History of the

Watson House Research Station

BG Technology

Gas Retired Employees Association, London HQ Branch

History of British Gas Research Stations

British Gas was for many years a major world gas company. A large part of its position was its activities in research and development (R & D).

There were five research stations

- Engineering Research Station (ERS)
- London Research Station
- Midlands Research Station
- Watson House
- On Line Inspection Centre (OLIC)

In 1995 at a time of major change in the structure of R & D, British Gas Technology published histories of the four of the research stations of British Gas. Unfortunately, there was no similar history published of OLIC although it is partially covered in ERS report.

This document is one of those histories.

These documents were never put into the public domain even though they were fascinating records of a key part of the gas industry. A full set of the reports was made available by Eric Francis, a former Director of the Midlands Research Station and the London HQ Branch of the Gas Retired Employees Association decided to fund their scanning so that they could be put into the public domain.

The London HQ Branch of the Gas Retired Employees Association is an organisation of British Gas pensioners who worked for all or part of their careers at the London headquarters of British Gas

At the time of publication of the reports British Gas had moved its R & D, renamed Research & Technology (R & T), to Loughborough.

When British Gas plc demerged in 1997 into BG plc and Centrica plc, R & T stayed with BG plc.

In 2000, a further demerger of BG plc took place into BG Group plc and Lattice plc. Lattice included Transco, the UK gas transportation company, and Advantica Technologies, the new name for BG Technology.

In 2002 Lattice merged with National Grid. At about the same time Advantica bought Stoner Technologies to broaden its reach to the US and to prepare the company for sale.

In 2007, Advantica with its 660-world staff was sold to Germanischer Lloyd.

In 2009, Germanischer Lloyd merged with Noble Denton to form GL Noble Denton and in 2010 they sold the equipment testing business inherited from Advantica to BSI.

Finally (?), in 2013 GL Noble Denton merged with DNV (Det Norske Veritas) to form DNV GL. DNV GL has a turnover of about £2 billion with around 14,000 employees world wide of whom about 1,000 are British. There is still an office in Loughborough.

OLIC has gone in a different direction. It was sold to GE and remains in Cramlington where there is the world headquarters of PII Pipeline Solutions a 50:50 joint venture between GE Oil & Gas and Al Shaheen

Holding, a wholly owned subsidiary of Qatar Petroleum. It has 11 locations globally and employs over 650 people.

While it is true that the vestiges of British Gas R & D survive after all these mergers we must ask why did it decline so dramatically?

The answer broadly lies in the competitive gas market which in Europe at least was initiated in the UK. Before this the world thought, and in parts still does, that gas was a natural monopoly; gas on gas competition was inconceivable, even illogical. That was the gas industry view, but politicians thought otherwise. In fact, the only part of the gas chain which is a natural monopoly is transmission and distribution.

British Gas as a nationalised monopoly industry could have a long-term perspective and some blue sky thinking to drive the industry forward in strong competition with the electricity industry and to a lesser extent oil. Technology was at the heart of this and the industry was more or less left to invest in R & D without external financial pressure and with a captive customer base to fund it.

If we look at the three demerged elements of British Gas plc in the context of our liberalised gas market, we can see how different the R & D demands are.

BG Group focussed on exploration and production and latterly became an extremely successful player in the LNG market. So successful that Royal Dutch Shell took them over. In terms of R & D the last BG Group annual report shows R & D at $33 million of which $19 million was with Brazilian third parties. Quite a contrast to the internal R & D with British Gas.

National Grid Gas Transmission has a continuing need for R & D support but is limited by the regulator OFGEM as to what expenses can be passed through in customer charges. For example, the most high-profile research currently is Project GRAID (Gas Robotic Agile Inspection Device). This is a National Grid project in conjunction with three British Small Medium Enterprises (SMEs) to develop ways to accurately assess the condition of its pipework assets that cannot currently be inspected via conventional Pipeline Inspection Gauges (PIGs). It secured £5.7m of Ofgem funding.

The third element is Centrica, the marketing company. Much R & D for marketing by British Gas plc and its nationalised predecessors was to compete with electricity. It also was a monopoly. Now Centrica through its British Gas brand sells electricity as well as gas so why should it spend on competing with itself? The other is that any developments funded by Centrica to improve gas could be taken up by its competitors. So, the type of R & D funded in the past is no longer economically viable.

In conclusion, the gas R & D landscape has changed remarkably since the 90s. However, we must not let the past be forgotten. It is right to celebrate the real achievements of British Gas and its predecessor companies. The publication of these reports is part of that celebration.

Rowland Sheard
March 2018

BG Technology

History of Watson House

1926 - 1993

HISTORY OF WATSON HOUSE
1926-1993

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Foreword

It could be said that the main topics covered by Watson House were unchanging. From the outset subjects such as combustion, ventilation, heat transfer and flueing, all closely linked to safety, recur repeatedly in the historical records. Undoubtedly the main technical change was in the evolution/demise of appliance types and the improvement of design for speed, efficiency and convenience. Thus, the gas mantle, the wash boiler, the gas iron and so on all had their day. On the other hand, the central heating boiler evolved to take over from the cooker as the main source of domestic load. The R&D role of Watson House changed, adapted and expanded. It always enjoyed close contact with manufacturers and was closely attuned to the problems of the district.

The testing role of Watson House also evolved. The setting of test procedures (later to become standards), applying the tests to new (approval) and production items (quality assurance) were there from the outset. These became much more formal and stringent and finally became closely linked to European and International requirements.

However, Watson House was always an establishment with notable people - past staff who returned often remarked that it had its own atmosphere. This did not mean that it did not have pressures - quite the reverse. The business environment became very apparent, particularly after the privatisation of British Gas.

The closure of Watson House should be regarded as the end of an era and the opportunity for a new future. It is only too easy to think of something new as bad but, human nature being what it is, the system and the people will adapt to one another. The advantages of having the different technical disciplines together in one establishment have become apparent only too soon. It is hoped that by collecting together this history, together with its most important archives, the name of Watson House will live on in perpetuity.

In preparing this document, I must sincerely thank the many staff and past staff I have requested, cajoled, threatened and pleaded with for information. My appreciation is given, in particular, to John Barnes, Pat Lehane and Gill Penrose for their help in assembling material for this document. I am also grateful for the opportunity to have prepared this history, which turned from a daunting task to an obsession. I can only apologise for the many items which, out of necessity, have been omitted.

A J Miles

History of Watson House
1926-1993

Introduction

The official birth date of Watson House is 29th October 1926, although its technical origins can be traced back as far as 1892. The foresighted person who decreed its formation was the Governor of the then Gas Light and Coke Company, David Milne-Watson. J G Clark, a chemist, was the technical expert without whom the formation might not have taken place. Milne-Watson became Sir David the following year and the Gas Light and Coke Company evolved eventually, by amalgamation with other gas companies, into North Thames Gas. During its lifetime, the name Watson House has been ascribed to three buildings, one at Nine Elms, one at Townmead Road and the final one at Peterborough Road.

The early days have been described previously very adequately by Masterman, Compton Mackenzie, Andrew, Bruce, Burden, Patrick and Purkis, covering primarily the time up to the Golden Jubilee in 1976. Therefore, the emphasis of the present document is on the period from the Jubilee to the closure of Watson House in 1993, when staff moved to the Gas Research Centre at Loughborough. The Directors during this period were Clifford Purkis, Pat Patrick, George Percival and Norman Ross. However, the earlier history has been reviewed briefly for those who might not have access to the previous documents.

Setting the Scene

Nine Elms

The 29th October 1926 minutes of the meeting of Directors of the Gas Light and Coke Company stated that 'the premises at present known as Imperial Wharf, be hence forth known as Watson House.' These four-storey premises in Battersea had been built in 1906 for Messrs Crosse & Blackwell and had been purchased from them by the Gas Light and Coke Company in 1924. The site, which no longer exists, was situated a few hundred yards from the Nine Elms Works and was commonly described by that name.

At the official opening on 17th November 1926 the Chairman of the London County Council, Sir George Hume, JP, MP described Watson House as 'a scientific and technical training centre of the Gas Light and Coke Company.' Its role was very different to that when eventually sited at Peterborough Road, with what would now be described as R&D being a minor but important activity. In those days Watson House was informally referred to as the 'Company's University.' The organisation was built around the various scientific disciplines, perhaps a precursor of the Technical Divisions formed so much later at the Loughborough Gas Research Centre.

The first floor of the building housed the chemical, physical and general laboratories as well as a demonstration room and the work there was most akin to what was later regarded as the responsibility of Watson House. The laboratories covered industrial as well as domestic utilisation and laboratory photographs also show commercial boilers were being tested. However, improved cookers, fires, flues and gas mantles were investigated and chemical analysis of solders, brasses and steels were undertaken. Already co-operation with manufacturers and inventors had been established. A test for measuring the radiant efficiencies of gas fires was being developed and there was an exhibit of a fire designed to give increased convected heat output. An optical projection technique was in use to test the quality of gas barrel threads. The building was also used as the Company's amalgamated central purchasing and stores, moved from other sites.

One of the operations carried out was the inspection of fitters' tools and stores goods for conformity to the standards drawn up by Watson House, a precursor to the eventual formation of Approvals, Standards and Quality Assurance. Another role was that of training fitter apprentices, more advanced pupils and fitters. All of this information is contained in contemporary accounts in the annals of the 'Co -Partners Magazine' (later Thames Gas magazine).

The title of the leader of Watson House changed a number of times during its evolution. The first person in charge was J G Clark, whose particular interest was the safety of water heaters, and his title was 'Manager.' in February 1931 the first monthly issue of the Watson House Bulletin was produced and it dealt with a variety of district problems relating to water heaters, thermostatically controlled cookers, ventiles (flue terminals) and industrial burner jets. This shows that its interests were predominantly domestic. The December issue of that year illustrated the yellow testing labels which were in future to be attached to fittings and guaranteed that 'the article had been tested and approved by the Company.' The Bulletin evolved over the years and was produced over the rest of the life span of Watson House, except for a 7 year gap starting in 1940 due to the 2nd World War.

The Gas Light and Coke Company formed the Watson House Club in 1926. The Club developed, actively promoting and financing many sporting activities and hobbies, including the Sketch Club, football, athletics, badminton, cricket, snooker, billiards, darts, table tennis, golf and bridge. The Sketch Club had been founded in April 1947 by art enthusiasts from Watson House and Imperial House. Bertram Vinter was the Sketch Club's first secretary until 1952 and just 6 months after its foundation, it held the first of its many art exhibitions. These were all enormous successes and showed a versatility of styles and media. Two of the exhibitors, namely F Kiss and W S Everson, were well known to readers of the Co-Partners' magazine for their cartoons and drawings on various aspects of the gas industry. Of the others, Bertram Vinter and Leonard 'Johnny' Walker were active into their 80s and had their work accepted by most major art societies.

In December 1932 Clark moved to the British Commercial Gas Association (the predecessor of the Society of British Gas Industries or SBGI) but was not replaced by another Manager. Instead, C A Masterman, who had joined Watson House in 1927, became Chief Technical Officer and R N Le Fevre, who had joined the following year, took charge of Training. In 1933 the Watson House Development Centre was formed, to which other gas undertakings subscribed. Initially it covered industrial utilisation but in January 1936 this was expanded to include domestic. In May 1934, Watson House had the honour of being visited by Prince George, later to become King George VI. The space available at Nine Elms was becoming cramped and Sir David Milne-Watson visited Imperial House in Townmead, Fulham, on 5th March 1936 to proclaim: 'This will be the new Watson House.'

Townmead Road

In the space of 6 months the move to Townmead Road had been completed and there was an official opening by Lord Snell, Chairman of the London County Council, on 3rd December 1936. The next major factor to influence Watson House was the 1939-45 war. The type of work undertaken reflected the change of circumstances and 20 staff including Masterman, Cooper, Dunning, Hayman, Purkis and Voice were seconded to the Chemical Defence Experimental Station at Porton. In this interim period the Assistant Chief Technical Officer, G C Holliday, took over responsibility for Watson House. Masterman did not return at the end of the war, being offered a post in the Ministry of Fuel and Power. On 1st July 1945 William Dieterichs became Manager of Watson House but he died after less than five years and Holliday succeeded him in February 1950. 1951 was the Silver Jubilee Year of Watson House. A new Exhibition with the theme 'The Efficient Use

of Coal' was set up and a photograph album still exists. In 1953 Pat Patrick succeeded Roy Hayman as leader of the Industrial Laboratory and the following year Holliday died, to be succeeded by Leslie Andrew. However, Andrew had a new double title, namely Director, Watson House Centre (answerable to the Gas Council) as well as Manager, Watson House, North Thames Gas Board. Shortly afterwards, Reggie Le Fevre was awarded the MBE.

In 1955 Gas Council Approval for domestic appliances was started. These appliances were deemed technically suitable for sale by Area Boards and, from the beginning of 1956, were listed in the Watson House Bulletin. This was extended to catering appliances at the end of 1956 and an interesting account of the procedures is available in a Bulletin article the next year. Prior to that, for many years Watson House had been issuing descriptions and Technical Data Sheets on new appliances. In 1958, additional Lists of Recommended Commercial Gas Appliances were produced but, as there were no agreed test procedures, these were kept confidential to Area Boards.

For those readers brought up on natural gas, they may need to be reminded that the gas industry was founded on coal, coke, coal by-products and town gas. The assessment of different coals, the amount and sampling of the coke produced and the classification of by-products were necessary and important roles. The gas itself had a much more variable quality than we are used to today, depending particularly on hydrogen content. The first proposal for classifying various gas types by Wobbe number came from Freddie Mills and led to the introduction of the 'G' classification. This meant that appliances needed testing on a range of test gases and these were available in the Watson House laboratories. Gilbert and Prigg of Watson House wrote a notable paper on the interchangeability of gases. The elements of another fundamental aspect of gas utilisation, namely flueing, were described in papers by Masterman, Legg and Noble, and Bennett et al, and the ensuing guidelines were incorporated in a Bulletin Supplement on Flues. Combustion and ventilation received early attention and led to a classic paper by Prigg on aerated burners and to a Bulletin Supplement on ventilation, particularly of kitchens and bathrooms.

The first gas market was for lighting and the market for street lighting by gas survived better than that for domestic purposes. Clifford Purkis pointed out that Freddie Smith at Watson House was an acknowledged authority on the subject - he was appointed President of the Illuminating Engineering Society in 1939. An optical bench was used for testing the light output of gas mantles. It was only later, when the gas mantle was superseded by the electric light, that the cooker constituted the main domestic gas market. The joint development of the GLC cooker by Watson House and Main marked a major achievement away from the traditional cast iron cookers that were then in vogue. By 1946, gas cooking accounted for nearly 40% and by 1962 it would represent over 50% of the domestic gas sold. The early methods of applying ignition to cookers were described by Bradley and Johnson, and Kitson and Prigg. The history of the gas cooker was summarised by Joy Houghton, a well known and formidable lady who looked after the Home Economics Laboratory until her retirement in 1973.

In 1934, the methods of space heating were classified into radiant, radiant plus convection and convection, with central heating receiving only a minor mention on account of capital and running costs. Duncan Wills considered the theory of intermittent heating in 1953, much of which is still relevant. Berry and Taylor wrote a classic paper on convector gas fires in 1960 and Berry summarised the history of the radiant convector fire in 1982. Chance and Dance examined the basics of warm air heating in 1961. Figures given by Purkis and Robb show that by 1963/4 the annual sales of gas space heating appliances exceeded the sales of gas cookers for the first time. A considerable expansion of warm air heating was thought likely as in the USA but this was not to be the case. It is in the subsequent period of growth of space heating that many publications on the subject were

produced by Watson House. However, the early Watson House workers must be given the credit for laying the foundation for much of the work which followed.

Watson House was always in the forefront of appliance design technology but, in the end, any prototype design needed to be produced by a manufacturer. Therefore, its main output was through the communication of information and advice either in the form of paper work or presentations. The numerous early papers by Watson House have been mentioned previously and this trend continued throughout its existence. Watson House always had the ability to communicate its findings to the industry and outside bodies and this is demonstrated by the large number of visitors it attracted. In the early days of Townmead Road there were approaching 7,000 visitors a year to Watson House. This figure probably represented a peak and was to reduce considerably in later years.

Originally technical staff employed by the Gas Light and Coke Company were classed as either chemists or engineers. However, in July 1955, other disciplines such as physicists, chemical engineers and mathematicians were recognised. Another constraint on early technical staff was that of not being able to sign letters in their own right. In January 1957 the first concession was made, namely, laboratory leaders were given the title of 'Officer in Charge' and were allowed to sign letters using that title.

By now the Townmead Road site was also getting cramped and North Thames decided to build a new Watson House at Peterborough Road. By January 1958 the detailed scale plans had been completed. Nine months before the move, Watson House became the third Research Station of the Gas Council.

Peterborough Road

Remainder of Andrew Era

A 16 mm movie film of the construction of Watson House at Peterborough Road still exists. One notable feature was the long spans of pre-stressed concrete support beams, used so that the interior partition walls could be modified later as necessary without affecting the structure. These beams were later to give rise to costly repair measures. The occupation of the building started in September 1961. In the early stages, the entrance was through a side route because the front entrance and cinema areas had not been completed.

The official inauguration of the building by the Duke of Edinburgh took place over two years later in November 1963. Two photograph albums of the occasion were compiled. It was just after the inauguration that the title 'Watson House' was redefined to apply to the work supplying the needs of the gas industry as a whole. Thus, purely North Thames Gas activities such as the Coke Department, the Industrial Showrooms, the Industrial Workshops, the Sports Association and the Training & Education Centre were no longer included, even though they remained based at Peterborough Road.

A joint committee on the standardisation of spare parts was set up involving manufacturers, Watson House and Area Boards. From this beginning, the Standardisation Section was set up at Watson House in April 1963.

One auspicious occasion was the celebration of the Centenary of The Institution of Gas Engineers at Watson House in May 1963. This was an historical exhibition of cookers, fires, geysers, heating stoves, lighting, meters and miscellaneous equipment collected together from a variety of sources. An album of photographs taken at the time is retained in the archives.

Once Watson House had become a Gas Council operation, a need was felt to reorganise on functional lines and this took place on 1st January 1964. This was brought about by Sir Kenneth Hutchinson, the Deputy Chairman of the Gas Council, because he thought Watson House was not doing enough fundamental work. It was at this point that the functions of Approvals Testing, Development and Research, previously all carried out in specialist laboratories on cooking, water heating etc., were undertaken as co-ordinated activities under specific managers. The Secretariat and Laboratory Services provided a support role. The industrial utilisation of gas was still a Watson House activity until the 1964 reorganisation, when it transferred to the Midlands Research Station in Solihull. The use of coke had been given a boost when the Clean Air Act declared smokeless zones in 1957 but, once the change from coal to oil as a feed stock started seriously in 1964, the need for a Coke Laboratory disappeared and it was closed in that year, having originally been formed in 1945. The overall effect, however, was that the number of staff grew considerably, particularly with formation of the new Research Division and because of the expansion of the Approvals Division, the Secretariat and Development Division. Many of the remaining archive records start about this time.

Although by now the cooker was responsible for most of the domestic gas consumption, it was by no means the only domestic appliance on the market; water heating was also important and was the subject of various Watson House publications. Even in 1954, the comparison of summer hot water efficiency for gas and electricity had been receiving attention and this continued until very recently. Other gas items being considered in the early days before conversion were refrigeration, drying cabinets, metering and gas fittings.

With the discovery of natural gas in the North Sea in 1965, a whole new era of activity at Watson House resulted. In 1966 Sir Henry Jones, the Chairman of the Gas Council, announced a decision to change nationally from manufactured to natural gas and the programme of conversion started the following year. The decision to operate appliances on natural gas at an increased pressure of 8 in wg (20 mbar) to achieve adequate air entrainment with aerated burners was largely a Watson House technical requirement for which much of the credit must go to John Prigg and John Harris. Conversion could be achieved merely by a reduction in burner injector size in the simplest cases. However, the air requirements for natural gas were about 6% higher than town gas and, for appliances with marginal air supplies, some measure of downrating was necessary. Changes to terminals were required with some room sealed appliances because of the reduced tolerance to recirculation of flue gases.

The search for a natural gas version of the quiet non-aerated pinhole burner (Bray jet) used on town gas boilers, water heaters and gas fires was one of the main reasons for Pat Patrick setting up the new Combustion 'B' Group under Dr Allan Brown in 1966 (John Prigg was the Assistant Manager of Combustion 'A'). Later, at the beginning of 1969, the Planning Group was formed under Allan Brown as part of the Development Division but by the following year it acted on behalf of the whole of Watson House. Dr Stuart Reed, of flame stretch theory fame, took over Combustion 'B' from Allan. Watson House was provided with an excellent facility for noise measurement, which had been set the aim of noise reduction in the use of aerated burners and warm air ducts, and the avoidance of burner resonance. This was described in an IGE paper in 1969.

By the mid to late 60s the combined amount of space required by North Thames and Watson House exceeded that available. This had two consequences. In the first place, the first floor void area was filled in. The new accommodation was occupied by the Instruments Laboratory, the Drawing Office, the Print Room and the Photographic Laboratory. This later building work resulted in a ramp leading to the area at first floor level. Secondly, three outstations were formed off site.

Outstation 1 (OSl) started in use in 1966 and was situated in the London Research Station at Michael Road. Materials Group moved to laboratories on the first and second floors, with Geoffrey Pickup as Group Leader and in 1968 Aerodynamics (later to become Fluid Dynamics) under Dr John Tipping moved to the void area on the ground floor. OS2 and OS3 were both formed in late 1969. OS2 comprised the original 1927 LRS building on Fulham Works site and housed Combustion 'A' and 'B' Groups, the Maths Group and later the new Planning Group. OS3 was the 'Natural Gas Conversions Laboratory' occupied by the Catering Approvals team under Jim Clayson on the Imperial House (Townmead Road) site.

The technical control of conversion sets was maintained by Watson House, to which much credit must go to Clifford Purkis, Allan Sharman and the Approvals team. By October 1966 a Conversion Approvals Laboratory had been set up at Watson House and in the following year the national programme of conversion started. This involved Regional, manufacturers' and Watson House staff in pre- and post-conversion surveys. Not all appliances were ideally suited to natural gas and some of the early conversion sets required improvement. This led to Mark I, II and III conversion sets, many of the improved versions being developed at Watson House in the Conversion and Development Laboratories. Although the conversion programme was not completed until 1977, the Conversion Laboratory was able to be closed down in January 1969, simultaneous with Duncan Wills retiring as Development Manager and just two months before Eric Dunning retired as Approvals Manager.

In 1966, the distribution of the Watson House Bulletin, which had limited circulation, was widened to include members of the SBGI. Previously they had only had access to extracts on items relating to their own products. Another important means of communication, particularly in the early days, was through the London & Southern Junior Gas Association of the IGE. Watson House staff wrote many papers in support of the 'Juniors' and were frequent contributors to the discussions. Many distinguished members of Watson House became Presidents of the London & Southern, Junior Gas Association, including Leslie Andrew, Eric Dunning, Peter Henshilwood, Clifford Purkis and Pat Patrick.

In May 1969, the traditional title of the Secretariat was changed to 'Administration and Information' and shortly afterwards the title of the Approvals Division was expanded to Approval and Installation. The period 1966 to 1971 was a time of recruiting for new R&D talent, when Norman Ross, Bob South, Adrian Miles, Norman Chapman, John Tipping, John Carmichael, John Wilson, Hugh Spivey, Ted Lanigan, Alan Wharf, Mike Green and Alan Sussex joined Watson House. Of these, John Tipping and John Wilson were later to leave the gas industry after making their own very individual contributions to Watson House. Bob South, John Carmichael, Hugh Spivey and Ted Lanigan would later move to other parts of the industry.

Leslie Andrew continued as Director until his retirement in late 1969, to be succeeded by Clifford Purkis.

Purkis Era

Even though Watson House had been newly constructed and its external appearance remained very much the same (except that the notorious Piper murals on the front facade faded with time), its internal usage changed repeatedly to cope with the effects of reorganisation, specific technical developments, improved comfort conditions and an increase in the proportion of office space. In 1970 the Development Managers moved to Laboratory 6 after it had been converted to a suite of offices.

In the middle of 1970, the Research Division and the Development Division were amalgamated into one under Assistant Director Pat Patrick. Following a suggestion from Lewis Stretch, the Director of Research, that Watson House should have a greater awareness of manufacturing processes and costs, the Engineering Development Division was formed at the beginning of 1971, with Alan Wharf as Assistant Director responsible. Initially it occupied Laboratory 9, later to house the Materials Group. Gradually it expanded its activities and the number of staff, moving in 1973 to space previously occupied by the workshops in Laboratory 10.

In September 1970 shortly after publication of the Morton report, which criticised the safety of converted appliances, the first two day 'Operation Update' was run by Bob Bruce. It covered an updating for Regions on district fittings and conversion. A further update was held immediately afterwards to update salesmen's knowledge. Operation Update continued as an annual method of communicating with Regions until 1987, being run by Ron Clifford after Bob Bruce's retirement.

The low noise level of non-aerated burners has already been mentioned. They also had the advantage of lower maintenance requirements than aerated burners and this influenced the introduction of non-aerated burners, firstly on gas fires, after the war. With aerated burners the combustion air contained suspended material (lint), which could accumulate within the burner, with the eventual risk of poor combustion. Pilot flames could also be affected. Many natural gas non-aerated burners were developed and tested at Watson House but the quest was finally abandoned in 1972 because of their flame instability and tendency to soot, especially on substitute natural gas (SNG), which contained hydrogen. Therefore, there was no alternative to using aerated burners on conversion. Watson House surveys, in which John Flood was the main technical expert in Alan Sussex's team, showed the lint was very variable in composition, containing 20-25% wool, 10-25% cotton, 15-30% dust and 0-10% fat and oil. The principles of designing lint resistant burners were established and the results were presented to the SBGI. In addition to this, another most important outcome of the work was the design of equipment to generate artificial lint, used as the basis of a boiler lint test.

The tendency for natural gas flames to lift off the burner because of the reduced flame speed of natural gas led to the introduction of retention flames, particularly on cooker burners. The ignition of gas cookers presented a formidable problem because of the reduced physical tolerances, reduced flammability range and increased ignition energy requirements of natural gas. Work was undertaken to improve existing pilot-flash tube and battery/filament ignition systems, Watson House issuing fault finding charts for both of these. Proposals were made to make the burners non-adjustable (fixed aeration). Another criticism levelled at cooker hotplates was the coarseness of the tap control (having been designed to adjust a flow twice that of natural gas) and the difficulty of simmering.

CLIFFORD PURKIS PROFILE

Clifford Purkis was educated at Owen's School, Islington and St John's College, Oxford where he was awarded a First Class Honours degree in Natural Science (Chemistry). He joined the Cooker Laboratory at Watson House as a chemist on 28th September 1936. He was originally requested to report to Nine Elms but this was countermanded with a revised instruction to report to Imperial House, Fulham where Watson House had just relocated. During the war he transferred with about 20 other Watson House staff to Porton in April 1940 to work on chemical warfare. In 1943, because of the threat of a Japanese attack, this expertise caused him to be transferred to North Queensland in Australia where he was involved in setting up an experimental station for the Ministry of Munitions.

He returned in 1946 to be appointed No 2 to James Cooper, beginning his highly reputable work on water heating. In 1950 he was co-author of his first IGE paper. When Cooper joined Potterton, Leslie Andrew transferred to look after water heating, including refrigeration. It was Purkis and Andrew who solved the initial technical problems of the Gascold refrigerator. With Leslie Andrew's promotion to Chief Technical Officer, Clifford Purkis became Officer in Charge of the Water Heating Laboratory. He was President of the London & Southern Junior Gas Association for the year 1958/9. At a Sales and Service Seminar in Harrogate he was introduced as 'Mr Hot Water,' a title that stayed with him permanently. In 1960 he won the IGE H E Jones London Medal with John Bennett of Watson House, and Jack Carne and Terry White of Segas, for a classic paper on Se-Ducts.

As part of the 1964 reorganisation he became the first Approvals Testing Manager at a time when the expansion of the industry and the pressure of preparing for conversion were beginning to be felt. It was he who succeeded in keeping the technical control of conversion set at Watson House. In 1967 he became Assistant Director (Technical) and on 24th November 1969 he took over as Director when Leslie Andrew retired.

Watson House probably reached its peak of recognition, both within the UK industry and abroad, during this era - in short it was centre stage. The ties with Marketing Division, Regions and manufacturers were all very strong. Clifford Purkis was a member of the Marketing Policy Committee and he organised visits of senior staff around the Regions. It was also during Clifford Purkis' Directorship that international links, especially within Europe, became particularly strong. Clifford Purkis became President of the Institution of Gas Engineers in 1976/7, a year when the 13th World Gas Conference took place in London and when Watson House celebrated its Golden Jubilee. He was Chairman of the International Gas Union (IGU) Sub-Committee on Regulations and Standards for six years and was a member of the main IGU Utilisation Committee.

Upon his retirement on 30th June 1978 he and his wife moved to live on the coast of N Cornwall near Padstow. He died on 21st September 1994.

The fundamentals of spark ignition systems had also been investigated, with a third ignition fault finding chart being issued. The most common early designs being produced by manufacturers were of the turret type, i.e. with the bare electrode being positioned close to the burner skirt. Ignition had not always been found reliable, the problems resulting from a combination of imprecise spark paths, inadequate spark energy, operating tolerances, spillage and draughts. Watson House had produced a number of possible improved designs. Later, Cannon produced a hotplate incorporating the features of one of these designs and the concept of concealed ignition systems was generally adopted by manufacturers. The Watson House Ignition Test Burner (WHITB) was developed for testing the adequacy of spark generating systems and was issued to manufacturers. A move to achieve interchangeability of the proliferating number of spark ignition components was pursued with the SBGI for some years.

In April 1972 the first Major Project Review, on the subject of Domestic Wet Central Heating, took place. These reviews were prompted by a McKinsey study, which promoted the concept of a customer/contractor relationship, and were masterminded by Pat Patrick. They were used as a means of obtaining a definite commitment from End Users for the work undertaken by Watson House. Book 1 presented the management case for the work and posed a series of questions concerning future work and/or funding. Book 2 included the technical background and progress. Book 3 recorded the decisions made at the meeting. The reviews represented a major step forward and continued for 17 years on a wide variety of topics using basically the same format.

In mid-1972 the Workshops staff transferred from being North Thames to Gas Council employees but it was not until much later (January 1983) that they were finally reclassified as staff rather than manual workers. The move of the North Thames Industrial Workshops out of Watson House in 1973 enabled much needed additions to the laboratory space to be made. In the first place, Outstations 1 and 3 staff returned to Peterborough Road in the summer of 1974. Engineering Development moved out of Laboratory 9 to the new Laboratory 10 area, making way for Materials Group to return from Outstation 1. Thermal Engineering also moved back from Outstation 1 into Laboratory 19. Catering Approvals moved out of Outstation 3 into the new Cooking and Catering Approvals Laboratory in Laboratory 10. The residual space was used for the General Workshop and the Research & Model Workshop. Finally a number of offices and environmental test rooms were constructed.

An unexpected consequence of the conversion to natural gas was its effect on the leather diaphragms of meters, which stiffened due to the dry gas, in some cases causing an increase in registration. The identification of synthetic diaphragm alternatives, which had been mooted first as far back as 1938, was narrowed down by the Materials Group. A constraint on selection was the effect of the various additives made to the gas, which could have an effect on rubber. By 1974 limited field tests of prototype meters with synthetic diaphragms were successfully under way.

At about the same time, two other factors started to exercise a major influence on the type of work done by Watson House. These were the considerably increased demand for gas and the energy crisis of 1974. The increased demand for gas was accompanied by a requirement for suitable appliances and installation procedures. Although there were many gas discoveries, there was a shortfall in supply, leading to the need for SNG and investigations of its effects on appliance performance. It was not until the Frigg field came on stream at St Fergus in 1976 that the situation eased. The energy crisis resulted in (i) much pressure on the fuel industries from government bodies such as the Department of the Environment and (ii) increased competition from electricity. A considerable programme of efficiency improvement, monitoring and publication was the outcome. In 1974, a mobile laboratory had been set up with the objective of testing the effects of different gas types on domestic appliance operation at source. The appliances installed

were ones with known weaknesses to changes in gas quality. The mobile laboratory first visited the Isle of Grain in March 1975 to test the gas from an SNG pilot plant. Tests at SNG production plants at Plymouth, East Greenwich, Tipton and Granton (Edinburgh) followed. Another interesting use of the mobile laboratory was in checking for the effects of the progressive accumulation of higher hydrocarbons in liquid natural gas (LNG) at Canvey Island.

In order to try to stimulate the gas cooker market, which was badly in need of a better image, a new initiative was started to look at a range of new design options. Over 30 options were produced and these were severely narrowed down to the solid top hotplate (glass ceramic or metal), improved simmer burners, the welled hotplate, a sandwich burner (with the combustion region incorporated within a solid hotplate) and a high speed hotplate. These designs were presented to the SBGI jointly by Marketing Division and Watson House in July 1973. Of the designs, the welled hotplate, which included pressings produced on the Dualform press by Engineering Development, was most successful and the principle was later incorporated on a Cannon cooker.

A further presentation to the SBGI on domestic cooking took place in February 1975. By then there was considerable concern about the reducing proportion of gas cookers being sold and some new design options demonstrated were a hotplate with raised discs (later produced by Parkinson Cowan), improved coating materials, self-cleaning oven linings, a hotplate extract system and a forced convection oven. A critical comparison of the features on current gas and electric cookers had been initiated and created much Marketing interest. The cooking performance of the two types of cooker had also been compared. These findings were also communicated to the manufacturers.

Although the cooker was a preoccupation at the time because of its declining position, the heating market was regarded with considerable importance, particularly where improved performance or cost reduction might be achieved. In 1969, Marketing Division had queried whether or not the industry should include a new central heating concept in their sales and servicing activities, namely the sealed system. The attraction was that it would eliminate the cost of the topping up cistern in the loft and, because of the increased working pressures possible, might even allow smaller radiators due to the capability to operate at higher temperatures. There was also the likelihood of reduced corrosion because of the exclusion of oxygen. By 1972 the laboratory and district monitoring had reached a significant stage and was reviewed with Marketing. One unexpected limitation of using sealed systems was slight water leakage at valves and joints, making it necessary to compensate for the loss. Direct connection to the water mains was not allowed by the water authorities but an automatic topping up device had been devised. Peter Finch spent quite some time analysing these data, submerged under a mountain of returns from the district. Whilst the principle of sealed systems had been demonstrated adequately, their acceptance by the installation trade was slow and Marketing decided not to promote them actively.

Another heating/hot water system development that had been carrying on simultaneously was that of the 'advanced boiler.' Jack Roberts was the champion of this appliance, which was designed to save the space of the hot water cylinder yet provide a full hot water service. To satisfy the then current BS 1250 requirements for filling a bath, the heater was rated at 50 kW to provide instantaneous hot water. The same burner provided the heating service. Included in the design were many novel features such as a lightweight heat exchanger, sophisticated controls and fanned burner and, for its rating, compactness. The appliance did not reach beyond the prototype stage because the requirements of BS 1250 were relaxed when the much lower rated combi boilers came along from Europe. When the work emphasis changed towards an expanding heating market, a range of new heating appliances and controls were evaluated, including possible central heating packs.

Concurrent with the tremendous expansion of the heating market, Watson House also evaluated boilers produced by manufacturers. One such appliance was the Abergas boiler, which could be regarded as the forerunner of the compact, wall-hung boilers which were later to dominate the market. The Abergas design incorporated a novel heat exchanger fabricated from small metal spheres brazed together, and a fully premixed cylindrical burner within the heat exchanger. The early models suffered from premature corrosion of the heat exchanger, familiarly known as 'ball-drop,' but broke new ground in boiler design.

Another development which facilitated the rapid growth of the domestic space heating market was the introduction of small-bore hydronic heating systems. The early work on this concept was conducted by the British Coal Utilisation Research Association, but the gas industry took it up and capitalised on the concept. Watson House facilitated its introduction through a series of publications covering the design and maintenance of wet central heating systems. One interruption to the successful introduction of gas-fired central heating was the unfortunate use of zinc-coated mild steel tube in place of the reliable, but more expensive, copper piping. Despite its successful use in Continental Europe, zinc-coated mild steel proved unsuitable to the installation conditions and practices of the UK market and was eventually withdrawn from the market. Watson House became heavily involved in the assessment of alternative methods of jointing this type of tube and whether its life could be extended through use of corrosion inhibitors. Although the measures were partially successful, the product was taken off the market.

The basic work on heating system design, flueing and ventilation was carried out at Watson House but required the monitoring of occupied dwellings to establish the effect of the occupants opening windows, running their heating systems incorrectly, and so on. However, the occupants created a considerable variability in the way their gas systems operated. Therefore, there was a need to monitor unoccupied dwellings in addition. The Segas test house at Old Kent Road had been in use for some time for such activities but, with new more highly insulated and sealed methods of house construction (low energy housing), there was an urgent need to be able to carry out monitoring tests in other types of unoccupied dwelling. A set of three highly insulated terraced houses were constructed on the Old Kent Road site in 1974, two of which could be monitored and the third housed the monitoring equipment. (Later all three houses were used for test work once a separate structure to contain the monitoring equipment had been built). The houses were used primarily for determining the annual consumptions and efficiencies of new forms of heating system, the results of which were used to combat attacks from the electricity industry, through government departments, on running costs. In the following year a detached house of conventional construction on a housing estate in High Wycombe was purchased for similar tests. The houses represented a good investment in terms of the valuable information they yielded.

A variety of environmental matters were being dealt with ranging from ventilation, minor constituents of combustion products, to comfort. Guidance on ventilation requirements was a regular feature of the Watson House Bulletin although little of this work was recognised outside the industry. The minor constituent of combustion given the most attention was carbon monoxide (CO) but, because its dangerous effects were so apparent, it was well covered by standards requirements. Much less understood were the very small quantities of oxides of nitrogen (NO_x) produced by combustion systems although it was quite clear their production should be minimised. The investigation of catalytic burners was prompted by this desire but the need for the catalyst to be pre-heated and its inability to combust the natural gas completely led to the abandonment of this work. Two other unknown quantities at the time were how to analyse NO_x samples accurately and what possible health effects NO_x might have. Thermal comfort was just beginning to be considered scientifically and in 1973 a Comfort Test Room was constructed. Another related long term project was the development of the building

energy model 'THERM,' the basic principles of which were originally developed by John Bennett and which could predict room temperatures as a function of time, knowing the heat input, the room thermal characteristics and the outside conditions.

In 1973 work on catering, which had been interrupted for some time by the extra effort required on domestic cooking, was restarted at Watson House. This marked the beginning of an exercise to produce a new range of catering appliances with upgraded specifications. New concepts of range, grill and fryer were designed by Watson House and an agreement for their production was entered into with a major manufacturer in January 1975, being termed 'Gascraft' appliances.

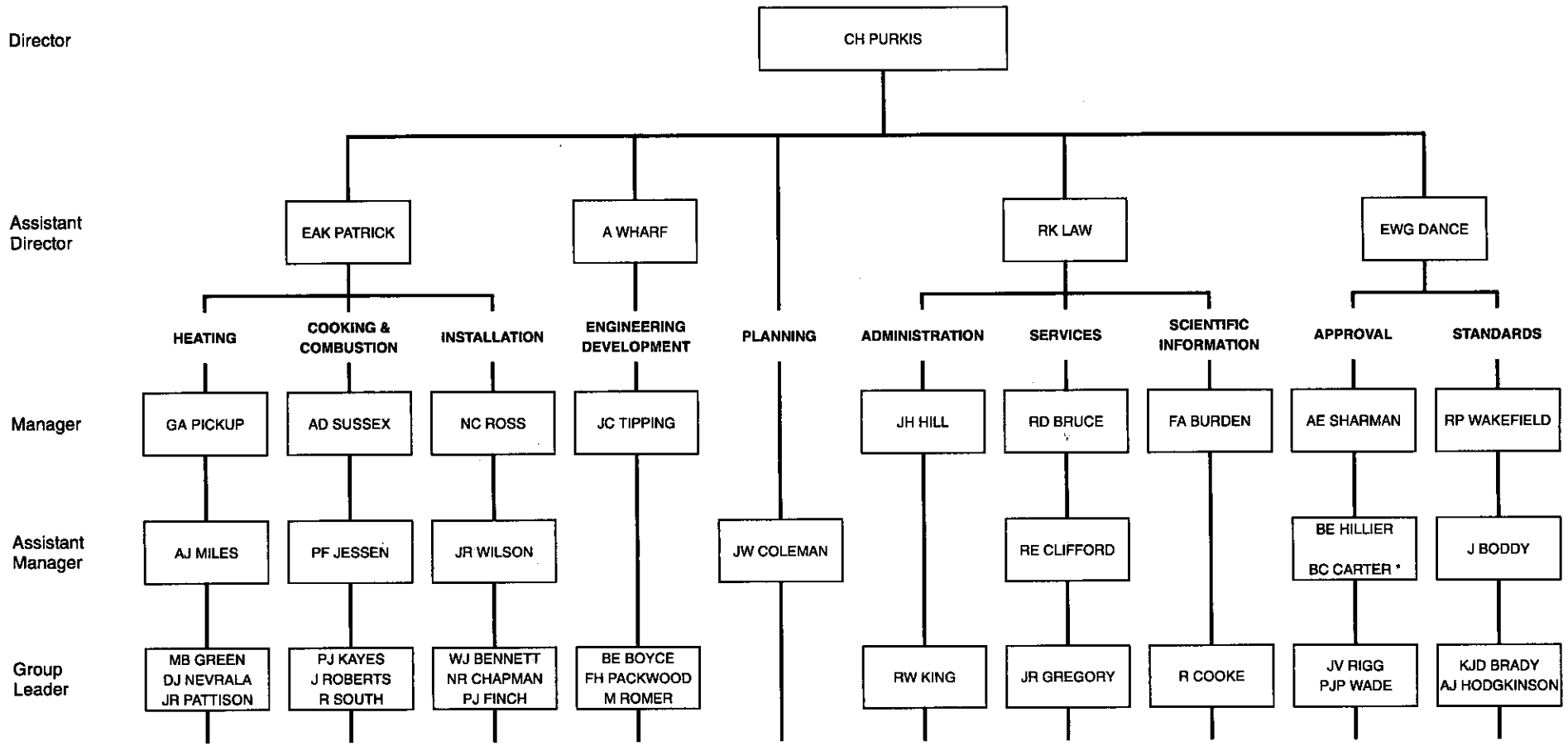
Older members of Watson House will remember the days of signing in the attendance book in the morning and the rush near 8-45 am to avoid John Heron closing the book and awarding lateness stars. The relatively remote location of Watson House from public transport services and the difficulties of some staff travelling long distances to arrive at a precise time were eventually recognised. Clifford Purkis, who always had staff in mind, was concerned about this and wanted an alternative approach. As a result, Flexitime was first introduced to Administration and Services Division on a trial basis in May 1975, with the Assistant Director Roland Law religiously clocking in and out to ensure he understood any problems faced by staff. A year later Flexitime was introduced to the whole of Watson House although by 1983 the withdrawal of the few Higher Managers in the scheme was encouraged. The core times of 10-00 to 12-00 and 14-00 to 16-00 were a considerable convenience to staff and Flexitime was certainly an attraction when recruiting new staff. The main disadvantage was the difficulty for management of tracing staff out of core time, which was never satisfactorily solved.

A major reorganisation of the R&D structure took place at the beginning of 1976, with Research and Development being replaced by the Heating, Cooking & Combustion and Installation Divisions. Their respective Managers were Geoffrey Pickup, Alan Sussex and Norman Ross. John Tipping became the new Manager of Engineering Development.

Throughout the 70s and 80s there was a programme of work on commercial heating and hot water. In the early 70s, under the leadership of Hugh Spivey, work was carried out on changeover of solid fuel and oil boilers to gas firing. This culminated in the production in 1978 of Technical Notes on Changeover (later revised in 1985). Another important area was flues, and in 1979 a Guide to the design of large flues was produced. This brought together practical and theoretical studies and gave recommendations on suitable materials.

One of the features which had penalised the further development of the advanced boiler had been the use of the fan, which was regarded in Marketing circles as an unnecessary expense and complication. However, Watson House could see the merits of employing fans for the reliable supply of combustion air, the forced removal of combustion products and for achieving greater compactness of appliance. One joint design from Norman Ross' and John Tipping's teams was a plastic terminal taking the combustion products from a high efficiency boiler, the terminal being a glass-fibre reinforced polyester resin. Extended flues were thought to be the means of producing flexibility in the siting of appliances and terminals and their design principles were investigated. This work did not get the recognition it deserved at the time, primarily because it was in advance of the market situation. Engineering Development were also working on improved fans, the most important one being the toroidal fan, which produced a much higher pressure than conventional fans, making it less susceptible to the disturbing effects of gusts of wind at the terminal. Another important step forward was George Kerac's meticulous determinations of the limiting separations of forced draught terminals from windows, doors, corners, guttering and drainpipes. Technical support on conventional flues

Watson House Organisation Structure: March 1976



* Principal Engineer

resulted in the design of flue 'pigs' to establish that pre-cast flues were not blocked and a vane test to indicate whether the flue flow was adequate. The latter is now widely used by field personnel.

Customer satisfaction with a gas appliance must be strongly related to its operating properly, continuing to do so for a reasonable length of time and the ability for it to be repaired quickly when necessary. A combination of Approving the appliance to a satisfactory standard, ensuring the quality of its production is adequate, installing it correctly and being able to supply the correct spare parts were all aspects dealt with by Watson House with this aim. To give feedback on the reliability of appliances during the in-guarantee period in the field, a scheme called the National Defect Monitoring Scheme (NDMS) had been set up in which selected Regions provided monthly feedback on appliance faults. In the early 70s a new approach to improving quality was taken, based on a statistical sampling technique to define acceptable quality levels. An inevitable information source used by Regions was the listing of the numbered Gas Council spare parts. The Standardisation Section at Watson House provided this service but the number of spare parts increased so much that the complete paper listing reached a size of 15 volumes. These were converted to much more compact microfilm versions in the early 70s. In addition, the Information Section produced the Watson House Bulletin as well as answering most of the many telephone and written queries received. One essential feature of the Bulletin continued to be the listing of newly Approved appliances, controls and installation components.

On the installation side, a wide range of activities was under way, including confirming the adequacy of 15 mm diameter copper pipework for gas pipework, improved materials, design and testing of improved components such as plug in connectors, developments of tap handles for the disabled, producing a specification for central heating pumps, development of a 'multifunctional' meter control and a flexible catering connector, early work on gas detectors, mathematical modelling and statistical analysis. Ideas which did not come to fruition at the time were fluidic control of gas flows, non-electric central heating pumps and the Shop Heater. The possibilities of using gas heat pumps were being seriously considered for the first time and this topic was to involve much future R&D effort.

The Watson House Club was run at Peterborough Road by Jack Fielder of the North Thames Training Department, with Edna Jenkins as secretary. In 1977 North Thames began to move their training base to other locations and from this point all of the Officers and Executive members were drawn from Watson House R&D staff. In 1978 the Watson House Club became independent, no longer having direct links with North Thames Gas Sports Association or British Gas HQ Sports and Social Club. In 1973 the Sketch Club became affiliated to SEIFAS (South Eastern & International Federation of Artists Societies) and some members of the club regularly had their paintings accepted at SEIFAS Annual Exhibitions in London. The Sketch Club closed in 1984 through departure of many of its members to greener pastures.

The Golden Jubilee

The Golden Jubilee celebrations of Watson House extended between 22nd and 29th November 1976. The schedule was as follows:

• Monday 22nd November	VIP Visit and Luncheon
• Thursday 25th November	Gas Industry Visits
• Friday 24th November	Staff and Families
	Evening Staff Party
• Monday 29th November (50th Anniversary date)	Press Visit

The celebrations consisted of guided or free tours around the laboratories and not only included technical displays but also demonstrations of other activities such as staff hobbies. It was impractical to extend the celebrations to the Outstation 2 site so those staff brought their exhibits back to the main building. A gold covered booklet with a prize-winning 1926/1976 logo designed by Bomi Kaverana was issued to visitors. Hostesses were in the front entrance to welcome visitors and an information desk was available. Staff acted as tour guides and speakers. Jim Clayson, a keen philatelist, had arranged a post-box in the front entrance at which a commemorative Watson House Golden Jubilee envelope designed by Sarah Grosvenor could be posted and receive a special '22 Nov 76' postmark designed by Bomi Kaverana. all at a cost of 35p.

The opening day was attended by Sir Michael Milne-Watson, the son of the founder of Watson House. The event was marked by a luncheon at which a toast to the Queen was proposed by the Chairman of the British Gas Corporation, Mr (later Sir) Denis Rooke, after which Clifford Purkis proposed a toast to the Guests. Sir Michael replied to the toast. A splendid Jubilee cake, cooked under the direction of North Thames Catering Manager, Bill Fairclough and his Assistant Manager John Curry, was cut by Denis Rooke. Its decoration was both original and appropriate. Clifford Purkis was presented with a Delft china bowl by M J (Jan) Kraak, Director of the VEG Gazinstitut in Holland.

Other eminent guests included past BGC Chairman Sir Arthur Hetherington, the then current Deputy Chairman, Mr Jack Smith, John Gray, the Director of Research, and retired Director of Watson House, Mr Leslie Andrew. Distinguished Watson House 'old boys' (and girls) were invited, as were BGC Regional Chairmen, members of the Research Committee, members of associated bodies such as the SBGI and members of the IGU, IGE and overseas gas industry members. A binder containing the menu, Alan Burden's Bulletin Jubilee Supplement on the history of Watson House and an advance copy of Pat Patrick's IGE paper on Watson House was given to the guests. They were also given a Golden Jubilee calendar, incorporating photographs of the old Nine Elms building of 1926 and the Peterborough Road one of 1976. After the luncheon, Jim Clayson took courage to obtain the signatures of Denis Rooke, Michael Milne-Watson, Clifford Purkis, John Gray, Arthur Hetherington, Leslie W Andrew and Bertie Higgins (then secretary of the IGE) on one of the Watson House Golden Jubilee covers. This historic cover he donated to the archives of Watson House.

The Tuesday and Wednesday coincided with the 42nd Autumn meeting of the Institution of Gas Engineers, of which Clifford Purkis was the President. Pat Patrick gave his technical paper on '50 Years of Technical Achievement by Watson House' on 23rd November. The Jubilee represented a pinnacle of communication to those in and outside the industry and the more normal communications paled into insignificance at that time.

The Thursday was a very busy open day at Watson House for IGE members, Regional staff, SBGI members and kindred scientific and technical bodies. This was an occasion for many old acquaintances to be renewed.

Much ingenuity had gone into making some of the displays interesting for the younger generation as well as the more seasoned members. This proved invaluable on the final day of the celebrations when families visited Watson House, often with their children. The hobbies display had its own booklet, the interests being wide ranging. The day concluded with a Staff Party, which was a notable event, with dancing to the music of 'The Keytones' in the canteen. A memorable part of the evening was the parade by Robin Hill, then Assistant Service Director, in full Scottish kilt, playing the bagpipes in most expert and tuneful fashion. Prize-givings took place to the holder of the winning Jubilee ticket (Barry Sutton), the winner of the competition to guess the weight of the 79lb 14oz Jubilee cake (John Flood) and successful raffle ticket holders (Ede Seymour).

There was also a Watson House sketch entitled 'The Gas Man Cometh - Eventually!' on the difficulties of getting a cooker serviced, organised by Dr John Wilson and scripted by Peter Budd of Information Section. It included Miss Everwait, a housewife with a faulty cooker, who wrote to complain to the Chairman, Denis Rooke. The complaint was passed to Watson House and depicted staff from the Director downwards in a humorous fashion. Other memorable characters in the sketch were a Watson House tea-lady and a Watson House telephone operator.

An 'It's a Jubilee Knockout' competition had previously been held on 26th June at North Thames Sports Ground, Acton, and was the first major event of the Watson House Jubilee celebrations. It was heralded as a 'day to end all days' and there were some 200-250 participants. The event was master-minded by Jim Harrington-Tucker and Rodney To, who designed and constructed all the paraphernalia associated with the competition. In this of course, they were assisted by many willing helpers.

The first planning for the celebrations started in October 1974 and credit for their resounding success must go to the person co-ordinating the arrangements, Bob Bruce, as well as the many staff involved. VIP invitations had to be sent out as early as January 1976. A film of the Jubilee celebrations was taken by Dr Bomi Karavana and makes most interesting viewing for contemporaries of that period. A month after the Jubilee celebrations, Bob Bruce was to retire having achieved a 'job well done' and the post of Services Manager was given to Ron Clifford, who took over the organisation of Operation Update, the new Central Heating Conference and Sales/Service Seminars. At the same time, John Coleman became Chief Planning Officer, replacing Allan Brown who had joined Eastern Gas.

Immediate Post-Conversion Period

In 1977 the national programme of natural gas conversion was completed and, for the first time for nearly a decade, attention could be properly focused on the future needs of the gas industry. Once the immediate pressures of conversion were over, the prospect of appliances designed with natural gas in mind became a reality. In this respect, much work was already being carried out on cooker design and improved heating systems and this continued apace. However, the image of the gas cooker had been irreversibly destroyed during conversion and it was never to retrieve its earlier dominant market share. The energy crisis had provided a very strong spur to work on energy conservation and this was combined with a strong and effective attack from electricity on the newly secured domestic gas heating market. Although appliance efficiency measurements had been made routinely as part of the development process, there had been great sensitivity about publishing such information. As a result, unfavourable efficiency figures were assumed for gas systems, especially by the electricity industry and government departments.

Geoffrey Pickup, as Manager of the Heating Division, was given the mandate to collect and publish the necessary factual information, leading to a spate of laboratory, test house and home monitoring surveys. An IGE paper by him with Adrian Miles in 1977 was awarded the HE Jones Medal. Co-operation with the Department of the Environment in their 'Better Insulated Homes' programme was both technical and highly political and involved the monitoring of collections of gas heated homes, knowing that similar exercises were also being undertaken on electrically heated homes. Furthermore, the gas homes that had been selected were not necessarily good examples of gas technology, often not being fitted with the best appliances, insulation or controls. However, in retrospect the programme did result in a long term improvement away from the minimum cost solutions being offered at that time to more energy efficient heating systems.

At the same time there was concern about the competitive situation of gas in new housing. There were three main factors influencing this concern, namely (i) the small differences in running costs between gas and electricity, (ii) the unavailability of suitable small gas heating systems and (iii) the tendency to omit the chimney from the house construction. Watson House was working to develop suitable space heating and hot water systems and contributed, for example, to the 1977 Housing Development Workshop.

A significant stage had been reached in the design of the multifunctional control. This integrated the functions of meter control valve (employing a convenient push button), governor and filter into one and fitted directly above the meter as a single unit. Carl Roderick was its designer but, because it was constructed in brass to survive the half hour fire resistance test, unfortunately it was too expensive to be adopted.

Apart from the Bulletin, the main Watson House internal communication route was through Major Project Reviews in the Purkis era. The chronological numbering had reached number 41 in the space of seven years although the actual number was 44, due to sub-division. The origins of Watson House had been built around a very close appreciation of district problems and a one-to-one technical relationship with manufacturers. However, the increasing centralisation of the industry made it more difficult to maintain contact with the Area Boards and retain a good appreciation of the needs of the district. There was also a degree of polarisation of the relationship between manufacturers and Watson House, although it was generally they who were going to implement the R&D work.

It had now been decided to phase out 'Approval' and introduce British Standards Institution (BSI) certification for safety administered by the Quality Assurance Council. British Gas was to operate a Sales List for all domestic appliances sold through its own retail outlets. To be included on the list, an appliance would have to be subjected to a marketing assessment and selection would also be based on fitness for purpose, durability, servicing and other factors. In the Standards field, a number of agreements had been reached with the SBGI, including ones on boilers relating to noise levels and lint resistance. The raising of boiler efficiency requirements was under discussion. Progress in Europe included the publication of a standard for instantaneous water heaters (EN26) and the drafting of rationalised standards for cookers and convector heaters.

The work on synthetic diaphragms for domestic meters reached a major achievement when it was decreed in 1979 that, as from 1st April 1981, all domestic meters purchased by the British Gas Corporation would contain synthetic diaphragms.

With regard to the building and its operation, as already mentioned the structural supports for the building included the use of very long concrete beams. These were made from high alumina cement and, later, the building industry realised this material could

deteriorate in some cases. This required drilling and sampling of many pre-stressed concrete beams to ensure the building structure was safe and took place between 1975 and 1978, causing some disruption. The movement of North Thames personnel out of the Peterborough Road site to their new offices in Staines in 1977 had the effect of releasing a considerable amount of space to Watson House. Laboratory 20, the one time North Thames Industrial Showrooms, was converted into office space for the Heating Division and was occupied in April 1978. There was a period when permits to work started to be issued, primarily to ensure that rigs or equipment were left in a safe condition. In the end, Building Services undertook to specify much tighter standards for equipment construction, at considerable disadvantage to the cost and speed of construction of rigs.

Technological Change

The Patrick Era

Pat Patrick was a strong supporter of longer term R&D to develop new ideas for the future. He had been fostering this approach for many years but it began to flourish under his Directorship. Thus, a more fundamental understanding of the effect of low energy housing on the performance and comfort achieved by heating systems was required. Dusan Nevrala and Mike Green were the main contributors to this work, predictions being made of the shortening of the heating season, the importance of ventilation and the posing of the question as to whether upstairs heating was still necessary. Other new developments started, such as studies of the airflow around buildings, comfort monitoring in Watson House, flame stability of aerated burners, solar energy and ventilation in insulated houses.

Geoffrey Pickup, as Heating Division Manager, always kept in close contact with Regional staff. He had been concerned about the long term effects of new housing trends on the future heating market and this was now being reflected in the field. As mentioned previously, the gas heated low energy house had little running cost advantage over its electrically heated alternative. Also, the cost saving trend of eliminating chimneys from many new houses was serious for the gas industry. Gas fires with or without back boilers were ruled out and natural draught gas appliances could only be fitted to outside walls. Housing sizes were reducing, making it almost impossible in some cases even to find space for fitting boilers and hot water cylinders internally or balanced flues externally. What was needed was a new generation of compact gas appliances, some with fanned extended flues. The combi boiler then coming on to the market in Europe might be one answer. The new housing market was seen as the forerunner of a major proportion of the future gas heating market. Geoffrey convinced Pat Patrick of his concerns and this led eventually to a whole new programme of work supported by Marketing which persisted and developed over the remaining life of Watson House.

The results on the monitoring and design of heating systems were coming to fruition and were reported in a number of papers. Pickup and Miles were awarded a second HE Jones Medal for an IGE paper analysing the findings. Theoretical predictions of heating load, ventilation characteristics and comfort were being used in conjunction with the practical findings. It was a most productive time for publications relating to the general area of heating. Work on condensing boilers had been started, some of the concerns being the effect the acidic condensate might have on drains and the possible dangers of adding a secondary (condensing) heat exchanger to an existing appliance. Serious new work also started on a gas absorption heat pump, in conjunction with ICI on working fluids and Stelrad on the design. At the time the project was clothed in great secrecy, the two outside participants being referred to as firms X and Y, the special lock on the door of Laboratory 13 still remaining until closure of the building. Although technically successful, the project was to fail, eventually, because the working fluids and their containment had too high a cost but provided valuable experience for future studies.

PAT PATRICK PROFILE

Pat Patrick was educated at Christ's Hospital and joined the gas industry on 4th September 1939 (the day after war broke out). During the war he worked on the generation of producer gas for vehicle propulsion and on an emergency standby production plant for town gas in factories. In this difficult period he also gained an honours degree in chemistry at Birkbeck College through part-time study in the short space of three years. He was awarded the Macnab Medal of the Institute of Chemical Engineers in 1945.

He worked for the Industrial Laboratory at Watson House after the war and, from 1953, took charge of it. In 1963 he was appointed Research Manager, rebuilding an effective activity which had previously virtually disappeared under the more short term activities of Development and Approval. He formulated the research programme in the knowledge that the industry would always require knowledge of combustion, heat transfer, aerodynamics and materials, the latter being a novel concept at the time. He succeeded in attracting new talent into a Watson House organisation that was essentially mature.

In 1969, upon Duncan Wills' retirement, he became responsible for both Research and Development and was appointed Assistant Director (R&D) in 1970. He was Chairman of Council of the Heating and Ventilation Research Association at the transition point when it changed its title to the Building Services Research and Information Association (BSRIA).

A McKinsey study of British Gas operating procedures suggested there should be regular joint reviews between Marketing and R&D. Pat was responsible for introducing the concept of Major Project Reviews, which was one way of achieving this objective. At the time the reviews were regarded as a novel and businesslike way of registering technical achievement with Marketing and of obtaining decisions on future R&D work programmes. There was the new challenge of communicating ideas to End Users who were a mixture of technical and non-technical people plus the risk of showing new ideas before they were adequately developed. Perhaps even more difficult was the identification of new lines of work that the End User would support. However, he recalls with satisfaction a Domestic Sales Manager telling him, "I can't tell you what research you should be doing - you can judge that better than I can."

Pat became Director on 1st July 1978, upon the retirement of Clifford Purkis, and continued in that role until his retirement on 30th June 1981. Two weeks before his retirement he was a contributor to a Parliamentary Select Committee on Energy on the subject of Energy Conservation in Buildings.

He and his wife now live in Ottery St Mary in Devon.

Some builders were considering a new type of house construction in this country, namely timber frame, in which the internal walls were of plasterboard covering the timber frame although the external brick appearance was quite normal. This new development was of relevance to the gas industry as, no longer could a substantial internal wall be relied on to support, for example, a heavy boiler. Much work, mostly by Segas Central laboratories on contract to Watson House, was undertaken on secure methods of fixing appliances. There were also concerns about condensation and eventual rotting of the timber frame structure should the plastic vapour seal be broken and not repaired, for example when fitting a flue or pipework. These reservations were confirmed some four years later when the reputation of timber frame houses suffered a setback and Watson House held briefing meetings for Regions and the SBGI.

Pat Patrick realised at an early stage the likely influence of the introduction of microprocessor based controls on gas systems. Microelectronic systems, as they were later to be called, were known to be subject to temperature limitations, otherwise reliability could be affected, and to corruption by electric and magnetic fields. The means of testing them in comparison with conventional mechanical systems was not at all clear. Therefore a Microelectronics Group was set up under Nigel Moore to tackle these problems, particularly in relation to the potential use of microelectronic controls in safety applications on appliances. This work developed to a liaison with the SBGI and TACMA (Timing and Controls Manufacturers Association) both on standardisation and safety issues.

Considerable effort continued on improvements to cookers, especially to improve their poor ignition reliability and appearance. Spark ignition had been seen as the answer to ignition problems but, of course, it too had its limitations. The two leaders on the short-term and longer term aspects of spark ignition were Bentley Ekins and John Sayers. Most of these problems could be overcome by the correct selection of ignition generator, proper specification and routing of the wiring, and integration of the ignition into the burner. It was important that the spark occurred in the correct region of gas/air mixture and had sufficient energy. There were also concerns whether accidentally touching a spark electrode might constitute a health hazard and whether spark ignition might cause unacceptable electromagnetic interference. A proposal was made to rationalise the proliferating number of spark ignition components and a presentation to cooker manufacturers took place in June 1979. Today these problems are largely overcome but, in their day, they presented a major technical challenge. John Sayers brought all of this work together by drafting a treatise on ignition.

The design of the cooker had been subject to considerable investigation in Clifford Purkis' time, especially that of the hotplate. Work was still continuing, but at a lower level. Both enamelled cast iron and stainless steel pan supports were in use and the discoloration of the latter, once having been heated by the flame, was a source of customer dissatisfaction. Alternative materials for pan supports were investigated by the Materials Group under Norman Chapman, including the stainless steel alloy containing yttrium. This was being promoted by Harwell as a new material and was supposed to form a thin protective aluminium oxide layer, preventing discoloration when heated. However, it was found that the material did not come up to expectation and, unfortunately, was as prone to spillage discoloration as conventional pan supports.

The concept of forced convection for catering ovens was already well established and Dick Burge pioneered the development (somewhat at odds to the official programme) of a 'dual purpose' domestic oven design which was capable of operating in both conventional or forced convection modes. The production of the oven was explored with Carron but, because the manufacturer had other commitments, unfortunately the oven never reached the market-place.

As early as 1966, Pat Patrick had taken the initiative for the Research Division at Watson House to investigate the possible environmental problems associated with the combustion of gas for domestic purposes. Consequently, as expertise grew an appreciation of the extent of, for example, oxides of nitrogen (NO_x) production by domestic appliances was gradually built up. It was not until some time later that academics such as Melia and Florey published papers purporting to establish links between gas cooking and respiratory health. However, these apparent links were not strong and Watson House suggested they could be associated with other factors such as smoking in the home, causing the authors to re-examine their data. Had Patrick not had the foresight to start the environmental work, it is quite possible that the gas industry could have been placed in a difficult position, and without foundation.

The Engineering Development Division was taking a critical look at the reliability of mercury flame failure devices (FFDs). This was the precursor of many reliability improvements to FFDs. With the Materials Group they were also examining alternative designs based on the differential expansion of metals, in co-operation with a manufacturer. Other components started to be examined, such as boiler thermocouples, heat exchangers and solenoids.

Watson House gained a very high reputation with Production and Supply Division from its work on the interchangeability of gases. This had led to the development of an empirical method of predicting the effects of changes in gas composition on the suitability of the gas for use in domestic appliances. Two safety limits were defined for distributed gas, one for normal use and one for limited emergency use. A demonstration of the effects of gas quality was set up showing the variation in flame characteristics on difference gases. Papers on interchangeability won Institution of Gas Engineers Gold medals for Watson House staff on two occasions, the first for Peter Jessen and Bob South in 1978 and the second for Brian Dutton in 1984. The same topic also resulted in a prize for the best paper at the London and Southern Junior Gas Association.

Within the space of three months after Pat Patrick became Director, George Percival had joined Watson House to take over his Assistant Director role, Alan Sussex had been promoted to Assistant Director replacing Roland Law, John Coleman had been promoted to Administration Manager and Martin Hatton had been promoted to Chief Planning Officer. In the next few months, John Tipping resigned from his post of Engineering Development Manager, Adrian Miles had been promoted to Installation Manager and Peter Jessen transferred from Assistant Manager, Cooking & Combustion to Heating.

The Monopolies and Mergers Commission were undertaking an investigation into the possible existence of a British Gas Corporation monopoly in the supply of certain domestic gas appliances, namely cookers, space heaters and instantaneous water heaters. This had been set up seven months before Clifford Purkis retired but the brunt of the investigation from the Watson House viewpoint was borne by Pat Patrick. The main queries with respect to Watson House were (i) whether there was any discrimination in the Approvals activities against appliances supplied independently of BGC and (ii) why BGC instead of manufacturers undertook R&D on appliances. On 24th February 1978 a list of questions was sent to BGC, Pat Patrick and Eric Dance being part of a Task Group set up to provide the answers. The replies were sent to the Commission on 28th July, to be followed by a further questionnaire to BGC on 24th October. The Commission visited Watson House on 8th December and were given a slide presentation on the work of Watson House by Pat Patrick. There was also a laboratory tour where senior staff gave presentations on BSI/QAC and sales listing test procedures, future gases and compatibility with appliances, gas fire and wall heater testing, cooker developments and appliance comparisons, fundamental research on ignition, reliability studies, accelerated life testing, noise research, test house studies, ventilation and flueing. In spite of this, the Commission wrote to BGC on 10th April 1979 indicating they had provisionally

concluded that a monopoly did exist. Following a BGC response the following September, the final report was produced in July 1980. It did have a profound effect on the type of testing carried out by Approvals, largely concentrating on safety with only limited attention to performance (primarily establishing the appliance is fit for purpose), and little further appliance development work took place in R&D for some years. Another major factor affecting Approvals was the EEC. This was described in a joint paper between a manufacturer, Watson House and the Department of Energy. There were proposals for a Gas Appliance Directive laying down the procedural framework for type testing, certification and production quality surveillance. This was to require considerable attention by Standards to the European scene, leading gradually to a harmonisation of standards.

In the spring of 1979, John Wilson took the adventurous step of leaving Watson House as Standards Manager to own and run a small hotel in Somerset. Jack Boddy retired as Assistant Manager at the same time, to be replaced in the next year by Ron Webb, who reported to John Elliott as the Manager of the newly formed Quality Assurance Division. Shortly afterwards, John Newcombe joined Watson House, reporting to Alan Wharf.

In 1978, the Watson House Club decided to hold their first Charity Walk in aid of Guide Dogs for the Blind. The route was over the riverside course via Putney Bridge and Hammersmith Bridge to the Bull at Barnes and back to Watson House. The organisers, Reg Needham, Pat Lehane and Ted Goreham, were heartened by the success of the walk, which raised the considerable sum of £750, and a presentation was made later by the Director. The walks, which were very popular with the participants and their families, became an annual event and raised the astonishing amount of over £30,000 in fifteen years. In 1986, the route of the walk was changed to Richmond Park by popular request. Pictures of some of the dogs were displayed in the Watson House entrance area. Pat Lehane's name became closely associated with the walks and in later events, part of the money raised was donated to St Joseph's Hospice in Hackney. The last walk took place in the autumn of 1992.

It was not until September 1979 that the Combustion, Ignition, Maths and Planning staff of Outstation 2 were able to complete their return to Peterborough Road. The Combustion Group moved to the first floor, the Ignition Group to Laboratory 7 on the ground floor, the Maths Group into part of the space left by North Thames Customer Accounting staff on the ground floor (Laboratory 4.3) and the Planning Group to the first floor. Later the rest of the space vacated by NT Customer Accounting housed the electrical testing section of Approvals and the new Microelectronics Laboratory, built after Nigel Moore arrived.

A new gas mixing and storage system had been installed in Watson House by the time Pat Patrick became Director, which meant the range of gases available to the laboratories was extended. Subsequently, there were three main changes in building requirements in addition to the laboratory modifications already mentioned. These were asbestos encapsulation, improved H&V equipment and flood precautions. The unfortunate discovery that asbestos had been used in the construction of the building meant that action had to be taken to protect staff. This was carried out by specialist teams of contractors closing and hermetically sealing one laboratory at a time, either removing or spraying the asbestos insulation material to make it safe. The activity started in 1981 and lasted for three years, the main task being completed in the first year. The Materials Group assisted in carrying out many sample analyses for asbestos. Improvements in the heating and ventilating system in Watson House were part of a continuing upgrading to improve the temperature control and comfort conditions in the offices and laboratories, especially the newly modified ones. In 1978, at a time before the Thames Barrier was built, there was a distinct risk of the river flooding the basement and ground floor of Watson House under an adverse combination of tide and wind. A Thames flood alert warning system was in operation and in true Watson House fashion, a contingency plan

was evolved by Ron Clifford, the Services Manager. Pieces of critical equipment on the ground floor, such as the electron microprobe in Materials or the Harris computer, were identified. The intention was that a standby crew would move any vital equipment if a flood alert was received. The purchase of a rubber dinghy, knowing Ron Clifford's liking for floating on water, was treated with some merriment. Fortunately the Barrier was erected in time before the feared flood occurred and life then returned to normal.

Probably the single most important event which took place in Pat Patrick's era was the Fellowship of Engineering Soiree. George Percival was put in charge of the arrangements and Ron Clifford and his team undertook a tremendous amount of preparatory work. The visit took place between 10th and 12th July 1979 and consisted of a Press visit, an evening visit of the Fellowship of Engineering, visits by school parties, an evening for Sir Denis Rooke's invited guests, a visit from the guests of Watson House and a family afternoon and evening. A blue booklet was prepared describing the many items on display. A large marquee was erected in the car park where the guests could dine and the event left everyone both elated and exhausted.

The first Sales and Service seminar took place in October 1980, with presentations to Regional representatives on the subject of heating and building construction. It was concerned, particularly with the revamping of heating systems for the new generation of highly insulated dwelling. The seminars were run by Ron Clifford and involved much collaboration between Marketing and Watson House.

An analysis of the numbers and types of visit made to Watson House was undertaken at the end of 1980 and showed that, over a period of 5 years, an average of nearly 2,400 visitors came to Watson House each year. This was considerably lower than the nearly 3,700 visitors in 1964, largely due to a reduction in educational visits. One visit which is still remembered by most of the management team of the time is that of Legal Services Committee on 8th March 1980. The exact date is given for legal reasons! The party were on their first visit to Watson House, had completed their morning meeting and had devoured their high class lunch on the fifth floor. They were conducted in parties to the lifts prior to the afternoon laboratory tour. Eric Dance's party, consisting of at least 50% of the British Gas HQ and Regional legal expertise in the country, travelled down to the ground floor, whereupon the brake mechanism malfunctioned. The eminent party was suddenly precipitated the last foot downwards onto the buffers in a great cloud of dust. It is supposed that legal people are used to disaster because of their profession. They took the necessary large step upwards out of the lift with amazing tolerance. The event certainly was not treated lightly by Watson House and the thought of possible appearances in court brought about the installation of a new lift brake mechanism in extremely short measure.

The Percival Era

By the time Pat Patrick had retired in 1981, to be replaced by George Percival, a number of new influences had arisen. These included changes in Marketing strategy to meet competition, mainly from the electricity industry. Other changes were brought about by the need to prepare for the single market in Europe, R&D agreements with the Japanese gas industry and decisions to work more closely with manufacturers. These all prompted a continuation of the spirit of innovation.

A new term was now beginning to be used, namely 'Starter Home.' There was deep Marketing concern that major builders were ignoring the gas option for new homes, particularly because of the combination of night storage heaters and immersion heaters. The troubles with timber framed houses had not had any apparent benefit to gas. Field evaluation of the new combi boilers had started and other ideas, such as the Cormorant storage system, were still on the drawing board.

GEORGE PERCIVAL PROFILE

George Percival was educated at the Roan School, Blackheath and Bournemouth Municipal College where he studied as an external student of London University. He joined the Gas Research Board (the Research Association of the Gas Industry) in January 1946 as a research assistant, working on gasification under Dr F J Dent. He first worked at Pitwines Works in Poole, Dorset on the development of processes for the production of low toxicity, sulphur free town gas at high pressure from coal, crude oil, fuel oil and, subsequently, naphtha. After nationalisation of the industry he continued the work in Birmingham and, from 1954, at the newly built Midlands Research Station in Solihull. In 1964 he was awarded the Gold Medal of the Institution of Gas Engineers.

He joined Woodall Duckham for two years in 1965 as Chief Process Engineer. He was co-inventor of the CRG process, used as a means of producing fuel gas from petroleum distillate, and for which he received the Queens Award for Industry in 1967. The process was one of a number for which he shared the MacRobert Award in 1971. He took up the role of Director of International Gas Consultancy Ltd. (a subsidiary company of British Gas) in 1973, based in the USA. In 1978 he was awarded the OBE in the Birthday Honours List.

He returned to this country in 1978, joining Watson House as Assistant Director, being responsible for Cooking & Combustion, Heating and Services Divisions, and for co-ordinating the research programme of the Station. He became Director of Watson House on 1st July 1981 on Pat Patrick's retirement. He was given the brief that an increased engineering emphasis was needed at Watson House, with attention being paid to the quality of construction and reliability of domestic gas appliances, particularly cookers. With regard to staff, he wanted to "create an environment in which staff could succeed and fail in their endeavours because true research is more about failing than succeeding." He was aware that the average age of staff was higher than in the other Stations and encouraged young talent and recruitment of staff in competition with external applicants. He says his sojourn at Watson House was one of the most enjoyable parts of his career.

He retired on 31st May 1985 and he and his wife continue to live in Horsham in Sussex.

A New Housing Task Force was set up, run by David Heslop of Marketing, on which Watson House representation was by Alan Sussex, Bob South and Norman Chapman. In 1983/4 there were visits of Laings, Barratts and Wimpeys to Watson House, including a visit of Sir Laurie Barratt with the BGC Chairman. They were shown the wide range of gas options on offer, including Hot Water Plus (W Midlands), the Andrews, Gledhill and Worcester Engineering Heat Slave hot water storage systems, the Se-Warm warm air/hot water system, the Baxi Brazilia convector/circulator system and an improved convector system. In addition, the Sevent and Williams gas flueing systems and the concealed meter installation were displayed as concepts.

Within two weeks of George Percival becoming Director, there was a one day national strike of British Gas NALGO members due to the threatened closure of many British Gas showrooms. This had the effect on Watson House that virtually no facilities were available that day (13th July 1981) and pickets were at the front gate. Ron Clifford and

Adrian Miles acted as overnight security guards and shared a cup of coffee with Stan Spraggons, NALGO Office Representative, when he arrived early in the morning as the first picket. Tragically, just over three years later, Stan was to die as the result of a car accident, only a matter of days before his retirement. He had represented the staff side on the Watson House Joint Consultative Committee for a number of years and was greatly respected as a reasonable man who could see both sides of an argument. This sad loss was commemorated by a clock which was installed in the entrance hall to Watson House. In October 1982 another highly respected member of staff, Ken Brady of the Standards Division, died. He was noted for his knowledge on all aspects of standards, especially flueing and ventilation.

Watson House publications on condensing boilers started in 1982. These appliances extract additional heat by condensing the water content of the flue gas, thereby achieving very high efficiencies. A paper by Martin Searle and Martin White explored the design challenges such appliances presented, as well as considering the features of even more energy efficient appliances, gas-fired heat pumps. For this they gained IGE Gold Medals. Condensing appliances did not become available in the UK until the next year although they were already having success in Holland. A new test rig was built to test them and a field evaluation started in 1984.

In the commercial field, the study of energy efficiency of heating systems in commercial buildings resulted in a number of papers being published. The performance of commercial condensing boilers was also studied in laboratory and field installations, again resulting in a number of published papers. A selection of these was brought together in a single booklet. British Gas R&D was awarded a contract to investigate energy savings in the commercial catering market in 1981. The contract, which ran until 1984, was co-funded by British Gas and the Commission of the European Economic Community. The results showed that 12% of catering energy could be saved from simple changes to appliance design, control and usage. The efficiencies of various designs of commercial boilers were measured and reported in a consistent manner. A guide to hot water plant sizing was produced in 1983 as a result of studies undertaken in 34 different schools, hotels, restaurants, offices and large stores.

Metering was being ascribed increasingly high priority and major expenditure towards the collaborative project on mainsborne remote meter reading supported by the Department of Industry was authorised. A policy statement on the possible implementation of remote meter reading, to which the gas, electricity and water utilities contributed, was prepared in 1983. Two more mundane metering concerns were the increasing pressures to introduce token meters and the challenging of the accuracy of diaphragm meter by the Gas Consumer Council, both of which occupied considerable management and staff time. One outstanding idea which received strong support from the New Housing Task Force was the concept of a novel domestic meter which was electronic in design. The challenge set was that it should be small and at least as accurate and cheap as the diaphragm meter. A Novel Domestic Meter Working Group was set up in 1984 to focus on the options for this design, involving expertise from all the Research Stations. This was chaired for most of its subsequent life by Alan Sussex.

The work in the relatively new field of microelectronics was beginning to mature. Meetings to evolve acceptance tests were in progress and, knowing that it is often much more difficult to identify a fault than correct it, a new approach of using microelectronic systems as an aid to diagnostics was being explored. Nigel Moore, Adrian Miles and Peter Finch were awarded an IGE Gold Medal in 1982 for their paper on the possibilities of using microelectronics in domestic utilisation. Improved communications, through the use of the telephone system Viewdata, was being sought by Quality Assurance as a means of transmitting information quickly to Regions. In retrospect, its capabilities ran far short of the future Company Office System but, in its day it was a considerable advance.

Some longer term work started in George Percival's time; of particular note was the work on fuel cells and the collaborative work between Watson House and TI on the fundamentals of cooker oven design. The first contact with Professor Steele of Imperial College on fuel cells took place in 1984 and was to continue for nearly a decade. The second took the flow pattern characteristics in relation to oven design and cooking performance. This identified the difference between desirable and undesirable features. What was not investigated at the time was the mechanism of transfer of heat into the food, combined with the cooking process and this was investigated later in a separate exercise.

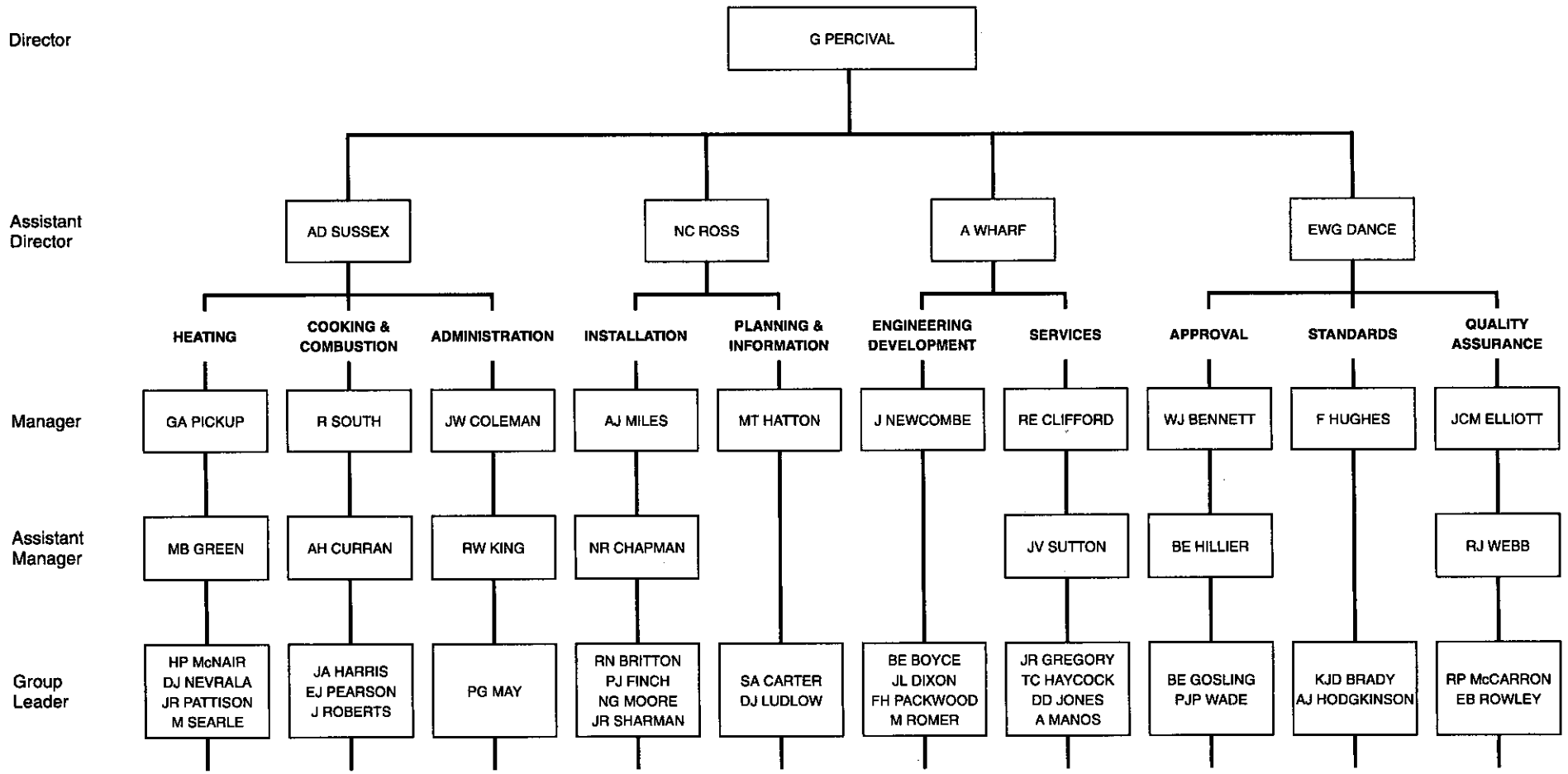
By 1983, the work on the toroidal and other fan alternatives by Engineering Development Division had reached the stage where a presentation was made to manufacturers. This was the beginning of the route leading to the manufacture of the fan and its incorporation into appliances. In the same year, the Watson House work on methane detectors had been in progress for a decade. At the time the two main types of detector, the catalytic and semiconductor types, still both had disadvantages of drift with time and other weaknesses.

The early 80s saw a large number of changes to the management structure. Just after George Percival became Director, Martin Hatton was made responsible for the Scientific Information Centre as well as Planning, the new team being termed Planning & Information Services. By October 1981, Norman Ross had been promoted to Assistant Director to fill the gap left by George Percival. At the end of 1981 there was a loss to Approvals Division, with Allan Sharman and Arthur Bullock both retiring. A few months later there was a redistribution of responsibilities of the Assistant Directors. Alan Sussex gained the Cooking & Combustion and Heating Divisions, retaining the Administration Division and passing the Installation and Planning & Information Services to Norman Ross. Alan Wharf became responsible for the Services Division in addition to the Engineering Development Division and Eric Dance retained his responsibilities for the Approvals, Standards and Quality Assurance Divisions. Furthermore, there were a number of promotions at Manager level, with Bob South looking after Cooking & Combustion Division, John Bennett (until that point regarded as a committed R&D man) being promoted to Manager of the Approval Division and Martin Hatton being given Manager status. These changes, plus the departure of Peter Jessen in late 1981, resulted in a further phase of promotions at Assistant Manager level, namely Alan Curran (Cooking & Combustion), Mike Green (Heating) and Norman Chapman (Installation).

Unlike later times, obtaining an adequate budget was not a major problem although a very strong case was required for its justification. Expenditure was always out of phase with the simplistic linear spend wanted by Finance Department - there was always virtually no expenditure at the beginning of the financial year and a worrying burst of expenditure at the end.

In the early 80s big changes started to take place in the way Line Service operated. This was due partly to the effect of the Monopolies Commission investigation of the gas industry, partly the result of the changing status of test houses in the EC and partly the need to demonstrate the capabilities of the test house. Thus it was that meetings to consider BSI Certification rather than the traditional Approval started in 1982, as did meetings to obtain accreditation by the government's National Testing Laboratory (NATLAS). By 1984, with the outcome of the MMC enquiry released, Sales Listing procedures of appliances changed, with Approvals test work concentrating on safety and, to a lesser extent, performance, leaving the rest to manufacturers. The title of the NATLAS and the BCS (British Calibration Service) schemes operated by the National Physical Laboratory at Teddington were amalgamated into one and were called NAMAS (National Measurement Accreditation Scheme) and Approvals gained accreditation in September 1984.

Watson House Organisation Structure: October 1982



In April 1983 there was a further reorganisation of the R&D Divisions, with replacement of the Heating, Installation and Cooking & Combustion Divisions by Utilisation Efficiency, Product Improvement and New Housing Divisions. Later on, the New Housing title was changed to Housing Development in line with changes in the main end user, Marketing Division. The organisation of the Watson House annual programme was changed accordingly for 1983/4. The responsibilities of the four Assistant Directors and the Divisions they controlled were modified at the same time. Eric Dance continued to be responsible for the Quality Assurance, Approval and Standards Divisions, Alan Sussex became responsible for New Housing and Utilisation Efficiency, and Norman Ross became responsible for Administration, Planning & Information Services and Product Improvement. At Assistant Manager level, Alan Curran and Jack Sutton joined Product Improvement Division and Norman Chapman joined New Housing Division. A further complication was that John Coleman took a secondment at ETSU, resulting in Martin Hatton becoming Acting Administration Manager and David Ludlow Acting as Planning & Information Services Officer. Geoffrey Pickup and John Pearson (Combustion Group Leader) resigned in August 1983 and in August 1984, Norman Ross was appointed to the post of Chief Co-ordinator at R&D (HQ). This resulted in a temporary widening of the responsibilities of the Assistant Directors until Bob South was appointed Assistant Director in February 1985.

In 1982 there was a first demonstration of the cook/chill food regeneration process to Watson House management at Acton. In this process, the food is pre-cooked at a central kitchen, stored/transported at 3 deg C and re-heated (regenerated) at the local site. There were some initial staff reservations about the associated hygiene and food safety but the quality of the food provided was excellent. It was on this basis and that of later demonstrations that cook/chill was accepted. A refurbishment of the Watson House kitchen equipment was undertaken during 1983/4 and the new facilities were given an inspection by the management team in February 1984 (i.e. some 9 months before the completion of the NT preparation area at Bromley). Not surprisingly, there were a few teething troubles when it was found that some food types were not ideally suited to cook/chill (e.g. fried foods). Even after these limitations were overcome, the general satisfaction was much lower than with the previous local cooking system, resulting in a liaison committee being set up.

The first North Thames First Aid competition was held in July 1983 at Acton Sports Ground, with the Watson House Women's team (Maureen Salter and Wen Reid) winning.

The building required continued expenditure on maintenance in the period 1981 to 1985. In 1981 there was a crane lift of new air conditioning plant to the roof of the building, temporarily closing the local roads. Phase III of the programme to replace obsolescent H&V equipment started in 1981 and was to last two years. The asbestos cleaning process was by now a familiar part of life in Watson House. The Exhibition area underwent refurbishment, a timber frame structure was built in Laboratory 17 and movement of some of the support beams at the front entrance caused disruptive remedial work in 1985.

George Percival quite rightly insisted on the traditional laboratory numbers (incomprehensible to all visitors and many occupants of the building) being changed to titles. Whilst many staff preferred the old laboratory numbers, it was also an opportunity for some of the more inventive to produce rather grand new titles.

George Percival's period as Director is remembered as one where the number of major committees visiting Watson House reached a peak. The types of communications activities was very varied. A Select Committee on Energy visit occurred in 1981, as did one of a number of visits from the Dutch meter purchasing organisation COOPRA. The latter were interested in the Watson House studies on remote meter reading and on the

history of the work on synthetic diaphragms for meters. These interests were shared by the visits of the Customer Accounting Committee and the Finance Policy Committee. In the same year George Percival was appointed to the selection committee for the Design for Energy Management (DEM) awards made to the Region and organisation achieving the most significant energy saving in the year. Roger Hitchin was called upon to undertake analyses of the various submissions, based on the work of the thermal loads of buildings and the work on running costs.

Another series of Watson House Open Days was held between 22nd and 25th June 1982. The first three days were reserved for Regional Marketing staff and the 25th for business contacts, HQ staff and LRS. Later the same day, friends and relatives of Watson House staff were invited. There were also visits from the Regional Chairmen's Committee, the Marketing Policy Committee, the Domestic Sales Committee, the Service Committee as well as the International Gas Research Conference (IGRC). In 1984 the final Sales and Service Seminar took place.

Turning now to the quality of Watson House communications through publications, Tony Manos joined Watson House on the Watson House Bulletin the same day as George Percival became Director. His brief was to revamp the main communication medium of Watson House, The Bulletin, into A4 size as a quarterly publication in full colour. The traditional appliance information of interest to service engineers was now separately covered in the Marketing publication 'Aspect' and this material was no longer included in the Bulletin, the target audience shifting towards Regional supervisory staff in Marketing. After a trial issue, which gained favourable comments from the readership, the new style Bulletin was first issued in April 1982. The following year, the Bulletin was voted as the best internal magazine with a circulation between 4,000 and 10,000 by the British Association of Industrial Editors. It was described as 'an outstanding example of technical journalism.' The appliance information was later reinstated by popular request and was provided as a handy removable folder.

The Dance Era

After George Percival retired in 1985, Eric Dance looked after Watson House in the interim period before a new Director was appointed. The main technical events which took place related to heating and metering. A seminar described the outcome of the Watson House work on condensing boilers was held, an article on energy saving summarised the results of field studies, including efficiencies and annual gas consumption, and the concept of a combined wall heater and circulator for new housing was being field tested. In terms of longer term work, there was the study of heat recovery which had started and a continuation of the work on heat pumps.

The main change to affect staff was the move of the Maths and Computing Group from the ground floor space (next to be occupied by Building Services) to Laboratory 230 on the second floor. These new facilities provided more space and separated the main computing facilities from the users of the terminals. During Eric Dance's period of responsibility the inner exhibition was refurbished and Morecambe Bay project staff took up residence in the building.

In November 1985 the tenancy of the rear car park, which had been in jeopardy for some time, was suddenly lost. This meant that staff who had previously been able to park their cars in that area were now obliged to leave them in the roads near Watson House.

There were a number of key events during the period. The first was the Open Days, which took place between 18th and 21st June 1985. The first three days were confined to nominees put forward by members of the Marketing Policy Committee. On the last days, members of organisations and business contacts nominated by staff were invited, followed by relatives and friends. The second event was the visit of the Research Committee three months later, to be followed by the third in December, a visit from the Chairman, Sir Denis Rooke.

Rationalisation of R&D

The Ross Era

1986, the year that Norman Ross became Director, was an eventful one in terms of British Gas, R&D and Watson House. It also represented a turning point in the history where it became clear that the unthinkable had happened - there was a finite life span for the building called 'Watson House.' It prompted a period of rationalisation where priorities were constantly changing, both from a personal viewpoint as well as in relation to the work being undertaken.

With regard to British Gas, it was the year that the announcement was made for the privatisation of the Gas Industry. This involved staff briefings and participation in the Privatisation Exhibition held at Altrincham in October 1986. However, it also had many long term implications.

In relation to R&D, the first rumours about relocation were voiced in 1986. The move of the southern stations was not confirmed until March 1987 but, for commercial and political reasons, the announcement of the site as being Stoneleigh was not made until October that year. Staff (including Mike Green) were seconded to help in the preparation of the case for using the site. When, unexpectedly, permission to use that site was refused by the Department of the Environment in November 1988, the search for an alternative location then began and over 150 sites were considered. It was not until October 1989 that Loughborough was officially confirmed as the site by British Gas. There followed a visit of R&D management on 13th November 1989 where a discussion on the New Research Centre, as it was then called, took place followed by a visit to the site, most unfortunately for David Lucas the organiser, in thick fog.

With respect to Watson House itself, it was transferred from North Thames to HQ on 1st April 1986. In retrospect, this can be seen as part of an increasing trend towards breaking traditional links which were no longer tenable. This resulted in unexpected changes such as improvements to the services available to staff, particularly the Minibus service calling at Parsons Green and Wandsworth Town Station (later Clapham Junction) and the establishment of a local banking facility on the first floor near Administration. However, it was not until 2 years later that Watson House staff salaries started to be paid by HQ. The change-over meant that the building was better utilised, with staff involved with the Morecambe Bay project being based at Peterborough Road for the period of their work. The transfer to HQ also had an important effect on the Watson House budget. Previously the expenses of running the building had been shared by Watson House and North Thames in a 70:30 ratio. The transfer meant that HQ were now responsible for the upkeep and servicing of the building, with the work continuing to be scheduled through Building Services.

NORMAN ROSS PROFILE

Norman Ross was born in Scotland and was educated at Aberdeen Academy. He obtained his BSc in Chemistry at Aberdeen University and continued there to complete a PhD. He first worked for six years on sponsored research and consultancy for the rubber and plastics industry at Yarsley Research Laboratories (later Fulmer Research Organisation).

On 31st January 1966 he joined the Materials Group (part of the Research Division) at Watson House, which was shortly to move in part, and eventually fully, to Outstation 1 at LRS. From his early days he started work on the development of synthetic diaphragms for domestic meters. Although such diaphragms are now commonplace, their structure is quite complex, consisting of a plastic fabric coated both sides with synthetic rubber. There were many technical problems to be solved such as life of the diaphragm, adhesion of the rubber to the fabric, pin-holing of the diaphragm and stiffness and general reproducibility of the material. The work culminated in a paper to the IGE in 1972 and eventually leather diaphragms were abandoned in this country in favour of synthetic ones on all domestic meters. He retained his interest in metering and flow measurement throughout his career.

He became Group Leader of the Materials Group in 1969. When the Research and Development activities were amalgamated into a single Division under Pat Patrick, the materials work transferred to the Development 'Unit.' When Pat Burke retired in February 1973, Norman took on extra responsibilities for installation, becoming Principal Technical Officer (Mechanical and Electrical Development), including ignition controls and mechanical engineering. He was promoted to Assistant Development Manager in 1973.

Following the changes that took place when Clifford Purkis retired, in 1978 he became Manager of the new Cooking and Combustion Division. Three years later he was promoted to Assistant Director. In 1984 he transferred to R&D (HQ) to become Chief Co-ordinator. He came back to Watson House as Director on 20th January 1986.

Norman Ross became Programme Controller, Domestic Utilisation and Corporate Research in the new matrix organisation for Loughborough on 17th February 1992. Therefore, his official role as Director of Watson House can be said to have ceased the previous day. However, staff still regarded him as Director and he still operated with most of those responsibilities until he moved to Loughborough in June 1993. He continued as Programme Controller at the Gas Research Centre until he retired on 30th November 1995.

He and his wife live in West Byfleet in Surrey.

There were a number of other events which occurred in 1986. For many years Watson House had allocated part of their funding to work undertaken by Segas Central laboratories at Old Kent Road. The Region was very useful in having close contact with district problems and had special expertise in flueing, heating system monitoring and installation techniques. Segas announced that the use of the site was going to change and all Watson House R&D work contracted to Segas stopped as a result. In April 1986, the final usage of the mobile test laboratory took place. It was transported to the Bacton terminal to investigate the effects of blending low Wobbe number gases from the Hamilton fields with normal gas. Immediately following Ron Clifford's year as President

of the London & Southern Junior Gas Association, David Jones took over from him in 1986. David Goodwin went on to win a prize for his short paper on token meters. It was also confirmed in that year that the canteen would continue to use the rather unpopular cook-chill food preparation process for at least another 2 years, this period eventually stretching to five years. Following the earlier termination of the tenancy of the rear car park, during 1986 the adjacent Drayton Paper Works was demolished, to be replaced by the new Hurlingham Square properties. It was also the beginning of a boom in building combined with the start of a Local Government general policy to upgrade Fulham, where gradually the new riverside sites near LRS, the building of superstores and improvements to the road system were to transform the area both north and south of the river. It was often remarked that the fifth floor of Watson House was an ideal spot to observe the large number of cranes towering above partly constructed buildings stretching to the limit of observation. This all changed, of course, when the economic crisis took hold.

With regard to the technical work in progress, Norman Ross had spent his early days at Watson House involved in metering studies but it is coincidental that, after interest in the topic had waned in the early 80s, it then took on an increasingly important role for the rest of the existence of Watson House. The mainsborne remote meter reading project was now operational at two sites, one in London and the other at Milton Keynes. Its purpose was to test the feasibility of passing signals and meter readings along the mains electricity wiring and involved considerable co-operation between Thorn EMI, British Gas, the Electricity Industry and the then Water Research Centre. A fair measure of technical success was achieved but the economics of remote meter reading, especially as meter reading costs were declining due to less frequent reading, were against it. A final report was produced in 1986.

About the same time, Seeboard had been demonstrating a telephone remote meter reading communication system also capable of load control called 'CALMU.' Later, the Electricity Council approached British Gas about possible collaboration in another project involving telephone communications and the use of a piece of a more advanced piece of electronic equipment called the Energy Management Unit (EMU). Both systems had the feature of remote meter reading but were primarily concerned with the Electricity Industry expanding their ability to adjust their electricity charges according to the load demands on their distribution system. An initial briefing note for the Director of Research had already been prepared. Neither system came to fruition but did exercise Robin Beasley to produce a 'Gas Interface Unit' (GIU) which was of modular design capable, by exchange of circuit boards, of operating using alternative communications media.

Whilst these rather forward looking projects were in progress, there was a much more down to earth concern about the security of prepayment meters. On the district, an increasing number of break-ins to retrieve coins was occurring. This resulted in much government pressure to develop a token meter, firstly mechanical and then electronic and this was done with the co-operation of manufacturers.

Then there were the special interests of British Gas in new housing, with the bulky diaphragm meter and its installation being seen at a severe disadvantage to electric alternatives. Neither was the conventional mechanical meter ideally suited to tomorrow's electronic technology. The Novel Meter Working Party examined a number of possible alternative working principles including ultrasonic, hot wire, fluidic and vortex shedding. In March 1987 a public seminar was held at Watson House at which potential manufacturers of a new meter were invited to submit their designs within three years to meet the Watson House specification. The proof of concept designs were tested in a new facility in part of Laboratory 17, including a very accurate piston prover 'Aerotrak' machine (the first to be installed in the country). This laboratory had been set up by January 1990. Although many proposals were offered, British Gas financially supported the development of only four of them. Eventually after field testing, the selection

was narrowed down to two ultrasonic designs, those by Siemens and Gill Electronic and these have been developed to production. In the early days of the Housing Development Task Force, replacements for the external meter box had been sought. The concealed and semi-concealed meter boxes resulted and the latter was particularly successful because it was less liable to water ingress and was easier to find. A seminar was held on the semi-concealed meter in 1986.

A metering distraction set for Peter Finch was to devise a gas meter suitable for use in schools. This was one of a series of measuring devices available to schools through British Gas but the meter was the most fundamental piece of gas related equipment. It had to be robust, safe, reasonably accurate and simple to use. Making use of a small diaphragm meter which was adapted to include an electronic output, a unit with convenient solid state visual display and a resetting facility was the end result. School children could now demonstrate that turning a hotplate burner up full with a small saucepan was wasteful.

One interesting line of investigation followed during the 80s was the development of new ways of increasing the gas load in the domestic market. Dr Ming Tung and his team devoted all of their considerable efforts to this task with a well noted persistence and enthusiasm. He had already been the technical expert who had developed the concept of a condensing gas fire, a variation of which was produced by Glowworm. The main lines of attack were (i) traditional electric loads such as the tumble dryer, (ii) ways of recovering some of the hot water load such as through the use of a novel high flow shower or a sink dishwasher and (iii) leisure applications of gas such as the Gas Spa and outside gas heating and lighting. Of these, the most successful was the gas tumble dryer but the shower concept also attracted the interest of a manufacturer. The original 3 kW version of the gas tumble dryer was produced by Crosslee , but the burner and control system for the later high speed 4.6 kW dryer was developed for Crosslee by Watson House within a very tight space constraint and manufactured cost target. Following challenges from the Electricity Industry about British Gas claims about running costs, Watson House arranged a survey to establish that tumble dryers did not need an annual service. One aspect looked at in particular was the possible susceptibility of the dryer to linting, to which it proved surprisingly resistant.

A number of condensing appliances were now available on the market and, in some cases, there were instances of corrosion. This was considered to be due mainly to very low levels of chloride contamination of the indoor combustion air. Two approaches were followed, (i) a survey of district chloride levels, collecting condensate samples and analysing them, and (ii) laboratory tests on appliances, contaminating the inlet gas/air mixture with known amounts of chloride. Alan Shiret was the acknowledged expert on this phenomenon, which was very difficult to investigate as the corrosion depended on the appliance operating conditions and its design. It was possible for highly acidic condensate to form in localised areas under a certain regime although this should be overcome by adequate design. The survey indicated a very wide range of ambient chloride levels, mostly very low. When any new design of appliance came to Watson House, should Marketing agree to it being tested, the manufacturer was well advised to wait for the rather lengthy chloride tests to take place rather than launch the product on to the market. The work vindicated the earlier decision that condensing boilers should only be used with balanced flues, as against open flues where the combustion air was taken from within the dwelling.

The collaborative work on oven design was mentioned earlier. This work was shelved for some years due to changes in TI. Pressures arose from Marketing for gas to compete in some way with microwave ovens, particularly for preparing convenience foods. It was discovered that virtually no published information existed on the thermal characteristics of food and this was an essential piece of information to progress further. A contract with the Biotechnology Department at South Bank Polytechnic (later University) was set up to

measure these characteristics, simultaneously with computer simulation of oven flows and temperatures, making use of the earlier work. There is every prospect that, using the information from this project, a more fundamental procedure for designing gas ovens, not just those for convenience foods, will result.

In 1987 there were a number of retirements from Watson House, including Ron Clifford, Jack Sutton, Bentley Ekins and Eric Dance. Mike Patterson succeeded Ron Clifford as Services Manager. There were also a number of changes in the approvals function. The Divisional name of Approval & Installation was changed to Testing & Certification (T&C) in April 1987, with formal agreement for Watson House to undertake BSI Approval testing the following November. The Assistant Manager, Brian Hillier, retired in March 1988, with Brian Gosling and Peter Wade then being promoted to Assistant Managers. This was followed closely by John Bennett, the Manager, retiring and the promotion of Brian Gosling to Line Service Manager, with responsibilities for Quality Assurance as well as T&C, taking over part of Eric Dance's previous responsibilities.

Another staff matter, which was implemented on 1st January 1988, was the R&D Classification Scheme for Scientists and Engineers. This was introduced to rationalise the job titles and staff grading throughout R&D and it defined the employee and job profile for each grading. Those in the scheme were guaranteed an automatic continuation to their maximum grading as per the previous Watson House Classification scheme. However, for new recruits progression to the next higher grade was based on performance. Some staff were, by definition, excluded from the new scheme. For the first time, a separate distinction was made between technical experts and Assistant Managers at the higher management grades.

For many years Watson House had been attempting to complete the protracted negotiations to obtain a Fire Certificate for the building. This was finally issued on 14th January 1988. Probably the most notable feature of the now ultra fire-safe Watson House were the seven large fire doors in the ground floor corridors which were held open electromagnetically and closed automatically any time the fire alarm sounded.

In August 1988, Mr Clerehugh's title changed to Director of Research and Technology and from this point onwards the previous R&D title was changed to R&T. At the same time, in Watson House Bob South transferred from his Assistant Director post to HQ and Mike Green was appointed as his successor. As a result there was some re-shuffling of the organisation, with Norman Chapman being promoted to Manager of Product Improvement, Adrian Miles transferring from Product Improvement to Utilisation Efficiency and Peter Finch transferring to Assistant Manager of Housing Development. Robin Beasley was promoted to Assistant Manager, Product Improvement. The previous changes were further complicated by a re-titling of the Watson House R&T Divisions in March 1989 with Utilisation Efficiency, Housing Development and Product Improvement Divisions changing to Appliances & Systems, Built Environment and Materials & Metering Divisions. However, within a few months of this the terms Technical Manager and Programme Manager (later to expand to Business Area Manager) started to be used in management meetings as part of the lead towards the new matrix structure. So it was that the old Divisional structure and an unofficial and evolving matrix management system operated simultaneously for over two years. Management discussions to consider the structure of the matrix started at the end of 1989.

The search for new ways of providing a heat and hot water service in homes and large buildings continued but a new approach pursued was through the use of designs using stored hot water to supply heating, enabling a reduction in boiler sizing. A study was carried out in association with Cranfield Institute of Technology to quantify the benefits in groups of dwellings. This system looked as though it might have application, in particular, in Eastern Europe and the work received strong support from Global Gas (a

new sub-division of British Gas). The measurement of heat supplied was another problem tackled using a system called 'Datagas,' where the apportioning of the total gas bill could be carried out by taking readings at a central point in the building or even remotely at the Regional Headquarters. The sensor units were much less expensive than accurate heat meters.

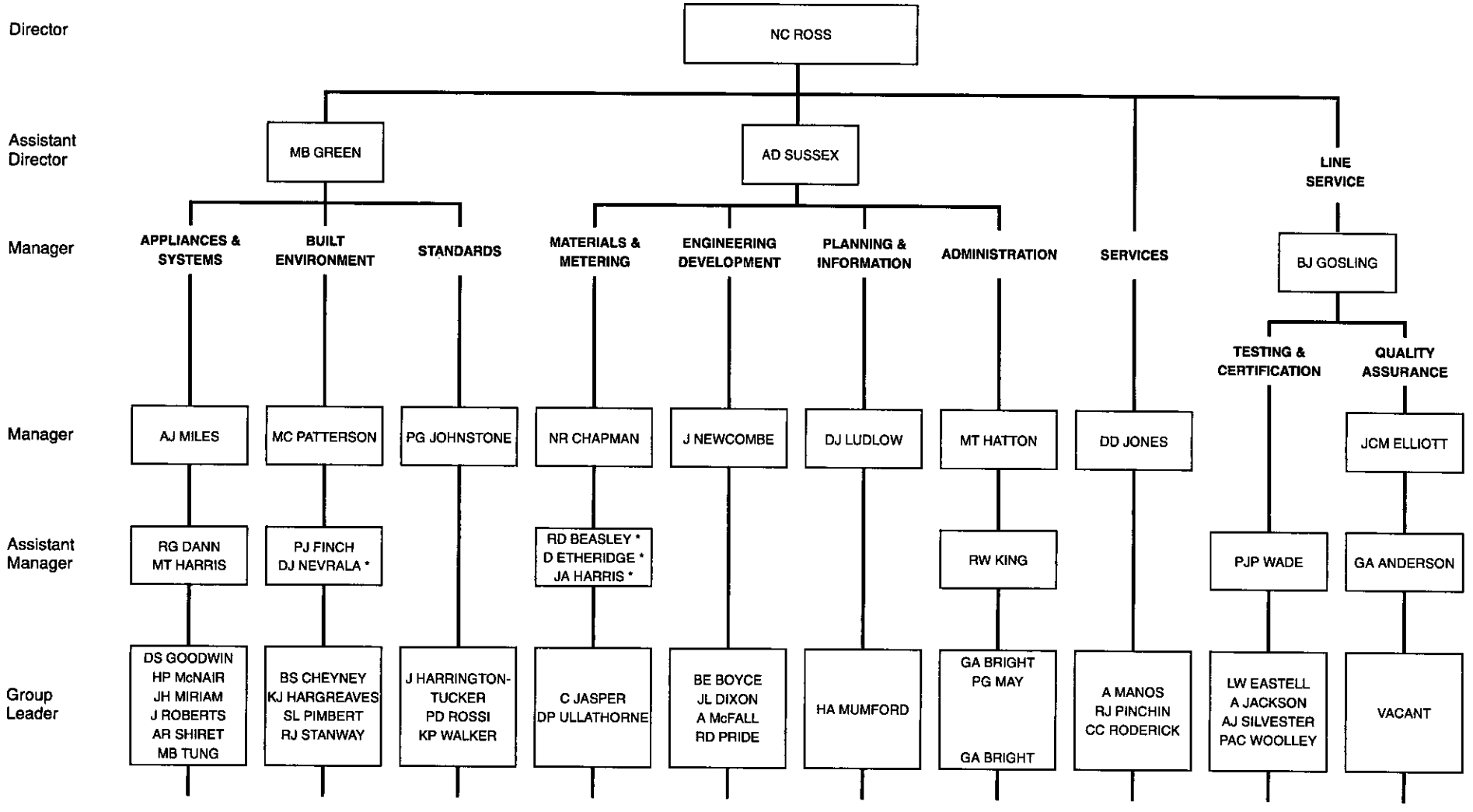
Looking forward to the next generation of heating appliances, work on pre-mixed burners and controls had been in progress for some years. The working limits of ribbon burners had been defined in terms of combustion characteristics, dimensions and burner overheat. These results were then extended to the use of surface combustion ceramic plaques, which had a wider operating range. A collaboration with the Japanese had also been completed. The main advantages of the pre-mixed system were its compactness, the use of minimum excess combustion air, so maximising the efficiency, low production of NO_x and the ability to work in any orientation. There was considerable pressure in Europe to reduce NO_x and this work was looking beyond the next generation of appliances to a time when most of the simpler techniques of NO_x reduction would not meet standards of the future. The findings were described in an IGE paper in 1986, which gained Gold Medals for the authors, Keith Hargreaves, Howard Jones and David Smith (LRS).

By the late 80s, the technical value of the High Wycombe test house became limited due to advances in methods of building construction and heat loss reduction since its original purchase. Therefore, it was sold and in mid-1988 a matched pair of houses was purchased on an estate at Didcot. Using such a pair of houses enabled the effects of subtle changes to heating systems to be compared. The site was chosen with both Watson House and the New Research Station in mind, taking into account that matched pairs of this type (not mirror image pairs) are extremely rare. Because of the distances involved, comprehensive remote monitoring and control facilities were set up and used successfully.

In the autumn of 1989 it was announced that the organisation of British Gas was to be changed and would be broken down into three Business Units, namely UK Gas Business, Exploration & Production and New Business Development. It was also about this time that the new Chief Executive of British Gas, Cedric Brown, indicated that he would like to see R&T effort concentrated on a number of selected activities, particularly power generation, cooling by gas and natural gas vehicles. Both had a considerable effect on R&T. The Watson House programmes on power generation and cooling were reconsidered and modified. The charging of R&T costs to End Users started with the financial year commencing 1st April 1990, with the rest being corporately funded. Another effect of these changes was that the last Major Project Review took place in October 1989, the topic being diagnostics. The demise of Major Project Reviews came about primarily because of (i) the evolution towards the new matrix management structure in which the 'Programme side' relied on a regular dialogue with the End User and (ii) the introduction of a system of deliverable appraisals, including cost-benefit analysis.

In August 1989, Alan Curran, Manager of Built Environment, transferred to R&T HQ. This resulted in Mike Patterson transferring from Services Division to replace him. David Jones was then promoted to Services Manager. In December 1989, both Alan Wharf, as Assistant Director and Frank Hughes, as Standards Manager retired. Paul Johnstone joined Watson House to take over Frank's post. However, from now on, not all senior posts vacated were refilled and Alan was not replaced. The retirement of Ron Webb from Quality Assurance took place in the spring of the next year and Gordon Anderson was promoted to Assistant Manager.

Watson House Organisation Structure: December 1991



* Senior Principal Scientist/Engineer

In February 1990 there were management presentations to all staff on the details and timing of the move, the setting up of a relocation agency, the proposal for individual interviews to take place and on the options of moving to Loughborough, seeking redeployment or, in the last resort, taking British Gas redundancy. Coach trips were arranged for staff and families to visit the Loughborough area.

At the end of 1990 it was announced that the 1991 R&T programme would be split into four, namely UK Gas Business, Exploration & Production, Global Gas and Corporate. The intention was to operate on a one-to-one basis between R&T Business Area Managers and the corresponding End User Liaison Officers. The next year's programme had to be revamped according to the new format very quickly as, for the first time, the next financial year commencement was to be on 1st January. The new programme was now broken down into 'Business Area Sheets.' Although there were a number of changes of responsibility, to a close approximation those acting as Business Area Managers (BAMs) were:

• Housing	Mike Patterson
• Domestic Power Generation	Adrian Miles
• Heating and Cooling	Adrian Miles
• Customer Services	John Newcombe
• Kitchen and Leisure	Adrian Miles
• Commercial Catering	Adrian Miles
• Global Gas	Peter Finch
• Corporate Work	Mike Patterson
• Standards	Paul Johnstone
• Line Service	Brian Gosling

In the temporary situation, the Business Area Managers still retained their old Divisional responsibilities for staff. Also, because not all of the appointments of End User Liaison Officers had been made, programme discussions were undertaken with nominated representatives, most of whom were not the final appointees. In the spring of 1991 it was announced that the new programme 'deliverables' would be expected to be fulfilled within 5% targets on both time and cost.

One project of direct concern to Customer Services related to boiler servicing. When undertaking regular servicing it was desirable to be able to gauge the condition of the appliance, to guide the extent of cleaning and servicing required. This was envisaged as being rather similar to the list supplied when a car has been subjected to a Ministry of Transport test. Therefore, a test device was needed for district use to indicate the combustion performance of the appliance. Engineering Development were heavily involved in this project and a small CO/CO_2 analyser, relying on solid state sensors, was the result. This was subjected to intensive laboratory and district testing. A new concept of measuring the combustion and then deciding whether or not to carry out cleaning of the appliance, based on the CO/CO_2 ratio, was tried and implemented successfully.

In November 1991, a newsletter was issued to all R&T staff naming those in the new matrix organisation structure down to Controller level. This is the point at which Norman Ross was announced as becoming 'Programme Controller, Domestic Utilisation and Corporate Research,' Mike Green was appointed 'Technical Controller, Chemical Sciences' and Lawrence Conway of Midlands Research Station was to become 'General Manager, New Research Centre.' He also had responsibilities for the administration and support services of the three southern Research Stations prior to their closure. By the end of August, most of the outstanding positions down to SM2 level had been filled and staff in the classification scheme had been sent letters informing them of the Division to which they had been allocated.

While all of the above important changes had been taking place, there had also been considerable alterations to the management support systems available in Watson House, primarily due to advances in information technology. Suggestions that a management information system should be set up to include details of the programme, expenditure and organisation changes were being discussed as far back as 1986. The increased usage of word processors, now by technical staff, some of whom were receiving training in the then preferred SAMNA system, was another factor. Some local networks for the interchange of electronic information had been set up. In addition, purchase of an R&D Management Information System (R&DMIS) for Watson House was approved in 1988. The key to further improvements was through the use of a standard communications system. This was organised by David Goodwin, the head of the Information Technology Group and Assistant Manager, Nigel Moore. In 1988 David gave the first presentation on the ALL-IN-1 Company Office System (COS), where users would be able to communicate through a network scheme via the use of their individual terminals. It also corresponded with the purchase of the VAX 8250 computer. Following a benefits analysis, secondment of David Goodwin to an R&T COS team and approval of the expenditure, COS started to be installed at Watson House at the end of 1990. It used WPS Plus rather than SAMNA. Mail could now be sent by COS and word processing became available through COS to a limited number of users in the middle of 1991. The system was introduced progressively to R&T and to other functions in British Gas. Refinements, such as an invoicing system (EARS), were added later.

Once the modifications to the car park had taken place to accommodate the new entrance and exit barriers for vehicles, including card operation, it was a logical step to extend this process to improve security of staff entry. In 1990 new turnstiles were fitted at the front entrance, also card operated. An unforgettable occasion for most members of staff is the hurricane that struck the country on 25th January 1990. Many were unable to travel to Watson House that day because of the fallen trees blocking their routes. The ceiling tiling in front of the building entrance was mostly ripped out but otherwise the building was relatively undamaged. It was fortuitous that the inclement weather coincided with a first visit of a party including Mr Clerehugh to the new Didcot test houses. One of the houses had suffered a lightning strike, damaging the ridge tiling, and during the whole of the remarkably successful visit the mains electricity was cut off, preventing most of the practical demonstrations of home automation taking place.

The previous high level of committee visits which took place during the Percival era settled to a lower level under Norman Ross. Of particular note was the Soiree held for the Worshipful Company of Engineers in March 1986. No special celebrations took place for the Diamond Jubilee of Watson House in October 1986. However, the occasion was recorded in a Bulletin article, especially as it coincided with the Golden Jubilee of the Bulletin itself. In the late 80s the committee structure of British Gas underwent a considerable reorganisation, with the number of committees being cut drastically. The representation of R&T on the remaining committees became very limited. Therefore, this traditional method of communication was largely lost, although the high level Research Committee still visited Watson House on a regular basis. On the other hand, undoubtedly the contact with End User supporters of the R&T programme increased dramatically. This was offset by an overall reduced liaison with Regions and the district. The final Operations Update, for example, took place in 1987. In the new business climate there were generally less formal presentations to the SBGI although an important seminar took place in 1989 on NO_x. Another milestone in external communications was the publication of a monograph summarising years of work on burners, written by a British Gas Teaching Fellow (formerly of Watson House) at the University of Cambridge, Dr Howard Jones.

A national organisation was very interested in producing the hot working tools designed by Engineering Development to enable the making of T-joints or changing thermostatic valve interiors while the heating system was still full of hot water. They are now available

on the DIY market. There was the Rotex heat pump project, supported by Global Gas and which received EC funding. This was aimed at providing domestic gas cooling as well as heating in the European market, and eventually in the US and Japanese markets. Caradon Mira, Lennox, Catalana de Gas and Fagor (Spain) have been collaborating with British Gas in the development of a working prototype. At the time of writing, the project is still progressing very well and is attracting considerable interest from abroad.

A number of longer term investigations were set up in Norman Ross' time, some of which could find an application in the future. Examples were the 'wideburn' appliance whose optical detection system adjusted the burner according to the quality of gas supplied, Japanese engine driven heat pumps and the Foster Wheeler absorption heat pump. Work on fuel cell developments, appliance diagnostics through the use of microelectronics and gas sensors was still continuing. A joint MRS/Watson House paper on the possibilities of utilising natural gas in fuel cells for direct electrical power generation and in combined heat and power schemes won an IGE Gold Medal for John Parsons. Other developments included second generation heating systems (involving a much higher features specification than conventional central heating), feasibility investigations of domestic power generation and new sensors for methane, oxygen and CO. One possible threat was the University of Bristol survey of children's health, which included looking at the effects of gas cooking, justifying the continued work on ventilation and NO_x.

Without a doubt, the major technical event to occur during this period was related to the success of the ultrasonic meter development. On 27th April 1992, the Prince of Wales Award was given to the Gill meter. The subsequent IGE paper, which gained Gold Medals for the authors, recorded the technical background and much credit must go to Alan Sussex, Norman Chapman, David Etheridge and the Watson House team involved as well as the manufacturer for the success of the project. On 22nd November 1995 the same project was awarded the prestigious Royal Academy of Engineering MacRobert Award for Innovation in Engineering. This was accepted on behalf of British Gas and Gill Electronic R&D by the Chief Executive of British Gas, Mr Cedric Brown. It represented the culmination of 10 years work, 8 of them at Watson House, leading to the widespread introduction of the new meter which is already installed in nearly half a million homes.

Closure

Although the move to GRC was increasingly a disturbing influence, as far as humanly possible the work on the R&T programme, Testing & Certification and Quality Assurance was maintained. Some pieces of equipment, such as central heating and hot water test rigs, were very difficult to move and had to be scrapped and rebuilt at GRC. Moves of equipment were arranged to cause the minimum possible disturbance to the work programme. At the beginning of 1993 a set of archive photographs recording the staff in their laboratories were taken. Increasingly those staff who were moving to the Loughborough area spent time gathering information, searching for their accommodation and being briefed on their new surroundings. The moves were phased on a weekly basis. As the closure of Watson House approached, the normal facilities were gradually withdrawn, such as visual aids in Committee Rooms, stationery, computer terminals, and print room and drawing office facilities etc. From January 1993, the Technical Information and Parts Listing staff, a total of 10 people, transferred officially to Headquarters Marketing. However, they continued to be sited at Watson House until they moved to the Holborn offices on 1st June. Progressively whole laboratories emptied during June, with a skeleton staff of those taking voluntary redundancy remaining. The loss of staff due to resignation, redeployment or redundancy was most dramatic at the end of June 1993.

The Watson House Club held a farewell evening and social function in February 1993, followed by a Social and Disco in early May. Regretfully, it was finally dissolved on 31st May 1993. A magnificent collection of Watson House trophies had been accumulated. The old Gas Light and Coke Company trophies, some dating back to the late twenties, were passed to the London Gas Museum at Bromley-by-Bow and those with a strong association with Watson House were passed to the Gas Research Centre, together with sports equipment. Over the years, apart from its sports interests, the Club had arranged the annual Christmas party for staff children, which started in 1978, as well as the annual Guide Dogs for the Blind Charity Walk mentioned earlier.

One of the final lunches to be held in the Visitors' Dining Room was for the past Directors of Watson House on 3rd June 1993. Leslie Andrew, Pat Patrick and George Percival attended although, unfortunately, Clifford Purkis was unable to be present. Other attendees were Bob South, Mike Green, Alan Sussex and Adrian Miles. A display of archive Watson House material created considerable interest and reminiscence. Norman Ross proposed a toast to 'The Staff of Watson House, Past and Present' and Leslie Andrew responded by proposing a toast of 'Gas - The Legitimate Choice,' the title of a paper he had given in 1963. Dr Ross gave the past Directors each a framed set of photographs of the Principals of Watson House. Sadly, both Leslie Andrew and Clifford Purkis have since died.

In view of the impending move out of Watson House, the money spent on maintaining the building was reduced to a minimum at the end. Instead, effort was concentrated on disposing of accumulated rubbish, selecting technical or archive material for transportation to the Gas Research Centre and arranging for the sale of all of the items of any value. This latter task was looked after by Alan Sussex for LRS as well as Watson House. An auction of the residual Watson House and LRS scientific, office and engineering equipment took place between 23rd and 25th September 1993. The front door of the building was finally locked by Alan Sussex on 12th November 1993.

Main Achievements

Watson House gained a very high reputation over the period of its existence but what were its real achievements? Many of the early developments which were important at the time could easily be overlooked. It is also true to say that in the development stage of an organisation it is easier to make a breakthrough than in a more mature organisation, when incremental improvements are more likely. However, that would denigrate the later achievements which, in themselves, had their own particular importance.

The early days of Watson House must be considered as making fundamental contributions to:

- Flue and terminal design.
- The principles of heat transfer.
- The principles of combustion.
- The understanding and rationalisation of gas quality in relation to appliance operation.
- The basic ideas of Approval, Quality Assurance and Standards.
- The principles of appliance design, including cookers, water heaters, heating appliances, commercial and industrial appliances.
- Design guidance for pipework and appliance installation.
- The improvement of appliance efficiency.
- The vestiges of appliance information and advice services.
- Communications through the Watson House Bulletin, visits, papers and technical visits.

In these there was a symbiotic relationship with manufacturers and a considerable feedback from the district, as can be seen, for example, from a cursory examination of the early Watson House Bulletins.

The one-to-one relationships characteristic of a small organisation working primarily in contact with the local Gas Light and Coke Company staff and individual manufacturers started to be broken when nationalisation of the Gas Industry took place in 1948 and when the affiliation of Watson House almost exclusively to North Thames changed to a national level. From then on, all of the above topics continued to be developed further, with the exception of those relating to declining gas uses.

Some examples of these further developments are:

- Development of the GLC cooker.
- Evolution of the 'G' Classification of town gases.
- Development of balanced flues, the GLC roof terminal, ridge terminal etc.

The next stage was the introduction of gas manufactured from oil, which started an expansion of the gas industry. At this time the market started to become dominated by gas cooking and heating systems. There was a close dialogue between Marketing and Watson House and it must be true that many major Marketing decisions of the time or later were strongly influenced by the Watson House view or findings. Then there followed the discovery of natural gas and the revolutionary commitment to appliance conversion. Watson House had to deal with a new era of problems, including:

- Advising on the 20 mbar appliance operating pressure for natural gas.
- Setting up Approvals Conversion laboratories.
- Working with manufacturers and Regions and developing conversion sets, approving them, setting new standards, briefing Regions, and carrying out pre- and post-conversion surveys.
- Attempting (unsuccessfully) to find alternatives to pinhole burners.
- Working to improve the ignition of appliances originally designed for town gas - especially cooker hotplates.
- Working to improve the turndown characteristics of burners.
- Contributing to offset the image that natural gas appliances were less safe than town gas ones (Morton Report).
- Critical manufacturing tolerances being greater on town gas than natural gas.

In the main, this period was both hectic and mostly successful but, surprisingly, damaging for Watson House. There were many very difficult conversion problems to be solved and, to some, there were not satisfactory economical solutions. Watson House tended to be blamed for these 'failures' and there was a new attitude of having to defend oneself in Headquarters and in Regions. This certainly applied to new limitations on fitting unflued water heaters in bathrooms, fitting of FFDs to cooker ovens, linting of aerated burners, safety of gas fires, vitiation sensing devices and pilot-flashtube and filament ignition.

It was not until conversion was well advanced that attention could be given to the gas industry to the design of natural gas appliances, which was destined to overcome most of these problems but not until this generation of converted appliances was eventually replaced. The next achievements evolved around:

- Development of the design principles of spark ignition.
- Development of a plastic balanced flue terminal (unsuccessful because efficiencies were not yet sufficiently high).
- Studies of the reliability of components and appliances.
- Risk analysis as relating to appliance safety.
- Guidelines on siting of terminals.
- New designs of cooker hotplate.
- Forced convection catering oven.
- Tap handles for the disabled.
- Advanced heating/hot water boiler.
- Interchangeability limits on natural gas.

These were superseded by new technologies such as:

- Testing and rationalisation of microelectronic controls.
- Monitoring and improvement of conventional domestic heating systems.
- Development of compact heating/hot water systems for new housing.
- Development of the semi-concealed meter box and plug-in gas connectors.
- Implementation of synthetic diaphragms on all domestic meters.
- Development of new pre-mixed burners/controls.
- Heat pump developments.
- Development of condensing appliances.
- Mechanical and electronic token meters.
- Demonstration of the technical feasibility of remote meter reading.
- The high speed tumble dryer.
- The high flow shower.
- The new meter.
- Major improvements to commercial appliances and systems through laboratory testing and field monitoring.
- Use of gas for group heating.
- Hot working tools.
- The test before service procedures for boilers.

There are still a number of new developments awaiting their successful or unsuccessful conclusion, such as:

- New methods of cooling for domestic application.
- The possible use of gas for domestic power generation.
- Electronic control of gas flows on appliances.

Of all these achievements since conversion, those probably having the most major impact on the industry are the use of synthetic diaphragms for domestic meters, improvements to the design of heating systems including the effect on running costs, guidelines on the siting of flue terminals, the specification of gas quality limits for natural gas and the implementation of the new electronic gas meter.

Postscript

Although the emptying of the building continued after 30th June 1993, that date can be identified as the point at which the life of Watson House came to an end, all but a skeleton staff remaining after that point. The bust of Sir David Milne-Watson had been removed from site two days before.

In its 66 years of history it was the staff through their technical expertise, their dedication, their hard work and their understanding who made Watson House become what it was. Good luck to all of them, whether they integrated into the Gas Research Centre, moved to other posts or retired. Many past members still remain in contact, particularly through the Watson House Society set up in 1994 and whose Honorary Secretary is Peter Budd, past Leader of the Information Section.

Long live the memory of Watson House!