemblies. You will note from the attached literature concerning these tools, the Type J Nipple has smaller dimensions by the I.D. and O.D. as opposed to the Type S. The Type J equipment restricts you to the smaller I.D. and the use of only one landing nipple. Type S dimension equipment would permit the use of more than one landing nipple in the tubing string. In wells using the Type J Landing Nipple, the operator is limited to an I.D. of 1-25/32 bore through the nipple. If you have proposed any future work on these wells, such as permanent completion operations or extensive operations below the nipple position, we would recommend the Type S, Position 1 Landing Nipple; otherwise, the Type J should fill your needs.

We feel that the attached instructions will more fully explain the operation of the Type J and Type S Mandrel assemblies. From your letter we were uncertain as to your need for surface control equipment such as a lubricator and wire line valve with associated swages. If you are interested in this surface control equipment, we shall be more than happy to furnish this information upon request.

ITEM	QTY.	PART NO.	DESCRIPTION	AMOUNT
1	1	43B01	$1\frac{1}{2}$" Type B Wire Line Socket @ $35.00 ea.	$35.00
2	1	44B2-3	$1\frac{1}{2}$" Type B Wire Line Stem - 36" Long @ $20.50 ea.	20.50
3	1	44B2-5	$1\frac{1}{2}$" Type B Wire Line Stem - 60" Long @ $28.00 ea.	28.00
4	1	44A04	$1\frac{1}{2}$" Type B Wire Line Jars - 30" Stroke @ $74.75 ea.	74.75
5	1	45B02A	$1\frac{1}{2}$" Type B Wire Line Knuckle Joint @ $60.00 ea.	60.00
6	1	65G1	2" Type G Wire Line Gauge Cutter @ $45.00 ea.	45.00
7	1	46D05	Otis Wire Line Stuffing Box for .072" wire c/w 2" 8rd EUE Pin and Collar to connect w/2" 8rd EUE Box end Otis Quick Union @ $345.00 ea.	345.00
8	1	46A15A	2" Type A Otis Quick Union 8rd EUE Thd. Box End @ $30.00 ea.	30.00
9	1	11J010	2" Type J Landing Nipple Assembly with N-80 Coupling @ $94.00 ea.	94.00
10	1	11S015-1	2" Type S Landing Nipple Assembly with N-80 Coupling @ $110.65 ea.	110.65
11	1	23DB1	2 x 1/2" Type DB Regulator c/w B Mandrel and D Regulator Cage Assy. @ $410.00 ea.	410.00
12	1	40RB1	2" Type RB Pulling Tool @ $180.00 ea.	180.00
13	1	41H07	2" Type H Running Tool @ $135.00 ea.	135.00
14	1	23DJ	2" Type DJ Regulator c/w J Mandrel and D Regulator Cage Assy. @ $420.00 ea.	420.00
15	1	23DS	2" Type DS Regulator c/w S Mandrel and D Regulator Cage Assy. @ $450.70 ea.	450.70
16	1	49S300A	Prong for use with DB Regulator @ $22.50 ea.	22.50
17	1	49S156	Prong for use with the DJ Regulator @ $22.50 ea.	22.50
18	1	49S282	Prong for use with the DS Regulator @ $22.50 ea.	22.50
[illegible]	1	41S01	2" Type S Running Tool for use with the DS Regulator @ $140.00 ea.	140.00

ITEM	QTY.	PART NO.	DESCRIPTION	AMOUNT
20	1	40RS1	2" Type RS Pulling Tool for use with the DS Regulator @ $180.00 ea.	180.00
21	1	41J1A	2" Type J Running Tool for use with the DJ Regulator @ $35.00 ea.	35.00
22	1	40LJ1	2" Type LJ Pulling Tool for use with the DJ Regulator @ $180.00 ea.	180.00
23	1	20G05A	2" Type G Equalizing Sub for use with any above regulator @ $75.00 ea.	75.00

The above quoted prices are F.O.B. Dallas, and consideration should be given to a 2-1/2% export packing and crating charge. At the present time, the proposed delivery date would be approximately thirty to sixty days.

We appreciate the opportunity of making this quotation and wish to assure you that should you favor us with an order, it will receive our prompt and careful attention.

Yours very truly,

OTIS ENGINEERING CORPORATION

KWRobbins

K. W. Robbins
Director of Export

WMG:gy

AIR MAIL.

3631.

27th November 1956.

The Otis Pressure Control Export Inc.
6612 Denton Drive,
Dallas,
TEXAS, U.S.A.

Dear Sirs,

Otis Removable Bottom Hole Regulators
for gas wells.

Will you please forward explanatory literature and submit separate quotations for the following equipment:-

1. Complete set of Otis wire line tools for running Otis subsurface equipment.

2. Landing nipples to be made up in 2" tubing strings to take the mandrel assembly which holds the control device.

3. Complete set of equipment for running a bottom hole flow regulator inside 2" A.P.I. plain tubing (i.d. 1.995"), not equipped with a landing nipple.

With regard to Item 1, we presume that the complete set of regular tools consists of (a) wire line socket (b) stem (c) jars (d) knuckle joint (e) tubing gauge. Will you please also quote separately for the Otis wire line stuffing box complete with 2" x 2" quick union. We are ourselves equipped with standard .072" measuring lines; and we would appreciate your confirmation that this size of line is suitable for running Otis wire line tools.

With regard to Item 2, we are proposing to insert landing nipples in tubing strings run in newly completed gas wells, with the intention of being able to run bottom hole flow regulators at a later date, essentially to prevent freezing of surface flow lines and well connections. We would therefore purchase a number of landing nipples for stock; and the rest of the equipment would be ordered when the gas wells have been completed. Since one of the main reasons for running the bottom hole flow regulator is to obtain the gas expansion at the bottom of the well, we presume that the type J landing nipple would be quite suitable for this work, and is to be preferred to the type S landing nipple when only the running of one control device is envisaged.

With regard to Item 3, we have recently run 2" A.P.I. plain tubing into a gas well which is not equipped with a landing nipple. The closed-in surface pressure is 620 p.s.i.g. We wish to run a bottom hole flow regulator to avoid surface freezing conditions. The depth of the gas sand is 1600' below surface. For this work we believe that we require the type B Otis Removable mandrel assembly, the type DB Otis Removable bottom hole regulator, the type H Running tool, and the type RB pulling tool.

We wish to be able to control this gas well at flowing rates varying from 100,000 cubic feet per 24 hours to 500,000 cubic feet per 24 hours by means of the bottom hole flow regulator. We note that similar control can also be achieved by means of Otis Removable bottom hole chokes. We do not know the advantages and disadvantages of these two items of equipment, and we would be glad to have your advice on this matter so that we can be sure of obtaining the correct equipment for the job.

It is presumed that the running ofthe type B Otis mandrel assembly is not such a straightforward operation as the running of the type S or J mandrel assemblies into their respective landing nipples. We would be much obliged if you would supply full operating instructions for the type B mandrel assembly, indicating as well particular difficulties which may be experienced with this tool.

Yours faithfully,
for BP EXPLORATION CO. LTD.,

C. M. Adcock.

CMA/EEK.

cc. Mr. J.E.Anderson,
610 Fifth Avenue,
New York, 20. N.Y.

INSTRUCTIONS

OTIS TYPE B WIRE LINE SOCKET

(Drawing No. 43B01 and sketches attached)

I. PURPOSE & OPERATION:

The Otis Type B Wire Line Socket provides the means by which the wire line is fastened to the tools. The attached print, No. 43B01, is a cutaway of the Otis Type B Wire Line Socket which consists of: 1. Body, 2. Spring, 3. Spring Support, and 4. the Disc.

The Body is bored to contain the inner parts, accept the wire line through its upper end and the stem from below. Near the upper end is a pulling flange, onto which a Pulling or Running Tool may be engaged. Above the pulling flange, the Body is tapered so as to guide the Pulling or Running Tool, thereby facilitating its engagement. The flat on the upper end is a striking surface to prevent peening the metal and closing the wire hole should it ever be driven on during fishing or other operations.

The Spring (not contained in the Type A Wire Line Socket) acts as a shock absorber to prevent the knot from failing under severe impact, as during jarring operations.

The Spring Support centers the Disc and the load so that the force applied is a straight pull.

The wire line is fastened to the Disc which is grooved around its entire circumference. This groove is sufficiently deep to prevent damage to the wire line when the Disc comes to bear against the Spring Support.

In order to serve its purpose well, to absorb the punishment to which it may be subjected, the knot, fastening the wire to the Disc, must be tied with great care.

II. TYING THE KNOT:

(Refer to attached sketch).

Fig. 1. Pass the end of the wire through the Wire Line Socket Body, Spring and Spring Support. Place the Disc in a vise and run the wire down between the jaws, behind the Disc, and then bend the end of the wire into a loop or similar

shape that will be comfortable to the grip. Hold the wire about five inches above the disc with a pair of pliers but take care not to deform or otherwise damage it. The Disc should contact the wire approximately 10 or 12 inches from the loop. Now, holding the wire taut with the end in one hand and pliers in the other, start bending the wire about the Disc. The wire should go about the Disc but once, then be wrapped about itself, making sure there is a minimum of slack in the wire when starting to wrap. These wraps should be made smooth and even and should hug the wire closely with the coils touching one another. Continue wrapping in this manner until about 9 or 10 coils are made.

Fig. 2. Now move the wire in the direction shown in order to twist off the free end. Be careful to keep the loop pointed in the same direction or slightly twisted during this part of the operation so that the torque is focused on the end of the last coil. The wire should twist off cleanly, presenting a neater appearance, and should be a far better job than could be accomplished with a file or other tools. (Until a wire line is used a few times, it may be difficult to twist off, or will not twist off cleanly. In such cases, the knot may be dressed with a file.)

Fig. 3. Place the disc crosswise in the vise or pliers and straighten the knot as well as possible. Now, using the wire, pull the knot into the socket and check to see that the socket swivels freely.

The socket is now ready to be attached to the upper end of a stem.

OTIS TYPE B WIRE LINE SOCKET

SPECIAL APPLICATIONS:

Although the Wire Line Socket is standard equipment, it lends itself well to special applications. The knot, for all practical purposes, should contain approximately 9 coils; however, there may be times when the operation to be performed will dictate otherwise.

THE WEAK KNOT:

This knot may contain only 2 or 3 coils and is used when difficulties are anticipated in the well, i.e., when there is the possibility of fouling the tools in such a manner that leaving them in the well may be desirable, especially if retrieving them at this particular time may be foreseeably disastrous. With only 2 or 3 coils in the knot, the wire may be pulled free of the tools without the danger of breaking the wire elsewhere, or hopelessly fouling the tools in the tubing.

This technique may be particularly desirable in deep wells since it is usually quite difficult to pull the wire out of the socket at depths below 5000 or 6000 feet with the standard knot. This is largely due to the resistance caused by the wire dragging against the inner wall of the tubing.

The depth at which the standard knot may be successfully pulled out of the socket is, therefore, largely dependent upon the straightness, or crookedness, of the tubing, which is, in turn, dependent upon the size of the tubing and casing, the depth of the packer, the weight placed upon it and the deviation of the well bore.

THE STRONG & EXTRA STRONG KNOTS:

The knot may be tied with more than 9 or 10 coils to obtain slightly greater strength. This is useful when one wishes to run or pull a heavier-than-normal string of tools or other controls. It is also of value in fishing operations, during which the line and tools may be subjected to tensions substantially above normal.

The strength of the knot may be increased to its maximum by eliminating the spring, tying a strong knot and pouring enough molten babbitt into the upturned socket to hide the disc. This added strength is used to good advantage when an accidental failure of the knot would be disastrous. This knot should be used on permanent well completion jobs, which use a tubing extension hanger containing several hundred feet of 1" aluminum pipe, and in fishing operations demanding the most from the wire line.

The Body used as a fishing aid:

The body of the wire line socket may be used to good advantage on tools that are dropped into or left in the tubing (e.g., perforators, perforator stops, circulating plugs, stems, etc.) to facilitate fishing them from the tubing.

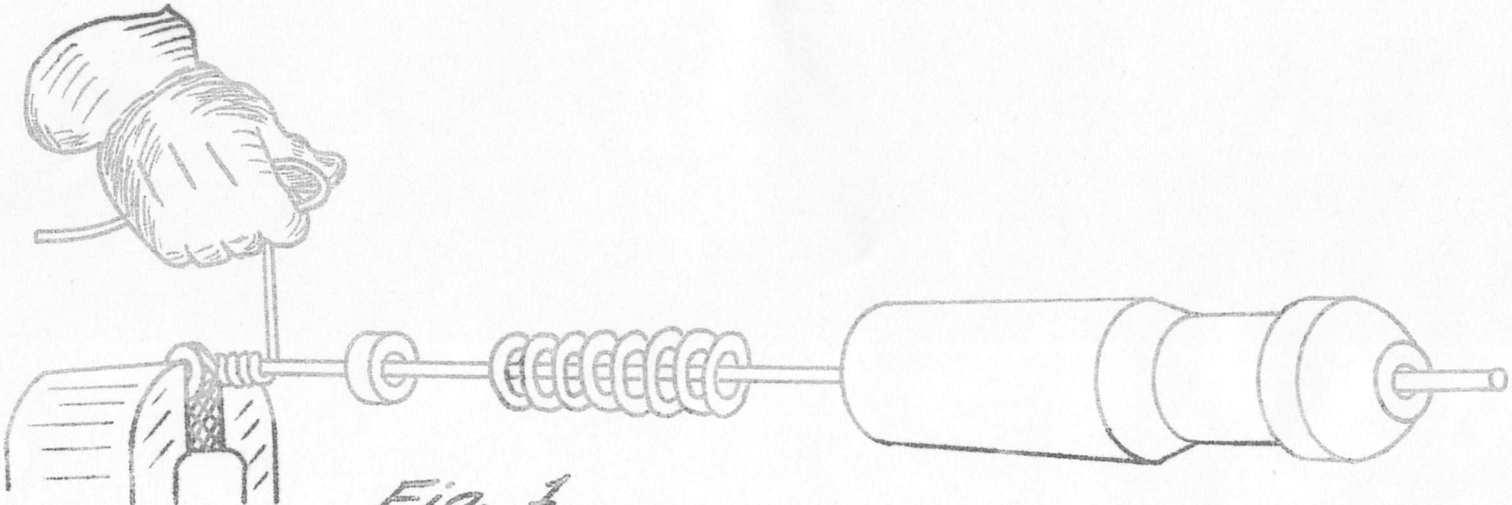


Fig. 1

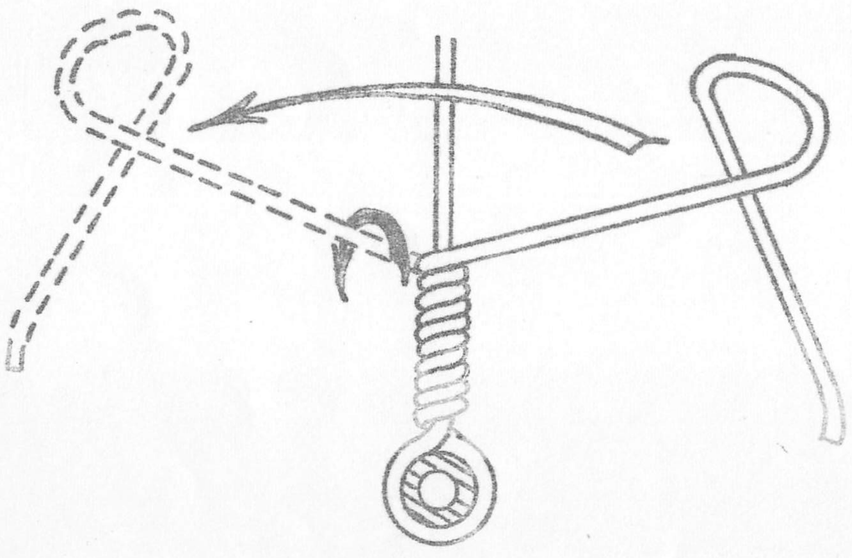
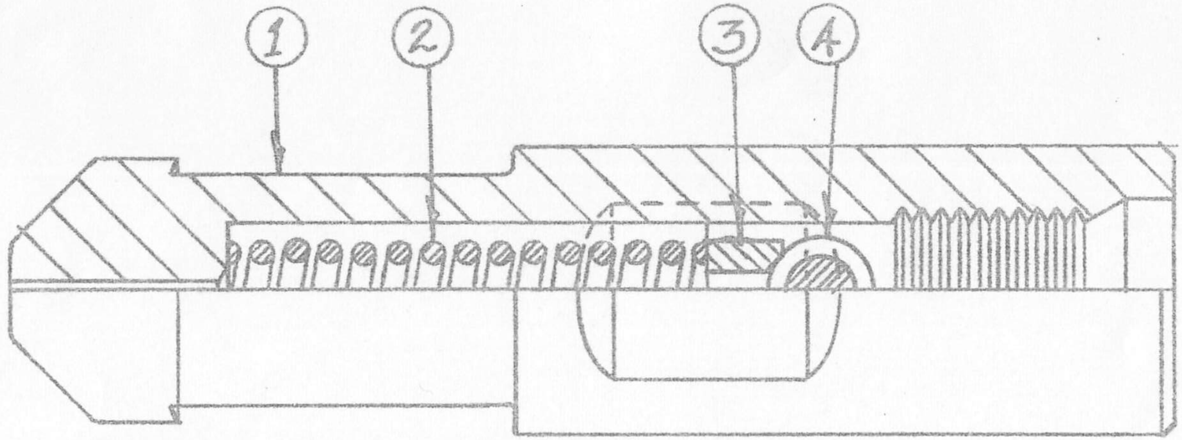


Fig. 2

Fig. 3

Tying the Wire Line Knot



WIRE LINE SOCKET

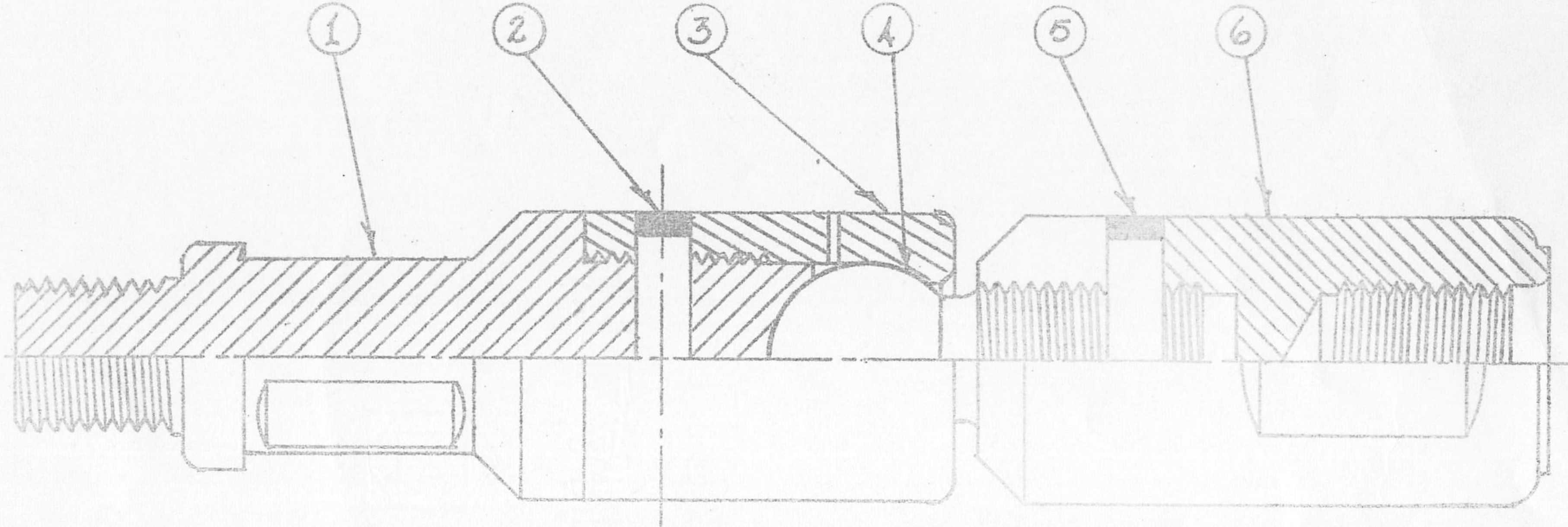
1 BODY
2 SPRING
3 SPRING SUPPORT
4 DISK

OTIS TYPE B KNUCKLE JOINT

Drawing No. 45B02

The Type B Knuckle Joint is similar to a stem but has a ball swivel in its mid-section. Its purpose is to provide flexibility in the string of tools to facilitate taking hold of various tools, and also to enable the tools to pass through crooked tubing where they may otherwise be fouled. The knuckle joint is almost always used in the string of wire line tools immediately below the jars where flexibility is important. Also, if crooked tubing is to be encountered, knuckle joints may be placed between the stems and jars and, perhaps, in extremely crooked tubing, between the individual stems.

The knuckle joint should be inspected frequently to make certain that the threads, ball and rivets are in good condition. If the rivets become loose, the tool should be sent in for rebuilding to prevent it from coming apart in the well.



TYPE "B" KNUCKLE JOINT

1 - Sub
2 - Rivet
3 - Socket
4 - Ball Pin
5 - Rivet
6 - Box

INSTRUCTIONS

OTIS TYPE B REMOVABLE MANDREL ASSEMBLY

(Drawing No. 10B01A, attached)

I. PURPOSE:

The Otis Type B Removable Mandrel Assembly is one of several basic Otis mandrel assemblies used to lock and pack off Otis Removable Bottom Hole Regulators and Otis Removable Tubing Safety Valves. In addition, the Type B Removable Mandrel Assembly can be equipped with either a flow bean or plug bean and used as a bottom hole choke or as a tubing plug.

II. OPERATION:

The locking and packing mechanism is composed of three hook-type serrated slips (3) suspended by a slip carrier (2) which is mounted around a tapered mandrel (1). Two Otis Choke Cups (7) are then mounted on the lower end of the mandrel. These cups are spaced in position by upper and lower cup rings (5 & 6), and are retained on the mandrel by a nut (9). The diameter of the cups is such that the mandrel assembly will pass freely down the tubing, but will expand sufficiently to effect a seal between the assembly and the tubing wall when a pressure differential is created across the device by flowing the well. Thus, all flow is directed up through the regulator, safety valve or flow bean, depending upon which control device is being used, and up through the bore of the Type B Mandrel Assembly itself.

After the proper sub-surface control has been attached to the lower end of the Type B Mandrel Assembly, the device is lowered into the well with either a Type H or CB Running Tool attached to regular tools and wire line.

The Type H Running Tool is attached to the slip carrier (2) to hold the slips (3) in a retracted position while the assembly is being lowered in the tubing. When the desired depth has been reached, manipulation of the wire line at the surface moves the slips downwardly over the tapered mandrel (1) and causes them to expand and wedge between the mandrel and the tubing wall. Downward impacts with the jars cause the slips to lock the assembly firmly in place. This same action also cuts the shear pin in the Type H Running Tool, releasing it from the mandrel assembly and permitting it to be removed from the well. Upward thrust caused by a pressure drop across the assembly tends to expand the slips further and lock the tool more securely in place.

The Type B Removable Mandrel Assembly is pulled with either a Type RB or BB Pulling Tool in combination with the regular wire line and tools. The tools are lowered into the well and rested atop the mandrel assembly. With pressures across the mandrel assembly equalized, jarring downwardly against the mandrel drives the tapered portion of the mandrel from between the expanded slips. Since the pulling tool has previously engaged the slip carrier, pulling upwardly moves the slips to the retracted position, thus permitting the assembly to be pulled from the tubing.

III. RUNNING THE TYPE B REMOVABLE MANDREL ASSEMBLY WITH THE TYPE H RUNNING TOOL:

1. Engage the slip carrier with the dogs of the running tool.

2. Lower into the well to the desired depth. (If lowered too fast, the skirt of the running tool will force the slips downwardly over the tapered portion of the mandrel and lock the device in the tubing. If this occurs, a light upward impact of the jars will unlock it. After a few such mishaps, the running tool pin may be sheared. If this happens, remove the running tool from the well, change the shear pin, lower it into the well again, re-engage the slip carrier of the mandrel, unlock it as previously described and continue with the running operation.) (See instructions for the use of the Type H Running Tool.)

3. When the desired depth has been reached, slack off on the wire line abruptly and allow the tools to overtake the mandrel assembly and lodge it in the tubing.

4. Continue jarring downwardly. This will lock the device firmly in the tubing and, at the same time, cut the shear pin in the running tool, disengaging it from the slip carrier, after which it may be removed.

5. After removing the wire line tools from the tubing, the well may be flowed to expand the choke cups.

IV. RUNNING THE ASSEMBLY WITH THE TYPE CB RUNNING TOOL:

(For this operation, a transverse hole 3/16" in diameter must be drilled through the mandrel (1) 1" below the upper end.)

1. Insert the Type CB Running Tool into the upper end of the mandrel and fasten with a 3/16" shear pin. File the ends of the shear pin so that the slip carrier will pass over it freely.

2. Lower into the tubing to the desired depth.

3. After the desired depth is reached, pull upwardly to move the tapered mandrel between the slips and expand same, locking the assembly in the tubing.

4. Jar upwardly to shear the pin and releaee the running tool. (When the pin shears, do not allow the running tool to strike the mandrel with a downward blow or the assembly will be unlocked and permitted to fall to the bottom of the tubing unless otherwise stopped by an obstruction, etc.) Now remove the running tool from the tubing.

5. After removing the wire line tools from the tubing, the well may be flowed to expand the choke cups.

V. PULLING THE ASSEMBLY:

1. Attach a Type RB or BB Pulling Tool to the regular tools and wire line and lower into the tubing until the mandrel assembly is contacted.

2. Jar downwardly to unlock the assembly.

3. Pull or jar upwardly to retract the slips and pull the assembly from the tubing.

VI. CHANGING THE CHOKE CUPS:

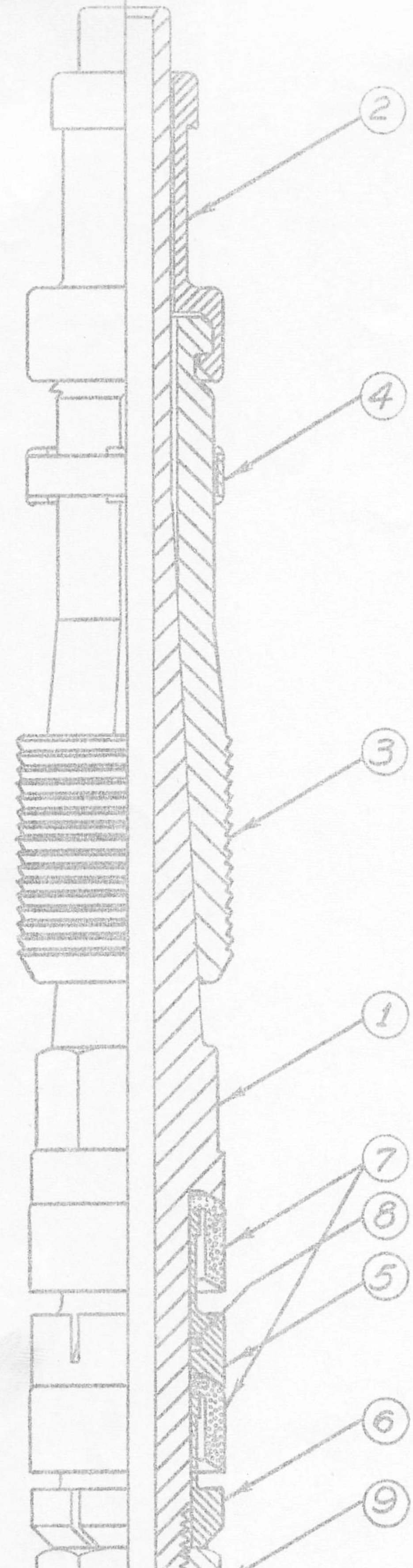
1. Place the mandrel (1) in the vise so that the jaws grip the flats which are located immediately above the upper choke cup.

2. Remove the nut (9). (Before removing this nut, clean the threads on the mandrel.)

3. Remove the lower cup ring (6).

4. Remove the lower choke cup.

5. Remove the upper cup ring (5).



OTIS TYPE B MANDREL ASSEMBLY

1. Mandrel
2. Slip Carrier
3. Slips
4. Mandrel Band
5. Upper Cup Ring
6. Lower Cup Ring
7. Choke Cups
8. "O" Ring
9. Nut

INSTRUCTIONS
OTIS TYPE "H" RUNNING TOOLS
DRAWING NO. 41H01

PURPOSE

This tool is used to run and set various controls and other tools in the tubing of oil and gas wells. Refer to "Running and Pulling Tool Selection Chart for Otis Sub-Surface Controls," for controls on which it may be used.

DESCRIPTION

This running tool is composed of the following parts, the functions of each part included: (Numbers correspond with the detail "balloon" numbers on the attached drawing.)

1. Sub. The sub contains a pin connection on either end; the upper pin accepting the stem or knuckle joint, the lower accepting the cylinder. The pulling flange is immediately below the upper pin.

2. Cylinder. The cylinder houses the working parts of the running tool; the core, shear pin and related parts.

3. Core Nut. The core nut retains the core in the cylinder by bearing against the machined shoulder therein.

4&5. Latch Spring and Latch Pin. These parts latch the core in the released position after the pin is sheared.

6. Shear Pin. This shear pin serves to hold the running tool core in the normal running position within the cylinder. It is completely housed in the pulling tool.

7. Hollow Head Set Screws. These screws retain the shear pin in the cylinder.

8. Core. The core contains the dogs and dog springs. Together, these parts grasp the pulling flange of the control which is being run until such time that the pin is sheared and they are forced to disengage. The lateral ports provide a by-pass for fluid.

9. Dog Springs. The dog springs maintain tension on the dogs so that their grasp will not be released prematurely.

10. Dogs. The lips of the dogs grasp the pulling flange of the instrument that is being run into the well. The dogs are actuated by the dog springs.

OPERATION

After the sub-surface control is locked in the tubing or set atop another device, downward jarring forces the cylinder (2) downward relative to the core (8), cuts the pin (6) and forces the upper end of the dogs (10) inward against the tension of the spring (9), disengaging them from the pulling flange of the control. As the core (8) and core nut (3) move upward in the cylinder (2), the latch pin (5) is forced outward, by tension of the latch spring (4), and comes to rest against the cylinder wall above the machined shoulder. This latches the running tool in the released position, with the dogs disengaged, so that it may be lifted freely off the control.

CHANGING THE SHEAR PIN:

Remove the Hollow Head Set Screws (7) with an Allen Wrench and allow the sheared ends of the shear pin to fall out. Place the cylinder (2) in the vise jaws with the core (8) pointing toward you. Rotate the core in a clockwise direction, all the while pulling on the core. When the latch pin (5) enters a longitudinal groove in the cylinder, the core will be moved to its extended position. (Both the cylinder and core are stenciled with arrows. Aligning these arrows with one another will also align the latch pin with the internal groove.) After the core is extended, continue rotating the core until the shear pin (6) is in register with the shear pin holes of the cylinder. Remove the shear pin by using a punch, another shear pin or similar tool.

Install a new shear pin. (This pin should not be so long that either set screw will be tightened against it. This would cause the screw to become loose, when the pin is sheared, and perhaps be lost in the well.) The set screws should be bottomed and tightened securely.

DISASSEMBLY:

1. Remove the set screws and shear pin.

2. Place the cylinder in the vise jaws and remove the sub.

3. Place the core in the vise and remove the core nut using the core nut wrench.

4. Place the cylinder in the vise again so that the arrow is on the top side. (Be careful not to close the vise jaws against the set screw holes and damage the threads.) Align the arrows on the cylinder and core.

5. Grasp the core and dogs firmly with one hand and pull them from the cylinder, using the other hand to cover that portion of the core containing the latch pin and spring to prevent their being lost.

6. Remove the latch pin and latch spring.

7. Remove the dogs and dog springs from the core being careful not to lose the springs.

ASSEMBLY:

1. Place the cylinder in the vise so that the arrow is on the top side.

2. Set the latch pin and spring in place in the core.

3. Insert the core in the cylinder so that the latch pin is pointing upwards.

4. Screw the core nut onto the core only about 3 or 4 turns.

5. Place a dog spring in its recess.

6. Place the upper end of a dog over the spring and insert it into the cylinder so that it may be lowered into its proper place.

7. Holding this dog in place, rotate the core 180 degrees and install the other dog and spring in the same manner. Now push the core into the cylinder as far as it will go.

8. Place the core in the vise and tighten the core nut.

9. Place the cylinder in the vise, replace and tighten the sub.

10. Align the arrows, extend the core and align the shear pin holes.

11. Insert a new shear pin.

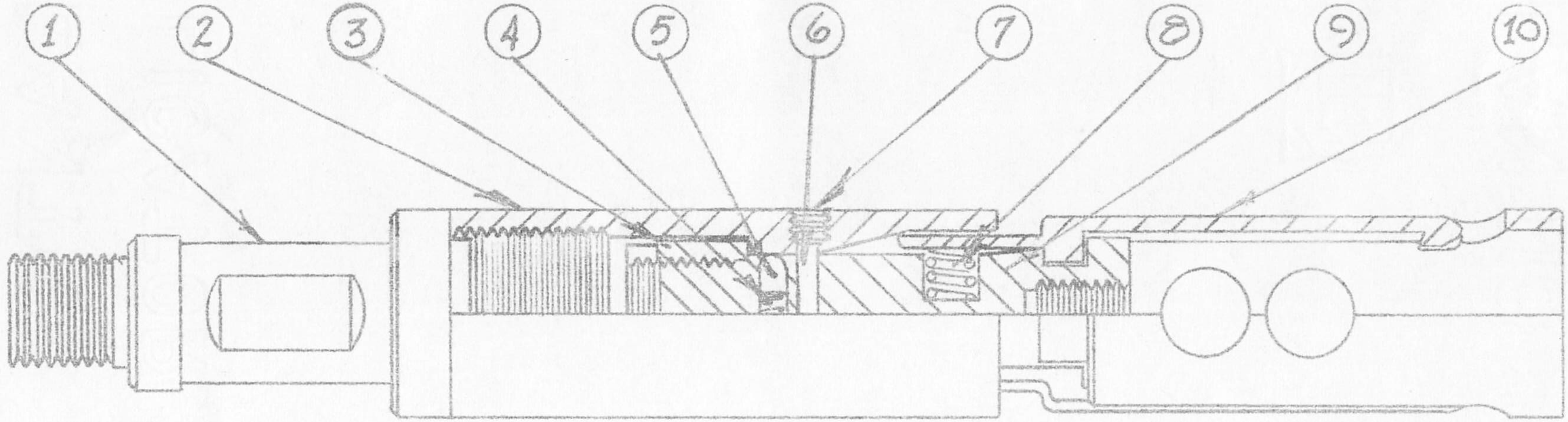
12. Replace set screws.

Note: Be sure that both the latch pin and the portion of the shoulder against which it latches are in good condition to insure proper latching. If these are not in good condition, the core may be allowed to move to the extended position and permit the dogs to re-engage the pulling flange of the control when the tools are lifted.

Check the core nut occasionally to make certain that it is tight.

Check the dogs occasionally to see that the lips, which engage the pulling flange, are in good condition.

Always loosen the set screws when the running tool is removed from the well. Otherwise, they may become siezed which will likely necessitate drilling them out.



TYPE H RUNNING TOOL

1 - Sub
2 - Cylinder
3 - Core Nut
4 - Latch Spring
5 - Latch Pin
6 - Shear Pin
7 - 3/8"-16x1/4" H.H.Set Scr.
8 - Core (Body)
9 - Dog Spring
10 - Dog

INSTRUCTIONS

OTIS TYPE "R" PULLING TOOLS

DRAWING NO. 40RB2

I. DESCRIPTION:

This pulling tool is composed of the following parts: (Functions of each part are included.) (Numbers refer to the Detail "Balloon" numbers on the assembly drawing.)

1. Sub. The sub contains a pin connection at the upper end for attaching to the knuckle joint or stem. The box in the lower end accepts the pin of the core while the cylindrical extension houses the cylinder spring. The pulling flange is located immediately below the pin connection. The sub is drilled and tapped for a set screw.

2. Set Screw. The set screw locks the core to the sub.

3. Core. The upper end of the core screws into the sub, where it is locked with a set screw. The core extends downwardly into the cylinder where it serves to back-up the dogs and is pinned to the cylinder with a shear pin. Its lower end contains an external shoulder which, when the pin is sheared, moves upwardly to lift the dogs to enable them to release. Jarring impacts are transmitted to the mandrel of the locking device by the core, the lower end of which is bored and tapped to accept equalizing prongs.

4. Cylinder Spring. This spring acts between the cylinder and the sub so that when the pin is sheared, the spring raises the core and causes the dogs to release their hold.

5. Shear Pin Cap. This cap retains the shear pin to prevent it or its pieces from falling out of the pulling tool.

6. Shear Pin. The shear pin fastens the core to the cylinder in their normal pulling positions and makes the pulling tool releasible. After considerable jarring, the shear pin shears, causing the pulling tool to release its grip. This shear pin is 5/16" dia. which is considerably harder to shear than the 3/16" dia. shear pin used in the Type B Pulling Tool.

7. Cylinder. The cylinder contains the dogs, dog spring, washer and shear pin. The lower end of the dog slots are bevelled to conform with the bevel on the lower end of the dog which acts as a cam to increase the gripping ability of the dogs to prevent them from slipping off and damaging the pulling flange.

8. Dog Spring. This spring maintains a constant downward pressure against the dogs so that their lower ends will be cammed inward, by the cylinder, to make them grip more securely. The lower portion of the cylinder is thickened to provide greater strength to resist bursting due to the outward pressure applied outwardly by the dogs because of the cam surfaces.

9. Washer. This washer transmits pressure from the dog spring to the dogs.

10. Dogs. The dogs are contained in the cylinder, their lower ends being forced inwardly by the cam surfaces mentioned above. The lips on the lower extremity of the dogs engage the pulling flange of the slip carrier of the choke. The upper end of the dog is tapered so that when the pin is sheared and the dogs are raised said upper ends are forced inwardly as the tapered portion thereof moves into the cylinder against tension of the dog spring.

II. OPERATION:

The Type "R" Pulling Tool is used to pull various sub-surface controls, stems, wire line sockets, choke extractors, etc.

When the pulling tool is set atop a pulling flange and driven downwardly, the lower ends of the dogs move outwardly allowing the pulling tool to pass over it. When the lips of the dogs pass the pulling flange, the dog spring and cam surfaces force the lower end of the dogs inward immediately, latching the pulling tool securely to the pulling flange.

The shear pin will withstand considerable jarring before shearing. When it finally shears, the energy stored in the cylinder spring acts between the sub and cylinder. This raises the core, relative to the cylinder, which, in turn, raises the dogs against the tension of the dog spring. As the dogs are raised, their tapered, upper ends move into the cylinder, forcing them inwardly and thereby forcing their lower ends outwardly. This causes the lips to release their grasp on the pulling flange whereupon the pulling tool is removed from the well so that the shear pin may be changed.

III. RELEASING THE PULLING TOOL MANUALLY:

The Releasing Tool, Drawing No. 40RB5-X, resembles a nut cracker and is used to manually release the pulling tool on the surface. This tool is placed around the pulling tool so that the wedges engage the dogs near the upper end. A squeeze of the releasing tool handles will force the dogs upwardly and release the pulling flange.

IV. CHANGING THE SHEAR PIN:

(Refer to the attached drawing and the "balloon" numbers thereon.)

1. Rotate the pin cover (5) until the openings are aligned with the shear pin (6). The ends of the shear pin should fall out with little difficulty.

2. Compress the pulling tool, longitudinally, using a vise or other means, until the remaining portion of the shear pin is aligned with the shear pin holes in the cylinder (7).

3. Insert a new shear pin and displace the sheared piece. Make sure that neither end of the new shear pin projects from the cylinder.

4. Rotate the shear pin cover about 90° to retain the shear pin.

V. COMPLETE DISASSEMBLY:

1. Place the pulling tool in the vise so that the jaws grip the cylinder (7).

2. Remove the set screw (2).

3. Remove the sub (1). Be careful! The cylinder spring is under considerable compression.

4. Remove the cylinder spring (4).

5. Remove the shear pin cover (5).

6. Remove the shear pin (6).

7. Remove the core (3). The core is removed through the lower end of the cylinder.

8. Remove the dogs (10) by pressing inwardly on each.

9. Remove the washer (9).

10. Remove the dog spring (8).

VI. ASSEMBLY:

1. Place the cylinder (7) in the vise, bottom-side-up.

2. Replace the dog spring (8).

3. Replace the washer (9).

4. Replace the dogs (10) by compressing the dog spring and inserting dog in the proper slots of the cylinder.

5. Replace the core (3) being careful not to dislodge the dogs.

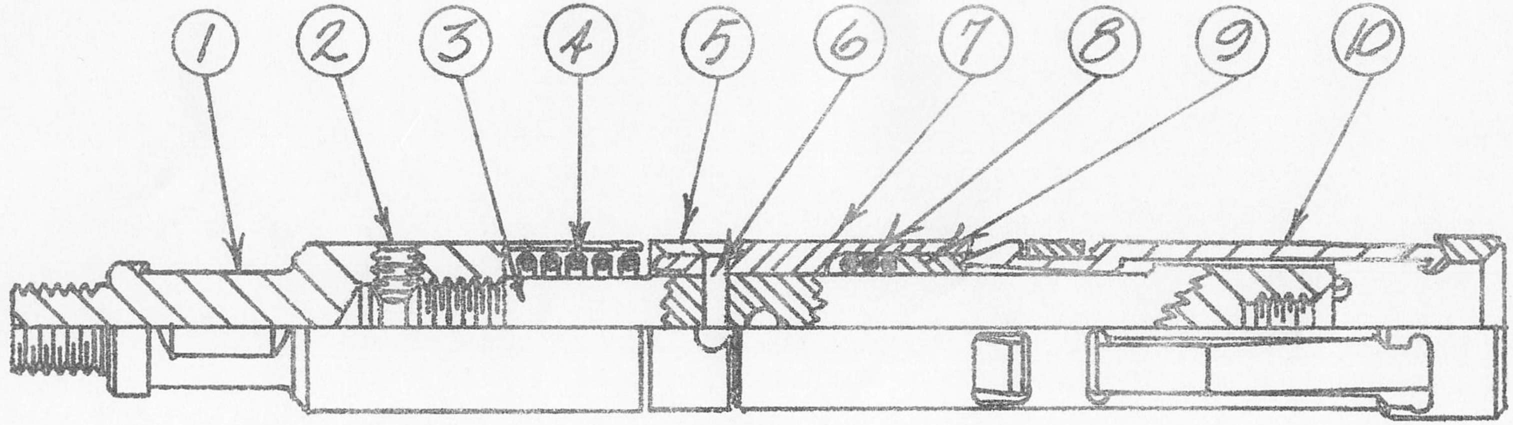
6. Replace the shear pin (6).

7. Replace the shear pin cap (5).

8. Replace the cylinder spring (4).

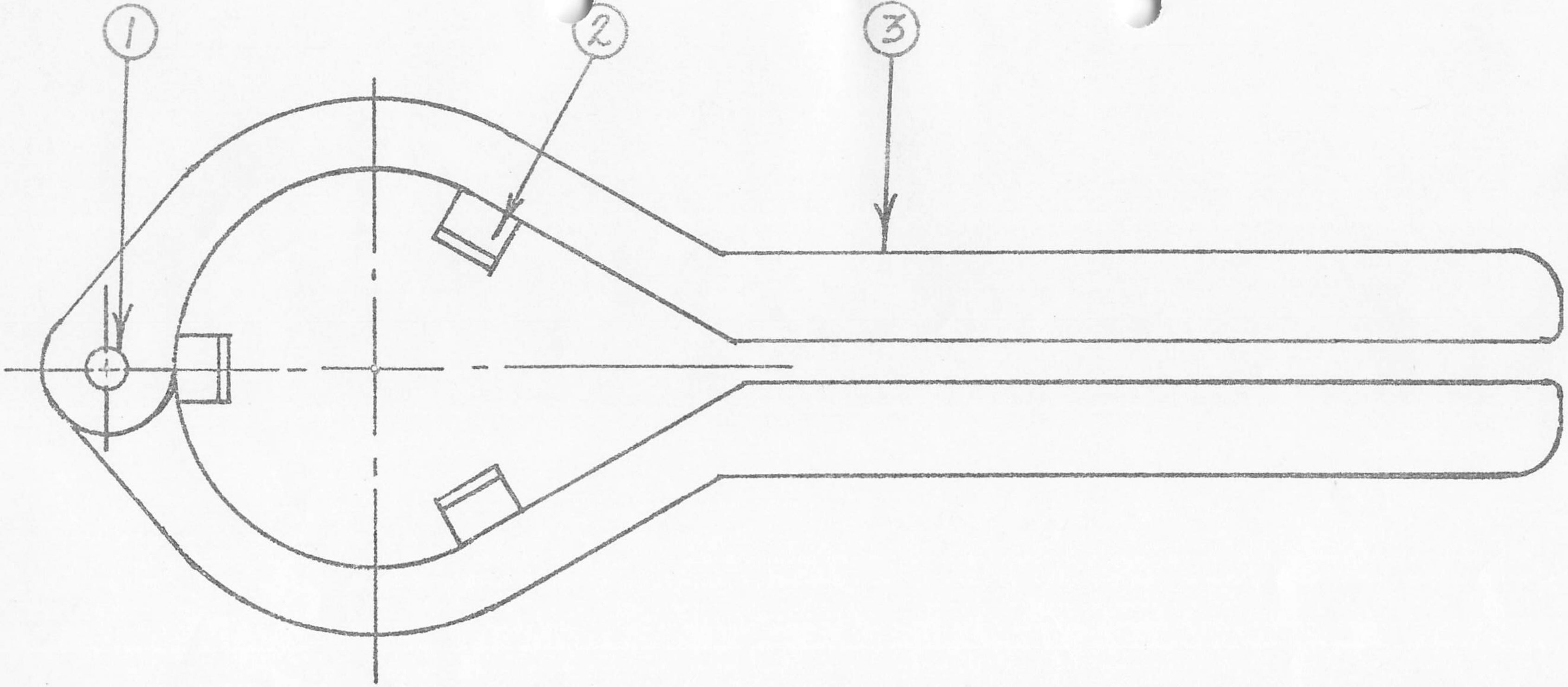
9. Replace the sub (1) and tighten moderately.

10. Replace the set screw (2) and tighten securely.



OTIS TYPE "R" PULLING TOOL

1 - Sub
2 - Set Screw
3 - Core
4 - Cylinder Spring
5 - Shear Pin Cap
6 - Shear Pin
7 - Cylinder
8 - Dog Spring
9 - Washer
10 - Dogs



OTIS PULLING TOOL RELEASING TOOL

1 - Hinge Pin
2 - Wedge
3 - Arm

INSTRUCTIONS

OTIS TYPE J RUNNING TOOL

(Drawing No. 41J1A attached)

I. PURPOSE:

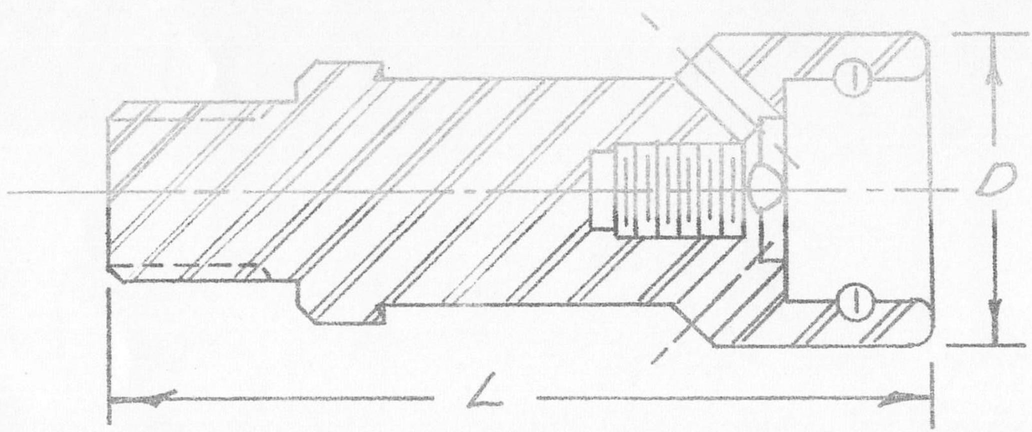
The Type J Running Tool provides a frangible means of running and setting practically all Otis Removable Sub-Surface Controls which seat in landing nipples (with the exception of those using a Type S Mandrel Assembly). It is used chiefly to run and set Types J, F, A, R, X, and E Mandrel Assemblies.

II. OPERATION:

The Type J Running Tool is connected to the sub-surface control by inserting the running neck or retaining nut of the mandrel assembly into the bottom of the running tool and fastening with two 3/16" shear pins inserted in horizontal tangential holes (or, four 1/8" rivets, driven through holes in the running tool and bradded in the groove of the retaining nut). After the control is lowered to the landing nipple and locked in place, the shear pins or rivets are sheared by a few upward impacts of the jars. This action releases the running tool and permits it to be removed from the tubing.

The running tool contains ports for fluid by-passes and a female thread connection for the acceptance of an equalizing prong, which is necessary when certain controls are being run.

(See instructions for the particular locking mandrel assembly being run.)



TYPE J RUNNING TOOL

Part No.	41J1A	41J2A	41J3A
Size	2"	2-1/2"	3"
Length	4-3/8"	4-9/16"	4-7/8"
Diameter	1-5/8"	2"	2-1/2"

INSTRUCTIONS

OTIS TYPE J LANDING NIPPLE ASSEMBLY

(Drawing attached)

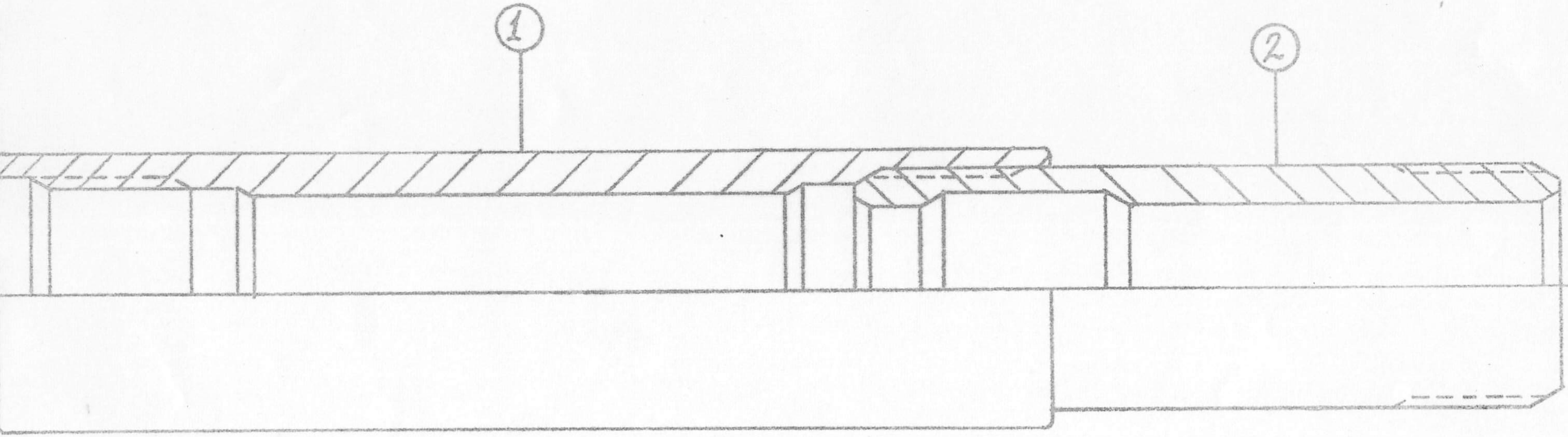
I. PURPOSE

The Type J Landing Nipple provides a positive seat for the Type J Mandrel Assembly, J Testing Tool or J Closing Tool. The bore of the nipple is slightly restricted; therefore, it is recommended that the nipple be installed as a part of the tubing string at a point below maximum swabbing depth. (However, bottom hole pressure gauges and samplers, the Otis Type M Tubing Perforator and Cutter, etc., can still be run through the nipple.)

The nipple has a honed bore which is a perfect surface for V-Type Packing or choke cups to seal against. The upper portion of this honed bore contains a locking recess in which the Otis Type J Mandrel may be securely locked.

The flow coupling is heavier and longer than an ordinary tubing coupling and is made up on the upper end of the nipple. This flow coupling greatly reduces the possibility of abrasive flow action immediately above the sub-surface control. For the same reason, the use of another flow coupling below the landing nipple is recommended.

The attached drawing gives the critical dimensions and part numbers for both the landing nipple and flow coupling in the 2, 2-1/2 and 3" nominal sizes.



OTIS TYPE J LANDING NIPPLE ASSEMBLY (ALLOY)

Size		2"				2-1/2"				3"			
Assembly No.		11J09				11J011				11J013			
Det.	Part Name	No.	Lgth	O.D	I.D.	No.	Lgth	O.D	I.D	No.	Lgth	O.D	I.D
1	Flow Coupling	11J26	15"	3 1/16	2"	11J29	15 15/16"	3.668	2 1/2"	11J31	18 1/4"	4 1/2"	3"
2	Nipple	11J25	8 1/2"	2 12/32"	1 25/32"	11J28	9"	3 3/32"	2 3/16"	11J30	12"	3 3/4"	2 3/4"

INSTRUCTIONS

OTIS TYPE J REMOVABLE MANDREL ASSEMBLY

(Drawing No. 10J012A, attached)

I. PURPOSE:

The Type J Mandrel Assembly is used to lock and pack off Otis Removable Bottom Hole Regulators and Otis Removable Tubing Safety Valves. In addition, this mandrel assembly can be equipped with either a flow bean or plug bean and used as a bottom hole choke or as a tubing plug.

The Type J Mandrel Assembly serves the same purpose as the Type B Mandrel Assembly except that it seats only in the Type J Landing Nipple.

II. OPERATION:

The locking mechanism includes four locking dogs (4) suspended by a dog carrier (1) which is mounted around a tapered mandrel (5) and carrier mandrel (3).

The packing mechanism is composed of two sets (3 rings each) of V-Packing (7) mounted on the upper and lower portions of the packing mandrel (2), backed up by male and female adapter rings (8 & 6) and held in place by the nut (9) and the locking mandrel (5).

After the desired sub-surface control has been attached to the lower end of the Type J Mandrel Assembly, the device is lowered into the well with a Type J Running Tool attached to regular tools and wire line.

The Type J Running Tool is fastened to the running neck of the carrier mandrel (3) by two tangential shear pins. (The dogs are not held in the retracted position as in the Type B or S Mandrel Assemblies.) When the mandrel assembly contacts the Type J Landing Nipple, downward impacts of the jars force it to its lowermost position within the nipple. During this downward travel, the dogs are forced upwardly to their retracted position, then fall downwardly into the locking recess while the mandrel assembly continues to its lowermost position where it will be stopped by the enlarged portion of the dog carrier (1) contacting the upper end of the nipple. After this has been accomplished, upward impacts of the jars are utilized to drive the mandrel upwardly. Since the dogs (4) and dog carrier (1) are not held by the running tool, the locking mandrel moves up between the slips and expands them into the locking recess of the nipple. Additional upward impacts cut the tangential shear pins and release the running tool, which is then removed from the tubing.

It is not necessary to flow the well to seat the V-Packing since it is pre-sized to fit the honed bore of the nipple. Thus, any flow will be directed up through the subsurface control and the Type J Mandrel Assembly.

III. RUNNING THE TYPE J MANDREL ASSEMBLY:

1. Attach the Type J Running Tool to the running neck of the carrier mandrel with two tangential shear pins, 3/16" dia.

2. Lower into the well until the mandrel assembly is stopped by the Type J Landing Nipple.

3. Jar downwardly for several good impacts.

4. Jar upwardly until the tangential shear pins are sheared.

5. Remove the wire line tools from the tubing.

IV. PULLING THE ASSEMBLY:

1. Attach a Type RB or BB Pulling Tool to the regular wire line tools and lower into the well until the Type J Mandrel Assembly is contacted.

2. Jar downwardly to unlock the assembly.

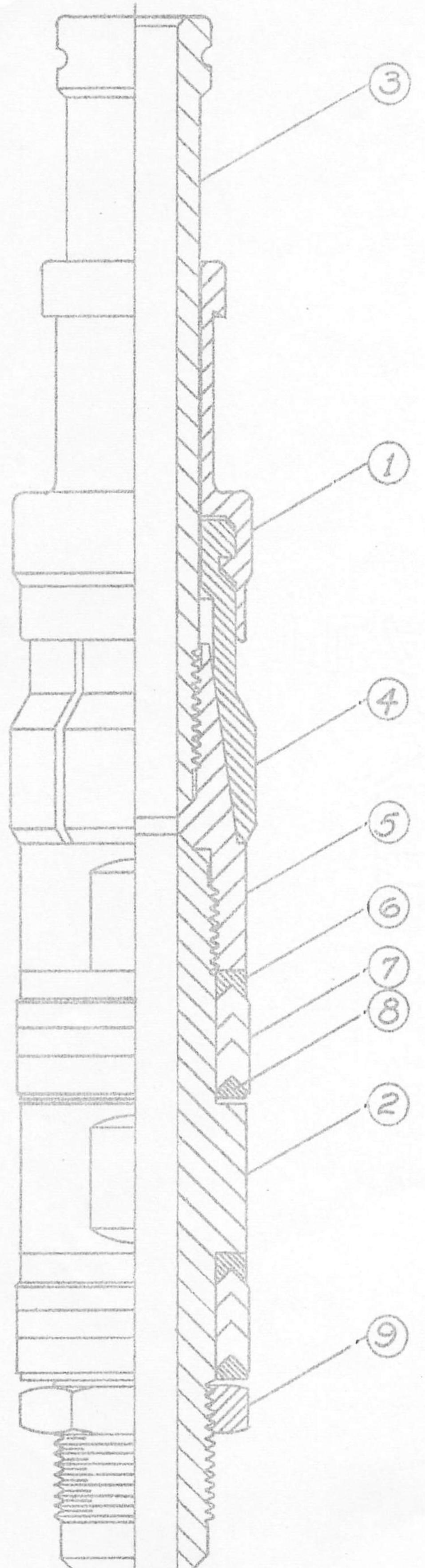
3. Jar upwardly to extract the assembly from the landing nipple.

   <u>Note:</u> Due to the short reach of the dogs on both the Type RB and BB Pulling Tools, they <u>cannot</u> engage the pulling flange of the dog carrier until the mandrel assembly reaches its <u>lowermost</u> position, at which time thedog carrier will be at its <u>uppermost</u> position relative to the carrier mandrel. This is known as the "FULL RELATIVE MOTION" feature.

V. DESCRIPTION OF "FULL RELATIVE MOTION"

Where possible, this feature has been incorporated in all locking mandrel assemblies which seat in landing nipples.

Aside from the fact that the pulling tool will not engage the dog carrier until the mechanism is unlocked, the full relative motions feature has another advantage, that of breaking any bond between the locking mandrel (5) and the dogs (4) or between the dogs and the landing nipple should they adhere to one another for any reason.



OTIS TYPE J MANDREL ASSEMBLY

1. Dog Carrier
2. Packing Mandrel
3. Carrier Mandrel
4. Dog
5. Lock Mandrel
6. Female Adapter
7. V-Packing
8. Male Adapter
9. Nut

INSTRUCTIONS

OTIS TYPE D REGULATOR CAGE ASSEMBLY

(Drawing No. 23D01, attached)

I. PURPOSE:

Otis Removable Bottom Hole Regulators are essentially variable bottom hole chokes installed in the tubing string, under pressure on a steel measuring line, to provide a surface-controlled rate of flow with all the advantages of bottom-hole choking. Although adjustments of the surface choke automatically change rates of flow through the regulator and the tubing, the regulator maintains an almost constant pressure differential.

Primary use of an Otis Bottom Hole Regulator is to reduce the surface pressure of a well and thereby prevent freezing of surface flow lines and well connections. This is accomplished by setting the regulator at a depth where temperature of the flow stream is sufficiently high to compensate for the loss in temperature caused by the pressure drop across the regulator. The tubing string above the regulator then acts as a "sub-surface heater" to re-heat the gas before it reaches the surface controls.

II. OPERATION:

The Type D Regulator Cage Assembly consists of a cage-like body (7) which houses the working parts of a double-acting regulating valve mechanism. A regulating spring (5) is compressed between an adjusting ring (4) and a valve seat guide (8). The amount of compression in this spring depends upon the thickness of the adjusting ring (4). The total force of the spring is transmitted to the valve seat (6) through the valve seat guide, and acts to hold the valve seat down in contact with the valve (9). The compression introduced into the spring by the adjusting ring determines the amount of pressure differential across the regulator necessary to move the valve seat up and away from the valve. As a result, flowing pressure above the valve seat always remains less than the pressure beneath it by approximately the amount of compression introduced into the spring regardless of surface choke adjustments (within limits). The valve (9) is held in its uppermost position against the tapered shoulder in the valve housing by well pressure, plus the force of the valve spring (11). A valve housing plug (12) supports the valve spring and acts as a guide for the valve.

If it becomes necessary to load the tubing with fluid without first pulling the regulator, the spring loaded valve makes this operation possible. In such cases, construction of the regulator permits the valve to move down to an open position, allowing the free passage of the fluids being pumped.

III. ADJUSTMENT FOR DESIRED PRESSURE DIFFERENTIAL:

Before installation in the tubing string, the regulator is pre-set to give desired tubing surface flowing pressures. (See calculations for Otis Removable Bottom Hole Regulators.)

IV. DISASSEMBLY:

1. Place the cage assembly in the vise so that the jaws grip the top sub (1).
2. Remove the skirt (10), or the connecting sub (13), whichever is present.
3. Remove the valve housing plug (12).
4. Remove the valve spring (11) and valve (9).
5. Remove the body (7). The valve seat will likely remain with the top sub. If so:
6. Grasp the valve seat (6) and regulating spring (5) and pull from the top sub. Now:
7. Remove the adjusting ring (4).
8. Remove the regulating spring (5).
9. Remove the valve seat guide (8) from the valve seat (6).
10. Remove the packing ring (3).
11. Remove the back-up ring (2).
12. Remove the top sub (1) from the vise.

V. REASSEMBLY:

(Make certain that all parts are in good condition, clean and well lubricated.)

1. Place the top sub (1) in the vise jaws as before.

2. Replace the valve seat guide (8) on the valve seat (6) so that the bevelled surfaces mate with one another.

3. Replace the regulating spring (5) on the valve seat.

4. Place the adjusting ring (4) atop the regulating spring.

5. Place the packing rings (3) atop the adjusting ring so that its lips contact said adjusting ring.

6. Place the back-up ring (2) atop the packing ring.

7. Insert the upper end of the valve seat (6) into the top sub (1).

8. Guide the body (7) over the valve seat and regulating spring, screw same onto the top sub and tighten.

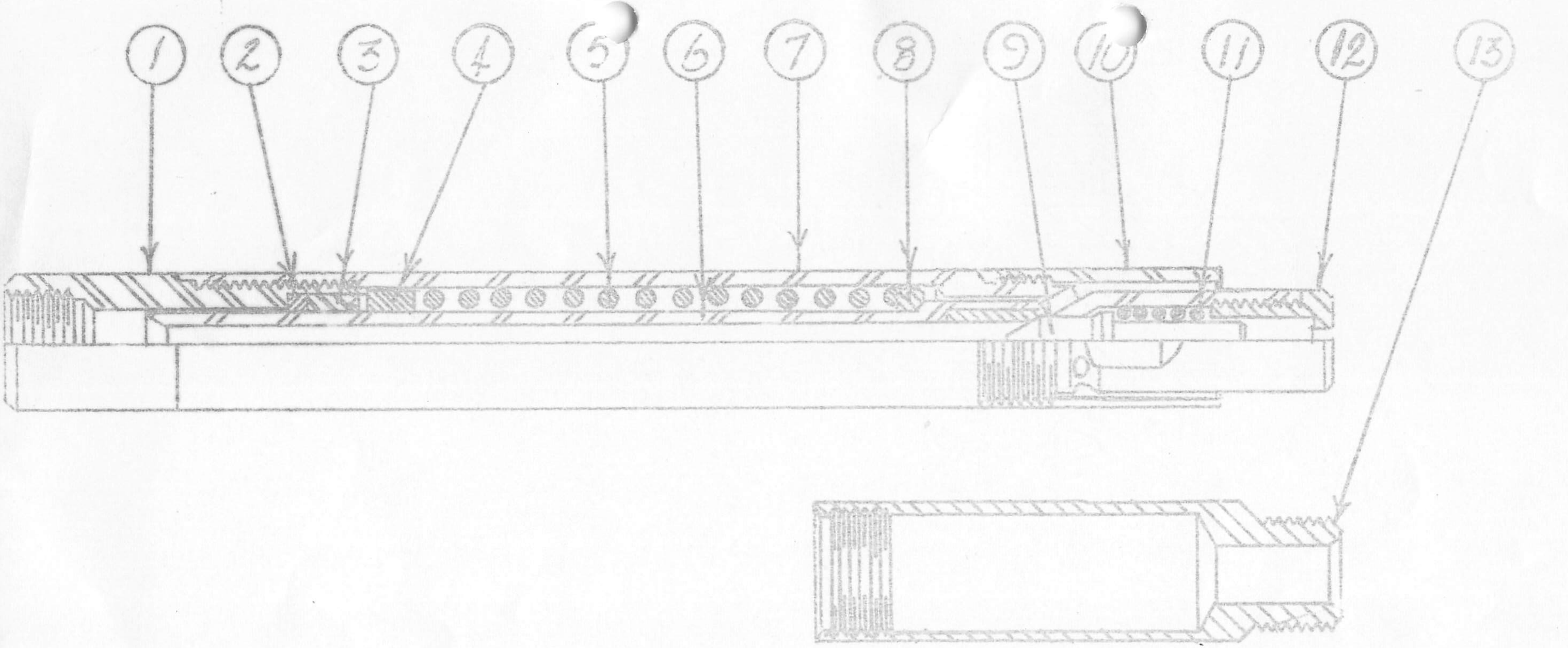
9. Place the valve (9) in the valve housing of the body.

10. Place the valve spring (11) over the shank of the valve.

11. Replace and tighten the valve housing plug (12).

12. Replace and tighten the skirt (10), or connecting sub (13).

The cage assembly is now ready to be attached to the locking device or equalizing sub.



OTIS 2-2½ x ½ TYPE D REGULATOR CAGE ASSEMBLY

1 - Top Sub
2 - Back-Up Ring
3 - Packing Ring
4 - Adjusting Ring
5 - Regulating Spring
6 - Valve Seat
7 - Body
8 - Valve Guide
9 - Valve
10 - Skirt
11 - Valve Spring
12 - Valve Housing Plug
13 - Connecting Sub

INSTRUCTIONS

OTIS TYPE S REMOVABLE MANDREL ASSEMBLY

(Drawing No. 10S06, attached)

I. PURPOSE:

The Type S Mandrel Assembly serves the same purposes as the Type J Mandrel Assembly but is the only locking and pack-off assembly available which affords a practical method of setting one, two, three, or more identical or different controls in definitely located seats in the same tubing string.

II. OPERATION:

The locating and locking mechanism includes a short tapered combination locking and packing mandrel (2 & 5) upon which are mounted a dog carrier (3), suspending four hook-type dogs (4) and a set of five fully supported V-Packing Rings (11); and a locator mandrel around which is mounted a set of spring-loaded keys (1). These keys are profiled to match with an identically shaped locator recess machined within the bore of the Type S Landing Nipple. Thus, by slightly varying the vertical dimensions of these keys and their corresponding nipple recesses, as many as five different Type S Mandrel Assembly and Nipple combinations are available for installation at different depths in the same string of tubing.

After the desired sub-surface control is attached to the bottom of the mandrel assembly, whose locator keys correspond with the landing nipple in which it is to be set, the complete assembly is lowered into the well with a Type S Running Tool attached to the regular wire line and tools. The assembly will pass through all upper Type S Landing Nipples until it reaches the one whose locator recesses match the profile of the keys. At this point, the spring-loaded keys will move outwardly and "select" the recesses in the lower portion of the nipple, causing the assembly to stop. Upward jarring impacts then cause the dogs to move out and firmly engage the upper end of the landing nipple locking recess as the tapered mandrel moves upwardly in the nipple. At the same time, the V-Packing effects an efficient seal within the honed bore of the nipple, which eliminates the necessity of flowing the well to create an initial shut-off. This is an important advantage where there is danger of pulling sand or water into the well bore.

Additional Type S Mandrel Assemblies, each carrying another sub-surface control, may be installed in their corresponding nipples in the same manner described above.

III. RUNNING THE ASSEMBLY:

1. Attach a Type S Running Tool to the running neck of the Type S Mandrel Assembly with two tangential shear pins, 3/16" dia.

2. Lower into the well until the proper Type S Nipple is contacted.

3. Jar downwardly to cut the transverse shear pin within the running tool.

4. Jar upwardly until the tangential shear pins are sheared.

5. Remove the wire line and tools from the tubing.

IV. PULLING THE ASSEMBLY:

1. Attach a Type RS Pulling Tool to the regular wire line tools and lower into the well until the Type S Mandrel Assembly is contacted.

2. Jar downwardly to unlock the assembly and to engage the pulling flange.

3. Jar upwardly to extract the assembly from the landing nipple.

   Note: The pulling flange cannot be engaged by the Type RS Pulling Tool until the mandrel assembly is forced down to the unlocked position.

V. DISASSEMBLY:

1. Place the mandrel assembly in the vise so that the jaws contact the lock mandrel (5).

2. Using a wrench, loosen the locator mandrel (9) and unscrew several turns.

3. Slide the upper retaining ring (7) upwardly and remove the keys (1) and flat springs (10).

4. Remove the locator mandrel (9).

5. Remove the male adapter ring (6).

6. Remove the V-Packing Rings (11).

7. Remove the female adapter ring (12).

8. Now, place the locator mandrel in the vise and remove the lower retaining nut (8).

VI. ASSEMBLY:

1. Place the lock mandrel (5) in the vise.

2. Replace the female adapter ring (12).

3. Replace the V-Packing Rings (11).

4. Replace the male adapter ring (6).

5. Replace the upper retaining ring (7) on the locator mandrel (9) and screw into the locking mandrel but do not tighten.

6. Replace the lower retaining nut (8), screwing it on only about half way.

7. With a key slot facing upwards, replace a flat spring (10) and a locator key (1).

8. Hold this key to keep it from falling out, rotate the locator mandrel until the opposite key slot is on top and replace the other flat spring and locator key.

9. Now, tighten the locator mandrel and the lower retaining nut.

6. Remove the upper choke cup.

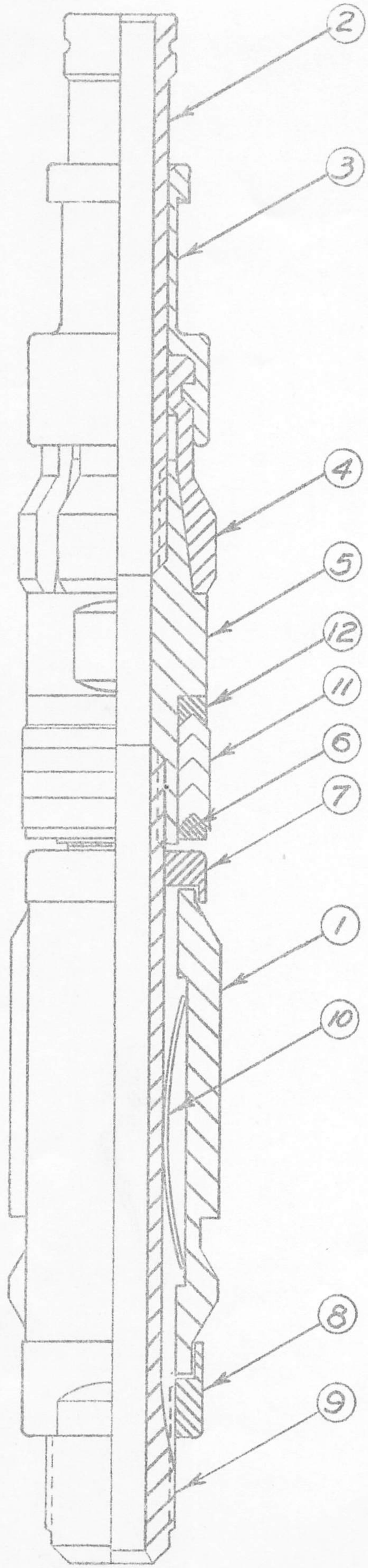
7. After cleaning the mandrel thoroughly, install a new upper choke cup.

8. Replace the upper cup ring making certain that the O-Ring (8) is in good condition.

9. Install a new lower choke cup.

10. Replace the lower cup ring.

11. Replace the nut. (Do not tighten this nut excessively or the flanges of the choke cups will be damaged which may cause them to rupture at pressure differentials far below their normal working limit.)



OTIS TYPE S CHOKE MANDREL ASSEMBLY

1. Keys
2. Carrier Mandrel
3. Dog Carrier
4. Dogs
5. Lock Mandrel
6. Male Adapter
7. Upper Retaining Ring
8. Lower Retaining Ring
9. Locator Mandrel
10. Flat Spring
11. V-Packing
12. Female Adapter

Copy

From BP EXPLORATION CO. LTD.,
EAKRING.

To MANAGER,
RESERVOIR ENGINEERING
DRILLING FLUIDS & PRODUCTION BRANCH.

Our Ref. PRO/1/3624 **Your Ref.** **Date** 26th November 1956

Subject PRODUCTION SCHEME FOR COUSLAND NO. 1 WELL

As agreed with you verbally we are sending you two copies of our drawing BM.655 showing the diagrammatic arrangement of the proposed plant for the Cousland No. 1 well production scheme. An explanatory note giving the considerations on which the scheme is based is attached to each drawing.

We are sending another copy of the drawing and covering note to Mr. Ricketts of the Scottish Gas Board. We have explained to him that our Engineering Branch will prepare the working drawings and obtain a cost estimate for the production scheme. We are also writing to Otis Pressure Control Inc. to obtain details and cost of bottom hole flow regulators and ancillary equipment.

C.M. Adcock.

CMA/EMH

3623

26th November 1956

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

Dear Mr. Ricketts,

Production scheme for Cousland No. 1 Well

When I spoke to Mr. Elgin during my last visit to Cousland I promised to send you a drawing showing the diagrammatic arrangement of the proposed wellhead plant to produce the gas into your pipeline.

After bringing the well in and carrying out production tests on 11th and 12th November, I think there is every chance that you will be able to obtain water free gas production, particularly at low production rates, for a fair period of time. Drawing No. BM.655 shows the proposed arrangement of the wellhead plant, including water separator, for a minimum of capital expenditure. The note attached explains the various considerations which have been taken into account before putting forward the present production scheme.

We are forwarding a copy of our drawing No. BM.655, together with covering note, to our Head Office Engineering Branch for them to prepare working drawings, and obtain a cost for the required plant. We confirm that we are able to manufacture the separator at Eakring.

With regard to the possibility of running bottom hole flow regulators in the tubing should you eventually decide to increase the offtake from the well, I am looking into this matter, and I will obtain details of the equipment required, including cost. This equipment has to be purchased from the U.S.A.

In due course I will be sending you details of the recent production tests, but I trust that the information you now have on Cousland No. 1 well will be sufficient for your immediate needs.

Yours sincerely,

C.M. Adcock.

CMA/EMH

COUSLAND NO. 1 WELL.

GAS PRODUCTION SCHEME.

Wellhead Plant required to connect the Gas Supply into the Gas Board's Pipe Line.

The diagrammatic sketch BM.655 shows the proposed arrangement for the production scheme. The layout has been arranged to keep capital expenditure down to a minimum. The proposals are based on the recent production tests carried out on 11th and 12th November. Details of the production scheme are as follows:-

1. Gas Offtake.

The planned gas offtake from the well is an initial 100,000 cubic feet per day delivered at 50 p.s.i. pressure into the Gas Board's pipe line to Musselburgh gasworks. The offtake is to be increased at a later date if the well is found to stand up satisfactorily to this production rate.

2. Essential Plant Requirements.

The gas production is to be drawn through 2" tubing in the well; and only exceptionally from the casing annulus. An initial wellhead pressure of 620 p.s.i.g. has been recorded after bringing in the well. The following are the main plant requirements:-

A. High pressure mist extractor and water separator.
B. Pressure regulator to reduce the gas pressure to 50 p.s.i.g.
C. Flow bean for rough production control.

A. High pressure mist extractor and water separator.

With the specific view of avoiding water production, only the top member of the 1582' - 1632' sand has been exposed by perforating the casing with shaped charges over the interval 1575' - 1605'. The gamma ray log indicated that the top sand member occurred over the interval 1580' - 1602'; and the lower sand member over the interval 1614' - 1630'. The1720' - 1806' sand has been left shut off by a cement plug inside the casing, as it was from this sand that water was produced when the casing was perforated to 1735'.

There is thus every chance that the well will produce dry gas for a considerable period of time, particularly at low production rates when no water coning will take place. The indicated gas/water level from pressure data (see report on Cousland Well 5) is put at 1675', or 70' below the bottom of the present perforated interval.

However, it is proposed to incorporate in the production plant a simple mist extractor and water separator as a safeguard against water production contingencies. The suggested high pressure water separator is based on the following considerations:-

(i) High pressure v. low pressure separators.

A high pressure separator operating at the wellhead pressure is to be preferred to a low pressure separator. At 600 p.s.i.g. the dew-point gas will contain 3 lbs. water per 100,000 cubic feet gas; but at 50 p.s.i.g. the water content of the dew-point gas will be trebled.

The centrifugal force type separator is not suitable for water separation at high pressure as the required tangential velocity of around 100 feet per second cannot be obtained with small gas production rates. For instance, 0.1 cubic feet of gas per second at 30 atmospheres is equivalent to 260,000 cubic feet of gas per day at atmospheric pressure.

(ii) Momentum type separator.

However, a simple momentum type separator should be quite satisfactory. This is preferably of horizontal design for ease of access, etc; and it is proposed to use two lengths of 11.3/4" casing approximately 12' long, and joined together by two flanged 4" pipe connections as shown on the attached sketch. The top section of casing is the mist extractor and water separator; and the bottom section of casing is a collecting chamber for the separated water. The gas inlet is at the top of the water separator section. The gas production impinges on an impact baffle plate which serves as a coalescing medium for water globules. The bottom of the baffle plate is perforated to allow the gas to pass into the separator chamber, and the water to flow into the collecting chamber.

The gas outlet from the separator is at the top on the far side from the gas inlet. The gas is made to pass through a plate with small perforations before it reaches the gas outlet. This plate is essentially a water agglomerator to trap and coalesce any water particles still carried in the gas. The base of the plate near the water outlet would not be perforated. It will be noted that the water drain-off is at the base of the water collecting chamber. Two high pressure 1" drain cocks are provided. When these two drain cocks are open the gas pressure will force the water out of the collecting chamber. It will be noted that the fitting of a reflex gauge glass is also recommended so that the water level in the collecting chamber can be observed.

B. Pressure regulator to reduce the gas pressure to 50 p.s.i.g.

The gas production tests indicated that at a production rate of 100,000 cubic feet per day there was no detectable wellhead pressure drop. In consequence, the full pressure drop from 620 p.s.i.g. to 50 p.s.i.g. will occur at the pressure regulator. The gas cooling, due to expansion, (Joule-Thomson effect) will therefore occur at the pressure regulator. During the production test at 100,000 cubic feet per day the temperature of the gas was lowered to freezing point. Freezing conditions became more severe up to production rates of around 1 million cubic feet per day; and became less severe thereafter due to the gas expansion taking place in the tubing itself. Freezing conditions result not only in the formation of ice, but also in the formation of gas hydrates, resulting in plugging conditions.

Natural gas hydrates form in the neighbourhood of 50°F with pressures of about 500 p.s.i. Hydrates form at the dew-point, and are most likely to collect at points in the system cooled by gas expansion. Hydrate control is by heating the gas to above the dew-point, or by various dehydration processes, or by the addition of anti-freeze compounds: this latter is the simplest method, and is the one indicated for small production rates. Methanol (Methyl alcohol) is a recognised anti-freeze compound. For pressures of 600 p.s.i. and a temperature of 40°F. the concentration of methanol in the vapour phase required to prevent the formation of hydrates is 27 lbs. Methanol per million cubic feet of gas. However smaller quantities, say 10 lbs. per million cubic feet, may be effective. If the Methanol is introduced into the gas stream as a vapour, the latent heat of vapourization (512 B.Th.Us per lb), and the heat of solution (112 B.Th.Us per lb) wouldbe available to help keep up the temperature of the gas. However, for small production rates of 100,000 cubic feet per day it is not considered necessary to make provision for Methanol injection.

At low production rates the gas will no doubt take up from the atmosphere the bulk of the heat loss on gas expansion. At higher production rates it will be necessary to install either some form of surface heating equipment, or a bottom hole choke in the tubing string. The simplest scheme for surface heating is a thermo-siphon system, gas heated, using water circulation through a simple heat exchanger. However, a better arrangement to overcome surface cooling is undoubtedly to incorporate in the tubing a bottom hole choke pressure regulator. The gas expansion will then take place at the bottom hole choke; and the bulk of the heat loss will be recovered from the reservoir, and so surface freezing conditions will be avoided. The required equipment will be expensive. However, details of cost are being obtained; and if it is found eventually that the well can be produced satisfactorily at substantially increased production rates, then the cost of this equipment will no doubt be justified.

For the present it is considered that the only equipment which must be installed is a reliable pressure regulator to reduce the pressure from 620 p.s.i.g. to 50 p.s.i.g. Consider using the type H 5 Controller made by Messrs.I.V. Pressure Controllers Ltd. (Technical Leaflet T.L.101). This controller has an 8" diaphragm, and 2" B.S.P.pipe connections. It is suitable for inlet pressures from 30-4000 p.s.i.g., and outlet pressures from 5-1500 p.s.i.g. With a 3/8" orifice valve size, 600 p.s.i. wellhead pressure, and 550 lbs. differential pressure across the regulator, the rated throughput capacity is 864,000 cubic feet per day. At 200 p.s.i. wellhead pressure and 150 p.s.i. differential pressure, the rated capacity is 288,000 cubic feet per day. Similarly, with a 1/2" orifice, 600 p.s.i. wellhead pressure and 550 lbs. differential pressure, the rated capacity is 1,440,000 cubic feet per day. At 200 p.s.i. wellhead pressure and 150 p.s.i. differential the rated capacity is 500,000 cubic feet per day. It is recommended that the regulator be fitted in the first instance with the 3/8" orifice.

C. Flow bean for rough production control.

It is proposed that the approximate rate of production only should be controlled at the wellhead. It will be noted that the pressure controller does this to some extent; and in point of fact the M.I.S. type flow bean shown on drawing BM.655 could be omitted from the production scheme if desired. However, this is a simple and inexpensive type of flow bean. Its main function is to restrict to a greater extent than can be obtained with the pressure regulator the quantity of gas flowing into the Gas Board's 4" pipe line. Hence the installation ofthe flow bean can be regarded as a safety precaution to keep the gas flow into the pipe line below a certain maximum agreed limit.

It will be noted that a 4" valve has been shown at the entry to the Gas Board's pipe line. No provision has been shown for metering the gas. It is presumed that the metering to conform with statutory requirements will be carried out at Musselburgh; and that any metering that may be undertaken at the wellhead will be for checking purposes only.

3. Discharge of Accumulated Water in the Well.

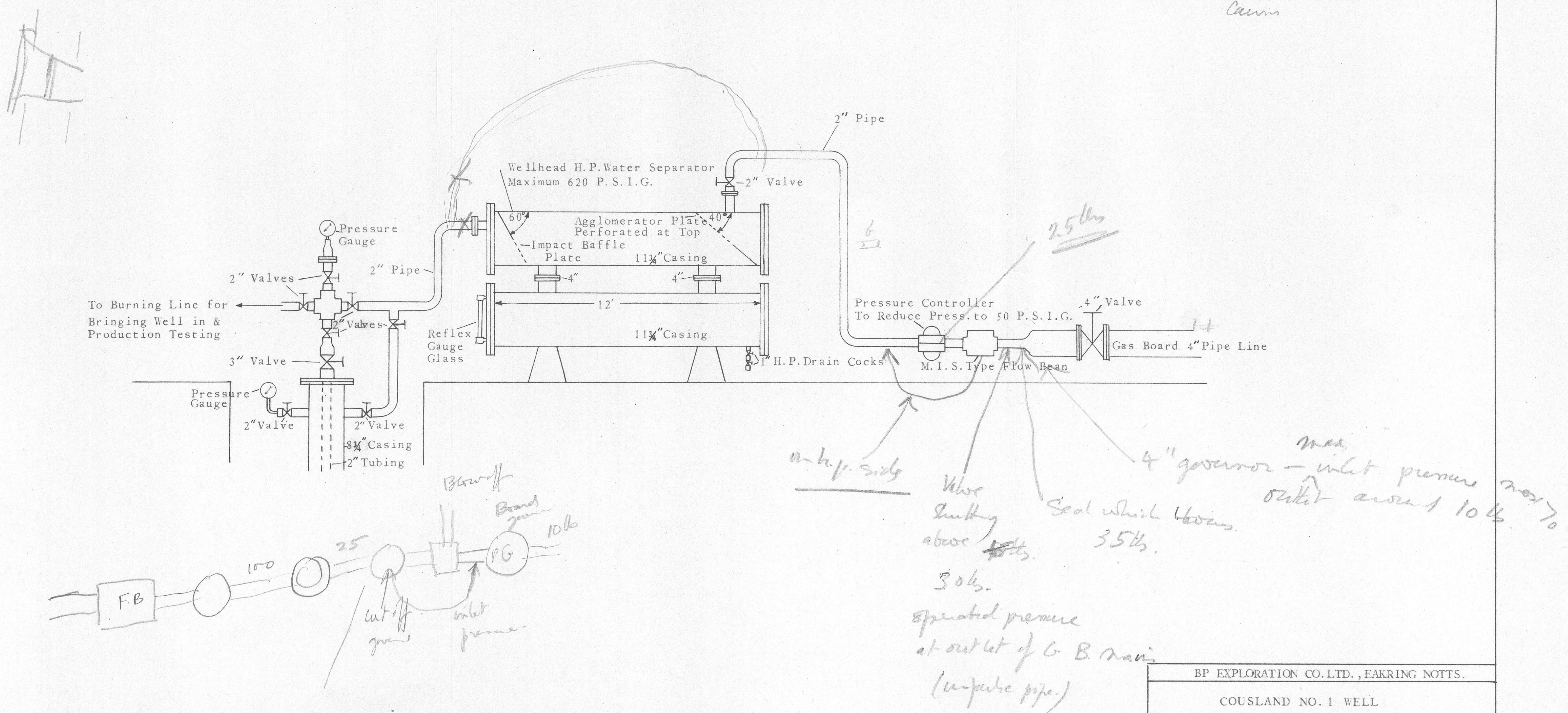
Should the well start producing water in any quantity it may accumulate in the casing. This will be indicated by an abnormal casinghead pressure drop; and also to a lesser extent by an excessive fall in the tubing pressure. Should this eventuality occur the gas production to the separator would be switched from the tubing to the casing annulus. The well would then be flowed at a fast rate through the tubing to the burning line until the accumulated water in the casing has been discharged at surface. The burning line valve would then be closed; and the gas production switched back from the casing annulus to the tubing. Wellhead pressures should return to the values recorded before the water began to accumulate. It is pointed out that if a bottom hole choke has been run the gas expansion will take place at the bottom of the tubing; and it will require less gas to discharge the accumulated water at surface.

No reservoir water has so far been obtained from the 1582'-1623' sand in No. 1 well. A geological correlation with No. 5 well (See P.E. completion report for No.5 well) shows the equivalent sand in Well 5 separated into three lenses, viz: 1693'-1700', 1712'-1720' and 1730' - 1760'. Samples of nearly uncontaminated reservoir water were obtained from the last two sands with specific gravities of 1.01 and 1.008 respectively. Both these edgewaters are of the chloride type; and it is anticipated that any water production from No. 1 well will be likewise a very weak brine.

C. M. ADCOCK.

EAKRING.
26.11.56.
CMA/EEK.

Cose
Elgin
Ricketts
Cairns



600
180,000
400

no levels - main
no drain point.

BP EXPLORATION CO. LTD., EAKRING NOTTS.	
COUSLAND NO. 1 WELL DIAGRAMMATIC ARRGT. OF WELLHEAD PLANT FOR GAS OFFTAKE TO GAS BOARDS' PIPE LINE	
Scale : Diagrammatic Date : 22.11.56	BM. 655
[signature]	Ch. [signature]

COUSLAND NO. 1 WELL

PROGRAMME TO PUT WELL ON PRODUCTION

ORIGINAL ROTARY TABLE ELEVATION 565'

WELL DATA

	Depth below R.T.
1. May 1945	
Top of cellar wall	6'
Cellar floor	12'
Perforations in upper sand (a)	1,582' - 1,613'
(b)	1,623' - 1,630'
Perforations in lower sand	1,720' - 1,735'
Top of cement plug in 8.3/4" casing	1,740'
11.3/4" casing shoe at	268'
8.3/4" casing shoe at	2,057'
Top of fish at	2,086'
2. July 1951	
Plugged back with cement to	1,465'
Anti-corrosive mud to	50'
Cement plug to cellar floor	12'
Wellhead burned off at cellar floor level	12'

WORKOVER PROGRAMME

1. Prepare wellhead for cleaning out operations

   i) Locate top of well at cellar floor level.
   ii) Weld joining plate between 11.3/4" and 8.3/4" casing.
   iii) Weld 8.5/8" casing collar to 8.3/4" casing.
   iv) Screw in flanged casing nipple with 2" side connections to bring wellhead up to ground level.
   v) Fit Shaffer gate for use during cleaning out operations.

2. Cleaning out operations

   i) Clean out top cement plug, anti-corrosive mud, and bottom cement plug to 1660', i.e. to circa 30' below the 1582'-1630' sand.
   ii) Change over to clean water. Capacity of 8.3/4" No.5 I.J. casing 2.154 gallons per foot; i.e. capacity of casing 3600 gallons to 1660'. Hence minimum surface storage capacity required 6000 gallons.
   iii) Run gamma-ray log to locate the position of the sand interval below the new wellhead.
   iv) Remove Shaffer gate.

3. Perforation programme

The original gas/water level in the 1582' - 1630' sand is put at - 1110' sub-sea, i.e. 1675' below original R.T. At this stage it is not proposed to perforate opposite the thin sand lens from 1623' - 1630'. Thus there is scope for the coning up of reservoir water up to 1613', the bottom of the main sand body, before water is produced with the gas production. It will be noted that this represents a rise of 62', so that there should be a reasonable chance of maintaining dry gas production.

The following is the shaped charges casing perforation programme:-

i) Fire five guns as follows:-

	Depths	
	Below original R.T.	Below cellar wall
Gun 1	1582' - 1588'	1576' - 1582'
Gun 2	1588' - 1594'	1582' - 1588'
Gun 3	1594' - 1600'	1588' - 1594'
Gun 4	1600' - 1606'	1594' - 1600'
Gun 5	1606' - 1612'	1600' - 1606'

The final depth corrections to be made after taking gamma-ray log.

ii) Keep the well full of water during perforation operations. Keep a record of all water lost to the formation.

4. Well completion after perforation

A. Run in 2" plain tubing string

i) Bottom two joints of tubing to be plain, with the end of the bottom joint plugged.
ii) Tubing joint opposite sand to be perforated with circa 40 holes each 1/2" diameter.
iii) Fit special coupling with aluminium bursting disc above perforated tubing joint.
iv) Run in plain tubing and screw into special matching flange.

B. Make up wellhead Christmas tree

i) Make up 3" (or 2") master valve above tubing flange.
ii) Make up 2" cross with 2" side valves and 2" top valve.
iii) Complete wellhead with a pair of flanges with 2" bull plug fitted with a 1/2" plug for a pressure gauge connection.

PROCEDURE FOR BRINGING THE WELL IN

i) Connect in the 3" burning line (as used at Fordon, complete with pressure connections) from 2" side valve on cross to burning point. By-pass the low pressure water separator used at Fordon.

ii) Open up fully side valve to burning line.

iii) Open up control valve above cross; drop go-devil; shut control valve immediately. After the aluminium disc has burst, produce at maximum flowing rate into the burning line until all water has been recovered from the casing.

iv) Keep annular space closed-in; and record annular space pressures.

v) After reproducing water in well close side valve on cross.

vi) Record annular space and tubing pressures until equilibrium pressure has been obtained. Check pressure by means of a dead-weight tester.

Notes

a) Suppose bursting disc is placed at 1500'. Internal volume of 2" tubing 0.136 gallons per foot. Hence volume of 1500' tubing 204 gallons.

b) Suppose the water is aerated by the gas so that the tubing fills to surface. Annular space volume 1.96 gallons per foot. Hence maximum initial drop in A.S. level 104'.

c) Indicated reservoir pressure at 1582' circa 640 p.s.i.g. Hence for water level 640/.434 or 1475' above 1582'; i.e. 107' from surface. Hence, the breaking of the bursting disc should just about bring the well in.

OPERATIONAL NOTES

i) The main production line to be one side line to the cross. The second side line to the cross to be used for bringing in the well, and specific productivity tests.

ii) One side line to the annular space to be retained as an alternative production line for use in emergency if production through the tubing is shut-in. The second annular space valve to be used for recording annular space pressures; and for pumping water to the well to kill it if required.

iii) The isolating valve above the cross is to permit the running of instruments into the well, such as floats, dippers, and pressure recorders.

Eakring
18.10.56
CMA/EMH

c.c. Mr. Falcon/Mr. Dickie
Mr. Malden
Mr. Adcock

29th March, 1956

Dear Mr. Ricketts,

Natural Gas at Cousland.

Mr. Adcock has forwarded copies of his correspondence with you dated 15th - 19th March from which it appears that we are at fault for not sending you a copy of his note on your meeting in Edinburgh on 12th January 1956. I must apologise for what has been a misunderstanding of his request and now enclose a copy of his note dated 19th January.

As regards the matter at issue, we have not been able to advise the Gas Council to include a test well at Carberry Hill at this stage in their present exploration programme as we consider that the prospects of such a test do not warrant its immediate drilling. There is certainly some prospect of finding some gas there and possibly in a quantity which would be commercially attractive but the Gas Council's programme of exploration is tailored to certain expenditures over a period of years and it is clearly not possible to include in it the testing of every prospect which holds any chance at all of success. It is part of our task to advise the Council on the order of attractiveness of the several prospects throughout Britain and to recommend a programme designed to test those prospects as nearly as possible in the order of their attractiveness.

Three years ago there seemed a good chance of proving, in the Cousland anticline, a gas field which would repay exploitation, but No. 5 well has seriously restricted its possibilities. The most satisfactory way of obtaining a useful estimate of the quantity of recoverable gas in the structure is to bring No. 1 well on production for a sufficiently long period to establish a depletion rate.

Any further expenditure on exploration of the Cousland anticline must be decided in the light of a maximum recovery which will probably not exceed 2000 million cu. ft. and may be no more than 250 million cu. ft.

....

I had hoped that you might be able to take say 500,000 cu.ft./day perhaps for mixing in small proportion with your mains gas for a period of say 12 months without having to spend more than some £20,000 to £30,000 on installation of the necessary pipe connections and other plant. At the end of such a period it would be possible to give a safe minimum figure for the field's total reserves. In any case, the prospect is a very minor one and to use the gas at any profit at all would require careful planning. We believed you were in the best position to evaluate whether this initial test is likely to be economically reasonable within the limits of probable availability we have indicated.

From Mr. Adcock's account of your meeting I infer that you did not think it desirable to undertake such an operation but turned to consideration of the adjacent structure at Carberry Hill. In spite of the advantages that would accrue from finding an additional field there which might have gas reserves of the same order as those at Cousland, or even more, we do not consider the prospect would justify the expenditure necessary for another test well at this stage in the Gas Council's programme.

In any case, I think it fair to say that we would advise determining the quantity of gas which is available at Cousland before taking the hazard of another well at Carberry Hill. If the cost of a temporary installation to make use of gas produced in a prolonged test of Cousland No.1 Well is too great to warrant such expenditure, it is justifiable to consider whether there would be merit in burning such gas to a flare. While it would then certainly be wasted such a procedure would give firm information of how much gas was left and in any case the gas while underground serves no useful purpose.

Yours sincerely,

(Sgd.) P. T. COX

T.S. Ricketts, Esq.,
Scottish Gas Board,
26, Drumsheugh Gardens,
Edinburgh 3.

VIA PRODUCTION RECORDS

Copy

From	D'ARCY EXPLORATION CO. LTD., EAKRING.	**To**	MANAGER, PETROLEUM DIVISION.
Our Ref. PRO/1/2678	**Your Ref.**	**Date**	19th March 1956

Subject REPORT ON VISIT TO SCOTTISH GAS BOARD TO DISCUSS THE DEVELOPMENT OF NATURAL GAS AT COUSLAND.

Further to my memorandum ref. PRO/1/2383 dated 23rd January, I have today received a letter from the Secretary of the Scottish Gas Board, saying that he has not yet received a copy of my report on Gas Prospects in the Cousland Area. I am sending you herewith a copy of his letter together with my reply, which is self-explanatory.

C.M. Adcock.

CMA/EMH

2679

19th March 1956

T.S. Ricketts, Esq.,
The Scottish Gas Board,
26 Drumsheugh Gardens,
Edinburgh, 3.

Dear Mr. Ricketts,

<u>Natural Gas at Cousland</u>

Thank you for your letter dated 15th March, and I was most surprised to learn that you had not received a copy of my report on the appraisal of gas prospects in the Cousland area.

The report is dated 18th January, and I forwarded two copies to our London Office together with a covering memorandum stating that you had specifically asked for a copy of this report to be forwarded on to you for your information. I also confirmed this request by telephone, and so I felt certain that our London Office would have communicated with you.

I must apologise for this omission, and I am getting in touch with our Head Office today to have the matter rectified.

Yours sincerely,

C.M. Adcock.

CMA/EMH

1 copy

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO SECRETARY

15th March, 1956.

C.M. Adcock, Esq.,
D'Arcy Exploration Co. Ltd.,
Eakrig,
P.O. Box 1,
Southwell, Notts.

Dear Mr.Adcock,

Natural Gas at Cousland

You will recall that during your meeting with our Chairman and other members of the Board on 12th January, you agreed to give further consideration to certain aspects of the Cousland project and to let us have a note of your conclusions in due course. I wonder if you are now in a position to comment further upon the matters then raised?

Our informal record of the discussion during your visit reminds me that you thought it would be possible for you to prepare a brief report summarising the information leading to the latest conclusions on the availability of gas at Cousland, together with a brief appraisal of the situation there as revealed by the latest findings. You will recall that the Chairman intends to submit this report to the Board so that consideration may be given to the possibility of recommending to the Gas Council that they contact your firm with a view to carrying out a drilling at or in the vicinity of Carberry Hill.

We should also be most interested to have a brief report summarising the outcome of the survey work which has been done in other parts of Scotland, particularly in the Forth/Clyde Valley.

I think that you understand that when the last drilling at Cousland was carried out, public interest was aroused and our Consultative Councils in particular continue to display a considerable interest in the matter.

Yours sincerely,

T.S Ricketts

Secretary pp

DCE/EWF

Copy

VIA PRODUCTION RECORDS.

From D.E.C. EAKRING. **To** MANAGER, PETROLEUM DIVISION.

Our Ref. PRO/1/2383 **Your Ref.** **Date** 23rd January 1956

Subject REPORT ON VISIT TO SCOTTISH GAS BOARD TO DISCUSS THE DEVELOPMENT OF NATURAL GAS AT COUSLAND.

We are sending you herewith two copies of the report setting out the results of the discussion with the Scottish Gas Board, Edinburgh, on the exploitation of Cousland natural gas.

The Scottish Gas Board has asked for a copy of this report; and it is assumed that you will arrange for this copy to be forwarded on to them.

C.M. ADCOCK.

CMA/MG

18th January 1956

Gas Prospects in the Cousland Area

The writer attended a meeting of the Scottish Gas Board, at 26 Drumsheugh Gardens, Edinburgh, on Thursday 12th January 1956, to discuss the development of natural gas at Cousland. Present at the meeting were:-

Sir Andrew Clow
Mr. Melvin
Mr. Rickett
Mr. Beavis
Mr. Cox
Mr. Elgin

In connection with Mr. P.T. Cox's suggestion that a detailed economic study should be made to determine the minimum gas production required to pay off the operation, it was pointed out that this work could only be undertaken by the Gas Board; since information would be required on the cost of pipelines, the cost of plant for gas reforming to reduce natural gas to the required calorific value; and a knowledge of the gas offtake rates which would have to be maintained for specific exploitation schemes etc.

A basic factor in this study is the value of the gas at the wellhead to the Gas Board. It was explained to the writer that there were so many factors to be taken into consideration that the Gas Board was not in a position to give a firm figure for the maximum value of the gas delivered to the pipe line which would be acceptable to the Board.

To be able to make an appraisal of the value of the Cousland gas reserves in very general terms, based on the various geological interpretations as to the extent of the structure, it has been necessary to assume an arbitrary value for the gas. This value has been taken as 2/6d per 1000 cubic feet of gas at the wellhead. It has the merit of corresponding to a value of 3d. per therm; and any figures can be quickly re-adjusted as soon as the true wellhead value of the therm is known. If for instance 6d. should prove to be a more realistic value for the wellhead therm, then the value of the gas reserves would ipso facto be doubted.

Applying this figure of 2/6d per 1000 cubic feet, i.e. £125 per million cubic feet, to rough estimates of Cousland gas reserves, then the data which have been set forth in the attached table are obtained. Too many assumptions have had to be made for the estimates of producible gas to be considered in any way accurate. The estimates are more in the nature of "intelligent guesses" for a given set of geological conditions. The purpose of the estimates is to give a generalised indication of the overall magnitude of the quantity of gas which might be produced from the Cousland dome.

It is evident that even under the most favourable conditions the producible gas is unlikely to exceed 2,000 million cubic feet. At 3d. per therm the value of these reserves would be £250,000. It would require the drilling of three or four additional wells, at a cost of £30,000 to £40,000, to produce this gas. In addition, there is of course the capital cost of making the gas available for utilisation; and it follows that it is the magnitude of the exploitation costs which finally determines whether the production scheme will prove to be a worth while economic project.

The writer was asked whether there were other areas which could be considered good prospects for obtaining additional gas reserves. He referred to the report GL-RGWB-5 where it was recommended that a test well should be drilled on the Carberry Hill-Falside culmination. The merit of this recommendation is that if the test well at Carberry Hill were to find gas in commercial quantities, the value of the Cousland structure would be enhanced by the additional gas reserves proved. There would be in consequence a greater incentive to develop both the Carberry Hill and Cousland areas. If, on the other hand, no gas were to be found in the Carberry Hill culmination, then it might be argued that the gas expectations at Cousland were not sufficiently promising to warrant exploitation; and there would then be a case for abandoning entirely the Cousland project.

At the meeting, the opinion appeared to be to accept this recommendation; in which case the Scottish Gas Board would propose to the Gas Council that a test well be drilled at Carberry Hill. After this well has been drilled, the Scottish Gas Board would be in a better position to decide on a firm scheme for the production and disposal of Cousland gas, or the abandonment of the area altogether.

Eakring
19.1.56
CMA/MG

COUSLAND GAS PRODUCTION

TABLE SUMMARISING PRODUCTION POSSIBILITIES

Assume value of gas delivered to main line @ 3d. per therm, i.e. 2/6d. per 1000 cubic feet or £125 per million cubic feet

Production Proposals	Producing Horizons	Average sand thickness feet	Reservoir Area Acres	Millions of cubic feet		Value of gas Reserves £	Average off-take Rate		Number of producing wells	Production life. Years	Remarks
				Gas in place	Producible Reserves		Cubic feet per day	Cubic feet per year			
No. 1 well only - See para. 3 of Mr. P.T. Cox's report to Gas Council	1582' sand top of 1720' sand	50	-	-	300	£37,500	100,000	36,500,000	1	8	Possibly a second well might be required. See Mr. P.T. Cox's report section 5 (a)
No. 1 well and a second well circa 1000' to the east. See report U.K.195 and contour map of Gilmerton Limestone.	1582' sand only.	50	100	1,000	600	£75,000	100,000	36,500,000	2	16	Producible reserves are assumed to be 60% of the gas in place, owing to by-passing etc.
No. 1 well, a second well 1500' to the east, and a third well located after drilling the second well. See report GL-RGWB.5 and contour map fig.2. A structural rise of up to 90' would be expected.	1582' sand only	50	230	2,000	1,200	£150,000	300,000	109,500,000	3	11	There would be a reasonable prospect of being able to maintain a production of 0.5 million cubic feet per day if required.
Three wells as above, if packers set to produce from segregated sands. Alternatively, another 2 wells would be required.	1582' sand 1720' sand	80	200	3,000	1,800	£225,000	500,000	182,500,000	3-5	10	See Section III of report GL-RGWB.5. With a possible 90' structural rise much of the 1720' sand should be above gas/water level. The average total sand thickness (both wells) has only been taken as 80', as there will not be much of the 1720' sand above gas/water level on the flanks of the structure.

Note:

The estimates for the gas in place are very rough, as the greater part of the data required has to be assumed.

The intention is to indicate the possibilities of Cousland after making certain reservoir assumptions, to assist in the appraisal of the area.

Note:

The 2094'-2122' sand in No. 1 well produced water free gas at a rate of 150,000 cubic feet per day. The production possibilities of this sand should not be lost sight of in any future well drilled.

Eakring
20.1.56
CMA/MG

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS
EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

~~REPLY TO SECRETARY~~

15th December, 1955

D'Arcy Exploration Co. Ltd.,
Eakring,
P.O. Box 1,
Southwell, Notts.

for the attention of
Mr. C.M. Adcock

Dear Sirs,

Natural Gas at Cousland

I was very pleased to see from your letter of 13th December that it will be convenient for you to come to Edinburgh on Thursday, 12th January to discuss the implications of the final reports on Cousland with our officers here. As previously indicated, we would like to meet you at this office at about 10.30 a.m.

Yours faithfully,

David Elgin

Technical Officer

13th December 1955.

The Scottish Gas Board,
26 Drumsheugh Gardens,
Edinburgh 3.

Dear Sirs,

Natural Gas at Cousland.

Replying to your letter of the 8th instant, the undersigned will be pleased to travel to Edinburgh for a meeting on Thursday, 12th January at 10.30 a.m., as suggested by you, to discuss the exploitation of natural gas at Cousland.

Yours faithfully,
for D'ARCY EXPLORATION CO. LTD.,

C.M. Adcock.

CMA/EMH

travel up on 10th
return

THE SCOTTISH GAS BOARD
26 DRUMSHEUGH GARDENS
EDINBURGH, 3
TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"
REPLY TO SECRETARY

D'Arcy Exploration Company Ltd.,
P.O. Box 1,
Southwell,
Notts.

8th December, 1955

For the attention of Mr. C.M. Adcock

Dear Sirs,

Natural Gas at Cousland

I refer to your letter of 5th December in which it was suggested that Mr. Adcock might come to Scotland during the current month. Unfortunately, however, the next few weeks are rather fully occupied by meetings, etc. and I would be very pleased to hear if it would be possible for Mr. Adcock to defer his visit until early in the New Year. In order to avoid further delay, however, I would suggest that we now arrange a definite date, and Thursday 12th January has been proposed. Would you please let me know if this date is likely to be convenient to Mr. Adcock. The meeting would be at this office at about 10.30 a.m.

Yours faithfully,

David Elgin

For Secretary

TO/5

5th December 1955.

The Scottish Gas Board,
26 Drumsheugh Gardens,
Edinburgh 3.

Dear Sirs,

Natural Gas at Cousland

We apologise for the delay in replying to your letter with reference to the exploitation of natural gas at Cousland.

The writer was unable to visit Edinburgh during November, but will be pleased to make an appointment with you during December.

Will you please suggest a suitable date, and the undersigned will make arrangements to travel to Edinburgh. Almost any date will be convenient during the forthcoming weeks.

Yours faithfully,
for D'ARCY EXPLORATION CO.LTD.,

CMA/MG

Copy

From MANAGER, PETROLEUM DIVISION. To MANAGER, EAKRING.

Our Ref. PRO/15/5690. Your Ref. Date 22nd November, 1955.

Subject <u>VISIT TO EDINBURGH IN CONNECTION WITH THE DEVELOPMENT OF NATURAL GAS AT COUSLAND</u>.

With reference to the proposed visit of Mr. Adcock to the Scottish Gas Board at Edinburgh, and to their undated letter received by you on the 31st of last month, a copy of which was sent to this office for information and further definition of Mr. Adcock's terms of reference, we referred the third paragraph of the Gas Board's letter to Mr. Cox.

His intention in his final report on the drilling of Cousland No.5 Well, paragraph five, in which he recommended that a detailed economic study should be made, was to determine the maximum cost of gas delivered to main line which would be acceptable to the Gas Board. With this figure he considered it would be possible to estimate whether or not it would be economic to exploit the estimated gas reserves at Cousland.

We trust this clarification will enable Mr. Adcock to make arrangements to pay the promised visit to the offices of the Scottish Gas Board at an early date.

(Sgd) R. K. DICKIE

R.K. Dickie.

cc: Mr. Adcock. ✓
Mr. Cox.

RKD/SVT.

Memorandum

From Manager,
Petroleum Division

To Manager, Eakring

Our Ref. RKD/5603 **Your Ref.**

Date 7th October, 1955

Subject COUSLAND AREA

In June of this year a request was received from D.E.C. for a Petroleum Engineer to visit the Scottish Gas Board to discuss certain points in the Report on Cousland to the Gas Council. At that time neither the writer nor Mr. Adcock was available and the trip was postponed until Mr. Adcock should return from the U.S.A. Mr. Brunstroms' report on "The Prospects of Finding More Gas in the Cousland Area" caused a further postponment of the visit, but it has now been decided by Mr. Cox that we should delay no longer in meeting the request of the Scottish Gas Board and we should be glad if Mr. Adcock could visit Edinburgh, in the near future, to discuss the points which are not clear to the Scottish Board.

This discussion should be based on the Completion Report on No.5 well together with Mr. Cox's covering note setting out the possible courses of action which might be taken to produce gas.

In making arrangements for this visit you should get in touch with the Scottish Gas Board direct. Their address is:

The Scottish Gas Board,
26 Drumsheugh Gardens,
Edinburgh 3

RKDicken

cc: Mr. A.F. Matthews
Mr. Maldon

RKD/SLS

1961

18th October 1955.

The Scottish Gas Board,
26 Drumheugh Gardens,
EDINBURGH 3.

Dear Sirs,

Cousland Area

We understand from our London Principals that you wish to discuss certain points in connection with the report submitted to you after the completion of Cousland No. 5 well.

The writer will be pleased to make arrangements to visit Edinburgh to talk over these matters with you. We would tentatively suggest Wednesday 26th October for this meeting. It would be helpful if you could indicate the topics you are particularly interested in beforehand, so that the undersigned can bring with him the relevant documents.

Yours faithfully,
for D'ARCY EXPLORATION CO. LTD.,

CMA/MG

Memorandum

From MANAGER, PETROLEUM DIVISION. **To** MANAGER, EAKRING.

Our Ref. PRO/15/5690. **Your Ref.** **Date** 22nd November, 1955.

Subject VISIT TO EDINBURGH IN CONNECTION WITH THE DEVELOPMENT OF NATURAL GAS AT COUSLAND.

With reference to the proposed visit of Mr. Adcock to the Scottish Gas Board at Edinburgh, and to their undated letter received by you on the 31st of last month, a copy of which was sent to this office for information and further definition of Mr. Adcock's terms of reference, we referred the third paragraph of the Gas Board's letter to Mr. Cox.

His intention in his final report on the drilling of Cousland No.5 Well, paragraph five, in which he recommended that a detailed economic study should be made, was to determine the maximum cost of gas delivered to main line which would be acceptable to the Gas Board. With this figure he considered it would be possible to estimate whether or not it would be economic to exploit the estimated gas reserves at Cousland.

We trust this clarification will enable Mr. Adcock to make arrangements to pay the promised visit to the offices of the Scottish Gas Board at an early date.

R.K. Dickie

R.K. Dickie.

cc: Mr. Adcock.
Mr. Cox.

RKD/SVT.

THE SCOTTISH GAS BOARD

26 DRUMSHEUGH GARDENS

EDINBURGH, 3

TELEPHONE 34331-5 TELEGRAMS "SCOTGASBO"

REPLY TO SECRETARY Your Ref: 1961 - CMA/MG.

D'Arcy Exploration Company Limited,
P.O. Box 1,
SOUTHWELL,
Notts.

For the attention of Mr. C.M. Adcock

Dear Sirs,

Natural Gas at Cousland

Thank you for your letter of 18th October indicating that Mr. C.M. Adcock will be visiting Scotland to discuss points arising from the reports prepared by you after the completion of your investigations at Cousland No.5 Well. It is unfortunate, however, that certain of our officers who would be present at such discussions are to be out of Scotland on Wednesday, 26th October, the date you have suggested for Mr.Adcock's visit. I wonder, therefore, if you can suggest a few dates during November which would be convenient to Mr. Adcock?

When our Chairman wrote to the Secretary of the Gas Council suggesting a visit of this kind, he had in mind that we should discuss the practical implications of your final report on the drilling at Cousland and also the report dated 20th December 1954 dealing with the possibility of storing towns gas underground at Cousland. In general terms, we are wondering whether the existence of a deposit at Cousland should be taken into account or on the other hand ignored in any consideration involving the future of gasmaking in the Edinburgh area.

In the final report by Mr. P.T. Cox, particularly in paragraph 5, it was recommended that a detailed economic study should be made to determine the minimum gas production which would be required to pay off the operation. We are not quite clear whether you are to undertake such a study or if we are expected to investigate the matter and let you have the necessary details.

You /

RECEIVED
EAKRING
24 OCT 1955

You will appreciate, I am sure, that the two reports referred to above contain many references of a specialist nature, the full practical significance of which is not immediately evident. I think that one of the main purposes to be served by Mr.Adcock's visit will be in clarifying such points.

Yours faithfully,

Secretary.

TO/5

GAS COUNCIL EXPLORATION PROJECT

COUSLAND AREA, SCOTLAND - NO.5 WELL

1. The Report by Dr. Lees, Mr. N.L. Falcon and Mr. S. Elder dated March 1953 has been filed as Report No.1 of this series.

2. The present report filed as No.2 presents a comprehensive record of the drilling of Cousland No.5 Well and correlate the results of this well with evidence obtained from previous drilling in this area.

3. In the course of its oil exploration D'Arcy Exploration Co. Ltd. drilled three wells on the main Cousland dome of which No.1 proved gas accumulations in certain Lower Carboniferous sandstone formations. The two principal productive sandstone groups occur in this well at depths of 1,582 ft. to 1,632 ft. and 1,720 ft. to 1,800 ft. They each yielded gas production on test at rates of approximately three million cu.ft./day and four million cu.ft./day respectively.

Observations of pressures in No.1 Well led to the conclusion that the quantity of recoverable gas contained in both these sandstone groups was of the order of 300,000,000 cu.ft., but uncertainties regarding the size of the anticline at depth and lateral variation in thickness and quality of the gas-bearing sandstones left open a possibility that the total quantity of recoverable gas was substantially in excess of this estimate. It was, therefore, agreed that an early item in the exploration programme of the Gas Council would be a step-out well located some 1,000 ft. to the south of No.1. This was drilled during the last year as Cousland No.5 Well, and the accompanying reports give a record of the formations penetrated and production tests made. Geological and Petroleum Engineering notes discuss these results in relation to the structure and stratigraphy of the anticline and its reservoir contents.

4. Cousland No.5 Well proved, firstly, that the formations which were productive in No.1 Well are some 100 ft. deeper in No.5 and, secondly, that these formations in No.5 are less effective as reservoirs, the sand members being thinner and of generally lesser porosity/permeability. The possibility that the structure rises or maintains an equal elevation southwards from No.1 Well location has thus been eliminated and the prospects of the structure are, therefore, appreciably reduced.

/2........

Nevertheless, the evidence gained from No.5 Well has not entirely eliminated the possibility of gas accumulations in this structure which would repay the cost of exploitation. Dr. Jones has drawn attention to a possible extension of the structure to the north-east and there is at least one other probable culmination to the north, separated by a saddle from the main Cousland dome. Furthermore, it is probable that the reservoir sandstones improve northwards both in thickness and in permeability.

5. Having regard both to the general reduction in attractiveness of its prospects and to the remaining possibilities of proving commercial gas production at Cousland, it is now recommended that:-

(a) A detailed economic study be made to determine the minimum gas production (in terms of daily offtake for a period of years) which would be required to pay-off the operation.

With our present knowledge, it can be said that there is a fairly safe expectation that an offtake of 100,000 cu.ft./day (thermal equivalent of say 1,400 tons of coal per annum) could be recovered for a period of about 6 years, but even this small production would probably require one further well to be drilled to a depth of about 1,800 ft. in order to ensure proper drainage of the reservoirs.

There is a fair prospect that an offtake of the order of 500,000 cu.ft./day could be maintained for about the same period or longer if:

(i) the lateral extent of the main Cousland dome is of the order of size indicated in the contour map (Fig.1) accompanying Dr. Jones' Report;

(ii) there is a substantial improvement in the effective reservoir volume of the sands to the east and north of No.1 Well;

(iii) further structural closures of significant size exist to the north of the main Cousland dome.

To produce this amount of gas at least one further well would be required.

(b) The study of structural and stratigraphical circumstances in the Cousland area be continued with the object of locating one or more further wells both to serve as tests for gas production and to give additional critical evidence of the size of the reservoirs.

/3........

As a result of this study it may be recommended that some shallow core-holes should be drilled, or a seismic survey be carried out, to gain further evidence of the structure before locating another test well.

5. The economic study recommended above is necessary to provide an adequate basis for deciding whether to abandon the Gousland project entirely, to bring No.1 Well on production without further drilling (over a period of a year or so this would enable a more definite estimate to be made of the total recoverable gas reserves) or to drill a further test well (with or without preliminary seismic or core-hole drilling) to prove greater productive capacity before any expenditure is made on installation of a production system. Should the first of these three courses be adopted our second recommendation (b) above would be unnecessary, and if the second alternative is chosen its urgency would be much diminished.

c.c. Manager (D.M.C.) Eakring
Mr. W.H. Dowling.

Copy

From D.E.C.
EAKRING.

To MANAGER,
PETROLEUM DIVISION.

Our Ref. PRO/1/755 **Your Ref.** **Date** 21st December 1954.

Subject UNDERGROUND STORAGE OF GAS AT COUSLAND

At your request we have examined the possibility of using the Cousland middle dome for the storage of gas.

We are attaching herewith a note for record, in which the various aspects of this project are discussed.

C.M. ADCOCK.

CMA/MG

20th December 1954

Underground storage of gas at Cousland

The possibility of storing gas in the middle Cousland dome is discussed with particular reference to the 1582'-1632' sand in well 1. The natural gas in place appears to be about 1000 million cubic feet: this is a small reservoir, which could not be used for storing large quantities of gas.

The gas/water level in the 1582'-1632' sand is placed at 1110' sub-sea; and the bottom of the sand occurs at a depth of 1067' sub-sea, or 43' above gas/water level. This should make it possible to produce the well at high production rates, after it has been charged with additional gas, without producing an undue amount of water coning.

Dr. Jones estimates that the mean diameter of the area of gas-bearing sandstones is approximately 2,500 feet. This is equivalent to 113 acres. The average sand thickness is put at 50'. Basing on 15% porosity and 40% interstial water, the quantities of gas which would be stored for given increases of reservoir pressure have been calculated. The results have been plotted on the accompanying graph, which also shows the corresponding wellhead pressures.

Suppose for instance, that 200 million cubic feet of gas have been injected into the sand; then the graph shows that the reservoir pressure may be expected to rise from the initial value of 663 p.s.i.a. to 776 p.s.i.a. This is of course a maximum pressure rise, which assumes no downward displacement of the gas/water level. From this it follows that the quantity of gas which can be stored for a given pressure rise will be substantially increased if the water level is lowered by the gas injection.

From geological considerations the closure in the middle Cousland dome appears to be rather more than 100'; and the reservoir may be nearly completely filled with gas to the"spill-point". If this is true, there would not be very much scope for further lowering of the gas water level by gas injection.

The pressure to which the storage gas has to be compressed to force it into the Cousland dome depends on the rate at which it is required to store the gas, and the quantity of gas to be stored before off-take begins. In the original formation test of the 1582'-1632' sand, a production rate of 3 million cubic feet gas per day was obtained with a bottom hole differential pressure of approximately 600 p.s.i. To attain this rate of gas input, it would be necessary to compress the storage gas to approximately 1200 p.s.i. before injection. - It would require a field test to determine the true gas input rates for a range of injection pressures.

It is not considered that there would be any danger of bringing about formation fracturing at this pressure. An injection pressure of 1200 p.s.i. is equivalent to a bottom hole pressure of 1250 p.s.i., and corresponds to a pressure gradient of 0.77 p.s.i. per foot depth. The pressure of the overburden is approximately 1 p.s.i. per foot depth; and it has been found at Eakring that a pressure equivalent to 30% above the overburden pressure is required to start formation fracturing. At Cousland, the equivalent bottom hole pressure would be 2300 p.s.i. to bring about formation fracturing. It is thought that an injection pressure of 1600 p.s.i. would be quite practicable.

It would be advisable to operate the Cousland gas storage project, at, or above, the present reservoir pressure. This is to assist the conservation of the gas, some of which would otherwise become trapped in the reservoir as a result of water encroachment, if the reservoir pressure is allowed to decline below its present value.

The supporting figures for this assessment are based on the injection of natural gas into the reservoir. This is of course mainly Methane. The assessment will be affected to the extent that compressibility factors and gas densities of the storage gas differ from natural gas. These are of course only minor points. The main factors which may extend the scope or limit the usefulness of the Cousland gas dome for gas storage depend so much on reservoir volume variations that it would only be possible to obtain more accurate data from a practical field test.

Cousland

Proposal for underground gas storage in 1582'-1632' sand

1. Gas Reservoir Space

$V = a\,f\,h\,(1 - Sw)$

where V = reservoir space occupied by gas - cubic feet
a = areal extent of reservoir not invaded by water - square feet
h = average pay thickness underlying reservoir area - feet
f = porosity for "ah" volume
Sw = average interstitial water content for "ah" fraction of porosity

Base on f = 15%
Sw = 40%

Then $V = ah \times 0.15 \times 0.6 = 0.09\ ah$

Area of reservoir $= (2.5 \times 10^3)^2 \times 0.7854$
$= 4.9 \times 10^6\ ft^2$

Base on h = 50'

Then $V = 0.09 \times 50 \times 4.9 \times 10^6$
$= \underline{22.1 \times 10^6\ ft^3}$

Notes:

(1) Gas in place 48 cubic feet per cubic foot
(2) Gas filled reservoir space 3920 cubic feet per acre-foot
(3) Areal extent of reservoir 113 acres
(4) Average thickness of reservoir 50'
(5) Gas in place $\underline{1050 \times 10^6}$ cubic feet

442000
22100000

2. Gas injection at increasing pressures

$$S = \frac{P}{0.02827\ TZ} = \frac{P}{15Z}$$

where S = Gas saturation - cubic feet at N.T.P.
T = Reservoir Temperature - 530° FA
P = Reservoir Pressure - p.s.i.a.

Assumed R.P. p.s.i.a.	Pseudo-reduced P. & T. Temp. $\frac{530}{336.8}$	Pressure $\frac{P}{652.4}$	Compressibility factor Z	Saturation P/15Z S	S_1-S	Gas Stored $V(S_1 - S)$ Million cubic ft.
663	1.58	1.003	0.920	48	-	-
700	1.58	1.07	0.915	51	3	67
800	1.58	1.23	0.900	59	11	244
900	1.58	1.38	0.892	67	19	422
1000	1.58	1.53	0.880	75	27	600
1100	1.58	1.69	0.871	84	36	800
1200	1.58	1.84	0.862	93	45	1000

3. Corresponding wellhead pressures

$$\text{Density} = \frac{1}{V} = \frac{PM}{ZRT}$$

$$D = \frac{P \times 17.85}{Z \times 10.73 \times 530} = 0.00314 \frac{P}{Z}$$

where M = Average molecular weight of gas
R = Gas Constant
T = Reservoir Temperature
Z = Compressibility factor

Assumed R.P. p.s.i.a. P	Compress. factor Z	Density lbs/ft³ $.00314\frac{P}{Z}$ D	Gas Gradient p.s.i. per ft. D/144	Pressure of 1632' gas column p.s.i.	Wellhead pressure p.s.i.a.
663	0.920	2.26	0.0157	25.6	637
700	0.915	2.40	0.0167	27.2	673
800	0.900	2.79	0.0194	31.6	768
900	0.892	3.17	0.0220	36.0	864
1000	0.880	3.57	0.0248	40.5	960
1100	0.871	3.97	0.0276	45.0	1055
1200	0.862	4.38	0.0304	49.6	1150

Eakring
20.12.54
CMA/MG

Basis Average Porosity 15%
Average Water Saturation 40%
Reservoir Area 113 Acres
Average Gas Column 50'

COUSLAND
1582'-1632' Sand
Underground Storage of Gas

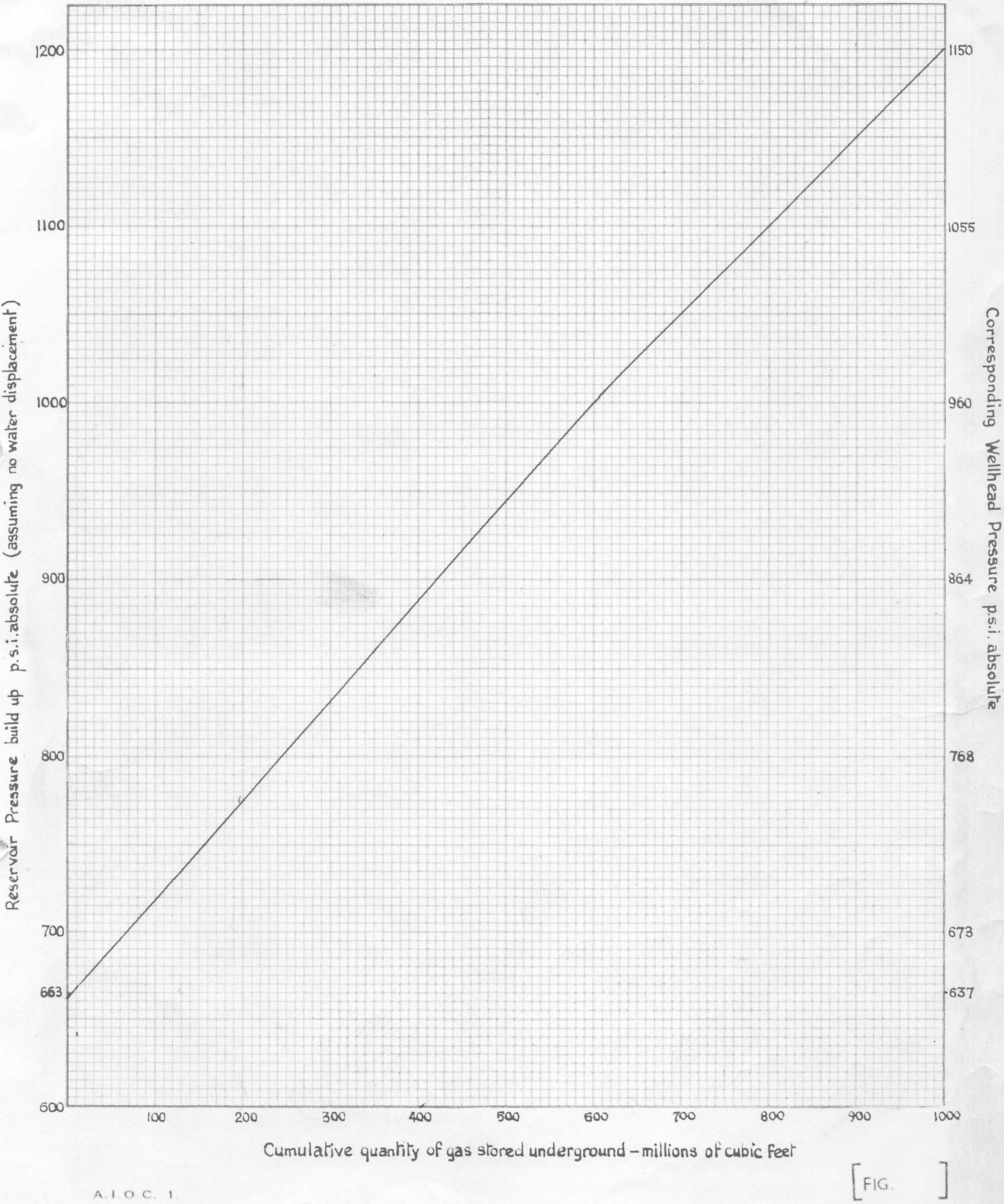


FIG.

A.I.O.C. 1.

A Note on the Cousland Area

by

W.D.V. Jones

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List of Figures

Report on the Cousland Area

1. Introduction

The first borehole drilled by D'Arcy Exploration Company on the main Cousland Anticline produced gas from sandstone within the Calciferous Sandstone Series. This gas was in considerable quantity, one of the sandstones giving production of about 4 million cubic feet per day.

This anticline became of great importance when the Gas Council decided to institute a search for Natural gas in Britain. It was decided that a further borehole should be drilled in the same general area with the view of obtaining a better estimate of the recoverable gas reserves.

This borehole was then located about 1100 feet south of No.1 on the best geological information available at that time. The results of the drilling and the search for gas are given in two reports: one being the Completion Report for Cousland No. 5 by W.A.H. Keenlyside and the other the Petroleum Engineering Report on the Cousland Area by C.M. Adcock.

This note is directed to an analysis of the results of the drilling of Well No. 5 and the exploration situation in the Cousland Area around Well No. 1.

2. The Results of Drilling at No. 5

The location chosen for No. 5 was near the central line of a north-south axis near the culmination of which No. 1 had been drilled. The new borehole was put south of No. 1 and should have been 20' higher structurally than No. 1.

In the event the gas-bearing strata were some 110' lower in No. 5 than in No. 1 and were very near to gas/water level. Further, the reservoir conditions in No. 5 were poorer and the reservoirs themselves were thinner than in No. 1. In brief, loss of good reservoir conditions and loss of elevation of the strata were responsible for the failure of No. 5 as a gas-producer.

The existing contour maps in this area have had therefore to be modified to include the results of this borehole. Whilst this work was being done it was discovered that some shallow borings to investigate the Limestones forming the surface beds of the area had been drilled. These records were made available to the Company by the Scottish Geological Survey in Edinburgh on a confidential basis.

3. The Present State of Knowledge of the Cousland Anticline

(a) Contour Map and Sections

The results of the drilling of No. 5 have changed the shape of the existing contour map of the north end of this anticline and made it necessary to close in the south side of the gas reservoir. This makes the gas field smaller than had originally been thought and has changed it from an approximately N-S structure to one which runs more nearly E-W.

Analysis of the results of the drilling of the shallow boreholes has shown that the picture of an E-W anticline is a probability at least. This analysis has been complicated by the fact that each of the two suface limestones (No. 1 or Gilmerton and No. 2 or North Greens) are about 100' thick and each is underlain by about 100' of sandstone. The Geological Survey believe that all these boreholes began above the No. 1 Limestone and this conclusion being agreed, sections and a contour map of the area on the top of the calciferous sandstone series have been drawn (Figures 2 and 1).

Figure No. 1 is the contour map and shows the results of co-ordination of surface and borehole evidence. The two faults are as drawn by the Survey; only the northern area (south of Cousland) of the much larger Cousland D'Arcy Anticline is shown. This contour map shows two high areas, one east and north of No. 1 and the other some 2000' south of Southfield. This latter could be as much as 75' higher than No. 1. These are separated by a saddle running generally NW-SE passing south of No. 2 and about 1000' south of No. 5.

The three sections are self-explanatory and show that a rise of some 22' above No. 1 could be expected at a point some 1000' from No. 1 in a direction of E. by N.

(b) Structure at Depth

Information at depth near the crest of the anticline is confined to No. 5 and No. 1. The remaining borehole (No.2) was drilled intentionally down flank. It is apparent from the results of No. 1 and No. 5 that although it is possible to draw a reasonable contour map on the base of the No. 1 Limestone (= top of the Calciferous Sandstone Series) the same structure may not be developed at depth. Correlation between No. 1 and No. 5 (Figure 5) shows that there are thickness differences in the Calciferous Sandstone Series just below the No. 1 Limestone. In Fig. 5 these amount to an excess of 61' in No. 5 over the same intervals in No. 1 and therefore the total loss of elevation = 45' + 61' or 106'. This is ascribed to faulting within this zone in No. 1 causing apparent thinning of strata from No. 5 to No. 1. A slight variation in these figures as compared with those in the Completion Report does not invalidate the argument. The factor is, however, quite impossible to assess and Figure 4 has been drawn on the assumption that the thicknesses at No. 5 are in fact the true thicknesses.

The mean diameter of the area in which the gas-bearing sandstones are above gas/water level then appears to be of the order of 2,500 feet. C.M. Adcock, assuming 15% average porosity for the volume of reservoir above water level and 40% for the average interstitial water content of that fraction, has calculated that the volume of the gas in situ in a 50' sandstone would be 1,000 x 10^6 cubic feet.

4. Reservoir Conditions

Within the area of No. 1 borehole, permeability conditions appear to be fairly good in the immediate neighbourhood but connection at distance appears to be more limited. These conclusions represent a fair statement after the results of the production tests on No. 1 producing sandstones.

In No. 5 there appears to be very limited connection in reservoirs thinner than in No. 1. The better reservoir connections and reservoirs themselves are therefore found when moving from No. 5 towards No. 1. If a further borehole in this area be required then any possible location should be chosen with this in mind.

5. Future Work

There is a possibility that the north-eastern side of the structure is not so uncomplicated as has been shown and it may be necessary to drill through the base of the No. 1 Limestone in two places to control this flank. This should be a necessary preliminary to any further deep drilling.

The anticline south of No. 5 across the saddle area is not at the moment thought to offer any strong attraction. It may be a pitching nose with the cross-fault cutting the axis further and further down pitch as the depth increases.

6. Conclusions

An area exists E. of No. 1 which is as high if not higher on the No. 1 Limestone than No. 1.

This high area is further removed from the poor reservoir area of No. 5 than No. 1.

The diameter of the area of sandstone above gas/water level is roughly 2,500'.

Eakring,
22.10.54.
WDVJ/MG

Mr Adcock!
DW.

From Mr. Comins

To Mr. Dickie

27th October, 1954.

COUSLAND GAS RESERVES

Reference the following reports returned herewith:-

(a) Correlation Report and Report on Packer Tests in No. 5 well by C. M. Adcock and K. Kirby, July 1954.

(b) Completion Report on Cousland 5 by W. A. H. Keenlyside, 12.10.54.

(c) The Cousland area by Dr. W. D. V. Jones, 12.10.54.

(d) Cousland Gas Reserves by C. M. Adcock, 8.10.54.

I have discussed these with Mr. Adcock and Dr. Jones and have come to the following conclusions:-

1. I agree with Mr. Adcock's recalculation of the reserves in place of the 1582-1632 and 1720/35 sands combined, based on the pressure decline of 40.6 p.s.i. in December 1939 as a result of producing 30.2 m. c.ft. of gas.

The 1720/35 sand would presumably not be opened up should No. 1 well be put on production, as there was evidence that it was going to water during the test. Furthermore any estimate of recoverable reserves would have to take into account the residual reserves at abandonment pressure, say 50 to 100 p.s.i.g. depending on the economics of production at the time which would entail some 10% to 20% reduction in the figure for recoverable reserves.

2. It would in my opinion be imprudent to attach any weight to the estimate of about 2500 m. c.ft., based on the slow recovery of reservoir pressure to the last reading in June 1947, such estimate being based on the assumption that this recovery was not due to water drive, but to slow migration of gas from other parts of the reservoir with which connection was restricted. It would seem more reasonable to accept that this recovery in gas pressure was due to recompression due to slow recovery of the aquifer water pressure over the years, even though water drive was not a factor during the production test. The equivalent volume of reservoir

gas to that produced during the test was after all very small, only about 4 million gallons. As regards migration of gas from other parts of the reservoir, the viscosity of the gas being very low, and the permeability of the sand in the hundreds, at least in parts, migration to the depleted pressure zone as measured in No. 1 well should have been rapid.

There was a 9 day interval between the completion of the production test, and the measurement of pressure in December 1939 on which the first estimate is made.

3. For the above reasons there would not appear to be any reason to alter the figures submitted to the Gas Council in the Report by Lees, Falcon and Elder for the estimate of Cousland reserves as 250 to 450 m. c.ft. as calculated from the pressure drop during this production test.

4. In view of the results in No. 5 well the figure of 2000 m. cu.ft. based on estimates of porespace above gas water level, given to the Gas Council in this report should certainly be drastically revised. I have no grounds for objecting in detail to the figure of 1000 m.c.ft. quoted by Dr. Jones applying Mr. Adcock's curves to his own estimates of area of the 1582/32 sand, to gas water level, roughly 1110' subsea and using a figure of 50' for sand thickness.

It should however be borne in mind that the validity of this figure is largely dependent on whether Dr. Jones is correct in his view that the deterioration of the 1582/1632 sand group between No. 1 well and No. 5 will be compensated by an improvement in the other direction. Moreover even in No. 1 well the effective thickness of actual sand, deducting shale breaks is less than 40' as compared with the 50' figure referred to.

With a productive area of less than ¼ sq. mile and a vertical gas column of less than 100' it would seem timely to play down Cousland prospects. The Report to the Gas Council did not specifically state whether the reserves figures given represented gas in place or gas which could be economically recoverable, but were no doubt read as the latter. On any estimates based on porespace a deduction of some 20% to 25% would therefore be necessary to allow for the combined factors of efficiency of recovery and of abandonment pressure.

Recommendation

With the above considerations in mind I would suggest that if a report is being sent to the Gas Council the section on reserves should be on something like the following lines.

"The unfavourable results in No. 5 well to the south of No. 1 i.e. deterioration of the sands and proof of gas-water level less than 100 feet below the top of the main producing sand in No. 1 well, indicate that, unless this sand greatly improves in quality and thickness to the north of No. 1 well; the estimate of recoverable reserves, based on porespace considerations, given in the Great Britain Report of March 1953, should be heavily reduced.

"On present evidence it would not appear justifiable to put the figure arrived at from gas bearing porespace considerations, appreciably higher in order of magnitude, than the ~~figures~~ figure of 450 m.cft., quoted in the Great Britain report as the upper limit deduced from the pressure drop consequent upon production. These figures relate to the Middle (No. 1 well) dome only."

(Sgd) D. COMINS

D. Comins.

Enclosures

copies to
Mr. Dowling.
Manager, Eakring (2).

DC/FEK

8th October 1954

Cousland Gas Reserves

Cousland Gas Reserves were estimated at some 500 million cubic feet after completing a flowing production test from well 1 in 1939. The value of these reserves at £200 per million cubic feet is £100,000.

Whilst the well was closed in during the following eight years, the wellhead pressure built up very slowly, the final pressure decline being 9.1 p.s.i. as compared with 40.6 p.s.i. at the end of the 1939 production test. There is thus a small, though good, local reservoir, with restricted connection over a wider area by poor permeability conditions.

On the smaller pressure decline, and assuming no water drive, the gas reserves would be about 2,500 million cubic feet. However, in view of the poor reservoir connection beyond the local well area, it is thought that the economic production from well 1 would not be more than the 500 million cubic feet of the original estimate.

To assist the appraisal of the Cousland Area gas contents of hypothetical reservoirs, varying from 1000' to 4000' diameter, have been calculated; basing on average sand porosity 15%, and water saturation 40% of the pore space. The results have been plotted on the attached graph.

It will be seen that if the average sand thickness is 100', the reservoir area required to contain 500 million cubic feet gas reserves is represented by a circle 1200' in diameter. If the reserves are 2500 million cubic feet, then the equivalent reservoir area circle is 2700' in diameter. Similarly, reservoir areas for other sand thicknesses can be read from the graph.

A note for record is attached giving the supporting data for these figures.

Note for record

1. Well Data

Perforations in Upper Sand	1582' - 1630'
" " Lower Sand	1720' - 1735'
Top of cement in $8\frac{3}{4}$" casing	1740'

2. Gas Recovery by gas expansion

(Park J. Jones - Oil & Gas Journal 16th July 1942)

(i) Assuming no water encroachment

(a) $$B = \frac{14.7}{520} \frac{TZ}{P} = .02827 \frac{TZ}{P}$$

where P = Reservoir Pressure - p.s.i.a.
T = Reservoir Temperature - 70°F - 530°R
Z = Compressibility factor = 0.920
B = Volume of reservoir space containing 1 cu.ft. gas

(b) $$S = \frac{1}{B} = \frac{P}{.02827TZ}$$

where S = Gas Saturation or cubic feet gas at N.T.P. in 1 cubic foot reservoir space

(c) Vol. gas originally in place = $V_1 S_1$

where V_1 = Initial Reservoir Space
S_1 = Initial Gas Saturation

(d) $C = V_1 (S_1 - S)$

where C = Cumulative gas produced
S = Gas saturation after producing C cubic feet

(e) Hence $$V_1 = \frac{C}{S_1 - S}$$

(ii) Calculation of Gas Reserves

$$S_1 = \frac{P_1}{.02827TZ} \qquad S = \frac{P}{.02827TZ}$$

3rd Nov. 1939 - C.I.P. - 645.2 p.s.i.a.
Hence R.P. @ 1740' 672.1 p.s.i.a.

11th Dec.1939 - C.I.P. - 604.6 p.s.i.a.
Hence R.P. @ 1740' - 631.5 p.s.i.a.

$$\therefore S_1 = \frac{672.1}{13.78} = 48.7$$

$$S = \frac{631.5}{13.78} = 45.8$$

Gas production during test 30.224 million cubic feet

$$\therefore V_1 = \frac{30.224 \times 10^6}{2.9} = 10.43 \times 10^6 \text{ cubic feet}$$

& Gas Reserves = $10.43 \times 10^6 \times 48.7$
= $\underline{508 \times 10^6 \text{ cubic feet}}$

By 4th June 1947   C.I.P. recovered to 636.1 p.s.i.a.
Hence R.P. @ 1740'   663.0 p.s.i.a.

$$S = \frac{663.0}{13.78} = 48.1$$

$$\text{Hence } V = \frac{30.224 \times 10^6}{0.6} = 50.4 \times 10^6 \text{ cubic feet}$$

$$\text{\& Gas Reserves} = 50.4 \times 10^6 \times 48.7$$
$$= 2450 \times 10^6 \text{ cubic feet}$$

3. Gas Reservoir Space

(i) $V = afh\ (1 - Sw)$

where V = reservoir space occupied by gas - Cubic feet
a = areal extent of reservoir not invaded by water - square ft.
h = average pay thickness underlying reservoir area - feet
f = average porosity for "ah" volume
Sw = average interstial water content for "ah" fraction of porosity

base on f = 15%
sw = 40%

Then $V = ah \times .15 \times 0.6 = 0.09\ ah$

Hence for h = 20' V = 1.8 a
h = 50' V = 4.5 a
h = 100' V = 9.0 a
h = 150' V = 13.5 a
h = 200' V = 18.0 a

Base on circular reservoir areas having the following diameters:-

Diameter feet	Area $ft^2 \times 10^6$	Values of V for the following values of h-cu.ft $\times 10^6$				
		h=20	h=50	h=100	h=150	h=200
1000	0.7854	1.41	3.49	7.06	10.6	14.13
2000	3.142	5.67	14.14	28.3	42.4	56.5
3000	7.06	12.7	31.78	63.5	95.3	127.2
4000	12.55	22.6	56.4	112.8	169.4	225.8

(ii) Gas in place

Basing on a gas saturation of 48.1 cubic feet at N.T.P. per cubic foot of reservoir space, determined from the C.I.P. recorded on 4th June 1947, the following gas reserves are calculated:-

Reservoir Diameter Feet	Gas Reserves for the following values of h-cu.ft $\times 10^6$				
	h=20	h=50	h=100	h=150	h=200
1000	70	170	340	480	680
2000	270	680	1360	2040	2720
3000	610	1530	3060	4580	6100
4000	1080	2710	5420	8140	10840

2500' $D^2 \times .7854$ 2.5×10^3

$6.3 \times 10^6 \times .785$
$4.95 \times 10^6 \times 2$
4.356×10^4 = 113 acres

Eakring
8.10.54
CMA/MG

Basis: Average Porosity 15 %
Average Water Saturation 40 %
Gas Saturation 48 ft³/ft.³ reservoir space

COUSLAND

Gas Reserves estimated for Reservoirs of 1000'–4000' diameter

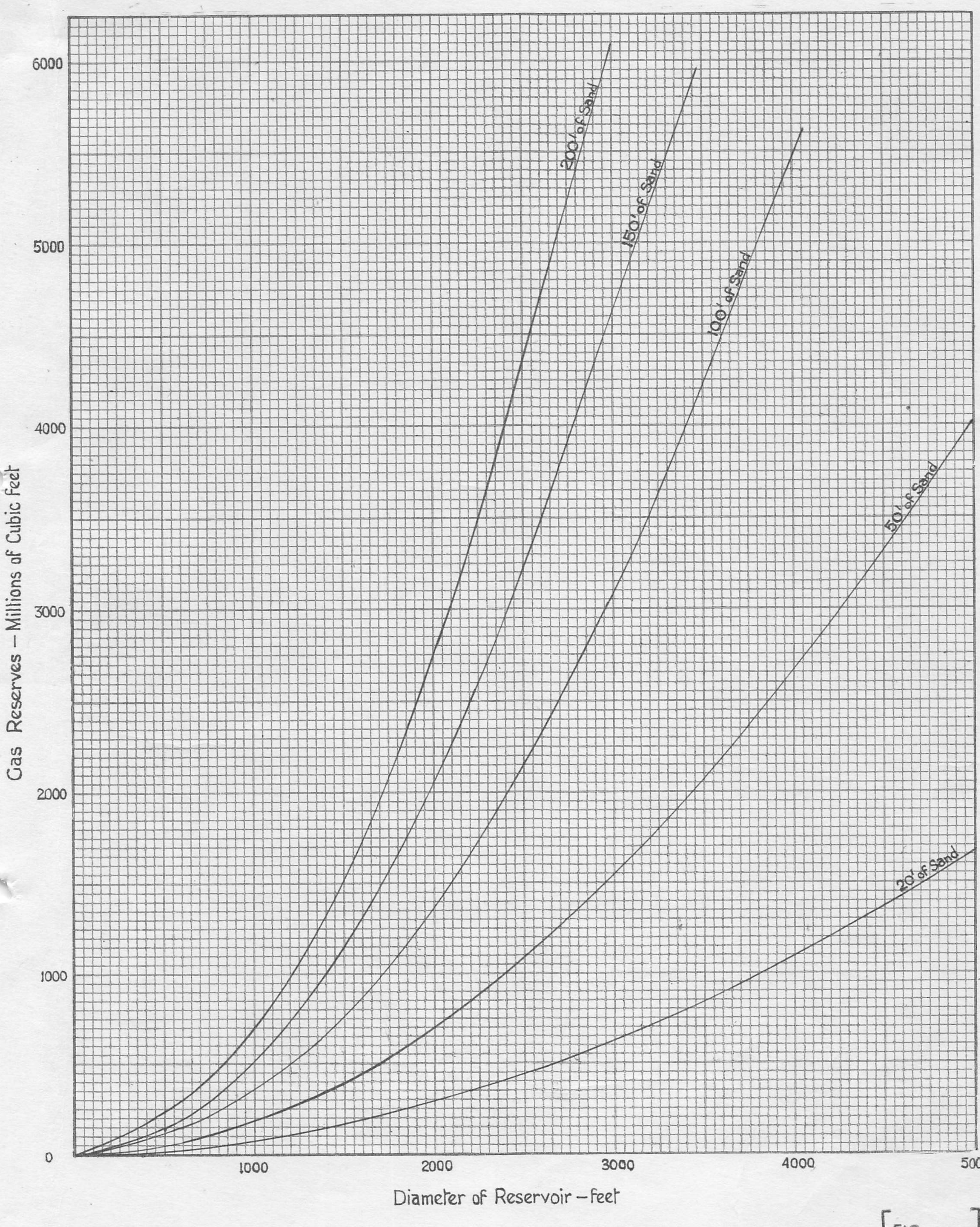

FIG.

A.I.O.C. 1.

H.120—C.7.47

Copy

Copy

From **To**

Our Ref. COMINS, SOUTHWELL. **Your Ref.** **Date** HARTLEY, SUNBURY.

Subject DC/358 31st January, 1942.

COUSLAND: GAS PRODUCTION SCHEME

A diagrammatic sketch outlining the revised scheme as agreed with you is attached, also a recapitulation of considerations taken into account in order that these may be borne in mind when reviewing the scheme as a whole or modifying it in detail.

Our understanding of the position is that, subject to your confirmation of the general scheme, you will now have it followed up in sufficient detail

(a) to forestall delay on account of plant design and enquiries for suitable equipment should we be asked to go ahead at short notice.

(b) to enable a time estimate to be made. The 15" casing can be supplied ex our stock in lengths varying from 24 to 28 feet.

The only points now in abeyance appear to be

(a) whether a Tracy Purifier shall be used instead of 15" casing for the Mist Extractor.

(b) whether some form of safety valve should be installed down stream from the master valve on the A.S. of the type which would close automatically in case of major damage, e.g. demolition of the system beyond that point, and prevent the well blowing wild. There would be no need for such a safety valve beyond the tubing master valve as production from the tubing would be intermittent. This point was not discussed with you.

Encs: 2

Sgd. D. Comins.

DC/CEP

DG/359

31st January, 1942.

COUSLAND: GAS PRODUCTION SCHEME

I. Recapitulation of Considerations taken into account.

1. Maximum requirements from Field 1.0 m.c.ft/day at 30# abs delivery pressure. Maximum delivery pressure to pipe line at site therefore 80# abs. Supply is to be regarded as partly or wholly standby. Provision therefore necessary for controlling lower delivery pressures at site over range 80# abs. to say 40# abs.

2. Sharing offtake with Anglo-American our normal proportion (maximum) would be 0.5 m.c.ft/day; but, in view of possibility of considerable delay before they are in a position to produce their proportion, and also as a precaution against increased demands from the Field, production scheme designed to handle 1.0 m.c.ft. maximum.

3. Initial flowing pressure of well at 0.5 m.c.ft/day estimated to be approximately 600# abs. and at 1.0 m.c.ft/day approximately 580# abs., declining at rate of 1.63#/m.c.ft. gas produced. Thus, at 0.5 m.c.ft/day offtake estimated decline about 25#/month and at 1.0 m.c.ft/day about 50#month. Velocities and dimensions are calculated on basis of an eventual flowing pressure at 1.0 m.c.ft/day of 200#, but, as estimated closed in pressure of well now is of order of 630/640# abs., high pressure piping and vessels provided to withstand this pressure with factor of safety of 3.

4. Water was rising in the hole during the prodution test. It was not proved whether this was edge water or only returning drilling water. If edge water, it would continue to rise and reduce the estimates quoted and eventually kill production entirely. There would also be a progressive increase in mist production.

As an insurance against this- the cost being negligible compared with that of the pipe line and of the issues involved-provision is made:-

(a) for running tubing to allow the water to be evacuated intermittently by gas lift, and

(b) for water separation and for mist extraction at the highest pressures available.

Routine production would be from the annular space with no free water and little if any mist - the separators then merely acting as first stage mist extractors.

With complete mist extraction at 600# and assuming a flowing temperature of 70°F, the water vapour going forward in 1 m.c.ft. gas per day should not exceed the equivalent of about 3 gallons of water per day, and there would have to be about 30°F of frost in the (unburied I understand) pipe line before any of this could condense in it. For 200#

Continued ...

mist extraction the comparable figures are about 8 gallons per day and 10°F of frost. (Even if the water now in the hole is returning drilling water and can be entirely evacuated, the gas would still carry water vapour, being in equilibrium with edge water in the reservoir.) Although a very small amount of condensation is possible in the pipe line, it would be advisable to allow for drips as a precaution against accumulation at low points which, through freezing, might lead to complete blockage of the line.

5. Owing to the varied conditions of pressure, production and water content which the production system must handle over a period, provision is made for as much flexibility as possible, including a positive integrating gas meter rather than an orifice meter, which will also save a good deal of work in operation.

II. <u>Notes on Sundry Details</u>

The diagrammatic sketch is mainly self-explanatory, but it is as well to record the reasons for certain details of arrangement. Working from the well:-

<u>The water blow off line</u> is provided in order that the initial gush of water when evacuating water through tubing may be disposed of and any mud or sand debris ejected before connecting in to the l.h. separator.

<u>Valves and piping around wellhead</u> are arranged so that flow from either tubing or annular space can be diverted to either or both separators. It may be necessary to maintain production from the annular space, simultaneously with gas lifting water through the tubing. The valves on the A.S. and on the tubing nearest the well should be considered as master valves - i.e. not for routine use.

<u>Liquid Level Regulators on Separators and Mist Extractor</u>
These have been shown as agreed with you instead of the drain traps originally proposed by us. It should be borne in mind however that, on routine production from A.S. it is probable that very little water if any will be produced, although water production when flowing through the tubing may be considerable.

<u>The Safety Valves on the Separators and Mist Extractor</u> would only appear necessary to comply with Board of Trade regulation It can be guaranteed that under no circumstances could the pressure exceed about 700# even with the separators shut in and isolated in hot weather.

<u>Emergency Waste Water and Gas Line</u>. This is for use when first admitting tubing production to the l.h. separator for testing whether separation is effective and for temporary use if there is considerable water carry over with the gas in the initial stages of water reproduction. If the carry over is only slight it would not be used and the tubing production be passed through both separators.

<u>Pressure Regulator</u>. Upstream pressures may vary from 600# to 200# abs. dropping during production life of well. Downstream pressures may vary from 80# abs. (assuming 1.0 m.c.ft. maximum demand from Field) down to say 40# abs. at low temporary demand.

Continued ...

Provision is made for warming the regulator or any other point where freezing up may occur with steam hose from the small gas fired boiler. It is a question as to whether some continuous heating arrangements should be provided at the pressure regulator.

The Variable Flow-Bean Box and fine adjustment valve on bypass This is where accurate control of delivery pressure to meet production requirements will be effected. (The flow beans shown at entry to separators are merely for purposes of preliminary beaning down of production near the wellhead to a figure at separator back pressure slightly in excess of the offtake required, in order to avoid use and cutting out of valves.) We will supply drawings of these bean boxes which are very cheap.

Gas Meter. Positive integrating meter provided in order to save work on changing orifice plates to meet fluctuating demand and in computing charts. (The staff position may be difficult.) Although specified in diagram to work at 80# abs. the actual working pressure may be as low as say 40# abs.

Water Meters. No provision is made for water meters, only for connections, as we shall have no idea of capacities required until the scheme is in operation, when preliminary tests can be made into say a 400 gallon tank.

Water Disposal. The water is nearly fresh and there should be no difficulty in disposal. If necessary it can be returned to No. 2 Well.

Sgd. D. Comins.

DC/CEP

MR. C.M. ADCOCK
EAKRING.

MR. D. COMINS
FIELDS BRANCH, LONDON.

1st February, 1951.

PRODUCTION AND DISPOSAL OF COUSLAND GAS

The Cousland Files T.4, T.9, T.10, T.11, and T.11a are being returned to you by express post. The abundant scope for Methane utilisation is evident, after having first proved the well by the production and disposal of a regular small quantity of gas.

The value of the reserves in No.1 well, at £100 per million cubic feet, could be up to £50,000. The value of the total reserves in the reservoir can only be determined by exploitation drilling, but might be some £500,000.

It would appear that a pilot scheme for gas disposal is warranted, even if in the first instance costs were only covered.

C.M. ADCOCK.

CMA/CP

COU/A5

Mr. Watson

WEW.

PE.11

22nd March 1957.

W.Y.Robb, Esq.,
Scottish Oils Ltd.,
Middleton Hall,
Uphall,
Broxburn,
West Lothian.

Dear Mr. Robb,

Natural Gas at Cousland

Thank you for your letter of 18th March and copy of the minutes of your meeting with the Scottish Gas Board. I have only a few very general comments to make on the Cousland Gas development scheme.

1. Distance between wellhead and separator.

This distance can of course be varied to suit local circumstances. I suggested an arbitrary figure of 50' to allow room for working on the well if necessary without interfering with the separator and ancillary equipment. You could of course come somewhat closer if necessary, but probably 40' should be regarded as a minimum distance.

4. Boundary fences for wellhead equipment.

As you point out this must depend largely on the local topography. The well itself is of course 100' from the roadway, this distance being governed by the Petroleum Act. Your suggestion of 75' being a safe distance for the rest of the equipment should be quite satisfactory. Otherwise the fencing can be as close to the wellhead etc., as is found convenient. If it should ever prove necessary to carry out a workover on the well, part of the fencing would have to be removed whilst this job is being undertaken.

5. Hydrate knock-out drum.

I agree that the hydrate knock-out drum is an unimportant item. If much trouble were to be experienced from hydrate formation it would be probably better to install a bottom hole flow regulator in the tubing itself so that the gas expansion can take place at the bottom of the well. The gas would then be warmed by the natural heat in the reservoir, which would prevent the formation of hydrates.

With regard to item 5 of the minutes of your meeting with the Scottish Gas Board I would not say that it is necessary to maintain a liquid seal in the bottom tank of the separator. The outlet is after all through two ½" valves; and there is nothing detrimental in blowing out a small quantity of gas when the separator is drained of any fluid accumulation.

Yours sincerely,

C.M. Adcock

C.M.Adcock

CMA/JMJ

Mr Adcock
100

ALL COMMUNICATIONS TO BE ADDRESSED TO THE COMPANY

RAILWAY ADDRESS—UPHALL STATION

SCOTTISH OILS, LIMITED

GLASGOW & LONDON

TELEGRAPHIC ADDRESS
"SCOILITED," UPHALL

TELEPHONES
BROXBURN 34 & 35

Middleton Hall,
Uphall, Broxburn,
West Lothian

Our Ref.- WYR/EC.

18th March, 1957.

The B.P. Exploration Co. Ltd.,
P.O. Box 1,
Southwell,
NOTTS.

Dear Sirs,

NATURAL GAS FROM COUSLAND.

We refer to our telephone conversation of last week when we discussed various points raised at our meeting with the Scottish Gas Board Engineers on 7th March.

We now attach hereto Minutes of this Meeting prepared by the Scottish Gas Board, also copy of our letter to them dated 14th March.

We should be pleased to have any comments you may wish to make.

Yours faithfully,
p. SCOTTISH OILS LIMITED.

W Y Robb

CHIEF DEVELOPMENT ENGINEER.

RECEIVED
EAKRING
21 MAR 1957

Encl.

WYR/EC. 14th March, 1957.

The Scottish Gas Board,
26, Drumsheugh Gardens,
EDINBURGH, 3. Att: Mr. T.S. Ricketts, Chief Engineer.

Dear Sirs,

NATURAL GAS FROM COUSLAND.

We would refer to our discussion on 7th inst. with your Representatives when we undertook to obtain information from B.P. Exploration Co. Ltd. on some of the points raised. These are as under. -

1. Check the distance of 100 ft. between the well head and the Separator, as shown on B.P. Drawing No. 1205. -
Mr. Adcock advised he would be satisfied with any distance between 50 and 100 ft.

2. Check the necessity for Valve No. 90 between flanges at well head. -
Agreed this valve can be eliminated.

3. Check if Separators should be insulated.-
Mr. Adcock advised that, in his opinion, it will not be necessary to insulate, as the gas temperature will be in the order of 60°F. and that he does not expect water will be present in the gas. The separator should be installed as a precaution.

4. What is the safe limit from well head and separators.-
Mr. Adcock agrees with what we said at the meeting, that 75 ft. is a safe distance from the roadway, but would not advise a minimum distance to the north, east and south. He felt this matter would be better settled locally between yourselves and the farmer.

5. Future hydrate knock-out drum.-
Mr. Adcock does not consider a knock-out drum will ever be necessary, but the branches should be added.

6. Safety Valves./

6. Safety Valves.-
We suggest that stop valves be inserted below the safety valves. These valves should be locked in the open position, and only closed when the safety valves are off for inspection.

7. Use of Class 300 Flanges.-
Mr. Adcock agrees to the use of these fittings, as the gas pressure will drop below the present pressure of 625 p.s.i.g.

We hope the above information will now allow you to prepare siting drawings.

In the meantime, we are altering the B.P. drawing to include the various items agreed at our meeting, and will then place an order on Messrs. Munro & Miller Ltd., so that a start can be made with fabrication.

Yours faithfully,
p. SCOTTISH OILS LIMITED.

W.Y. Ross

CHIEF DEVELOPMENT ENGINEER.

REPORT OF MEETING

HELD ON THURSDAY 7th MARCH 1957 TO DISCUSS THE PROPOSED INSTALLATION AT COUSLAND No. 1 NATURAL GAS WELL

The meeting was held at Scottish Gas Board Headquarters, 26 Drumsheugh Gardens, Edinburgh, and commenced at 10.30 a.m. Those present were:

Mr. Robb	Scottish Oils Limited
Mr. Greenhorn	Scottish Oils Limited
Mr. Hay	Scottish Oils Limited
Mr. Elgin	Scottish Gas Board Headquarters
Mr. Emmony	Scottish Gas Board Headquarters
Mr. Cairns	Scottish Gas Board Edinburgh Division
Mr. McCallum	Scottish Gas Board Edinburgh Division

The purpose of the meeting was to discuss and consider the arrangement and details of the separators, link-up pipework, governor equipment and pressure relief valves at Cousland No. 1 Well as shown on Drawing No. 1205 supplied by B.P. Trading Limited, and also to arrange a programme for the work to be carried out by Scottish Oils Limited.

The following is a list of the items discussed, together with notes relating to action which requires to be taken and points needing further clarification.

1. It was agreed that Dennis of Dalkeith, a firm of Civil Engineering Contractors, would be employed by the Board to carry out the civil engineering work. Scottish Oils Limited have already contacted them on this matter and the firm have expressed their willingness to undertake the necessary work.

   Mr. McCallum agreed to make contact with this firm and Scottish Oils Limited would arrange to provide them with the metal pipe supports as required.

2. Mr. Robb of Scottish Oils Limited agreed to query the need for the first valve on the link-up pipework shown on Drawing No. 1205.

3. The subject of boundary fences and the probable need for these to be some definite minimum distance away from the wellhead and governor equipment was discussed at some length. It was agreed that Scottish Oils Limited would make the necessary enquiries to ascertain the following:

   (a) Does the wellhead have to be a certain minimum distance from a public highway, and if so, what is this distance?

   (b) Does the governor and relief valve equipment with vents have to be a certain minimum distance from the wellhead and from a public highway. If so, what are these distances?

   (c) Is it necessary to provide a boundary fence around the perimeter at a certain minimum distance from the equipment, and if so, what is this distance?

4. The pipe between wellhead and separators is to be laid underground in a trench excavated to a depth of 4 feet, and the steel tubing, which is to be welded at joints, will be wrapped with "Denglas" tape before being buried.

   The representatives of Scottish Oils Limited did not feel that dropping this pipe to a lower level and rising up to the separator would be detrimental in any way, and a syphon or drain point would not be required on this length.

5. / ...

5. A stainless steel thermometer pocket will be installed in the bottom tank of the separator in a position where the temperature of the condensate can be taken. It was also agreed that it will be necessary to maintain a seal in the botton tank and that this should never be completely emptied of condensate.

6. It was agreed that a total of 7 pressure points, each consisting of a branch connection with valve and plug, should be installed in the following positions:

   (i) at wellhead

   (ii) at inlet to separator

   (iii) at inlet to needle valve

   (iv) between needle valve and first pressure governor

   (v) between first and second pressure governors (items 98 and 99)

   (vi) on inlet to safety shut-off valve

   (vii) on outlet of "Gas Board's" governor

   The two pressure gauges indicated on Drawing 1205 are to be fitted to two of these connections at positions to be decided upon later.

7. It was agreed that it might be an advantage to have the separator installed in the building housing the governor equipment to obviate the risk of condensate freezing during cold weather. Mr. Robb is to seek Mr. Adcock's (B.P. Exploration Limited) advice on this matter.

8. Mr. Robb is also to check with Mr. Adcock that Series 300 flanges are suitable for the standing wellhead pressure, which is believed to be in the region of 625 lbs. per square inch.

9. The hydraulic test on the equipment installed by Scottish Oils Limited will be at 900 lbs. per square inch pressure. It was agreed that a Board's representative should witness the test.

10. It was considered that the separator would be classed as a pressure vessel and therefore it was suggested that the Gas Board's insurers should be contacted with regard to testing this item of equipment.

    Mr. McCallum agreed to take up this matter with the Insurance Company in consultation with the Insurance Clerk and the Board's Legal Department.

11. With regard to the hydrate knockout drum referred to in Drawing No. 1205, Mr. Robb agreed to ascertain the purpose of this item and the reason for its position being as shown on the drawing. During the discussion on this particular subject it was thought that it might be the intention to re-position the safety shut-off valve and blank off these flanges in the event of a knockout drum being installed.

12. It was agreed that lockable stop valves should be fitted below the two relief valves. The needle valve should also be lockable.

13. After consideration, it was agreed that it would be beneficial to increase the size of the pipe to 4-inch diameter immediately on the outlet of the Gas Board's governor. Mr. Robb agreed to arrange for this to be done.

14. / ...

14. With regard to the building which will house the governor equipment and possibly the separator also, the representatives of Scottish Oils Limited stated that the best arrangement would be for the concrete floor to be put into position prior to their carrying out the pipe work and installation of separator and pressure reducing equipment. The completion of the building should then be left until after the apparatus had been installed. It was agreed that the building would be of normal construction having 11½ inch cavity walls (air space to be sealed). The building is to have two doors, preferably metal, opening outwards and the interior is to be adequately ventilated with air bricks in a similar manner to that employed for town gas governor houses.

15. It was agreed that it would be preferable for the official order for the work involved in the wellhead installation to be placed by the Board direct with Scottish Oils Limited and it was also agreed that Mr. Robb would confirm with Mr. Adcock of B.P. Exploration Limited that this procedure had their approval.

16. Scottish Oils Limited recommended Munro and Miller as sub-contractors for the pipework involved and agreed to submit to the Edinburgh Division a quotation which would include both Munro and Miller's work and their own. As stated previously, the Edinburgh Division of the Scottish Gas Board would be dealing directly with the firm, Dennis of Dalkeith, for the civil engineering work involved in this scheme.

17. With regard to the programming of the work involved, it was agreed that this should be settled at a further meeting but that the target date for the completion of all the work at the wellhead was early June 1957.

ROE/DE/EWG

14th March 1957.

18th January 1956

Mr. Warman

Cousland File

Gas Prospects in the Cousland Area

The writer attended a meeting of the Scottish Gas Board, at 26 Drumsheugh Gardens, Edinburgh, on Thursday 12th January 1956, to discuss the development of natural gas at Cousland. Present at the meeting were:-

Sir Andrew Clow
Mr. Melvin
Mr. Rickett
Mr. Beavis
Mr. Cox
Mr. Elgin

In connection with Mr. P.T. Cox's suggestion that a detailed economic study should be made to determine the minimum gas production required to pay off the operation, it was pointed out that this work could only be undertaken by the Gas Board; since information would be required on the cost of pipelines, the cost of plant for gas reforming to reduce natural gas to the required calorific value; and a knowledge of the gas offtake rates which would have to be maintained for specific exploitation schemes etc.

A basic factor in this study is the value of the gas at the wellhead to the Gas Board. It was explained to the writer that there were so many factors to be taken into consideration that the Gas Board was not in a position to give a firm figure for the maximum value of the gas delivered to the pipe line which would be acceptable to the Board.

To be able to make an appraisal of the value of the Cousland gas reserves in very general terms, based on the various geological interpretations as to the extent of the structure, it has been necessary to assume an arbitrary value for the gas. This value has been taken as 2/6d per 1000 cubic feet of gas at the wellhead. It has the merit of corresponding to a value of 3d. per therm; and any figures can be quickly re-adjusted as soon as the true wellhead value of the therm is known. If for instance 6d. should prove to be a more realistic value for the wellhead therm, then the value of the gas reserves would ipso facto be doubted.

Applying this figure of 2/6d per 1000 cubic feet, i.e. £125 per million cubic feet, to rough estimates of Cousland gas reserves, then the data which have been set forth in the attached table are obtained. Too many assumptions have had to be made for the estimates of producible gas to be considered in any way accurate. The estimates are more in the nature of "intelligent guesses" for a given set of geological conditions. The purpose of the estimates is to give a generalised indication of the overall magnitude of the quantity of gas which might be produced from the Cousland dome.

It is evident that even under the most favourable conditions the producible gas is unlikely to exceed 2,000 million cubic feet. At 3d. per therm the value of these reserves would be £250,000. It would require the drilling of three or four additional wells, at a cost of £30,000 to £40,000, to produce this gas. In addition, there is of course the capital cost of making the gas available for utilisation; and it follows that it is the magnitude of the exploitation costs which finally determines whether the production scheme will prove to be a worth while economic project.

The writer was asked whether there were other areas which could be considered good prospects for obtaining additional gas reserves. He referred to the report GL-ROWB-5 where it was recommended that a test well should be drilled on the Carberry Hill-Falside culmination. The merit of this recommendation is that if the test well at Carberry Hill were to find gas in commercial quantities, the value of the Cousland structure would be enhanced by the additional gas reserves proved. There would be in consequence a greater incentive to develop both the Carberry Hill and Cousland areas. If, on the other hand, no gas were to be found in the Carberry Hill culmination, then it might be argued that the gas expectations at Cousland were not sufficiently promising to warrant exploitation; and there would then be a case for abandoning entirely the Cousland project.

At the meeting, the opinion appeared to be to accept this recommendation; in which case the Scottish Gas Board would propose to the Gas Council that a test well be drilled at Carberry Hill. After this well has been drilled, the Scottish Gas Board would be in a better position to decide on a firm scheme for the production and disposal of Cousland gas, or the abandonment of the area altogether.

C. M. Alcock

Eakring
19.1.56
CMA/MG

COUSLAND GAS PRODUCTION

TABLE SUMMARISING PRODUCTION POSSIBILITIES

Assume value of gas delivered to main line @ 3d. per therm, i.e. 2/6d. per 1000 cubic feet or £125 per million cubic feet

Production Proposals	Producing Horizons	Average sand thickness feet	Reservoir Area Acres	Millions of cubic feet: Gas in place	Millions of cubic feet: Producible Reserves	Value of gas Reserves £	Average off-take Rate: Cubic feet per day	Average off-take Rate: Cubic feet per year	Number of producing wells	Production life. Years	Remarks
No. 1 well only - See para. 3 of Mr. P.T. Cox's report to Gas Council	1582' sand top of 1720' sand	50	-	-	300	£37,500	100,000	36,500,000	1	8	Possibly a second well might be required. See Mr. P.T. Cox's report section 5 (a)
No. 1 well and a second well circa 1000' to the east. See report U.K.195 and contour map of Gilmerton Limestone.	1582' sand only.	50	100	1,000	600	£75,000	100,000	36,500,000	2	16	Producible reserves are assumed to be 60% of the gas in place, owing to by-passing etc.
No. 1 well, a second well 1500' to the east, and a third well located after drilling the second well. See report GL-RGWB.5 and contour map fig.2. A structural rise of up to 90' would be expected.	1582' sand only	50	230	2,000	1,200	£150,000	300,000	109,500,000	3	11	There would be a reasonable prospect of being able to maintain a production of 0.5 million cubic feet per day if required.
Three wells as above, if packers set to produce from segregated sands. Alternatively, another 2 wells would be required.	1582' sand 1720' sand	80	200	3,000	1,800	£225,000	500,000	182,500,000	3-5	10	See Section III of report GL-RGWB.5. With a possible 90' structural rise much of the 1720' sand should be above gas/water level. The average total sand thickness (both wells) has only been taken as 80', as there will not be much of the 1720' sand above gas/water level on the flanks of the structure.

Note:

The estimates for the gas in place are very rough, as the greater part of the data required has to be assumed.

The intention is to indicate the possibilities of Cousland after making certain reservoir assumptions, to assist in the appraisal of the area.

Note:

The 2094'-2122' sand in No. 1 well produced water free gas at a rate of 150,000 cubic feet per day. The production possibilities of this sand should not be lost sight of in any future well drilled.

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