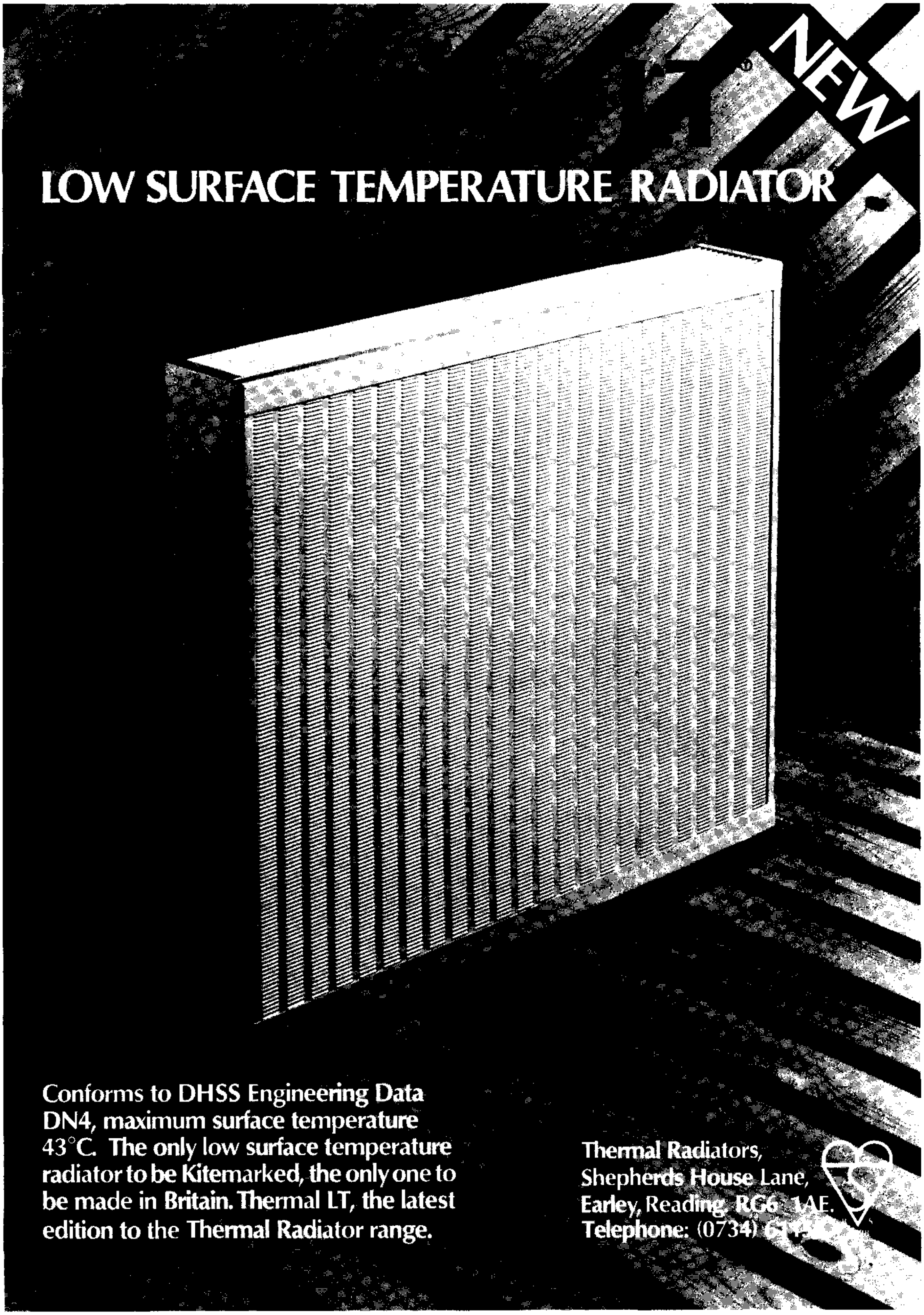
The Journal of The Institute of Hospital Engineering February 1984

HOSPITAL ENGINEERING

- Transport fleet costs cut – experience with LPG
- Automatic supervision of storage battery supplies
- Local authority disposal of hospital waste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HOSPITAL ENGINEERING

The Journal of The Institute of Hospital Engineering

Contents

Volume 38 No 1 **February 1984**

Front cover: An ambulance stops for fuel at the computer controlled LPG installation at South Cleveland Hospital

Institute News

No news is bad news as far as Hospital Engineering is concerned. We are sure that branches across the country will be interested in what their colleagues are doing – professionally and socially – and we shall welcome any accounts and pictures of their happenings. Both the Welsh and West Scotland branches are reporting this month. Let us have news of faces, places, and any matters of interest from everywhere – preferably by the beginning of the preceding month if you want it published next month!

BRANCH NEWS

Wales

During the summer break the Welsh Branch began planning its series of pre-Christmas meetings. After much debate, it was decided to look at aspects of energy utilization.

Lighting is an area where energy can be easily wasted or misused so it was decided to have our first meeting around the concept energy efficient lighting.

Philips Industries produced a package and the Symposium was arranged for September 8th at the Dental Lecture Theatre, University Hospital of Wales.

The Symposium with an introduction into the concept of lighting and how it may be utilized in various ways. This was followed by the film '100 years of lighting' which depicted mans first attempts at carbon arc lighting up through the various stages of tungsten and then into the modern energy efficient discharge lamps of today.

The Symposium then discussed Philips' programme for the SL, PL and TL lamps which have now been in production for several years. They also gave a demonstration on a small microcomputer showing how to size lighting installations for clients. A typical area was chosen, its size stated, colour and other factors included, surface luminance stated at 300 lux and the micro-produced an answer of X number of fittings at Y height would be satisfactory.

A talk then followed, which included a number of practical demonstrations one of which is being carried out at the U.H.W. at this present moment and involves the reduction of electrical consumption from 120w per fitting to 24w. As there are some 2,000 fittings to convert, the potential savings are high with pay back in under 2 years.

Other aspects of lighting were discussed with the emphasis on energy lighting management systems. This included the IFS system of lighting control and its basic construction. Philips answered various technical questions on this system. It is a micro-based system which can be installed around existing wiring providing certain modifications are carried out. It has the following facilities:

(1) It can handle endless on/off permutations.

(2) It has solar control whereby when lighting can be maintained by solar energy alone it will automatically extinguish artificial lighting.

(3) Manual override is provided by means of an infra red control unit.

The Symposium closed with a question and answer period which continued over the allotted period.

West of Scotland

Presentation to Former Chairmen

At an informal gathering of members, their wives and guests, two of our former Chairmen were presented with engraved silver tankards in recognition of their services to the Branch. Amongst the guests were the past secretary of the Western Australian Section of the Institute of Hospital Engineers (Aust), Mr R A Aitken and his wife Carol-Ann. Mr Aitken is on extended leave and has already spent part of this at Falfield on the management course and is returning later to take part in the course on Electro Medical Equipment.

Our pictures show from left to right standing behind their respective wives Mr D E Moss, Branch Chairman 1980-83, Mr W Gormley, present Chairman and Mr A Peters, Branch Chairman, 1979-80.

New Year's Honours List

It is appropriate, surely, to note the inclusion in the New Year's Honours List of Professor Jack Levy, Director Professional Institutions, Engineering Council, who was appointed OBE.

Revised energy survey scheme

The Department of Energy has announced a Revised Energy Survey Scheme. One of the main changes from the old scheme, which has been running for seven years is that the Department has discontinued the special lists of consultants available to undertake surveys under the terms of the Energy Survey Scheme.

Instead, now, applicants for a Survey will be advised to use the lists of Consultants held by relevant professional Institutions.

The Institute of Hospital Engineering is included in the list of professional Institutions held by the Department.

Accordingly, it will be necessary for the Institute to build a list of Consultants willing to carry out an Energy Survey.

Will consultants who wish their names to be included in this list please advise the Institute's office, giving full particulars and some evidence of experience and expertise in this particular field.

TALKING POINT

IHospE - Phoenix or Dodo?

DAVID HANSON BArch ARIBA FCIOB A IHospE

David Hanson worked as an architect in local authority and private practice before joining the NHS in 1963. He is at present Regional Works Officer in the South Western Regional Health Authority. He has a strong commitment to seeing close collaboration between designer and maintainer, a clear definition of standards to facilitate constructive monitoring and the development of more reliable information about all aspects of the Estate.

Sandy Ratcliffe's article in the October issue spells out very clearly the qualification issues and the constraints resulting from membership of the new Engineering Council. I have had sight of Howard Goodman's letter drawing attention to the wider significance of the qualification 'engineer' abroad. The practical result of the too-rigid interpretation of 'engineering' in the UK is that when the International Congress of Hospital Engineering was set up their UK link was with IHospE only. As a result and taking a case in 1974, DHSS took the view that the International Hospital Engineering Congress in Athens was for engineers only and NHS architects were not allowed to attend (with official support). However, some 50% of the papers in Athens were on architectural topics, or given by architects. It is the same at most International Congresses!

IHospE was born out of the determination of Engineers to shake off the control of Regional Architects (their position in the 1960's) and to forward the training needs identified in the excellent Tyler Report. The setting up of an IHospE was a very shrewd move, and since the Chief Engineer saw the advantage of such a body, the Institute was quickly endorsed by DHSS to the point that Robin Manser became one of the Institute's first Presidents. Membership was drawn from all levels of the service and from the commercial sector and several qualified and unqualified classifications were created. Thus the strong top-to-bottom link between Engineers from the top at DHSS to the lowest hospital engineers in the field was established. The Branch organisations were set up, and many seem to be only just ticking over.

Yet, in conversation with one Institute President after another, debating the desirability of changing the Institute's stance from purely Engineering, to Works, post 1974, each one has seemed to agree the need but confessed that 'the decision is with the Branches and they will not support such a change.'

Although an Associate of some years standing (non-voting therefore *strictly* non-influential) I am increasingly wondering whether the Instiute post 1974 – still 'Hospital' not 'Health', and still 'Engineering' not 'Works' – is more like a Dodo than a Phoenix. When Reports of national significance are published the journals print comments from ACAHA and AHST, along with BMA and RCN, and *never* a Works comment, so time and again the views of the fifth discipline on the RTO team, and a vital one at District level, are not recorded. With the new initiatives of Griffiths and so on, it is a tragedy, that nine years after Reorganisation there is still not a recognised national Works platform from which a united reaction can be given. As the incoming Chairman of the Association of Regional Works Officers I have as a personal top priority the creation, with District Works Officers, and others who embrace the main objective, of a recognised national forum for the Works discipline.

My sadness is that this was not created out of a reborn IHospE – an 'Institute of the Health Estate and Engineering'. This would have required the decision to give up the IHospE direct link to the Engineering Council, in order that Works Officers with Building qualifications could be admitted. And why not? Just as 'Building' Works Officers qualify professionally through RICS, RIBA (and hopefully one day CIOB) 'Engineer' Works Officers qualify through IMechE, IEE, CIBS and so on. Surely the education and training need is not so strong as to cause everything else to be sacrificed? Or is the unspoken strength of the IHospE its non-NHS members? Surely they could be accommodated in any reformed Institute. All it needs is the will.

It is certain in the absence of any positive reaction from the IHospE to this need, that yet another group will be formed, membership of which will be of greater relevance to the development of Works and the Estate as a whole than IHospE is in its present form, despite all the seminars it may organise (in collaboration with or opposition to kindred organisations like CIOB).

What needs to be emphasised is the tremendous respect and camaraderie which has grown up between Works Officers from different professional backgrounds. New developments like the Ceri Davies Report, the Griffiths Report and no doubt the Evans Enquiry into the Works Function when it is published, require a response to management change and it is in these directions our energies should be chanelled, not into fighting old inter-professional battles which have long since been won.

The engineer is acknowledged as an important equal member of the Works team. The operational pressures on him, with the consequent responsibilities, are acknowledged. Works officers (as a group) need the *full* commitment, of their colleagues in the Engineering discipline. Isn't it time the IHospE recognised the challenge of these wider opportunities?

The Institute and The Engineering Council

As is known, The Institute of Hospital Engineering is placed in Group 2 of the Engineering Council, which Group has the 'short title' of the 'Construction Group'.

In addition, of course, the Institute is one of the 'Nominated bodies' of the Engineering Council and, in this way, and through its representation on the Board for Engineers' Registration, is able to make its voice heard in the current developments in the engineering profession.

However, the Engineering Council will prescribe a new list of 'nominated bodies' in 1985 and has decreed that the new list will comprise, only, Chartered Institutions and 'Chartered Institution' 'Affiliated bodies'. The Institution of Civil Engineers is placed within Group 2 of the Engineering Council. The Institution of Mechanical Engineers and The Institution of Electrical Engineers, for instance, are placed in different Groups. As a matter of information, set out below are lists of the composition of the five Engineering Council Groups:

Group 1.
Bureau of Engineer Surveyors
Institute of Engineers and Technicians
Institution of Engineering Designers
Institution of Mechanical Engineers
Institution of Mechanical and General Technician Engineers
Institution of Production Engineers
Institution of Technical Engineers in Mechanical Engineering

Group 2
Association of Water Officers
Chartered Institution of Building Services
Highway and Traffic Technicians Association
Institute of Hospital Engineering
Institute of Plumbing
Institution of Agricultural Engineers
Institution of Civil Engineers
Institution of Highway Engineers
Institution of Municipal Engineers
Institution of Public Health Engineers
Institution of Structural Engineers
Institution of Works and Highways Technician Engineers
Society of Civil Engineering Technicians

Group 3
Biological Engineering Society
Institution of Electrical Engineers
Institution of Electrical and Electronic Incorporated Engineers
Institution of Electronic and Radio Engineers
Institution of Public Lighting Engineers
Institution of Railway Signal Engineers
Society of Electronic and Radio Technicians (including the Incorporated Practitioners in Radio and Electronics)

Group 4
Association of Mining Electrical and Mechanical Engineers
British Institute of Non-Destructive Testing
Institute of Energy
Institute of Measurement and Control
Institute of Metallurgical Technicians
Institute of Quality Assurance
Institute of Sheet Metal Engineering
Institution of Chemical Engineers
Institution of Gas Engineers
Institute of Metallurgy
Institute of Mining and Metallurgy
Institute of Mining Engineers
Institution of Nuclear Engineers
Institution of Plant Engineers
Minerals Engineering Society
Society of X-Ray Technicians
Welding Institute

Group 5
Institute of Automotive Engineer Assessors
Institute of Marine Engineers
Institute of the Motor Industry
Institute of Road Transport Engineers
Institution of Engineers and Shipbuilders in Scotland
North East Coast Institution of Engineering and Shipbuilders
Royal Aeronautical Society
Royal Institution of Naval Architects
Society of Licensed Aircraft Engineers and Technologists

The Engineering Council has ruled that a 'non Chartered Institution' MUST Affiliate to a Chartered Institution within its own Group.

As a consequence, The Institute of Hospital Engineering is seeking an 'Affiliate' relationship with The Institution of Civil Engineers in order that it may be included in the list of 'nominated bodies' to be approved by Engineering Council for issue in 1985, and so that it may continue to sponsor its members eligible for registration at Chartered Engineer, Technician Engineer and Engineering Technician level.

FORTHCOMING BRANCH MEETINGS

East Midlands Branch: *Hon Sec E. A. Hall TN Nottingham (0602) 475783*

6th March	Annual General Meeting followed by a management film with John Cleese related to engineering	Mapperley Hospital, Nottingham
11th April	Microprocessors	Rotherham College of Technology Computer Laboratory

Southern Branch: *Hon Sec R. P. Boyce TN Chichester (0243) 781411*

17th March	Visit to Spinal Unit and talk on Spinal Injury Treatment	Odstock Hospital

North Western Branch: *Hon Sec E. A. Hateley TN Manchester (061) 236 9456 ext 266*

23rd February	Design and Maintenance of Lifts	St. Marys Hospital Manchester
20th March	Annual General Meeting followed by talk on Energy Tariffs in the Regional Health Authority, at Bolton Medical Centre	
9th March	Annual Dinner Dance at Worsley Court House	

Midlands Branch: *Hon Sec W. Turnbull TN Birmingham (021) 378 2211 ext 3590*

22nd February	Visit to Central Independent Television Centre (limited numbers)	
13th March	Annual General Meeting followed by The telecommunications Revolution	Lecture Theatre, Post Graduate Medical Centre, Queen Elizabeth Hospital, Edgbaston.

British Standards Institution – Electrical switchgear and controlgear

BSI has published a new code of practice, BS 6423 **Maintenance of electrical switchgear and controlgear for voltages up to and including 650 V,** which revises and extends relevant clauses of CP 1011 and BS 5405. A complementary code is being prepared to cover the high voltage aspects and, following its completion, earlier standards will be withdrawn.

Copies of BS 6423 may be obtained from the Sales Department, BSI, Linford Wood, Milton Keynes MK14 6LE. Price: £14.00 (£7.00 to subscribing members).

Pickerings Lifts Specifier Pack

Leaflets giving full details of service, goods and passenger lifts suitable for hospital use are contained in a new ringbinder recently published.

Further details from Pickerings Limited, Globe Elevator Works, P.O. Box 19, Stockton-on-Tees, Cleveland TS20 2AD. Tel: (0642) 607161.

IHEX '84

The International Hospital Engineering Exhibition, held in association with the Annual Conference of the Institute of Hospital Engineering
Dragonara Hotel Bristol
16-18 May 1984

Information and further details available from: T Jarvis (Exhibitions) Ltd, 75 Masons Hill, Bromley, Kent BR2 9HP Telephone: 01-464 4129

NEXT MONTH
March
International issue

Jim Turnour promotes this year's IFHE Melbourne Congress

The microprocessor applied to boiler fuel conservation – C Newell

Responsibility for safety – R Atkins

LETTERS TO THE EDITOR

Oily rag men?

I would like to respond to the letter from Mr Howard Goodman regarding wider membership for the Institute of Hospital Engineering.

The Institute in its wisdom recognised that as an Engineering Institute its future lay within the Council of Engineering Institutions. We now have the new Engineering Council who have just published the initial list of Nominated Bodies. It is interesting to note that the Institute of Hospital Engineering is placed in the group incorporating The Institution of Civil Engineers, The Institution of Municipal Engineers, The Institution of Structural Engineers and other learned institutions.

As explained by Mr Ratcliffe in the October Journal, our participation within the Engineering Council will inevitably lead to stricter control over qualifications, but what are the alternatives? Are we to surrender the benefits of being an affiliated body within the Council for the uncertainty of attracting a wider membership of non-engineers and where would this leave the Institute relative to its present position.

The Institute of Hospital Engineering has an increasing membership from private practice and overseas, and plays an active role in the affairs of the International Federation of Hospital Engineering. It would wish to widen its multi-disciplinary involvement and would welcome a more positive relationship with other professions and to bring all skills engaged in the field of health care more closely together.

So come on Mr Goodman, use your influence to motivate those members of your own profession engaged in the health field. Let the dialogue start and, who knows, with the sunrise technology of tomorrow we may find an acceptable alternative for the future.

J B Packer *Fellow*

I suppose that after 26 years as a chartered engineer (20 in the NHS) one should have become accustomed to architectural arrogance. Nevertheless, I was still capable of surprise at the sheer effrontery of Howard Goodman's letter in the December issue. He proposes – nay demands – the right of full membership of the IHospE for architects!

The converse of his case, based on the multi-disciplinary, interacting process was not discussed. Logically, his argument would mean widening the membership of the RIBA to allow engineers to join their exalted ranks. However on reflection, engineers may not fancy the lobotomy, which I understand is obligatory for all those aspiring to join the RIBA!

Meanwhile, let us keep our architect members as associates – it can only do them good – whilst ensuring that they do not damage the reputation of our Institute.

R H Dean
(Formerly Area Works Officer, Wiltshire Area Health Authority)

Asbestos – air sampling

It was with interest that I read the excellent paper entitled 'Asbestos – Evaluating the Risks' in the October issue of Hospital Engineering. However, I am writing to disagree with one of the points made in the article.

Under the heading of Air Sampling, it is stated that air flow rate through the sampling head should be checked before and after sampling. Whilst agreeing with this statement the paragraph continues, 'For sampling times over 1 hour it is also advisable to check and adjust the flow rate during the sampling period. Samples where the flow rate is not checked are worthless'. Whilst with many air sampling pumps the absence of flow control will provide an inaccurate volume flow, pumps are available that will provide continuous flow control. The Du Pont personal sampling pumps will automatically control air flow, within ± 5% up to a pressure drop of 15in water gauge at a flow rate of 2 litres/minute.

P D Walton
Sales Engineer
Shawcity Limited

Letters for publication are always welcome and the editor would like to have your views and opinions. Please send your letters to *The Editor, Hospital Engineering, St Agnes House, Cresswell Park, Blackheath, London SE3 9RJ England.*

WISE – and what it means this year

PROFESSOR DAPHNE F JACKSON ARCS DSc FInstP MIEEE

Daphne Jackson is Professor of Physics and Dean of the Faculty of Science at the University of Surrey. She was the first woman to be appointed as a Professor of Physics in the UK in 1971 and is still the only one.

She graduated from London University and has been a visiting Professor in Belgium, Sweden and the USA. She is President of the Women's Engineering Society and a member of the National Radiological Protection Board. She is currently a Vice-Chairman of the W. Surrey and N.E. Hants District Health Authority, a member of the Scientific and Research Committees of the SW Thames Regional Health Authority, and of the CSTI Health Care Scientific Advisory Committee.

Her research interests were originally in the field of nuclear physics but she is now interested in the medical uses of nuclear particles and with imaging for medical and industrial purposes.

1984 has been designated as Women Into Science and Engineering (WISE) Year. This has arisen from an initiative of the Engineering Council and the Equal Opportunities Commission. The main objectives are to arouse the interest of schoolgirls in science and engineering before they make decisive subject choices, and also to introduce them to a wide range and level of careers in science and engineering. The needs of older women, who may wish to return to their careers after a break or to retrain to enter a new occupation, will also be given attention.

At present, the proportions of women in engineering are very low. Only 2% of those taking BTEC engineering courses are women, while the percentage of women among technician trainees has risen – quite steeply – to 4% as a result of the special schemes initiated by the Engineering Industries Training Board. Of those starting degree courses in October 1982, women contribute 12% in chemical engineering, 9% in general and combined engineering subjects, 8% in civil engineering and lower percentages in the other engineering disciplines.

The reasons for these low proportions of women entering careers in engineering are many and complex. Most girls, and their parents, have little knowledge and many misconceptions about engineering and this is made worse by poor careers advice. Inappropriate teaching methods and social pressures seem to have an adverse effect on girls in mixed schools, and lack of confidence in the use of basic tools is often inhibiting.

Many able girls care about the quality of life and they want to take up some employment which can be seen to be of service to the community. Talks at schools about the range of engineering work done in a typical health district, with emphasis not only on what the engineers do at various levels but also on the responsibilities that they carry, could change the attitudes of girls (and some boys, also) to engineering.

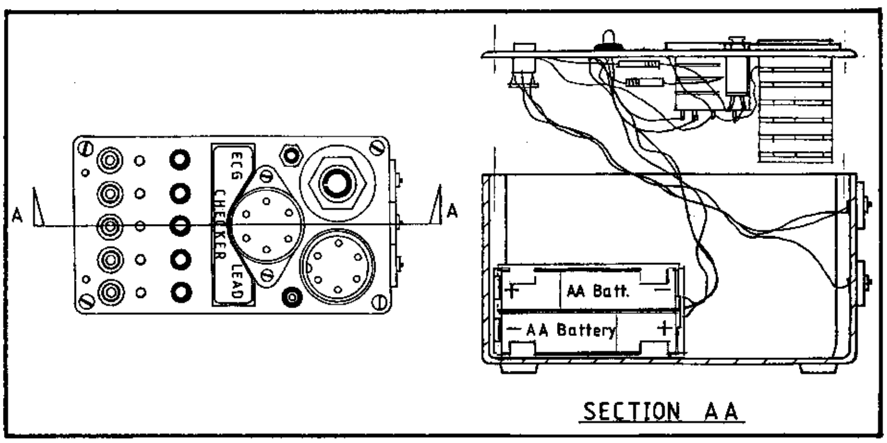
Obviously, the health service is in no position to offer many new jobs, in any field, but I hope this will not deter members of the Institute of Hospital Engineering from considering how they can contribute to WISE Year. Where there are female technical staff, more sympathetic guidance can be given to their career development. Often women are not given information about training available through day-release courses or are discouraged from attempting such courses; this must change. Money is available from the Manpower Services Commission to enable appropriate sandwich students to obtain professional training in the NHS (circular PM(83)20). I strongly recommend sandwich courses to girls on the grounds that the practical experience builds up their confidence, and a placement in a hospital would be attractive to many girls. (It might also be quite stimulating for existing staff!) Finally, the Women's Engineering Society is building a network of student groups in universities and polytechnics. I am sure these groups would welcome talks and visits in order to learn about professional engineering in the health service.

INNOVATIONS

ECG lead checker

Robert Marsh, chief electronic technician in charge of the department at Park Hospital, Trafford, invented his lead checker 5 years ago. 'I had hundreds of ECG leads to check', he remembers. 'It was an extremely awkward and laborious job, especially where there were intermittent breaks. I needed at least six hands. I dreamed up this new lead checker which really makes everything quick and easy. You might say that necessity was the mother of invention.'

First in an occasional series featuring innovations, inventions and good new ideas thought up by readers. Hospital Engineering is waiting to hear from you if you have solved a problem, plugged a gap, taken a short cut by your own ingenuity. Send us the details. This feature is yours!



During the routine servicing of ECG monitors and recorders of various types, it became evident that some quick and reliable method of checking patient cables was necessary. This was especially so when checking for intermittent breaks. An ECG lead checker was, therefore, developed which provides the following functions:

(1) Simultaneous continuity check of up to five lead patient cables.
(2) Check insulation between any two leads.
(3) Easy check for intermittent breaks.
(4) Simple calibrated dynamic check with cable and ECG monitor or recorder.

Operation

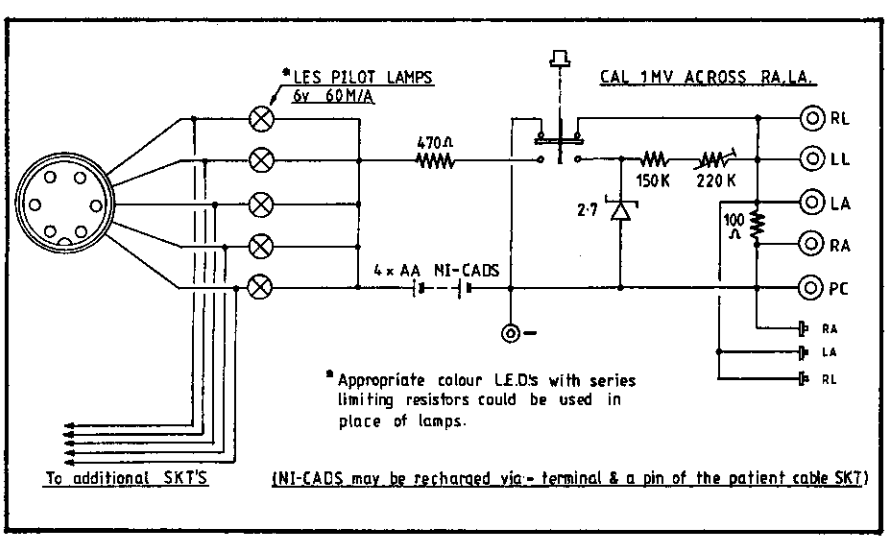
The ECG cable to be tested is plugged in to the appropriate multiway socket on the checker. Each of the patient lead connectors is then plugged in, in sequence to the marked sockets on the checker. ie RL, LL, LA, RA and PC.

Failure of any of the lamps to illuminate will indicate a break in those particular leads ie all lamps lit indicates continuity of all leads. The illumination of more than one lamp at a time during the sequential connection of the patient leads would indicate a short between the lead being connected and the lead indicated by the extra lamp illuminating*.

Suspected intermittent breaks can be found by mechanical flexing of various parts of the cable and leads (both hands being left free to do this) while watching for a flicker in any of the lamps.

When the cable has been tested, it can be plugged into the monitor or recorder and a 1mV. calibration pulse applied by depressing the cal. button on the checker.

Circuit diagram of ECG Lead Checker



Construction

Construction and layout is largely a matter of preference, the prototype being built into a diecast box measuring 4½ins x 2½ins x 2¼ins thus keeping the unit fairly compact and robust.

Parts

Apart from the multiway patient sockets and stud connectors (which will obviously depend upon the types of ECG cables in use), the rest of the parts needed are readily available from such suppliers as RS Components Limited.

**Currently LEDs are usually used rather than lamps.*

The project described in this article was undertaken by Cleveland Area Health Authority. Until the time of writing – late 1982 – all the authors were employed by CAHA and had been associated with the project from the start as Area Engineer (JWH), Senior Vehicle Engineer (GH), Project Engineer (DG) and Health & Safety Advisor (Works) (PEK).
Since the appointment of J. H. Williamson with Darlington Health Authority, the LPG work has been continued by the remaining officers under South Tees Health Authority.

Transport fleet costs cut – experience with LPG

J H WILLIAMSON. P E KNAPP. G HUBBARD. D J GILBEY

Introduction

It is easy to overlook the fundamental objective of energy conservation – saving money. Whilst it is true that there are fundamental arguments for the conservation of non-renewable energy sources such as coal and oil, our immediate concern in the health service is that of saving money – though we may call it 'more efficient use of resources.' Of course such energy conservation frequently proceeds from technological development – the use of heat pumps, or the detailed instrumentation and control of a boiler, for example – but when justification for money saving lies immediately in the use of lower cost fuel, perhaps we technically minded engineers may dismiss it too easily. 'If it really is so economical it would have been done before'. 'There are bound to be some big snags'. There *is* a lower cost fuel for road vehicles. It is LPG. It is about 70p per gallon less expensive than petrol and a rough approximation put the savings in road vehicle fuel costs for the Cleveland Ambulance Service at £50,000 a year.

In the light of such a large potential saving there is a duty to investigate further. What capital investment is required and what is the payback period? Is it safe? What are the snags and why have so few vehicle fleets turned to LPG? In Cleveland Area these questions were being asked and partially answered in 1978/9 but it was not until 1981 that a detailed study of the main pros and cons was completed. This showed that such major savings were practicable, that the payback period was slightly over two years, that several vehicle fleets were operating successfully in the country but that much energy and effort would be needed to bring such a scheme to fruition. It was very plain that the Health Authority needed to be fully convinced of the viability of the scheme and that the main user, the Ambulance Service, should agree the savings and then become totally committed to its introduction. The decision to proceed with the conversion of 89 vehicles and with the installation of bulk storage facilities at 6 sites in the area was made at the end of July 1981, and it was expected that the project would be completed within twelve months.

Table I compares the physical properties of butane and propane.

	Propane	Butane
Chemical formula	$CH_3-CH_2-CH_3$	$CH_3-CH_2-CH_2-CH_3$
Boiling point at atmos. press.	−45°C	−2°C
Vapour pressure (approx) at 15°C	7 bar (100 psig)	1.5 bar (20 psig)
Relative density of gas compared to air at 15°C and 30 inch Hg.	1.5	2
Relative density of liquid compared to water	0.50	0.57
Ratio of gas volume to liquid volume at 15°C and 30 inch Hg.	274	233
Calorific value	26 MJ/litre	28.3 MJ/litre

LPG – liquefied petroleum gas – is a generic term applied by the oil industry to those gaseous hydrocarbons which are generated from crude oil and which can be liquefied by the application of moderate pressure. The main components of LPG are propane and butane. Each is a product widely marketed by the oil industry under such names as 'Propagas' or perhaps more familiarly 'Calor Gas' – whose blue cylinders contain butane and red cylinders propane.

Both propane and butane are in principle suitable fuels for internal combustion engines, although their calorific values are considerably lower than that of petrol (34.4 MJ/litre). However it is apparent that the comparatively high boiling point of butane will not permit its general use, because at temperatures of −2°C and below, it will not be boiling and there will be an insufficient generation of vapour. This phenomenon is known to campers and to other open air dwellers who have encountered the difficulty of boiling water on a butane stove early on a winter's morning. There is no likelihood of a similar problem occurring with propane, with its boiling point of −45°C, until the Ice Age returns! Thus when we talk about LPG as a vehicle fuel we are in effect talking of liquid propane, and as a vehicle fuel it does have major advantages. First of all it gasses off from the parent liquid with the greatest of ease in contrast to petrol where the fuel is presented to the engine as vapour and atomised liquid. Thus there is a much more complete burn with propane and the percentage of unburnt hydrocarbons in the exhaust gas is about 100 ppm compared with 0.5% for petrol. Secondly propane has no added lead – although it has an octane rating of 110 – and contributes less carbon monoxide and oxides of nitrogen to the atmosphere than does petrol. Moreover it is low in sulphur. Because of its cleanliness there are less carbon deposits in the engine and the interval between oil changes can be extended.

If these are the 'pros' what are the 'cons'? The major disadvantage is that a steel pressure vessel weighing say 70lb., must be mounted on the vehicle and the fuel system adapted or changed to accommodate propane. Furthermore the 'liquid gas' part of the system is under pressures of 100 psig and must therefore be free from leaks. Perhaps the only remaining disadvantage concerns the ignition system. Whereas a poor spark can be persuaded to ignite petrol vapour in the cylinder, it refuses to do the same for propane. It is important therefore that the ignition system of the LPG vehicle is maintained at a high degree of efficiency.

Propane is becoming more widely available now for the convenience of the motorist. There are refuelling points on motorways and several self serve refuelling systems are being installed at garages by major oil companies. This suggests that they have confidence in LPG sales increasing for road vehicles. Of course it is always open to the Government to increase the excise duty on LPG for road use. The present administration have stated that their intention will be to maintain the present arrangement whereby the duty on LPG for road use is half that of petrol. One consequence of this is that in order to minimise any financial risk, the payback time of a conversion scheme must be short.

Vehicle Conversion

It is not surprising that there is a wide choice of vehicle conversion equipment now on the market. In early 1981 we in Cleveland Area looked at the four major sets (all of foreign origin) with the object of being able to decide on the most suitable for our purpose. One very important point emerged from a consideration of vehicle tank sizes and our ambulance fleet. Most of our ambulance vehicles are Ford Transits with 2 litre engines. Incidentally many vehicles are seven years old and clearly any conversion equipment had to be capable of being removed and refitted on new vehicles – 3 litre Transits – with a minimum of trouble and cost. We do have Bedford CF vehicles in the fleet. These are already close to their maximum permissible axle loading with their standard complement of patients and crew, and the addition of an LPG tank with fuel would not be acceptable. Conversion questions therefore focussed upon the Transits. There were miscellaneous vehicles including patient buses and some district delivery vehicles. It was not proposed to convert diesel vehicles.

The savings are obviously a maximum where LPG is exclusively used. Because we would still be using petrol vehicles and would therefore necessarily retain petrol dispensing facilities at amublance stations, the decision to convert to LPG in such a way that petrol could still be used was not difficult. It was also seen as a means of keeping vehicles functioning if or when running difficulties appeared with propane. Furthermore there was an advantage seen in virtually doubling the range of the vehicle for special journeys by retaining the petrol option. In cases of industrial action in the fuel supply industry, it would be possible to draw upon two sources of fuel.

Conversion kits by Renzo Landi, Landi Hartog, Impco, Tartarini were fitted to Ford Transit vehicles. Records were kept of mileage and fuel consumption and compared after approximately 2500 miles with the fuel consumption and performance of the same vehicles as they had previously run on petrol. Whilst it was recognised that there were shortcomings to this procedure viz the difficulty of getting accurate data of mileage on LPG on a dual fuel vehicle and the differences between the types of journeys made by the vehicles and the driving techniques of their drivers, it was hoped that the exercise would at least provide an opportunity to discard equipment which was plainly unsatisfactory, and so it proved. There was a persistent failure of the vehicle fitted with one particular kit to start on gas despite the repeated efforts of the agents. Of the remainder, one emerged as clear favourite. This was the Impco equipment (made in USA). This was the only equipment to have a gas carburettor and it also had a variable venturi. Thus it was possible to set up the equipment (using a dynamometer) so as to give maximum economy or maximum performance for example. *Figure 1* compares fuel consumptions for the Impco equipment. It can be seen that there is a higher volume of liquid propane consumed per mile than petrol. These consumption figures were obtained by adjusting the mixture so as to give a satisfactory compromise between economy and performance. Such adjustments were not possible with other equipment.

Figure 2 shows Impco equipment installed in the engine compartment of a 3 litre ambulance.

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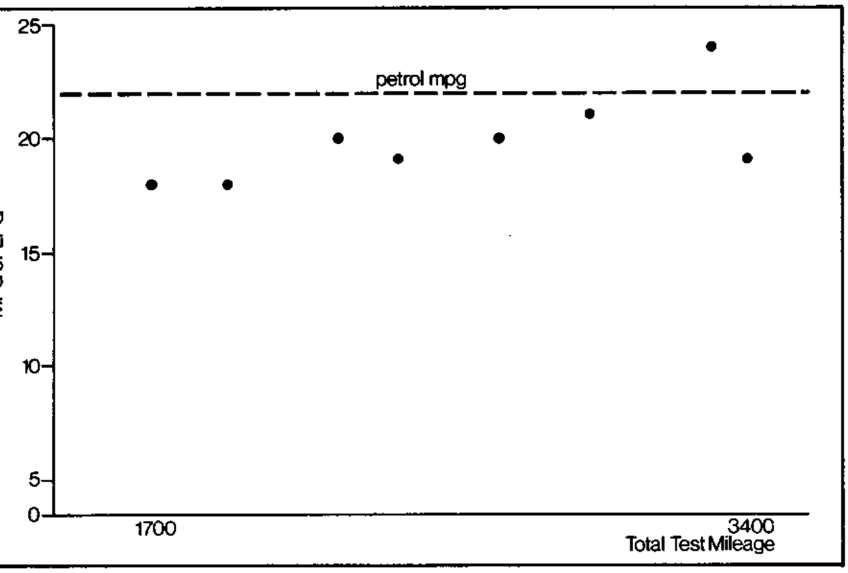

Figure 1. Fuel consumption for a vehicle converted using Impco equipment.

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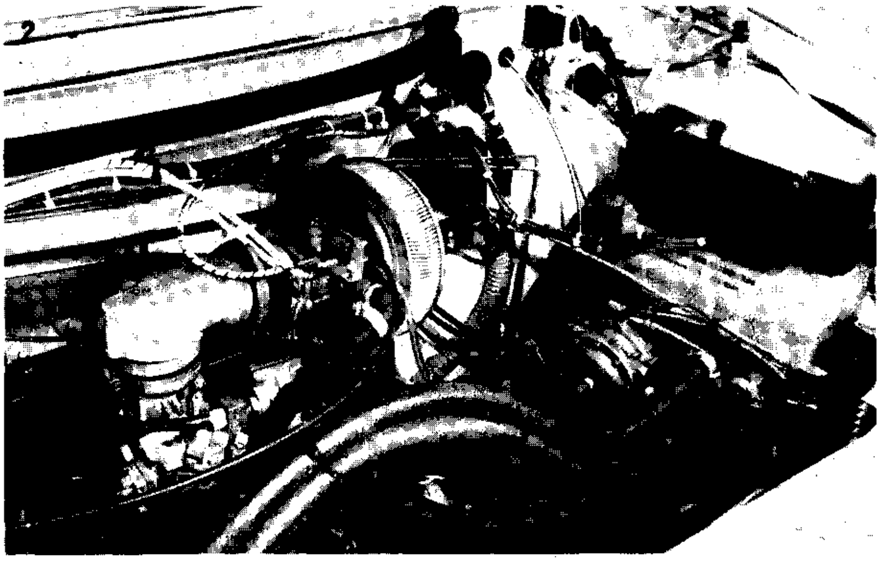
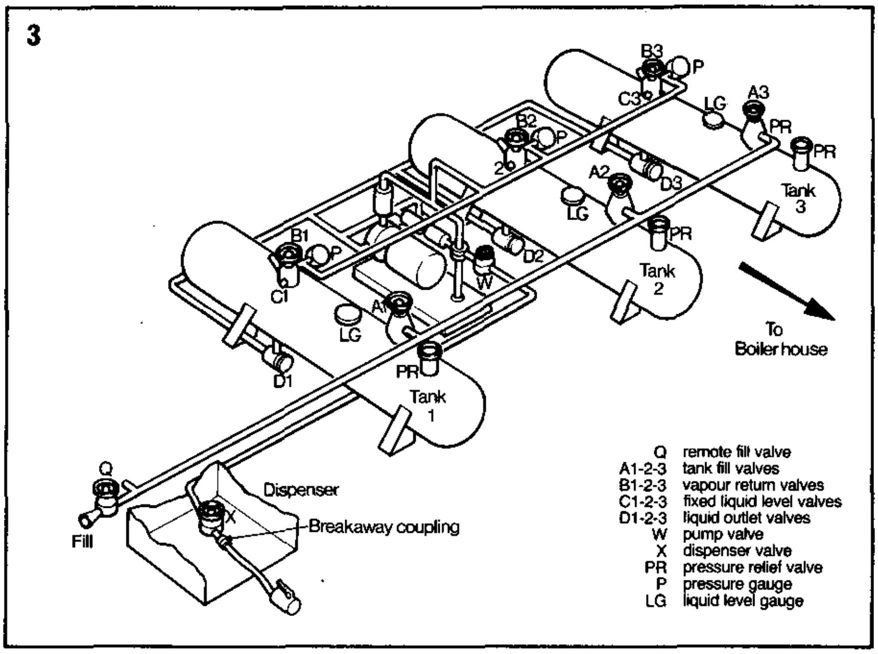


Figure 2 Impco equipment installed in a 3 litre Ford ambulance. Two of the prominent hoses in the foreground circulate water to the converter which is mounted below the battery: the third carries gas to the engine.

Bulk LPG Storage

Although the retail cost of LPG at the pump is approximately 130p per gallon, the cost of it in bulk deliveries of 2 tonnes and more is about 90p per gallon. Availability of our own bulk storage was



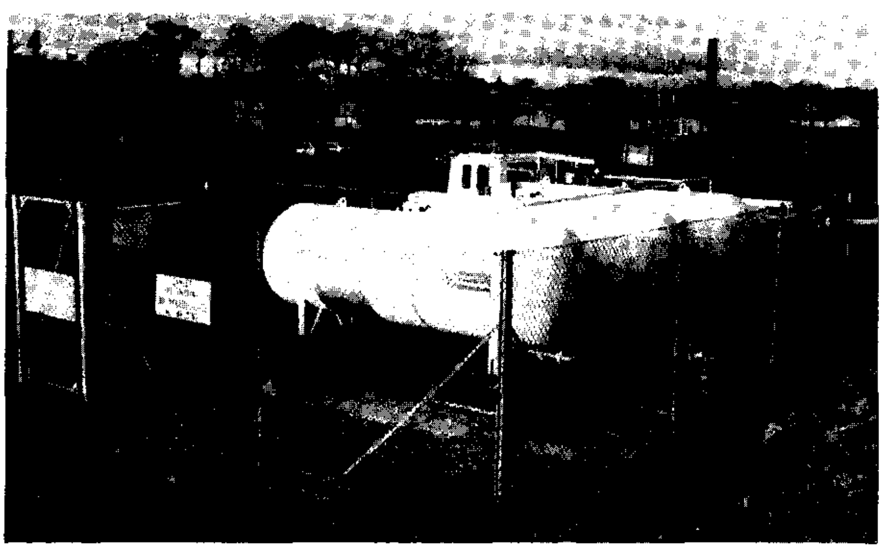


Figure 3 Diagram of a typical above-ground LPG storage tank installation at South Cleveland General Hospital.
Figure 4 LPG storage facility at South Cleveland Hospital. At this installation fuel dispensing is controlled by the computer.

therefore essential. Although we considered rental of bulk storage facilities, such an arrangement ties the customer to a particular supplier. In order to retain the freedom to purchase propane at most advantageous bulk rates we installed our own bulk storage facilities.

Provision of storage for liquid propane is not quite as simple as that for petrol although curiously enough, the storage facility does not have to be licensed. Both the local fire authority and the HSE are interested and it is important that the requirements – non statutory though they are – are well appreciated by the project engineer. Guidance Note CS5 and the LPGITA Code of Practice 1 cover these requirements and are based on experience over many years.

The storage installation must not pose a threat to its surroundings – as did the LPG cylinder storage depot at Mitcham in Surrey where there was a fire in 1970 – but neither must it be endangered by its surroundings. For example it must be sited sufficiently far away from sources of ignition (buildings, roads) and it must be protected from the ubiquitous vandals. (On hospital sites the presence of liquid oxygen storage may be another complicating factor). Of course the storage vessel itself must be properly designed, supported, and protected by emergency valves and safety valves.

Figure 3 shows a typical above ground installation comprising 3 – 2 tonne tanks. The three tanks are run in parallel and feed a pump and metering unit. Valves D1,2,3, and X are backed up by excess flow valves, and valves A1,2,3, and Q by non return valves. Valves C1,2,3 are too small to need specific back up valves. Each tank is fitted with a pressure relief valve and any pipeline where liquid can be trapped is protected by a hydrostatic pressure relief valve.

Figure 4 is a photograph of a similar installation. At two of our hospital sites underground storage was decided on, and this became the source of some difficulty. Our original specification required that the bulk installation should comply with the requirements of the HSE and that the storage vessels should be manufactured to BS 5500. The tender which was accepted submitted tanks of Dutch manufacture for underground installation. It was claimed that this equipment was acceptable to the HSE. At this time (April 1981) CS5 had not been published, but the HSE advised against the installation of these underground tanks which had only 2ins. of ground cover because the manways extended such a short way above the top of the vessel. There were other problems: the manway diameter was narrow at 17ins. and no support saddles were provided, the Dutch practice being simply to lay the vessel on a bed of sand. Having explored all possibilities we cancelled the Dutch tanks and ordered afresh in the UK so that we got a tank which was designed to BS 5500 and met all the HSE requirements.

The Dispenser

To dispense LPG, the essential equipment is a flexible hose with means of making a pressure seal on the vehicle tank, a means of controlling the flow of fuel and a fuel meter. Because this has to be immediately accessible to vehicles, it must necessarily be removed from the bulk installation itself in order to comply with the requirement that the installation shall be 25 feet (for storages up to 4 tons) from an ignition point. The equipment must be housed if only for security purposes and we designed a brick cabin for the purpose. This accommodated switch gear, MCBs etc as well as the dispenser nozzle itself. There is a problem of housing the dispensing hose near electrical equipment. The dispenser hose cabinet must be a Zone 1 Area (by BS 5345; an area in which an explosive gas/air mixture is likely to occur in normal operation). The electrical equipment must either be safe for operation in such an area or preferably, on cost grounds, it must be situated in a safe zone. To locate a safe zone hard by a Zone 1, a 'gas proof' boundary was made of two pieces of masterboard sealed to the walls of the cabinet with mastic, the space in between being ventilated. This design was accepted by the HSE and enabled us to have one cabin which safely housed both dispenser hose and standard metering and electrical equipment.

It was with this equipment that we realised we had to give particular thought to satisfying the auditors of the security of the system. Unlike petrol, LPG is not easily metered and it is not possible to 'dip' a tank so that deliveries of fuel are accepted either by volume on the basis of the suppliers meter corrected for temperature, or by weight measured at the supply company's weighbridge. Fuel would be very dangerous and difficult to pilfer from a dispenser without having a tank at hand, so the most likely method of pilfering would be to take fuel directly into a private vehicle. For those installations which are constantly manned, merely having the dispenser cabin locked is considered security enough. A private vehicle at the dispenser would attract attention. The problem is more severe however at unmanned sites. Here there are no eyes to see the would-be pilferer, so that he must be positively prevented from drawing fuel. To this end, a keyreader and a small computer unit have been installed at the three unmanned sites. Fuel can be drawn against valid keys only, and all transactions are logged by the computer. The computer also notes the total fuel remaining in store, and warns when the re-order level is reached. It will also log the fuel usage for all vehicles at a particular base for example, so that recharging to a particular district of fuel used by that district's vehicles is simplified.

Figure 5 shows a dispenser serving an installation at an unmanned site.

Works Department has a frequent involvement with the bulk installations because we have insisted that restocking of the storage tanks may take place only under the supervision of an authorised member of Works Department. But there is in addition a maintenance requirement for the responsible engineer to inspect each site every six weeks, and to authorise any necessary remedial work.

Table 2 gives approximate costings for the scheme.

Safety

It is almost inevitable that when talking about bulk storage and transport of LPG, the spectre of the Spanish Camp Site disaster appears. It should be analysed: it provides the strongest justification for many established procedures. A contributory factor to the disaster was the over filling of the road tanker. Allowance *must* be made for expansion of the LPG in any pressure vessel and the detail of the allowance to be made is given by the Code of Practice referred to above and by BS 5355. The primary safeguard against overfilling is by the fitting during vessel manufacture of a fixed liquid level gauge (sometimes called an ullage valve). This consists of a small diameter (1.4 mm) pipe one end of which touches the liquid LPG surface inside the tank when the tank is say 87% full (the exact figure depends upon the tank size and other factors) and the other end is open to the atmosphere. There is a valve in this line. When replenishing a tank therefore, this valve is opened and there is an audible escape of gas to atmosphere. As soon as the liquid level reaches 87% capacity, liquid propane is forced from the outer end of the pipe vapourising in a dense plume as it does so, and providing an unmistakable indication to the operator that filling must cease. As an additional safeguard for vehicles, we have provided float operated valves on vehicle tanks which automatically prevent filling beyond the 80% level, for we are aware of the temptation to fill beyond this 'maximum' level, a temptation to which we have observed customers succumbing at commercial filling stations. Fortunately the safety margin is large but it is not a margin on which we are going to permit trespassing by our staff.

The Spanish road tanker was filled to the brim. Moreover it had no pressure relief valve nor had it a current pressure vessel certificate. All our fixed vessels and vehicle tanks (and all LPG tankers) are, needless to say, fitted with PRVs and require recertification every 5 years. Incidentally we have equipped our 10

Table 2. Costs and potential savings

	Petrol	LPG
Contract price of fuel	£1.64 per gall	£0·94 per gall
Annual fuel consumption	85,000 gall	92,000 gall*
Annual fuel cost	£139,400	£86,500
Annual saving	£52,900	

Costs
LPG Bulk Storage Installations**

Equipment	Purchased Capital	Purchased Revenue	Leased Capital	Leased Revenue	Rented Capital	Rented Revenue
3 – 2 tonne tanks	£4,500	£60	—	£960	—	
Meter & pipework	£3,000	£50	—	£640	—	£850
Remote fill pipe	£400	—	—	£90	—	
Elect. installation	£1,700	£50	£1,700	£100	£1,700	£50
Civil work	£4,900	£100	£4,900	£100	£4,900	£100
Fire precautions	£600	£20	£200	£110	£600	£20
Security system	£2,500	£70	—	£610	£2,500	£70
	£17,600	£350	£6,800	£2,560	£9,300	£1,090

Vehicle Conversions (using Impco Equipment)

Cost of Kit (at 25% discount).	£320.00 + VAT.
Labour Cost. (10 hrs with 2 men).	£110.00
Total	£430.00

Total cost of project £145.000***
Total saving (including District vehicles.) £62,200

Pay back 2.33 yrs

**Based on an 8% increase in fuel consumption due to the lower calorific value of LPG.*
***The cost of installing an LPG refuelling point on a remote site, i.e. not under direct supervision by ambulance personnel.*
****A total of 89 vehicles (67 ambulances and 22 other vehicles) to be converted, and 6 LPG refuelling points to be installed.*

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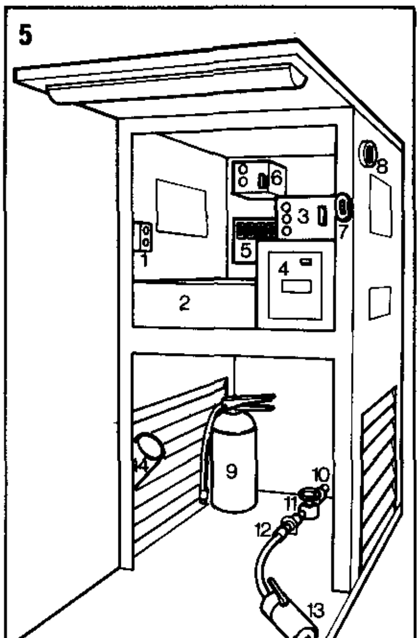

1. Push buttons.
2. Computer.
3. Key reader.
4. Meter display.
5. M.C.Bs.
6. Motor contactor.
7. Light switch.
8. Fireman's switch.
9. Fire extinguisher.
10. Excess flow valve.
11. Manual valve.
12. Breakaway coupling.
13. Nozzle.
14. Nozzle holder.

Figure 5 Dispenser cabin.

tonne underground tanks with an adaptor device below the PRV which permits the immediate removal and replacement of the PRV without taking the vessel out of service.

The operation of refuelling ambulances is obviously one which demands careful consideration both in engineering design and operational procedures. To refuel safely it is necessary swiftly and reliably to make a joint which is leak free. Moreover prudence calls for provision to be made for the things that may go wrong. The standard coupling seen at many commercial stations consists of a threaded collar or a three pronged clamp which is secured on to the vehicle tank making a rubber to metal joint. We felt this to be unacceptable because it is possible to operate the trigger on the dispensing nozzle and release fuel before any connection is made with the tank. We therefore selected a bayonet type fitting which requires an adaptor to be screwed onto the tank first *(Figure 6)*. There is no trigger on the dispenser hose itself: this is replaced by a pump operating button in the dispenser cabin and until the bayonet nozzle is coupled to the adaptor on the tank, fuel cannot be delivered. Other safeguards for this operation include a break away self-sealing joint in the delivery hose to ensure minimum escape should the vehicle be driven away whilst still coupled up, and a pump operating button which must be kept depressed by the operator to ensure flow of fuel.

Concern has frequently been expressed concerning the safety of our bulk storage installations. There are fears about the damage which can be done by vandals and the consequences of such damage. We have been guided by the Code of Practice in protecting our sites which, with the exception of one are in urban areas.

When speculating upon the consequences of vandalism it is important to appreciate the amount of safety bestowed by the installation design. The security fence will not keep all intruders out but it will deter many. The random operations of valves inside the compound has a nuisance value only. If, by the application of great force a pipeline were breached, automatic excess flow valves would prevent a major gas escape although a limited fire would be a possible consequence.

When siting LPG in bulk in hospital grounds we must think even harder and in more detail of things that can go wrong. The most catastrophic event would result from major rupture of an LPG storage vessel. Spontaneous rupture of a vessel made to a recognised code (BS 5500 in this case) and properly maintained is as remote an event as the exploding of a steam boiler. Such an event is not beyond the bounds of possibility so we must consider possible reasons for vessel failure. Discounting the gradual effect of corrosion which is taken account of during the five yearly inspections, a possible cause of severe weakening could be flame playing onto the vessel above the liquid level. This scenario can be eliminated if the tank is buried underground and underground storage has therefore been adopted at our two sensitive hospital sites. The possibility of failure remains for the delivery tanker. Some additional safety features were therefore incorporated into the site design. These were a layby for the tanker to minimise the possibility of collision with other road traffic whilst restocking takes place, sloping the ground in the layby away from the tanker to reduce the possibility of a pool fire beneath the tanker, providing a gravelled area to assist evaporation in case of spillage, and increasing the storage tank capacity to minimise the annual on-site time of the tanker.

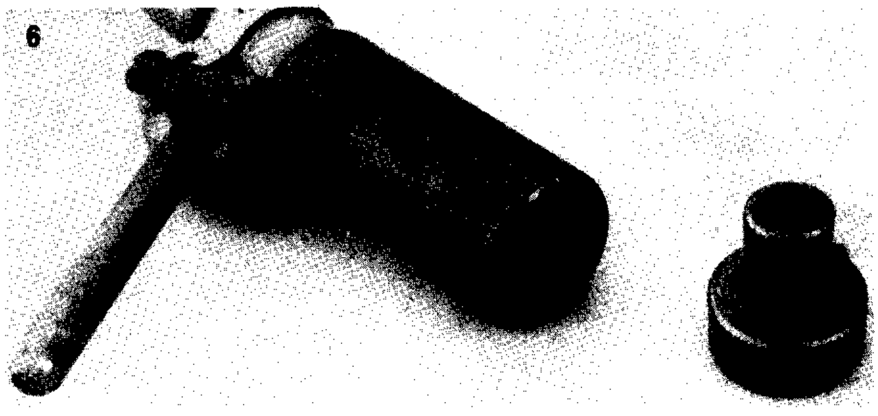

Figure 6 Bayonet type dispensing nozzle with screw-on adaptor.

All this attention to hardware is merely the foundation of the operational safety of such a project. We were convinced, and remain so, of the vital importance for day-to-day working of thorough training and good communications – so easy to say but so difficult to achieve! At an early stage – in fact well before the project was sanctioned and when trials were just starting – a working party was set up. Representatives of the Works Department, Ambulance Service and the Districts – both management and union – met together to share problems and to discuss solutions. Safety considerations were prominent. The working party sought information to assure themselves of the safety of ambulances in case of collision or in case of an incident arising at refuelling for example. They discussed the technical and practical experiences of the trials and spent a profitable day visiting Humberside Ambulance Service to share their experiences with LPG. When the project was sanctioned, training for everyone involved was agreed in some detail. Vehicle maintenance staff who were to fit and maintain LPG equipment on vehicles attended a three day course arranged by the equipment supplier. All ambulance personnel and all district drivers and their managers attended a lecture demonstration of ninety minutes which covered the nature and properties of LPG basic safety and an appreciation of the LPG equipment particularly that on vehicles. As refuelling sites came on line, every ambulance man and district driver was personally instructed in refuelling procedures and on what action to take in emergency. In addition everyone was given a card as a reminder of the essential do's and don'ts. This detailed and personal training has had additional value, particularly when mop-up training has taken place after LPG usage has become established, in encouraging communication of comments and complaints from drivers direct to those of us in works department who have been intimately concerned with the project from the start. The reporting of all incidents involving LPG has been strongly encouraged and staff have co-operated. We make a point of responding swiftly to every difficulty. So far there have been only slight problems. We have had weeping and sticking LPG valves, and freezing vapourisers due to water leaks. The micro switches controlling the fuel changeover have given trouble but we have been surprised and delighted at the ease with which conversions have been completed and accepted.

To date December 1982 we have not commissioned our two remaining storage sites and as a consequence although all vehicles are converted to LPG only 50% are using it. Our direct savings in fuel costs have been approximately £27,000 so far, only a part of the potential savings. Factors outside our control have seriously delayed completion of the programme but our experience so far indicates that the project will provide a major and continuing saving.

CORRECTIONS

Morriston Hospital, Swansea

The October 1983 issue included an article on event-recording in hospitals from information provided by our past president and chairman of Static Systems Group, Lawrence Turner OBE. Mr. Turner informs us that reference to Morriston Hospital, South Wales, using a consulting engineer was incorrect. The Engineering Services installations were designed by the Staff of the Chief Engineer's Department at WHTSO including the specification of a Statiscan TDM system using event recorders.

Natural lighting in hospital design – December 1983 issue

The new district hospital at Maidstone was designed by Powell Moya and Partners for the South East Thames RHA and **not** the South West Thames RHA.

Automatic supervision of storage battery supplies

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The high reliability of the Electricity Board's supplies that is now applicable may tend to give us a false sense of security which is further enhanced by the number of installations which have total load capacity from their standby generator sets. It is sometimes overlooked that this total load capability is reliant upon the weakest link in the chain, that is the starting battery.

Should air start facilities be fitted then very often this can only be actuated after the lubricating pump has started – this pump is, in a large number of cases, battery powered; again the potential weak link in the system.

Secondary cells, if chosen specifically for the duty required do, with impecable maintenance routines, give proven service but financial considerations can often produce a compromise between these being merely adequate for the load or ideal for given operational conditions.

Over the past few years many papers have been presented on the subject of total generator liability and various memoranda have been circulated on particular aspects of this subject.[(1),(3),(4),(5)] From the dearth of statistical information available, the factor which appears to command a lions share of the 'failure to start' reports is the starting battery and its associated electrical wiring and equipment.

The competitive tender which is not tied down to detailed specifications has, I believe, led to most standby generator manufacturers offering the lowest cost battery, very often an automotive type, which may be considered adequate as an integral part of their equipment. When one considers the complete range of batteries that can be used, these being priced from considerably less than £100 up to almost £1000, there is quite an incentive to economise in this area.

If the potential failure points are appraised on the charger, the battery, the wiring and starter system, then means of having an 'early warning of the failure' can be oriented towards the most likely faults. In battery packs which use individual cells, the bolted connecting points between units and the corrosive conditions applicable, increase the risk of high resistance joints. Given an initial starter motor current of 200/300 amperes, on 0.1 ohm joint resistance would effectively reduce the voltage at the terminals of the starter to a level which would not be acceptable. Cells which have multiple plate assemblies can, due to distortion of the internal supporting bars, be subject to cracking of the individual plate connecting pillars. This reduces the capacity of the cell in question giving rise to an increase in internal resistance of the battery pack.

Generator equipment which is mounted on the main chassis is subject to vibration and the ancillary wiring and connections to the starter and solenoid are no exceptions. In particular, the terminations may become loose and as in the case of the previous potential fault, a test voltage reading on its own will give no indication of impending faults unless a predetermined load is taken from the battery pack and its connecting cables. Another potential hazard is the failure of the charger due to either one of its components or an inadvertant disconnection of the supply.

Ideally, tests on equipment should be frequent, but these are governed generally by:

a) Qualified manpower being avail able and

b) Financial costs involved.

Generator equipment that was purchased in haste a few years ago which was fitted with automotive type lead acid batteries which has, by now, been generally brought up to standard and, where applicable, has had the starting battery replaced by either planté type or heavy duty alkaline cells, as per HTM.11[(2)] recommendations.

The statistics obtained by Messrs Green and Selman and those listed in the paper produced for the reliability conference 1979,[(3)], together with those detailed in HSE.44 in 1980,[(4)], were presumably applicable to equipments that had been brought up to the HTM.11 standards, these being revised in 1974,[(2)].

The percentage of failures to start attributable to batteries, chargers and starter motors is given as 41.9% of the total failures with batteries and chargers alone accounting for 27.2%; the starter motor and solenoid faults accounting for the remaining 14.7%[(4)].

Changing from automotive type to heavy duty type batteries will improve reliability; the HSE.44 article on reliability of NHS generators[(4)], quotes a possible improvement from 14 down to 5 failures per million hours of operation for batteries by this change alone. It should be noted that the same article makes the point that on the sampling undertaken 14% of the total failures occurred during emergency use of the generators implying a high potential risk under loss of supply conditions.

Maintenance schedules are tuned to the requirements of the maintenance manual[(7)] recommendations and tailored to meet any local conditions which may necessitate more frequent checks, batteries are quoted as requiring 3 weekly test of EMF and electrolyte specific gravity with visual examination of physical condition.

As was stated earlier, terminal voltage readings give little indication of either circuit resistance or ability to deliver current.

The recommendations for a full load test on a generator in the NHS is given as at 6 weekly intervals,[(6),(7)]. This, therefore, may be the only time that a rise in circuit source resistance could be detected as this may be the only opportunity for drawing a heavy load from the battery pack.

The cell EMF read under no load test conditions could in fact be the output voltage of the charger which in the case of lead acid cells would be in the order of 2.65 to 2.75 volts per cell, or in the case of alkaline cells, 1.40 to 1.55 volts per cell. This does not represent any meaningful datum to judge the cell's integrity. Specific gravity of the electrolyte can give some indication of the state of charge in certain conditions, but again is no guide to the cells capability to deliver high current. As the specific gravity depends to an extent on the amount of water which has been 'used' by the cells, a reading taken before 'topping up' is carried out could be high, but if one is taken after 'topping up' but before time has been allowed for dispersion of the water throughout the cell (24 hours is the period recommended by most manufacturers), then the specific gravity values would be falsely low. Generally for automotive and traction lead acid batteries the charged and discharged values are in the region of 1.280 and 1.110 respectively, whereas the same conditions for Planté type cells should give 1.210 and 1.110 respectively.

For alkaline cells the problem of interpreting specific gravity values is more difficult than with the lead acid types; for all practical purposes the figure does not change throughout the charge/discharge cycle, remaining at 1.200. The electrolyte is almost a passive component of the cell and acts as an ion transfer medium, its specific gravity being unaffected by the charge/discharge cycles.

However, the SG does alter by ageing and if the value falls to 1.160 then the cells should be drained and refilled with a 1.200 electrolyte solution.

All the above does cast some doubt on the values obtained on the 3 weekly checks[7] and this has pointed to the advisability of an automatic system which would:

1

1

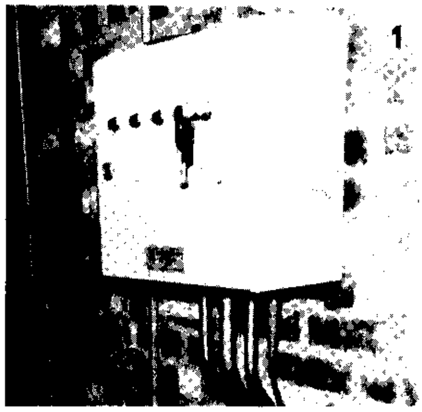
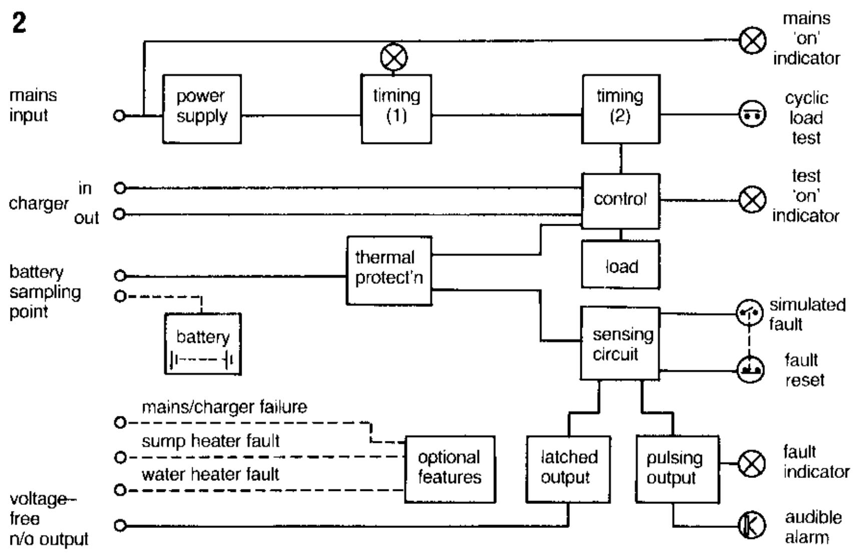


Figure 1 illustrates a typical installation with the wall mounted Cyclic Loading Unit[8] sited as close to the generator as possible.

Figure 2 A block diagram of the monitor units installed and shows the degree of failure to safety that has been built into the units and is evident by the backup of a thermal circuit breaker to ensure an alarm should malfunction of the unit occur; and the provision to disconnect the charger during the 'sampling' period should this be required.

2



1. Have the facility to 'load' the circuit under test.

2. Operate automatically twice a day.

3. Have clearly defined parameters for load current and acceptable terminal voltage.

4. Facilitate manual application of the load during normal maintenance visits.

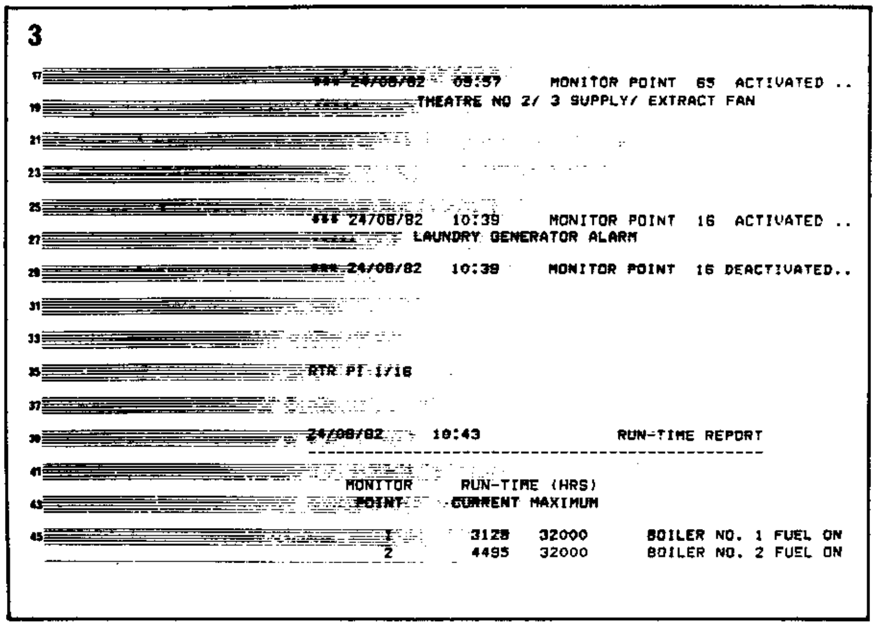
5. Provide both visual and audible 'local' warning.

6. Contain a voltage free output to operate remote data link terminals.

7. Enable authorised personnel only to re-set any fault condition.

8. Have facilities for optional alarm from other risks such as charger, sump heater and water jacket heater failures.

9. Be economically viable and simple


3

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*** 24/08/82   09:57      MONITOR POINT  65  ACTIVATED ..
THEATRE NO 2/ 3 SUPPLY/ EXTRACT FAN

*** 24/08/82   10:39      MONITOR POINT  16  ACTIVATED ..
LAUNDRY GENERATOR ALARM
*** 24/08/82   10:39      MONITOR POINT  16 DEACTIVATED..

RTR PT 1/16

24/08/82       10:43              RUN-TIME REPORT
-----------------------------------------------------
MONITOR      RUN-TIME (HRS)
POINT        CURRENT  MAXIMUM
  1            3128    32000      BOILER NO. 1 FUEL ON
  2            4495    32000      BOILER NO. 2 FUEL ON
```

Figure 3 All three units are now installed and operational with their alarm outputs fed via data links to the building engineering management system in the hospital Engineers office, this provides an audible warning as well as a print out; a sample read out of a simulated fault is shown here.

to install.

The failure of a charger unit on the generator installation which supplies the hospital boilerhouse and laundry accelerated our search for equipment and, after initial examination a cyclic loading unit[8] was installed on a trial basis.

A few weeks later, during which period a low battery voltage fault was detected, two further units were installed on the remaining generators on the Groby Road site, charger failure alarm being included in the specification of the later models.

One of our major concerns has been to ensure continuity of supply at all times; our experience with the generator which supplies the main boiler house and laundry has emphasised the need for close supervision of our standby supply system. The volume of throughput on the laundry of 200,000 to 300,000 items or 100/150 tons per week makes this section of load high on the priority list to ensure the smooth running of the patient care system.

Similar conditions of maintenance apply to those cells used for switchgear tripping, where a failure of battery supply under fault conditions would upset the pre-determined trip discrimination and prevent switch operation, therefore the fault would reflect back on the system and in doing so cause more widespread failure of supply than was commensurate with the original fault condition.

The Cyclic Loading Unit[8] is ideally suited to situations that have the battery supply centralised, such as theatre lighting and other essential standby supplies, or in those cases where manual loading of the system is either too costly or impractical. Fire alarm installations are generally fitted with loss of voltage detectors, but large installations could benefit from periodic loading to ensure that the capacity is available to operate all the alarm equipment. For sites where the installation battery supplies are fragmented, then a portable unit which was polarised to suit individual battery parameters would perhaps offer financial advantages over individually permanently connected test units.

Conclusion:

Automatic supervision of vital equipment has always been attractive but with the advent of increased economies being called for, manpower is at a premium and effective means of applying available resources are essential. The installation of monitoring equipment enables this to be carried out with minimum labour requirements and where installations have centralised data facilities then their application can be maximised to test and log potential fault conditions in detail, making the forward planning of maintenance programmes on equipment easier to accomplish and more effective in operation.

References

1. The Department of Health and Social Security, 'Dear Engineer' CE(78)7 25th April, 1978.
Emergency Electrical Supplies.

2. The Dept. of Health and Social Security, **Emergency Electrical Services** – HTM11.

3. Second National Reliability Conference – March, 1979
An Emergency Generator Reliability Study in the National Health Service Prepared by M. F. Green/A. C. Selman.

4. 'Operation and Maintenance' HSE 44 – June, 1980.
A Reliability Study of NHS Emergency Generators by Mr. M. F. Green.

5. HSE No. 38
Emergency Generator Systems in Hospitals – Can Reliability be Improved by M. F. Green and B. C. Selman.

6. DHSS Ref: ED75/38
'Dear Engineer' 10th December, 1975.
Test Running of Standby Generators.

7. Planned Maintenance Manual
Eastman Code PMG/12.

8 G.B.S. Harrison Limited, Dinnington, Sheffield S31 7QY.

The life and work of Christopher Hinton

The great engineer-industrialist Lord Hinton of Bankside died on 22nd June, 1983, at the age of 82. The Institute of Hospital Engineering was represented by the President and B A Hermon at a service of thanksgiving for his life, held at Westminster Abbey on October 26th 1983. Margaret Gowing, Professor of History of Science at Oxford University, said in her address that Christopher Hinton, 'bestrode his profession like a colossus.' Extracts of Professor Gowing's address appear here.

At 16 Christopher Hinton became an engineering apprentice with the Great Western Railway at Swindon and evermore valued the initial, repetitive work because he understood the boredom of production line workers. At 22, after studying five hours a day on top of a 54 hour week, he won the Institution of Mechanical Engineers scholarship to Trinity College, Cambridge. Having gained a degree in two years, he spent his third year in research under the great Charles Inglis.

Hinton was to have four posts in his career – the first at Brunner Mond, and the second directing the explosive filling factories in the war. His third post was as head of the industrial group of the government atomic energy project. Lastly from 1957 to 1964, he was the first chairman of the Central Electricity Generating Board.

The most heroic phase of Hinton's life began in 1946 when he was charged with producing the fissile material required for atomic bombs. Hinton's challenge was to create in war-weary Britain a new industry comprising four very different plants, all on the furthest scientific-technological frontiers.

He refused to make unrealistic promises, but he fulfilled almost exactly the detailed programme he compiled in 1947. From an early stage Hinton was anxious to develop nuclear power and in 1952 work began at Risley on fast breeder reactors. Meanwhile, big new demands for military plutonium led to the decision to build Calder Hall as a thermal reactor that would produce power as a by-product.

Teamwork produced success, but Hinton built and inspired the teams. Since qualified engineers were scarce, continuous teaching was crucial. Hinton himself was ubiquitous, his six and a half feet figure in and out of laboratories, drawing offices, workshops and sites, talking to very junior, as well as senior, staff.

He could be kind but also scathing. Proud, uncompromising in his standards, unswerving in his integrity, incapable of dissimulation, Hinton's inspiration made a motley team achieve individual and collective greatness.

More than a year before the Queen opened Calder Hall in 1956, the Government had published a modest nuclear power programme, emphasising Britain's world lead. But the strain on Hinton was telling in nervous exhaustion. In 1956 an important and triumphant visit to Japan was substituted for sick leave. On his return, Hinton was disturbed to find a new, prematurely ambitious, nuclear programme under discussion. Increasingly at odds with some atomic colleagues, he accepted the invitation to become chairman of the about-to-be-formed Central Electricity Generating Board.

In these turbulent years he asked the right – and often new – questions, and more often than not formulated the right answers, though his diplomacy was less sure. He was always deeply concerned with the environment, pollution, health and safety.

In retirement he was active as ever, and always in the public service. He was passionately interested in the past, the present and, even in his last years, in the future. His words to the students at University of Bath (he was it's first chancellor) enshrined his optimism and his creative courage. 'You are going out into a changing world . . . but all change is a challenge. I am not offering you any pity. What I wish is that I was young enough to share the challenge with you.'

A bust of Christopher Hinton was executed by Nigel Boonham ARBS during the last month's of the great engineer's life. The portrait-bust joins those of George Stephenson, James Watt and others at the HQ of The Institute of Mechanical Engineers, of which Lord Hinton was a past president.

William Townend is Divisional Manager (Operations), of the Solid Waste Management Branch, Department of Public Health Engineering, GLC. This paper was presented at the 1983 General Conference of The IHospE.

The author wishes to thank Mr Derek Ayres Director of Public Health Engineering for permission to publish the paper, and points out that the views expressed in the paper are the author's and do not necessarily represent the policy of the Greater London Council.

Local authority disposal of hospital waste

WILLIAM K. TOWNEND FRSH FBIM MINSTWM

Introduction

Since January 1979 central Government has been considering the problems associated with the storage collection and disposal of hospital waste and there have been a number of working parties engaged in preparing recommendations for the safe and proper handling and disposal of hospital waste and resolving associated problems.

Local authorities spread throughout the country have found difficulties with disposing of toxic, dangerous or offensive material from hospitals.

For example serious incidents have occured in Greater London where on a number of occasions clinical waste was washed up on the Essex beaches in the Thames Estuary. Meetings were held between all parties concerned culminating in the setting up of a working party jointly by the Minister of Health and the Under Secretary of State for the Environment, to examine the disposal of clinical waste in Greater London. Their report was published recently.

This paper, examines, at this moment in time the storage and collection and disposal of hospital waste from a local authority viewpoint, considering the statutory duties involved, the manner in which they are carried out, and the major problems encountered in fulfilling them.

What is hospital waste

Hospital waste is defined in a number of ways but for the purposes of the local authorities involved one must turn in the first instance to the Health and Safety Commissions (HSC) guidance note on 'The Safe Disposal of Clinical Waste' which defines clinical wastes.

All other non clinical hospital waste falls into the category of household industrial or commercial waste defined in section 30 of the Control of Pollution (CP) Act 1974.

Some categories of clinical waste and other hospital waste may also be special wastes covered by The Control of Pollution (Special Waste) Regulations 1980 made under the provisions of Section 17 of the C.P. Act 1974. A system of consignment notes is prescribed which has to be used by all who produce, transfer and dispose of the special wastes.

At this time the definitions contained in Section 30 of the C.P. Act 1974 do not apply to the collection and disposal of hospital waste and local authorities are still operating under the provisions of the Public Health Acts of 1936 and the Local Government Act 1972 with respect to England and Wales.

There is no legal definition of refuse and the three categories of waste contained in Sections 72. to 74. of the Public Health Act 1936 namely house refuse, trade refuse and other refuse 'which collection authorities are not under any obligation to remove', have been modified in the courts over the years. Up until 1974 based on case law it was argued that waste from hospitals was house refuse.

The case Iron Trades versus Sheffield Corporation 1A11ER182 established that house refuse is refuse produced by a house and of the kind which one would ordinarily expect a house to produce occupied as a house. In the Public Health Act 1936 a house is defined as 'a dwelling house whether private dwelling or not'. Clearly waste from separate nurse's homes or caretakers houses would be considered to be house refuse, but it can be argued that hospital waste since the Sheffield case no longer falls into the category of house refuse but is either trade refuse in the case of private hospitals or 'other refuse' as set out in Section 74 of Public Health Act 1936.

The storage and collection and on site treatment of hospital wastes

Applying the definitions set out in the previous chapter collection authorities have a duty to collect house refuse free of charge. With exception of an Inner London Borough who have to collect trade refuse on request a collection authority may undertake the collection of trade refuse. All authorities however must make reasonable charge for collection and disposal of trade refuse.

A collection authority may also undertake the removal of other refuse and may make such a charge if any as they think fit.

All hospitals should always in the first instance, discuss with the local collection authority, the arrangements for the storage, collection and disposal of their waste. Each collection authority has its own system and can offer advice on the most economic methods including compaction methods.

If a hospital is considering the disposal of clinical waste other than by on site incineration, then, it is imperative that they fully discuss these options with the collection authority who will advise on the practicality of the proposals. In England the collection authority will also consult the disposal authority where the responsibilities lie with another tier of local government and is separate to the collection authority.

The disposal of hospital wastes

All, non-clinical hospital waste that can be identified as falling into the category of household, commercial or industrial wastes as defined in the C.P. Act 1974 requires no special arrangements for its disposal providing the site to which it is being transported is licensed to receive it, the site licensing conditions are met, and the usual care taken with its disposal.

Clinical waste, however, requires special measures for its proper disposal and the recommendations made in the HSC guidance document need to be adapted by all engaged in the disposal chain to protect their own employees and other members of the public. Local authorities as well as Health Authorites should include systems of work for the handling of clinical waste in the disposal process which should form part of the employees safety policy required under the provisions of the Health and Safety at Work Act 1974.

In additon to the HSC guidance document the Department of the Environment are in the process of finalising a technical memorandum to deal with the arisings, treatment, and disposal of clinical wastes which is complementary to the HSC document, and the two documents, when the latter is issued, should be read together.

Planning the disposal of hospital wastes

Section 2 of the C.P. Act 1974 makes it the duty of every waste disposal authority to investigate and decide what arrangements are needed for the disposal of waste in its area which includes hospital waste. This plan, must be pre-pared in consultation with the collection authorities and health authorities, with respect to hospital wastes. A number of waste disposal authorities have produced draft waste disposal plans and references made to the disposal of hospital, clinical and other medical wastes.

A comprehensive examination of the disposal of clinical wastes in the London Area and the final report of the working party is mentioned in the introduction.

The recommendations of the working party, have been submitted to the Greater London Council, (G.L.C.) the waste disposal authority, who have incorporated them as the plan for dealing with clinical waste in Greater London.

The most important recommendations as far as the National Health Service is concerned is No. 1 which says:

'Incineration on the spot is the best way to deal with clinical waste because it is safer, easier and environmentally more acceptable than other solutions it may well also be cheaper'.

In Wales, Scotland and Northern Ireland where collection and disposal is carried out by the same authority, it may be necessary to consult another Department of the Council with respect to Site Licensing conditions.

The local collection authority may not have the resources to collect and dispose of waste from a hospital or the hospital may for convenience decide to use local waste disposal contractors. In this case the hospital administration should satisfy itself that the contractor is a reputable one and if there are problems in identifying a suitable company the National Association of Waste Disposal Contractors of 26/29 Wheatsheaf House, 4 Carmelite Street, London, EC4Y 0BN, are always willing to offer advice. It should also satisfy itself that the waste is being disposed of in the proper manner at a suitable licensed site. In obtaining tenders the disposal site should be nominated and the administration should check with the appropriate disposal authority that the disposal site is licensed to receive whatever category of hospital waste is being disposed of.

In June 1976, under the provisions of Part 1 of the C.P. Act 1974 it became an offence to deposit controlled waste on land, or use plant or equipment, for treating waste prior to disposal, without having a valid disposal licence.

The Control of Pollution (Licensing of Waste Disposal) Regulations 1976 inter alia exempted certain categories of controlled waste from the requirement to be licensed. Of interest to hospitals is the exemption of sites to be licensed contained in Section 4 (1) (j) of the Regulations:

'Waste is disposed of on the site on which it is produced by static plant with a disposal capacity of not more than 200 kilogrammes (Kg) per hour'.

For example a hospital incinerator with a capacity of less than 200 kg/hour would be exempt. However if waste was being transported from another hospital or from home nursing or outside clinics then the exemption would not apply.

It may appear academic to representatives of the National Health Service that I quote the example above as part 1 of the Control of Pollution Act 1974 does not apply to Crown Premises. However in Circular 55/75 of the Department of the Environment 'Control of Pollution Act 1974 Part 1 (waste on Land) Disposal Licences' paragraph 62 says 'Part 1 of the Control of Pollution Act does not apply to the Crown but the Secretary of State believes that the Armed Services and Government Departments will wish to take account of the provisions of the Act and the Regulations made under it. Departments are therefore being asked to review any arrangements they have for the disposal of controlled waste on land and to ensure that operating standards meet with the approval of the relevant Waste Disposal Authority'.

Waste disposal authorities in giving their approval would expect the waste disposal facilities to meet the same standards and conditions that are applied elsewhere in their area.

It is part of the waste disposal authorities duties, in the production of the plan, for waste arising in their area, to prepare a statement of the arrangements made, and proposed, for disposing of waste by others, as well as the disposal authority. This includes the N.H.S. disposal facilities, their incineration plant capacity at the hospitals and the ability of hospitals to deal with clinical waste produced in the community.

The planning of waste disposal is a very important duty of the waste disposal authority, In some parts of the country, particularly Wales, where the duty lies with the district council it is rendered more difficult where the district council is even unable to provide in some instances basic disposal facilities. In these circumstances the hospital may need to deal with all the waste produced.

The problems of disposal

The most intractable problem is the proper segregation of hospital waste into the clinical waste as defined by the HSC and non clinical waste. The inability of hospitals to find lasting solutions to this problem has resulted in draconian measures being taken. In Greater London for example hospitals have been refused permission to use the local authority disposal facilities until they can give evidence of proper segregation and management systems working.

This inability to segregate has led to a number of other problems. It is accepted that for certain categories of clinical waste landfill could be used as an outlet providing the site was licensed to receive it and proper precautions were taken with its disposal. However the inability to segregate the clinical waste from non clinical waste of which operative staff in the collection and disposal authorities are well aware has led to lack of confidence in the further segregation of clinical waste to exclude infected material and human and animal tissue and a reluctance to deal with the material on site from a fear of injury or infection.

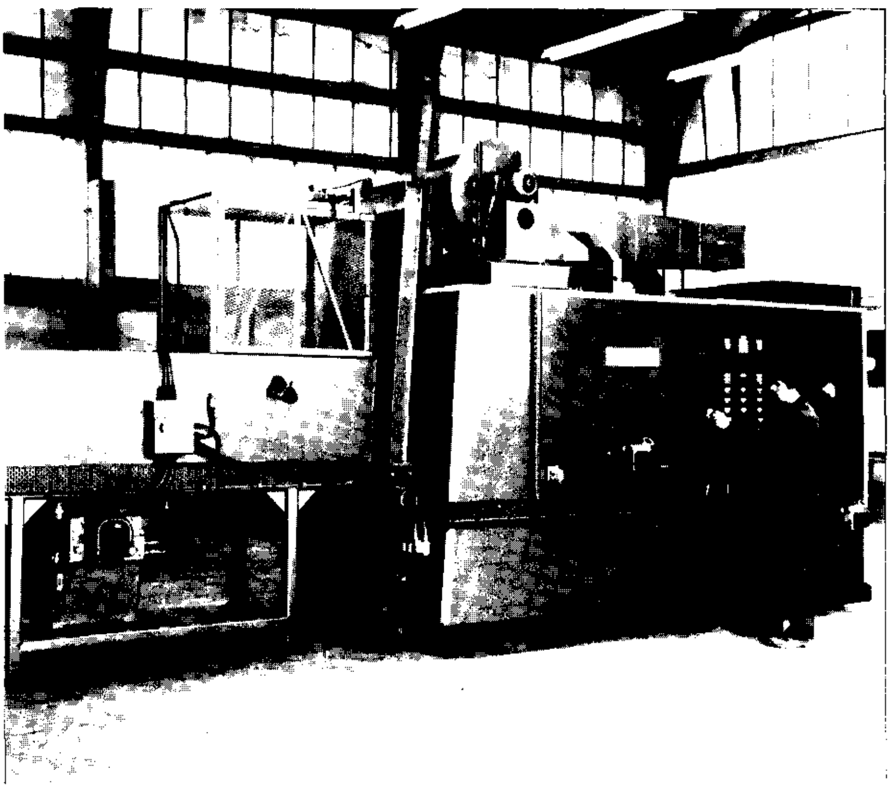
This lack of confidence extends to local authority incineration plants which are often required to provide an emergency back up for hospitals. Further segregation is also required because these incinerators are designed to deal with municipal wastes which have a different composition to clinical wastes and where the process is continuous the retention time in the furnace is inadequate to deal with animal carcases or sharps.

The proper utilisation of the colour coded system in the guidance document would help to prevent other problems. Black plastic sacks have been used for storing clinical waste as part of the policy of a hospital. Black plastic sacks are also used by local authorities for domestic refuse collection and confusion can occur in the collection of waste from hospitals and also in the disposal function. Where this kind of system is in operation all waste from the hospital concerned is treated with suspicion as it would not be possible to identify an error taking place. The yellow coded bags for incineration recommended in the HSC document are more easily identified.

Injuries have occurred to operatives in both collection and disposal authorities from 'sharps' where they have not been placed in the proper disposal containers or in the case of incineration plants have not been changed in their form by heat and appear in the residual ash and clinker.

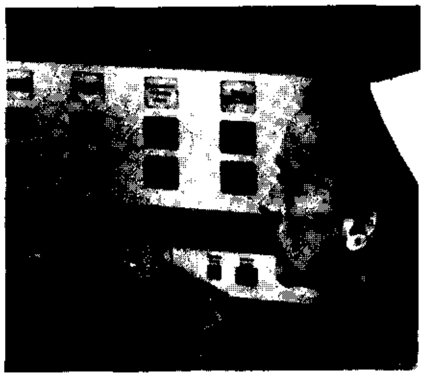
Conclusion

The framework for the treatment and proper disposal of waste from hospitals is as yet incomplete, but there are clear signs of progress to completion. The publication of the Health and Safety Commission's guidance document was a big step forward and so is the issuing of the documents revising the BS 3316 for hospital incinerators. The Department of the Environment have issued their Technical memorandum on the 'Arisings, Treatment and Disposal of Clinical Wastes' for consultation and it should be published later this year. The law concerning the storage, collection and disposal of wastes from hospitals is still unclear and the implementation of Sections 12 to 14 of the CP Act 1974 would be beneficial. However, the definition of household waste in Section 30 which, by implication includes all waste from hospitals would require a local authority to collect it all without charge. Clarification of the different types of wastes in hospitals and their redefinition would resolve this particular problem which could be acheived by Regulations made under the provisions of Section 30 of the CP Act 1974.



Typical hospital waste incinerator unit – a modern semi-pyrolysis incinerator and hydraulically operated ram loader unit suitable for dealing with 200 kgs/hr of mixed hospital wastes.

Product News



Electronic medical gas supply monitoring

A high integrity electronic system which constantly monitors pressures in piped medical gas systems has been developed.

The new system complies with the requirements of DHSS Hospital Technical Memorandum 22, and will now enable medical staff and hospital engineers to economically pre-empt the urgent need, often at a crucial moment, to replenish medical gas containers.

The medical gas alarm is designed to connect into the widely-used FOC-approved Statiscan TDM (time division multiplexing) system of fire and plant monitoring in many British hospitals.

Further details from Static Systems Group, Heath Mill Road, Wombourne, Wolverhampton WV5 8AN. Tel: (0902) 895551.

Load-break switches

With the introduction of these compact three-pole OETL 25 and OETL 40 load-break switches, the current ratings have been extended at the smaller end of this range. These two new designs have continuous current ratings of 25 A and 40 A at 660 V and a utilization category of AC23. They are therefore suitable for control of motor loads and as local isolators in both a.c. and d.c. networks. Short-circuit capacity with fuses is 50 kA.

Further details from Stromberg (UK) Limited, Bilton Road, Kingsland Industrial Park, Basingstoke, Hampshire RG24 0DY. Tel: (0256) 57181.

Safety autopsy table

Specifically designed to overcome infection hazards and odours in the post mortem room, is a new safety autopsy table which offers:

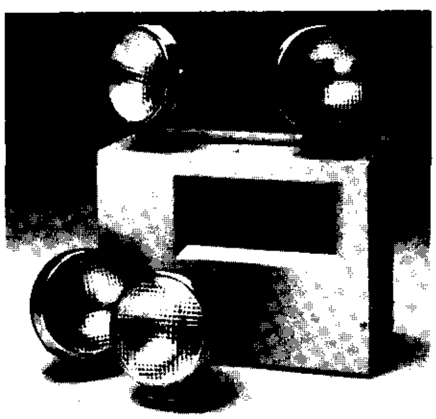
- operator protection from pathogenic organisms to the standards laid down in BS 5726 for microbiological safety cabinets.
- operator protection from odours and formaldehyde fumes.
- controllable exhaust zones making the unit equally suitable for complete autopsy work.
- an effective and economical method of upgrading ventilation in post mortem rooms.

Further details from Howarth Air Engineering Ltd, Lorne Street, Farnworth, Bolton BL4 7LZ. Telephone: (0204) 71131.

Directional emergency light

A new self-contained directional emergency light, capable of powering various combinations of tungsten halogen projectors, and, so far, is the only directional emergency light to receive ICEL certification.

In basic form, it consists of two high-efficiency tungsten halogen projectors mounted on an epoxy-painted steel housing containing battery pack, charger and control and monitoring circuitry. The unit monitors potential fault conditions – a high intensity LED gives indication that the AC supply, charger and lamp filament are healthy, and that the battery is connected. The battery pack uses maintenance-free, sealed lead-acid recombination cells with a minimum four-year life, and an expected six year-plus life in normal conditions.



Self-contained emergency directional light

The unit is designed for use either in permanently wired emergency lighting applications, or as a portable, switchable light. In both cases, the projectors can be directed to provide bright white light wherever needed.

Further details from Chloride Standby Systems Ltd, Security Division, William Street, Southampton SO9 1XN. Tel: (0703) 30611.

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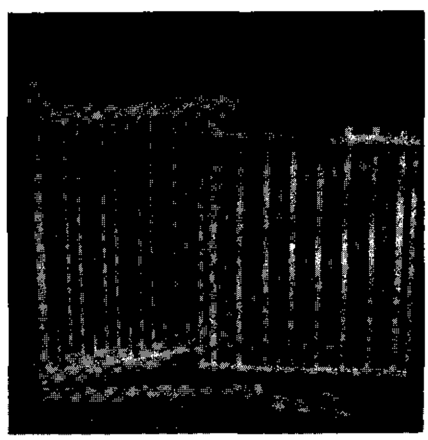
Further details from Portable Balers Limited, Summit Works, Smith St, Hockley, Birmingham B19 3EW. Tel: (021554) 7241.

Surface Temperature Radiator

Recently launched at Interbuild are the Thermal-LT range of British made radiators, specifically designed to meet the surface temperature requirements laid down by the DHSS in Engineering Data DN4. This requires a maximum surface temperature of 43°C with an inlet water temperature of 82°C.

Further details from Thermal Radiators, Shepherds House Lane, London Road, Earley, Reading RG6 1AE. Tel: (0734) 61155.



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Applications are invited from Officers currently employed in the NHS and who are within the eligibility criteria laid down in the Advance Letter GC 1/82, for three Unit Works Officer posts within the Great Yarmouth and Waveney Health Authority.

Applicants must be able to demonstrate an ability in multi-disciplinary staff management and have a sound knowledge of general management techniques.

UNIT WORKS OFFICER GRADE 6

Responsible for the Works function at four small hospitals and with district-wide responsibilities in respect of the engineering function including energy monitoring, medical equipment maintenance, control of maintenance contracts and management of capital projects.

UNIT WORKS OFFICER GRADE 4

Responsible for the Works function at the District Hospital at Gorleston. Great Yarmouth, which is currently being expanded to approximately 600 beds.

UNIT WORKS OFFICER GRADE 3

Responsible for the Works function at three hospitals in Great Yarmouth and Lowestoft.

For informal discussion, telephone the District Works Officer, Mr. M. Brooke, on Great Yarmouth 50411, extension 39.

For a job description and application form, please contact the District Personnel Officer, Great Yarmouth and Waveney Health Authority, Havenbridge House, North Quay, Great Yarmouth, Norfolk, NR30 1HZ. Tel: Gt. Yarmouth 50411, ext. 45.

Closing date for receipt of completed application forms: 24th February 1984.

Gt. Yarmouth and Waveney Health Authority

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Candidates should send full curriculum vitae with supporting documentation and addresses of 2 referees to:

Dr Fahad A Jabbar, Dean, College of Medicine
King Khalid University Teaching Hospital
King Saud University, PO Box 7805
Riyadh, SAUDI ARABIA

with copy to:

Mr J Aston
King Saud University Office,
Saudi Arabian Educational Office
29 Belgrave Square, London SW1X 8QB

Only shortlisted candidates will be notified of interview arrangements.

DEPUTY DIRECTOR HOSPITAL MAINTENANCE

The Aga Khan Hospital and Medical College is being constructed in Karachi, Pakistan. In March 1983, the institution became The Aga Khan University when it was granted the Charter by the Government of Pakistan. It is the first private University and the largest philanthropic project in Pakistan.

The Aga Khan Hospital will be a 721 - bed teaching complex for the University and a resource for primary and secondary care facilities throughout the country. The Hospital will be commissioned in phases, with the first phase opening in early 1984.

The Aga Khan Hospital requires a Deputy Director, Hospital Maintenance, who will be responsible for the direction, coordination and maintenance of all Electrical/Mechanical services and equipment installed at the hospital. In addition to supervising day to day maintenance activities, the incumbent will be required to develop & implement policies and standards for:

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- Fire and other safety programmes
- Effective routine maintenance
- Water and sewage quality control

The candidate must have atleast 8 - 10 years of Hospital Engineering experience, with responsibility for the management of Electrical/Mechanical plants and exposure of planned preventive maintenance.

The candidate should be a qualified engineer, with minimum qualifications as laid down in DHSS (UK) Professional and Technical staff 'B' council handbook.

Salary and benefits will commensurate with qualifications and experience. If you are a qualified professional meeting the requirements for this position and are seeking a challenging opportunity, please send your résumé with accompanying references to the Personnel Director.

The Aga Khan Hospital and Medical College, Karachi

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For further information and an application form, please contact (quoting reference number V11/84):

The Recruitment Officer,
Oxford Regional Health Authority,
Old Road, Headington, Oxford OX3 7LF.
Telephone: Oxford 64861 Ext. 268/228/246.
Closing date: 9 March 1984.

Oxford Regional Health Authority

CHIEF WORKS OFFICER

SALARY SCALE: £17,430-£21,298

A promotion vacancy arises for this important post which heads the works profession in the South Tyneside Health Service.

The District has a population of 162,000 and a revenue allocation of £17 million per annum. Major capital developments are now on stream with an 82 bed community hospital under construction from November 1983.

Applicants must have wide experience at a senior level and must be corporate members of either the Institute of Civil, Mechanical, Electrical or Electronic and Radio Engineers, or the R I of Chartered Surveyors or Qualified Architects.

Informal discussions are welcomed by the present Chief Works Officer, Mr J H Millar, telephone 0632 561161.

Application form, job description and further details are available from the District Personnel Officer, South Tyneside Health Authority, Horsley Hill Road, South Shields, Tyne and Wear.

Closing date: 24 February 1983

South Tyneside Health Authority

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Telex: 847064

Together, we can find the answers.