## The Origins and Growth of the British Gas Plant Operations Department

The Plant Operations Department had its origins in the organizational changes which took place in the gas industry in the 1960s to pave the way for the arrival of natural gas. It was to be responsible for the operation of all terminals, storage plants and compressor stations which were to form part of the new National Transmission System. Six maps of the developing National Transmission System from 1966 to 1977 are attached as an Appendix.

### The Importation of Algerian LNG

After experimenting with liquefied natural gas (LNG) cargoes from Lake Charles, Louisiana, the Gas Council began in 1964 to ship LNG from Algeria into a newly-built onshore storage terminal at Canvey Island. Gas produced there was fed into an 18inch diameter "Backbone Feeder" which was built specially to take natural gas from Canvey towards Leeds with offshoots to Sheffield and Manchester for use in reformer plants to produce town's gas.

### The Arrival of North Sea Gas

The discovery of natural gas in commercial quantities off the east coast of England in 1965 led to the signing of a contract with BP in 1966 for the delivery of natural gas from the offshore West Sole field to a new onshore terminal at Easington near Hull. This was also connected into the 18 inch feeder. Later in 1966, further substantial offshore discoveries were made in the southern sector of the North Sea and it became clear that enough natural gas would be available to supply the whole of the UK directly and to justify the construction of the major new transmission network which became known as the National Transmission System (NTS).

This led the Gas Council in 1968 to reorganize itself along divisional lines in order to facilitate the development of a national high pressure gas transmission system. The five divisions were Marketing, Economic Planning, Production and Supply, Finance, and Personnel. However, the anticipated rate of growth in natural gas supply meant that the task would soon be larger than anticipated, and that further organizational changes would be required to deal with it.

### From Gas Council to British Gas Corporation

To prepare for the increased demands on the gas industry, the government introduced the Gas Act 1972 which allowed the formation of a new organization, the British Gas Corporation, which would take over the role of the Gas Council along with some extra responsibilities. The British Gas Corporation retained the old divisional structure previously adopted by the Gas Council.

The new technical challenges of handling natural gas at high pressures, and the very demanding operating conditions would require the rapid acquisition of experience from abroad and from offshore and the recruitment of many highly trained specialists from outside the industry.

### The Plant Operations Department within Production and Supply Division

The Production and Supply Division, of which Plant Operations was part, was given the enormous challenge of designing, constructing, and operating all of the new high pressure pipelines, reception terminals, storage installations and compressor stations that would form the nucleus of the new National Transmission System.

Reporting to G.F.I. Roberts, the Board Member for Production and Supply, were the Director (Engineering Planning), the Divisional Administration Manager, and the Director (Operations). The Director (Operations), Donald Young, was responsible for the Communications and Instrumentation, Central Control, Pipelines, and Plant Operations Departments.

Several of the design departments and Central Control Headquarters were based in London, but the operational departments of Production and Supply Division had their headquarters at Hinckley in Leicestershire where Grid Control, Pipelines, Communications and Instrumentation and Plant Operations initially occupied various offices on the old East Midland Region Gas Works land prior to the establishment of new purpose built facilities on the same site.

**Plant Operations Headquarters - Role and Organization**

The role of the Plant Operations Department (POD) was to staff, commission, operate, manage and maintain all of the new high pressure terminals, storage installations and compressor stations that were constructed from the mid 1960s onwards along with legacy assets such as the Easington terminal and the Ambergate LNG storage site and compressor. Its remit did not extend to the operation and maintenance of the backbone feeder, NTS pipelines or regional offtakes, which were the responsibility of Pipeline Operations Department.

The POD headquarters organization was initially based in an unsightly brick building appropriately called Bleak House on the Hinckley Gas Works site and then moved temporarily to some old East Midlands Gas Board offices in Hinckley town before occupying new offices on the gas works site to join the other P&S operational departments. On the same site in another building was the Hinckley Operational Control Centre, (usually known as Grid Control) for the National Transmission System - a useful arrangement for the necessary close liaison between the two departments.

Reporting to the Plant Operations Engineer, Peter Faulkner, at the Hinckley headquarters were three principal manager**s:** the Storage Operations Manager, Leslie Hearfield, responsible for all terminals and storage sites plus the development site at Westfield in Fife; the Compressor Operations Manager, Peter Dixon, responsible for all compressor stations; and the Plant Engineering Services Manager, Keith McEwan, in charge of safety policy and other important specialist engineering support functions. General administration and financial reporting were the responsibility of the Planning Engineer, Alec Ball.

**Staffing and Management in the Field**

The terminals and storage sites were significant and important national assets, each large enough from a safety and security perspective to justify a full onsite management team and 24hr shift cover. Managers and many of the support staff were by and large readily recruited from the existing ranks within the gas industry.

The compressor sites were widely scattered over great distances from the north of Scotland to the south of England and were administered in small groups each managed by a Compressor Group Manager based at one of the four Group Centres at Perth, Coleshill, Peterborough and Bury St Edmunds. The Compressor Group manager was designated as The Occupier all of the sites under his control, for the purposes of The Health and Safety at Work Act, and had a small team of specialist engineers and administrative staff.

The initial group of managers within the Compressor Groups came from within the gas industry, typically with high pressure reformer plant experience, but their ranks were soon augmented by an influx of engineers from outside the industry who brought with them experience of high speed turbo machinery. Engineers came from the services, the merchant navy, the oil industry and elsewhere, but the largest single group came from the power stations.

For the later arrivals the rather alien and deafening concepts of venting and purging high pressure natural gas and other everyday practices of the gas industry tended to come as something of a surprise. This understandable reaction was overcome by allowing all the new recruits plenty of time to acclimatize on operational sites prior to accepting their full responsibilities.

Also, all new recruits undertook a well-regarded two week induction course known as the Plant Operations Staff Training Course which offered visits to all types of installation and became a very popular course used by many other BGC departments. The course offered recruits the opportunity to extinguish some spectacular gas fires at the North West Gas training centre, some of which were lit by throwing a burning rag. It was rumoured that the resulting detonations from less well controlled efforts had occasionally broken windows in neighbouring properties.

**Terminals**

The Canvey Terminal, a Gas Council legacy asset in operation since the mid 1960s, and operated firstly by North Thames Gas, was the first installation to import bulk natural gas in liquid form for processing into the UK transmission system as a gas, firstly on a trial basis from the Gulf of Mexico and then from Algeria under a long term contract. An interesting feature at the Canvey site was the tendency of the subterranean storage tanks to create permafrost which gradually spread to cause ground heave in some areas. [This led to interesting problems when the tanks were subsequently decommissioned.] In the mid-1960s the bulk transmission network extended only as far as London, Reading, Birmingham, Manchester and Leeds via the 18 inch “backbone feeder.

After the signing of the 1966 West Sole contract with BP work immediately commenced on the Easington Terminal near Hull which was the first onshore terminal to receive high pressure natural gas from offshore. To exploit further large discoveries in East Anglian offshore waters, work commenced in 1969 on the huge Bacton Terminal in Norfolk which was destined to become the UK's largest single source of natural gas supply for many years.

The last terminal to be constructed on the east coast was Theddlethorpe in Lincolnshire, completed in 1972. Mention should also be made of the Pickering terminal in north east Yorkshire which was the connection point to the NTS for the onshore Lockton gas field developed by Home Oil of Canada. The field proved uneconomic and was soon abandoned.

At this stage the new National Transmission System used mainly 30in and 36in pipe designed to handle gas at pressures up to 1000psi but in later years’ research within British Gas justified increasing both the diameter and pressure limits. The NTS initially accepted supplies directly, without onshore compression at the terminals. By the early 1970s the supply terminals were in the east of the country with far network extremities at London, Exeter, Wales, Manchester and Glasgow, and there were plenty of anxious moments in winter when pressures could fall due to loss of an offshore supply or the failure of a compressor on a pipeline.

The system came into better balance after 1977 when gas arrived from the Norwegian sector of the North Sea into Scotland via the massive St Fergus Terminal north of Aberdeen. Because of the low supply pressures arising from the long transmission distances from Norwegian waters, eight compressors were installed at St Fergus, making it the exception among terminals.

In 1974, the South Morecambe Field was discovered, followed in 1976 by the North Morecambe Field. In 1985, South Morecambe gas came ashore to the Barrow Terminal followed in 1994 by North Morecambe. The gas was of low calorific value (CV), however, and was usually blended near Carnforth with southward flowing high-CV gas from St Fergus. No compression was necessary onshore at Barrow but the terminal was built to handle large quantities of gas condensate liquid piped from offshore platforms.

The construction of several new pipelines to cater for the new supplies arriving in the north helped to ease the supply situation at extremities particularly in the north-west of England, which had been something of a problem in the earlier years.

**Storage Sites**
The storage sites were designed to provide peak shaving at times of high load and as an alternative supply in case of emergency. Large scale onshore storage fell into two categories, firstly refrigerated liquefied natural gas (LNG), and secondly underground high pressure storage in salt caverns. Smaller scale regional storage (including local gasholders) was also employed for local purposes and to avoid subjecting the national transmission system to excessive fluctuations.

By the end of 1977, LNG plants had been built at the then system extremities at Glenmavis near Glasgow and at Partington near Manchester, and others were under construction or planned at Avonmouth (Bristol), Isle of Grain (Kent) and at Dynevor Arms (South Wales).

A large underground salt cavity storage site was also under construction at Atwick near Hornsea on the Yorkshire coast. This site expanded from the original 2 caverns to a total of nine.

All of the aforementioned were operated by Plant Operations but the one significant exception was the Rough offshore field operated by BG Exploration Group, which used the partly-depleted gas reservoir for seasonal storage and delivered its gas to the Easington Terminal.

In similar vein to the terminals, the storage sites contained large inventories of gas, were important national assets and warranted their own site-based management and staff sufficient to support a 24hr manned operation.

The Westfield Development Plant in Fife came nominally under the control of POD and was originally built as an advanced coal gasifier utilizing the Lurgi Process. The design was greatly improved by Hebden and Dent of the Midlands Research Station to become the Slagging Gasifier. The American gas industry invested in the plant to establish the suitability of American coals and latterly to investigate the technology in connection with the coal firing of gas turbines.

**Compressor Stations**
Compressors were installed at intervals on the transmission system to boost gas flows at time of need and to ensure that Grid Control could deliver the nominated gas at the required pressures and flows at all extremities and delivery points. They were also used particularly in the winter months to deliberately raise pressures in certain sections of pipeline and create a reserve of “linepack” or diurnal storage to supplement and eventually replace gas holders. They could also be used for blending lower CV gas e.g. from the Barrow Terminal with higher CV gas flowing from Scotland on its way south. Another occasional use was in creating the correct flow and pressure conditions for pipeline pigging operations.

In the 1960s when the first compressor station was being installed at Alrewas in Staffordshire, BGC decided to use a turnkey form of contract perhaps for speed of implementation and because there was insufficient design and engineering capacity in house at the time. The station design was based on practices developed in the US and Canada for moving large flows of gas over long distances at high pressure. A unitary concept was adopted, with each compressor housed in an individual acoustic enclosure with its own gas turbine driver. Motive power was derived from gas-fuelled industrialized jet engines which provided the stream of hot exhaust gases to drive a high speed free power turbine directly coupled to a centrifugal compressor.

The concept proved largely successful, and the basic design principles were adopted for all subsequent compressor sites although much of the later design work came to be done in house. For Alrewas and the great majority of the later sites, the jet engines were either Avons or RB211s supplied by Rolls Royce from their works at Ansty near Coventry. Because of the lower power requirements, the sites at Bishop Auckland and Churchover (Rugby) were powered by Canadian Orenda engines which had their origins in De Havilland designs. The established compressor manufacturers of the time were Cooper Bessemer (American), De Laval (Dutch), Dresser Clarke (American) and Nuovo Pignone (Italian).

The machinery package design was usually integrated and carried out in the UK by vendors such as Cooper Energy Services who had a manufacturing plant at Bootle which supplied offshore machinery equipment, or by GEC at Whetstone, Leicester.

One of the key factors in the control of compressor machinery and site processes was the design of the instrumentation and control systems and of the telemetry which allowed a degree of remote control from Hinckley. Early experience gained at Alrewas and elsewhere showed that although the first generation of compressors did their job they were not reliable enough to permit unattended operation and that a high proportion of faults were associated with controls, instrumentation and valve actuator systems rather than with the main machinery.

From the outset, compressors were manned 24hrs a day by shift operators but were designed so that Grid Control at Hinckley could send start up and shut down signals, receive alarms, and make basic adjustments to station output via telemetry. This was quite successful but the sheer complexity of the other on-site controls and equipment introduced some unreliability and manual intervention was often required particularly in cold weather.

It was to take many years of development before reliability had improved enough for remote unmanned operation to be contemplated, and when the time came it brought about some opposition from the trade unions because it meant that the shift operators' posts would become redundant. However, once these problems had been overcome, all compressor sites were eventually converted to full remote operation.

By 1995, compressors were installed or planned on sites at St Fergus, Kirriemuir, Bathgate, Wooler, Moffat, Bishop Auckland, Carnforth, Scunthorpe, Warrington, Ambergate, Hatton, Alrewas, Churchover, King's Lynn, Peterborough, Aylesbury, Wormington, Ross, Wisbech, Cambridge, Diss and Chelmsford. The compressor station near Ross on Wye was the first to use electric drives rather than gas turbines.

**Reorganisations and Takeover**

By the 1990s POD had become a large, successful and technically proficient organization which had continually worked to improve and develop. It had pioneered the introduction of remote controls for compressor stations, operated some of the earliest low NOx gas turbines anywhere and floated off a world leading highly advanced computerized condition monitoring scheme to the private sector.

These achievements may not have been realized without the resources and technical skills of a large unified organization but changes were on the way.

In the mid 1990s moves were gradually made to reorganize the department by closing the Compressor Group Centres and placing the operational installations under the management of the Gas Districts who were also undergoing some uncertainty at the time. Any POD headquarters staff to be retained were located at Solihull.

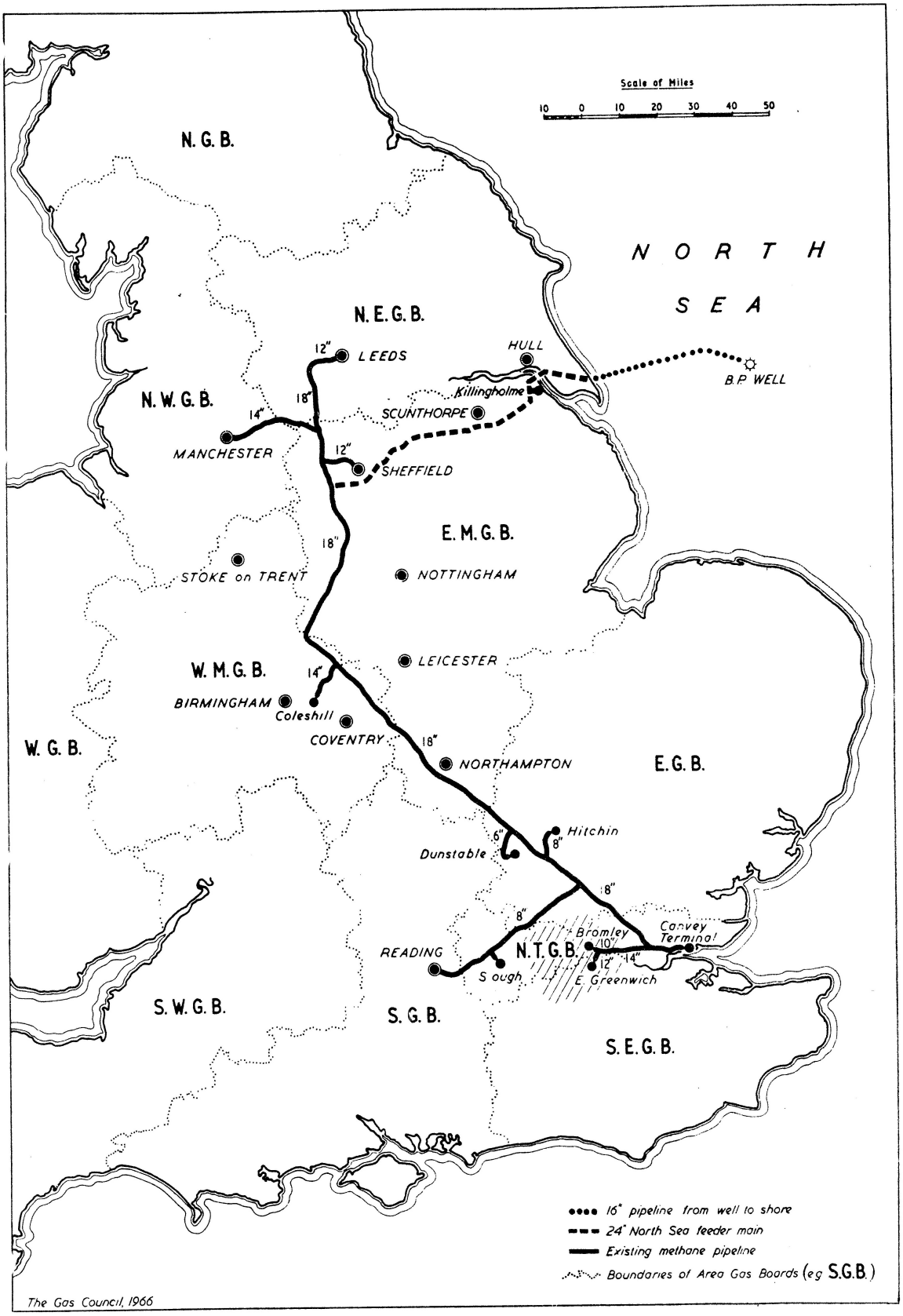
It is difficult to summarize the impact of all the organizational changes which took place throughout the 1990s when Centrica and BG demerged and the NTS came under the control of Transco and then Lattice. There was another ownership change in 2000 when BG and Lattice separated and another in 2002 when Lattice and National Grid merged to form National Grid Transco.

In 2005, the Transco name disappeared and the National Transmission System came under the control of National Grid Gas at Warwick so that there is again a form of centralised control. Many of the original POD engineers and technicians have remained as part of a very sensible move by National Grid to retain valuable technical skills. Now, in 2014 those engineers find themselves in another large, unified, technically aware organization which has brought together the operation and maintenance of the entire NTS.

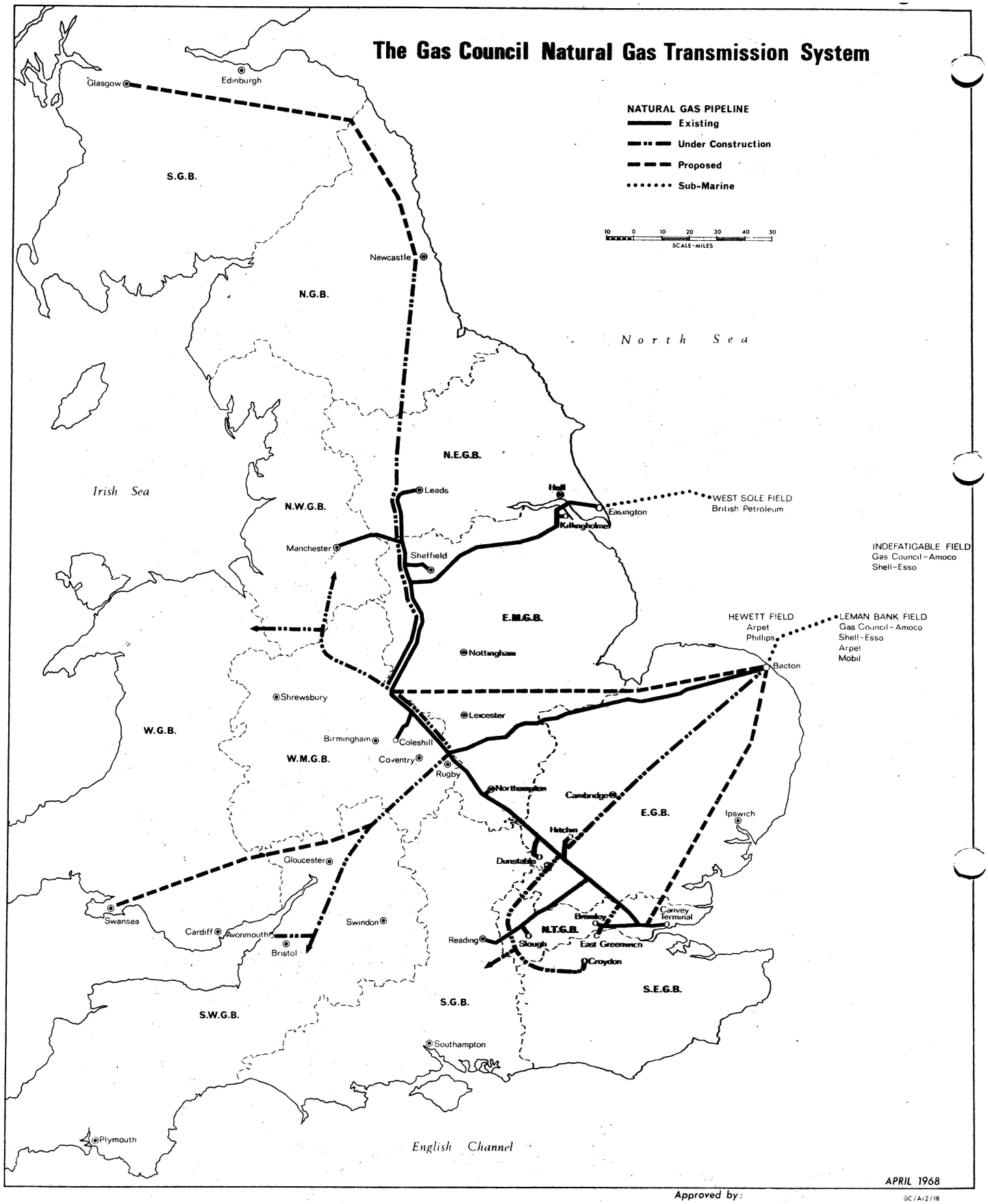
**John Ellis a former manager in Plant Operations Department (POD)**

**Appendix, Gas Council Transmission maps 1966, 1968, 1970, 1972, 1977.**

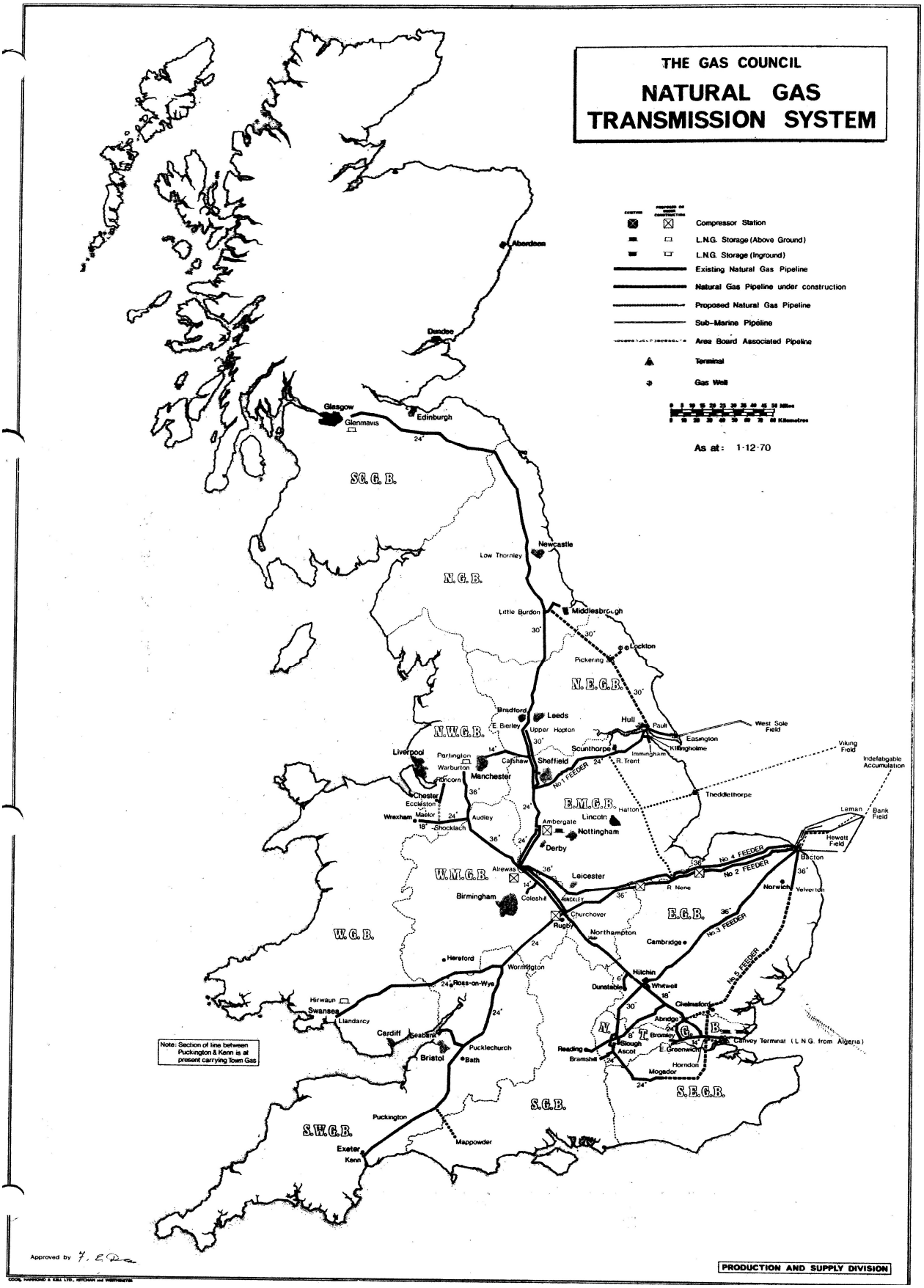
1966



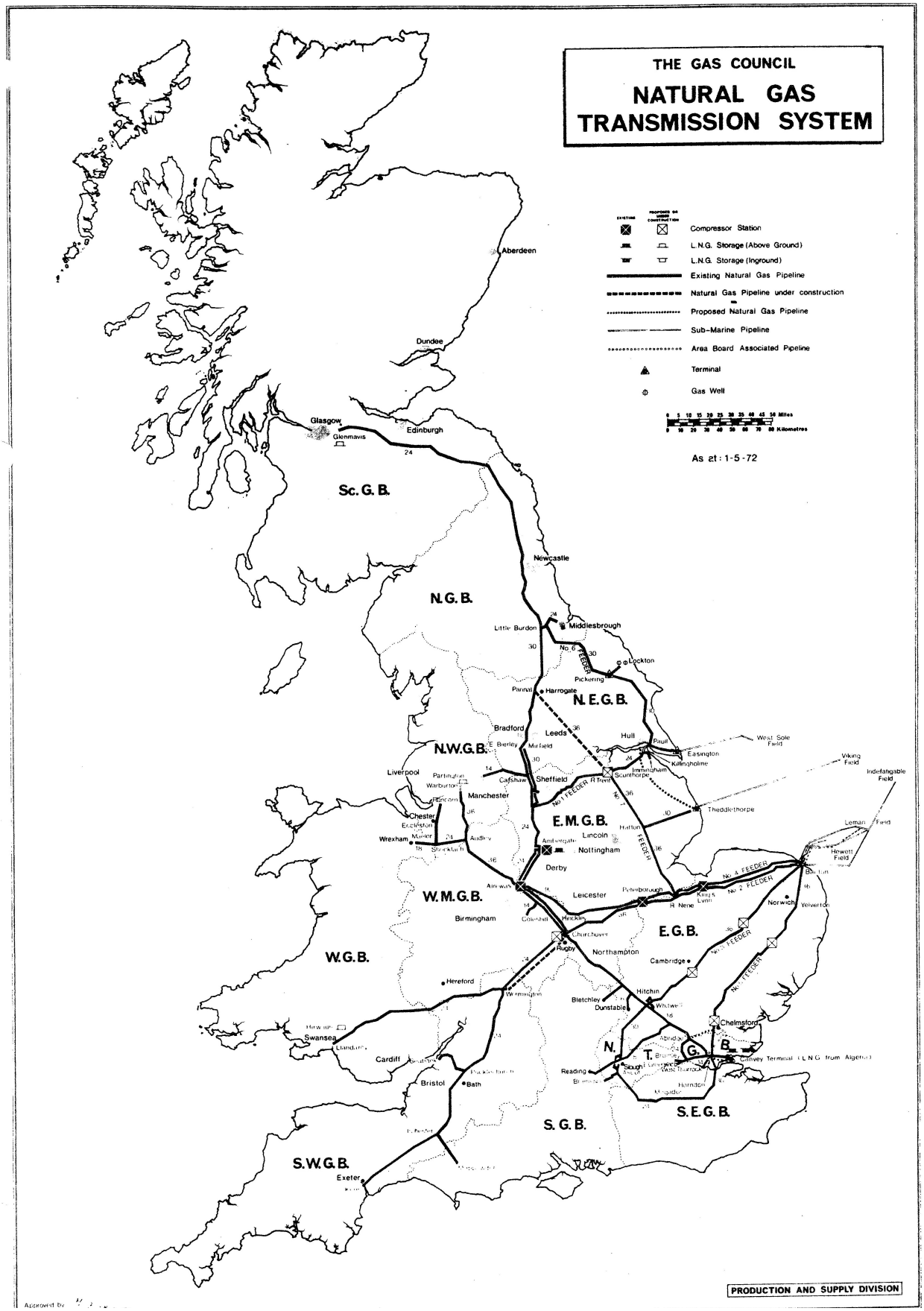
1968


The Gas Council Natural Gas Transmission System
NATURAL GAS PIPELINE
Existing
Under Construction
Proposed
Sub-Marine
SCALE-MILES
Glasgow
Edinburgh
S.G.B.
Newcastle
N.G.B.
North Sea
N.E.G.B.
Irish Sea
Leads
N.W.G.B.
Hull
Easington
Killingholme
WEST SOLE FIELD
British Petroleum
Manchester
Sheffield
INDEFATIGABLE FIELD
Gas Council - Amoco
Shell - Esso
E.M.G.B.
HEWETT FIELD
Arpet
Phillips
LEMAN BANK FIELD
Gas Council - Amoco
Shell - Esso
Arpet
Mobil
Nottingham
Bacton
Shrewsbury
Leicester
W.G.B.
Birmingham
Coleshill
W.M.G.B.
Coventry
Rugby
Northampton
Cambridge
E.G.B.
Ipswich
Hitchin
Gloucester
Dunstable
Swansea
Cardiff
Avonmouth
Swindon
Bristol
Reading
Bramley
Canvey Terminal
N.T.G.B.
Slough
East Greenwich
Croydon
S.E.G.B.
S.G.B.
S.W.G.B.
Southampton
Plymouth
English Channel
APRIL 1968
Approved by:
GC/Ar2/18

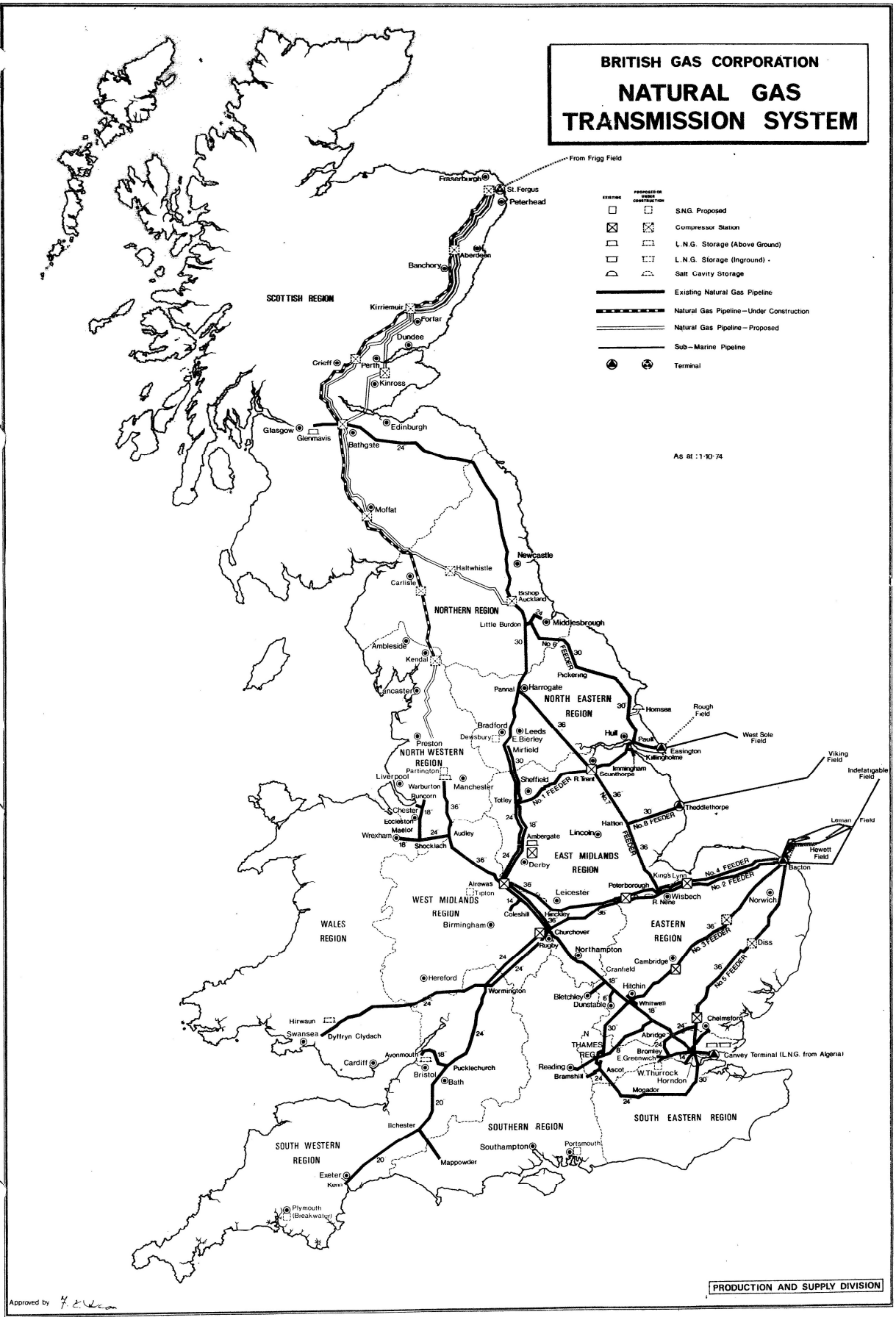
1970


THE GAS COUNCIL
NATURAL GAS TRANSMISSION SYSTEM
Compressor Station
L.N.G. Storage (Above Ground)
L.N.G. Storage (Inground)
Existing Natural Gas Pipeline
Natural Gas Pipeline under construction
Proposed Natural Gas Pipeline
Sub-Marine Pipeline
Area Board Associated Pipeline
Terminal
Gas Well
As at: 1-12-70
S.G.G.B.
N.G.B.
N.E.G.B.
N.W.G.B.
E.M.G.B.
W.M.G.B.
W.G.B.
E.G.B.
S.W.G.B.
S.G.B.
S.E.G.B.
Aberdeen
Dundee
Glasgow
Glenmavis
Edinburgh
Low Thornley
Newcastle
Little Burdon
Middlesbrough
Lockton
Pickering
Bradford
Leeds
E. Bierley
Upper Hopton
Hull
Paull
Easington
Killingholme
West Sole Field
Immingham
Scunthorpe
R. Trent
Sheffield
Liverpool
Partington
Warburton
Rixcorn
Manchester
Calshaw
No 1 FEEDER
Chester
Eccleston
Wrexham
Maelor
Shocklach
Audley
Ambergate
Lincoln
Nottingham
Derby
Halton
Theddlethorpe
Viking Field
Indefatigable Accumulation
Leman
Bank Field
Hewett Field
Bacton
No 4 FEEDER
No 2 FEEDER
Alrewas
Leicester
R. Nene
Norwich
Yelverton
Birmingham
Coleshill
Hinckley
Churchover
Rugby
Northampton
Cambridge
No 3 FEEDER
No 5 FEEDER
Hereford
Worthington
Ross-on-Wye
Dunstable
Hitchin
Whitwell
Chelmsford
Hirwaun
Swansea
Llandarcy
Cardiff
Seabank
Pucklechurch
Bristol
Bath
Abridge
Bromley
Slough
Ascot
Reading
Bramshill
E. Greenwich
Canvey Terminal (L.N.G. from Algeria)
Horndon
Mogador
Puckington
Mappowder
Exeter
Kenn
Note: Section of line between Puckington & Kenn is at present carrying Town Gas
Approved by
PRODUCTION AND SUPPLY DIVISION

1972


THE GAS COUNCIL
NATURAL GAS
TRANSMISSION SYSTEM
Compressor Station
L.N.G. Storage (Above Ground)
L.N.G. Storage (Inground)
Existing Natural Gas Pipeline
Natural Gas Pipeline under construction
Proposed Natural Gas Pipeline
Sub-Marine Pipeline
Area Board Associated Pipeline
Terminal
Gas Well
As at : 1-5-72
Sc. G. B.
N.G.B.
N.E.G.B.
N.W.G.B.
E.M.G.B.
W.M.G.B.
E.G.B.
W.G.B.
S.E.G.B.
S. G. B.
S.W.G.B.
Aberdeen
Dundee
Glasgow
Glenmavis
Edinburgh
Newcastle
Middlesbrough
Little Burdon
Lockton
Pickering
Harrogate
Bradford
Leeds
Hull
Paull
Easington
Killingholme
West Sole Field
Viking Field
Indefatigable Field
Leman Field
Hewett Field
Theddlethorpe
Immingham
Scunthorpe
Sheffield
Liverpool
Manchester
Chester
Wrexham
Lincoln
Nottingham
Derby
Leicester
Peterborough
Norwich
Yelverton
Birmingham
Rugby
Northampton
Cambridge
Hereford
Hitchin
Bletchley
Dunstable
Chelmsford
Swansea
Cardiff
Bristol
Bath
Reading
Exeter
Abridge
Canvey Terminal (LNG from Algeria)
No. 6 FEEDER
No. 5 FEEDER
No. 4 FEEDER
No. 3 FEEDER
No. 2 FEEDER
No. 1 FEEDER
FEEDER
PRODUCTION AND SUPPLY DIVISION

1974


BRITISH GAS CORPORATION
NATURAL GAS TRANSMISSION SYSTEM
From Frigg Field
Fraserburgh
St. Fergus
Peterhead
Aberdeen
Banchory
SCOTTISH REGION
Kirriemuir
Forfar
Dundee
Crieff
Perth
Kinross
Glasgow
Glenmavis
Edinburgh
Bathgate
24
Moffat
Carlisle
Haltwhistle
Newcastle
Bishop Auckland
NORTHERN REGION
Little Burdon
Middlesbrough
Ambleside
Kendal
Lancaster
No. 6 FEEDER
30
Pickering
Pannal
Harrogate
NORTH EASTERN REGION
Homsea
Rough Field
Bradford
Dewsbury
Leeds
E.Bierley
Hull
Paull
West Sole Field
Easington
Killingholme
Preston
NORTH WESTERN REGION
Mirfield
Immingham
Grunthorpe
Viking Field
Indefatigable Field
Liverpool
Partington
Warburton
Manchester
Sheffield
R.Trent
No. 1 FEEDER
No. 7 FEEDER
Theddlethorpe
Buncorn
Totley
Chester
Eccleston
Maelor
Wrexham
Audley
Shocklach
Ambergate
Lincoln
Hatton
No. 8 FEEDER
Leman Field
Derby
EAST MIDLANDS REGION
Hewett Field
Bacton
Alrewas
Tipton
Peterborough
King's Lynn
No. 4 FEEDER
No. 2 FEEDER
WEST MIDLANDS REGION
Leicester
Wisbech
R. Nene
Norwich
Coleshill
Hinckley
Birmingham
WALES REGION
Churchover
Rugby
EASTERN REGION
No. 3 FEEDER
Diss
Northampton
Cambridge
Cranfield
Hereford
Wormington
Hitchin
Bletchley
Dunstable
Whitwell
No. 5 FEEDER
Hirwaun
Swansea
Dyffryn Clydach
Chelmsford
Abridge
THAMES REGION
Bromley
E.Greenwich
Canvey Terminal (L.N.G. from Algeria)
Avonmouth
Cardiff
Bristol
Pucklechurch
Bath
Reading
Bramshill
Ascot
W.Thurrock
Horndon
Mogador
SOUTH EASTERN REGION
Ilchester
SOUTHERN REGION
SOUTH WESTERN REGION
Southampton
Portsmouth
Mappowder
Exeter
Kenn
Plymouth (Breakwater)
EXISTING
PROPOSED OR UNDER CONSTRUCTION
S.N.G. Proposed
Compressor Station
L.N.G. Storage (Above Ground)
L.N.G. Storage (Inground)
Salt Cavity Storage
Existing Natural Gas Pipeline
Natural Gas Pipeline—Under Construction
Natural Gas Pipeline—Proposed
Sub-Marine Pipeline
Terminal
As at : 1-10-74
PRODUCTION AND SUPPLY DIVISION
Approved by