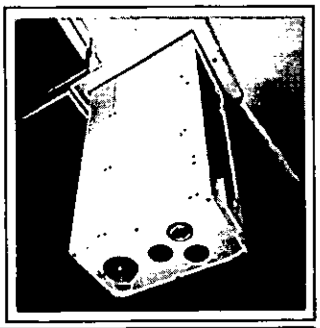
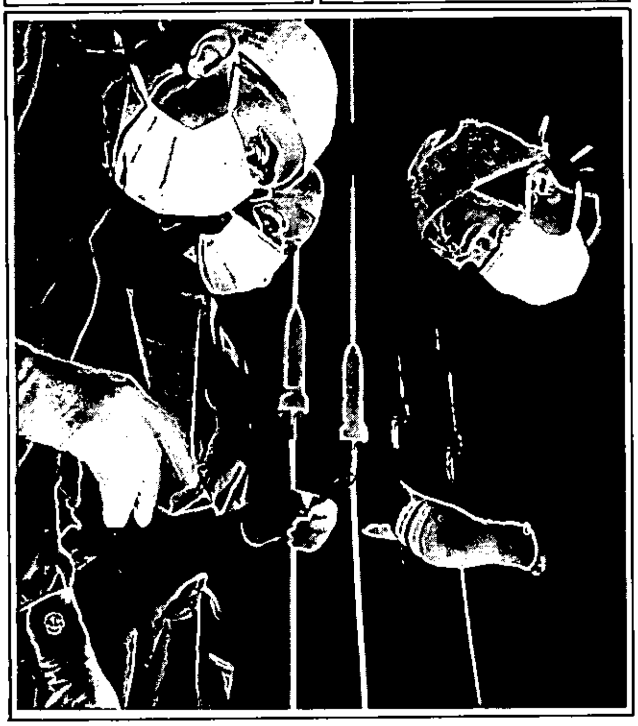
The Journal of The Institute of Hospital Engineering April 1984

HOSPITAL ENGINEERING

- Fire precautions in health care premises
- Air cleaning by electrostatic filters
- The development of an energy conservation model
- Estate control plan

VITAL PATIENT HEALTH CARE SYSTEMS





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HOSPITAL ENGINEERING

The Journal of The Institute of Hospital Engineering

Contents

Volume 38 No 4 **April 1984**

Front cover: The effect of 'flash-over' and fire damage on a fully-furnished 6-bed bay in a test mounted by the DHSS. The bed shown was adjacent to the point of ignition.

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.

Southern Branch 1984/1985 Officers and Committee

Chairman: Mr. L. House, District Works Officer, West Dorset
Vice Chairman: Mr. S. Whiteley, Engineering Works Officer, Salisbury
Secretary/Treasurer: Mr. R. Boyce, District Works Officer, Chichester

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Mr. S. Snow, Chichester
Mr. J. Walker, Southampton
Mr. D. Muspratt, Southampton
Mr. E. Feasey, Basingstoke
Mr. D. Townley-Jones, Portsmouth
Mr. P. Webb, West Dorset
Mr. D. Wicks, Winchester
Mr. A. Styles,
Mr. E. Boyland, Portsmouth
Mr. D. Chaplin, Southampton
Mr. A. Fry, Southampton
Mr. McNeil, Basingstoke
Mr. L. Jennings, Winchester
Mr. R. Laird, Southampton

Basil Hermon to retire

Basil Hermon, Regional Works Officer at South West Thames RHA, has announced his intention to retire from the NHS on 30 September 1984. He has been a member of the Institute's Council since 1967 but has decided not to seek re-election when his present term expires in May. He has been associated with the International Federation of Hospital Engineering since its inception in 1970 and is currently the Honorary Treasurer.

Although he is not seeking re-election to Council he has agreed to be coopted on some of the committees.

Engineering Council designatory letters

The Engineering Council has issued the following Statement:
The following Engineering Council titles and designatory letters should now be adopted:
Chartered Engineer – C Eng
Technician Engineer – T Eng
Engineering Technician – Eng Tech
Use of the Council of Engineering Institutions titles and designatory letters is to be discontinued.

FORTHCOMING BRANCH MEETINGS

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

11th April	Microprocessors	Rotherham College of Technology Computer Laboratory

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

9th May	Timber Preservation by Rentokil	Committee Room, Centre Block Southampton General Hospital

Yorkshire Branch: *Hon Sec. J. Bate TN Wakefield (0924) 890111 ext 210*

12th April	A visit to Bootham Engineering Co. York.

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

11th April	Visit to new factory of JEL Energy Conservation Ltd. Stockport.

Thursday 7th June	Oxford Spring Lectures (organised by the 6 Branches)	John Radcliffe Hospital

Programme given on Page 3 of this Journal

Please contact the local Branch Secretary with regard to any of the above meetings.

Northcroft Silver Medal

Council of the Institute is pleased to announce that the Northcroft Silver Medal for 1983 has been awarded for the Paper entitled 'The Application of Hyperbaric Engineering' by R.D.Buckley which appeared in the April issue of the Journal.

The presentation of the Medal will be made to Mr. Buckley at the Annual Conference Dinner.

LETTERS TO THE EDITOR

R.H. Dean responds to Howard Goodman's letter in the December issue in what can only be described as a predictable way for an engineer.

Whilst not wishing to further inflame the relationship between engineers and builders in the NHS I feel that some response is necessary.

Is it not time that we all accepted that engineers and builders (or architects) are necessary to the functioning of the NHS, instead of this continuous sniping of each other? We do nothing but harm to the works officer cause by this fragmentation. After all, I am sure that each individual whether they be engineering or building discipline would accept that they are skilled in their own profession first and foremost and would not presume to be an expert in both.

I might add that the situation is not peculiar to the NHS. As someone who has been employed in a variety of companies in private industry for 25 years, the same problem arises there, particularly in building/civil engineering companies when civil engineers tend to think of themselves as the 'creme de la creme'.

Perhaps the term 'engineer' should be abolished and we should use more down to earth terms like electrical designer, mechanical designer, architectural designer or consultant, etc., or perhaps some good may have come out of re-organisation by the use of the title 'works officer'.

G.G. Bryan
Assistant District Building Officer, Trafford District Health Authority.

TALKING POINT
Funding of Engineering Training

The Engineering Council has published a discussion document **Funding of Accredited Training Places in Engineering** which examines the serious problem of the present and increasing shortage, in both quantity and quality, of industrial training places as part of the initial education and training of engineers. The following summary must be of interest to all engineers.

If British industry is to retain and improve its competitiveness, it requires an adequate supply of properly educated and trained engineers. It follows that there needs to be sufficient high quality training places for those who will become chartered engineers, technician engineers and engineering technicians. The Engineering Council is convinced that there is a serious shortage of such places and believes that this situation must be remedied if the economy is not to suffer. The Engineering Council believes that the shortage has come about because economic pressures have forced industry to reduce expenditure on training. Large firms are only able to train for their own immediate requirements and small firms on their own do not have the resources necessary to make up the shortfall. The net result is a serious shortage in both the quality and number of places.

The cost of the initial training of engineers is high, industry's pay-back period on the expenditure is a decade or more and there is no certainty that the engineer will remain with the employer. While The Engineering Council fully supports the concept of market forces, it believes that they cannot by themselves be totally effective in this area. Present schemes providing financial contributions for engineering training are not designed to provide the type of long-term support that is necessary. Neither does the government's training policy as outlined in the White Paper 'Training for Jobs' give adequate recognition that there is a problem.

The Engineering Council stresses the importance of integrating academic education with practical training. It believes that the nation should commit itself to ensuring that well-qualified engineering staff come out of the education and training system. There is a need for government to make a firm commitment to contribute towards the cost of training places for chartered engineers, technician engineers and engineering technicians.

In the second part of this discussion document, The Engineering Council puts forward some proposals on how the provision for practical training for potential chartered engineers, technician engineers and engineering technicians might be stimulated. Large sums of money are involved. Industry has been spending £2.5 billion per annum on training. The government, through the Manpower Services Commission, will be spending nearly £1 billion this year. The Engineering Council suggest that about £200 million per annum of government funds should be redirected to help finance engineering training.

The discussion document outlines the training arrangements for those who will become chartered engineers. It suggests that either a flat rate contribution of £50 per head per week throughout the training period could be paid or, alternatively, a contribution weighted towards the early stages of training. These alternatives would each cost about £80 million per annum. It also proposes a system of payments for those providing training for technician engineers and engineering technicians which would cost around £120 million per year.

The discussion document further proposes that contributions should only be given for training which meets The Engineering Council's standards. The Engineering Council's system of accreditation could be used to monitor the disbursement of any government funds. The Engineering Council would use professional institutions, statutory and non-statutory training organisations as its agents for this purpose.

Views would be welcomed on these and any other alternatives that respondents care to propose.

Copies of the document may be obtained from The Engineering Council and comments on the document should, by 31st May 1984, be sent to:

The Director Education and Training
The Engineering Council,
Canberra House,
Maltravers Street,
London, EC2R 3ER.

OXFORD SPRING LECTURES

10.00 Registration and Coffee

10.30 Official Opening by the Midlands Branch Chairman
Chairman for the day:
B.A.HERMON ESQ CBE CEng, MICE, FIMechE, FCIBS, CIHosp E
Regional Works Officer. South West Thames Regional Health Authority

10.40 RECENT DEVELOPMENTS IN CLINICAL MAGNETIC RESONANCE
Speaker: DR. PETER BORE FRCS
Department of Clinical Magnetic Resonance, New John Radcliffe Hospital, Oxford.

11.45 ENGINEERING INFLUENCE ON MEDICAL CARE IN WARTIME – LESSONS FROM THE FALKLANDS
Speaker: SURGEON COMMANDER JOHN WILLIAMS MSc MRCP RN
Professor of Naval Medicine, Royal Naval Hospital, Haslar.

12.55 Lunch

14.00 FLUIDISED BED COMBUSTION – PART I
Speaker: D.M.WILLIS ESQ BSc CEng FInstE
Chief Industrial Development Technologist, National Coal Board, Coal Research Establishment.

15.15 Tea

15.30 FLUIDISED BED COMBUSTION – PART II

16.30 CLOSURE by the MIDLANDS BRANCH CHAIRMAN

Please advise your local Honorary Branch Secretary should you wish to attend.

The author is a director of Arden Laundry Power Systems Ltd of Stafford, a company which he set up in 1975 for engineering projects including hospital, commercial, and private laundry equipment.

Air cleaning by electrostatic air filters

W F MURRAY CEng FIMechE MIPrpdE FBIM ARINA

The air around us

Our planet has only a limited amount of air to breathe. The atmosphere extends about 7 miles up. All the air that is available to everything living on the planet is contained within those 7 miles. No new air can enter and polluted air cannot escape. It must be used over and over again to eternity.

Each year the air is becoming more and more polluted. The human race is, of course, to blame and air pollution will continue to increase as the population increases. It is not only the obvious sources of pollution, such as industry and automobiles, that give cause for concern. As the population increases we encroach more and more on nature, uprooting forests and grasslands and turning them into concrete jungles. This has reduced natural sources of air filtration and oxygen recycling. It has also caused a proliferation of more primitive vegetation such as moulds, yeasts, fungi and bacteria which add to air pollution.

The effect on man

The human race is extremely aware of the damaging effects of air pollution. This country has been one of the pathfinders in legislating against air pollution in response to public concern. Public uproar following the London smogs led to the Clean Air Act in 1956, and has resulted in a 50% reduction in air pollution levels in our industrial centres, particularly steelmaking centres such as Sheffield and Port Talbot. In 1972 regulations were introduced to control pollution from motor vehicles, and the 1974 Health and Safety at Work Act controls the working environment. However, air pollution continues to increase despite these legislations.

In this country to-day the average person's respiratory system has to eliminate, every day, over two heaped tablespoons of particulate matter – dust, pollen, smoke, bacteria, exhaust fumes, spores and many other contaminants. Some of every material ever used by mankind or produced by nature is in the air to-day.

The body, has, of course, its own defence mechanism against air pollution in the fine hairs lining the nostrils and upper respiratory tract. However, this is only effective against large particles. The size of particulate matter is compared by measuring the average diameter of the particles in microns (one micron equals one millionth of a metre. The body can only prevent particles which are larger than 4 microns from penetrating into the lungs.

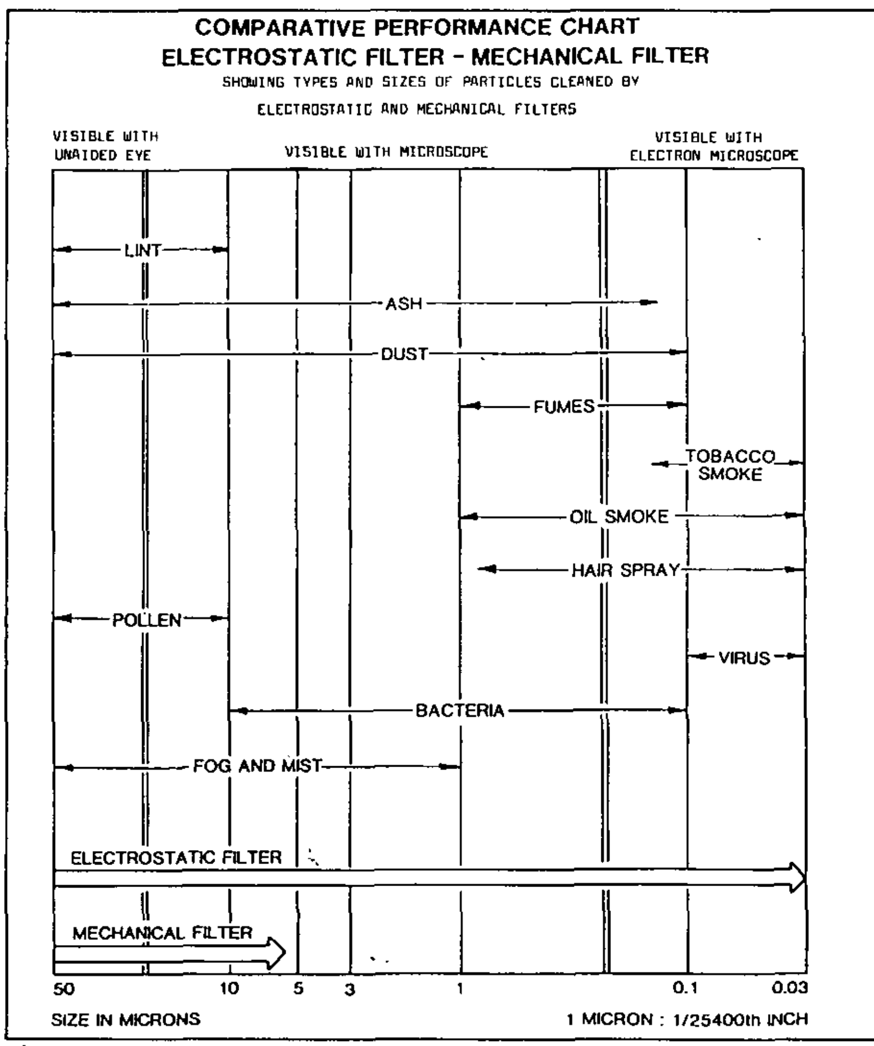


Figure 1 Comparative performance chart – electrostatic filter – mechanical filter

Tobacco smoke, consisting of millions of tiny particles of matter all less than 1 micron in size, penetrates to the lungs very easily and constitutes a serious health risk not only to the smoker but to other people forced to breathe their smoke. Many airborne bacteria are smaller than 4 microns and viruses are all less than 0.1 microns. Common house dust is also very fine, most being under 4 microns. The modern trend towards double glazing and insulation has effectively sealed our homes which have become dust traps. Example of particle size are shown in Figure 1.

Small wonder that a growing percentage of the population has chronic sinusitis, allergies such as hay fever and house dust allergy, asthma and other respiratory diseases.

Solution

Air pollution will inherently increase as the population increases, despite our efforts to control industrial and automotive pollution. It is totally impractical to clean the entire atmosphere. This is why the air must be cleaned inside buildings where we work, live and spend our leisure hours, thus providing clean local environments where our bodies have a chance to recover.

The traditional methods of providing fresh air inside buildings is to open a window or turn on an extractor fan. This has three obvious disadvantages. Firstly, we replace the expelled air with air drawn from outside and in many instances, particularly in cities, the ensuing pollutant may be worse than the original problem. Secondly, we throw the polluted air at our neighbours which is socially undesirable and in some instances in contravention of the Health and Safety at Work Act. Thirdly, and perhaps most significantly, we throw away air that has been heated at considerable expense. Electrostatic air filters are designed to provide clean air inside buildings without these disadvantages.

The principles of electrostatic air filters

Electrostatic air filters (ESF's) work in four stages to clean air of particles and odours. A powerful fan draws air into the unit through a pre-filter element which removes large particles over 10 microns in size. The smaller particles remaining in the air, such as cigarette smoke, dust and bacteria, then pass through a charging section where they receive a strong electrostatic charge. The charged particles are then deposited on a bank of special collector plates. The remaining air, which is free of particulate matter, may still contain gaseous odours which are removed by an activated carbon absorption filter. Figure 2 illustrates a typical assembly of an electrostatic air filter unit.

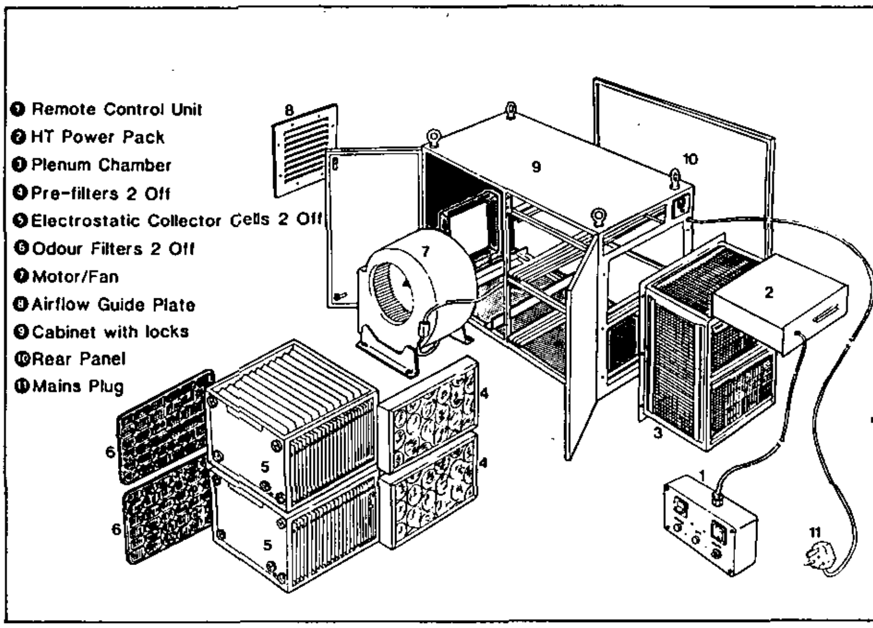


Figure 2 The ESF electronic air cleaner

Electrostatic air filters were first developed in the 1960's for industrial application, and particuarly for steelmaking furnaces. Their great advantage over mechanical interception filters such as panel or bag filters is that they do not interrupt the air flow. Mechanical filters can remove small particles, under 5 microns, only by severely restricting air flow, this requiring very large, noisy fans to draw the air through. The system is a miniaturised version of the industrial process suitable for use in rooms and small buildings. Electrostatic air filters are capable of removing particles down to 0.03 microns.

The charging section of the electrostatic filter comprises fine tungsten wires suspended between earthed plates. A high voltage of +6000 volts is passed down the wire which sets up a corona between the wire and the surrounding earthed plates. A corona is simply a flow of electrons and ions across the air gap. Dust particles passing through the corona are given a strong positive electrostatic charge.

The collector cell comprises a stack of spaced aluminium plates which are alternatively positively charged and earthed. The postively charged particles are repelled by the positive plates on to the earthed plates where they are strongly bonded. Both charging and collector sections are built into one simply constructed cell.

Early ESF's suffered from severe design problems due to poor understanding of the physical principles. Too high a voltage or too narrow a gap between the plates results in the production of excessive amounts of ozone, which is health hazard. Too low a voltage or too wide a gap makes the system inefficient and unable to remove very fine particles. Too narrow gap also means that the plates have to be cleaned too often to be practical. A narrow gap can also be readily bridged by stray hairs or particles of lint, causing arcing the plates which generates ozone.

The market for electrostatic air filters

The market for air cleaners is booming, mainly as a result of the energy crisis. The major selling benefit is their ability TO RECYCLE AIR (rather than extract with conventional ventilation systems), thus providing valuable savings in fuel costs. For example, a typical ESF handling 1500 cubic feet per minute of clean air can provide all the requirements for a space of 8-12,000 cubic feet.

If outside air was used to meet this requirement, assuming an ambient temperature of 10°C and a desired indoor temperature of 20°C, then 1500 cubic feet of air per minute will need to be heated by 10°C. This would require some 9 KW of energy, which would cost approximately 45p. The cost of running the ESF, which uses only 950 watts of electricity would be less than 6p! At the same time the machine is providing a healthy and comfortable environment and is also making considerable savings on cleaning and decorating.

ESF's have been marketed for several years. Their early use was limited to specific applications requiring air such as computer rooms and telephone exchange switch rooms. Their use has steadily become more widespread to include pubs, clubs and restaurants as the public has become more and more concerned about health particularly anti-smoking. The Health and Safety at Work Act has made their use commonplace in offices and meeting rooms. The reduction in bacteria and pollen has led to an increasing use in the medical field, in hospitals and clinics. Now the equipment has been developed to industrial size units – capable of handling 1500 CFM.

The benefits of electrostatic air cleaners are clear. They offer a comprehensive solution to air pollution and to-day's health and safety requirements demand that companies provide the cleanest environment possible for their employees and customers. The cost of providing clean air is outweighed by savings in energy, cleaning and decorating.

Operation of an industrial model

A fan system circulates air at volume through the unit. Within the unit advanced electrostatic techniques are employed which charge the impurity particles in the air (including smoke, fumes, bacteria etc.) and trap them on electrically-charged metal plates.

A pre-filter system is fitted to prevent the ingress of large particles and a replaceable odour filter is fitted to assist with the removal of odours present in the atmosphere.

The unit operates from a standard 240V 50 Hz mains supply and is designed to be either mounted on a platform or suspended from the ceiling by four suitable mounting eyes incorporated in the top of the unit.

The use of this unit retains the heat in the air so avoiding the losses of extraction systems. It is a heat saver in all respects. In cold weather clean, comfortable and warmed air avoids open doors and windows for fume and odour removal.

Description

The components are housed in a lockable two-door metal cabinet. In operation, the collector unit generates a high voltage (HT) and, as with all electrical equipment, the cabinet doors should only be opened by trained personnel. The doors incorporate actuators which engage with micro-switches and automatically disconnect the mains power supply when either of the doors is opened. The HT circuit is safely discharged to earth immediately a door is opened.

Systems usages

The industrial size units are designed to purify the atmosphere in an area by removing such impurities as lint, fibres, dust, powders, and foul and soiled linen odours, etc., from the air. Ducts can be supplied to collect air from one area and supply the purified air to another area.

Additionally it may be feasible to use the heated exhaust air from a calender to pre-heat the air being discharged from the unit. This enables warm air heating for general or particular use. This form of secondary heating can be fitted with 'on/off' diversion ducts.

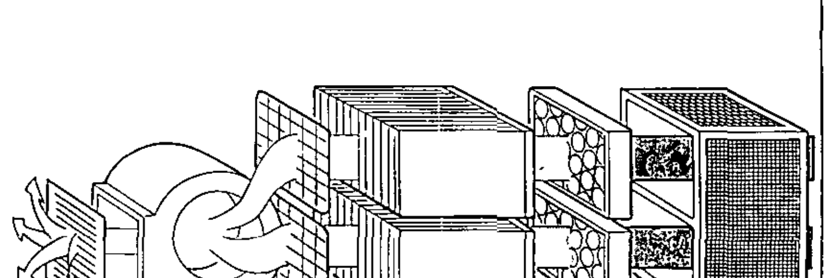
The air is drawn through plenum chamber grilles into the right-hand side of the cabinet. The grilles are removeable for cleaning off large fibres and fluff. Spare grilles are supplied enabling substitution so that cleaning does not stop the use of the unit.

Disposable pre-filters are fitted between the grill chamber and the two collector cells and they are removeable and replaceable. The pre-filters are a simple slide fit. Different types of pre-filters are available for various applications.

The air then passes into the heart of the machine, the two electrostatic collector cells. The entry part of each cell is the charge section which consists of a number of electrically charged wires stretched across the front of the cells. Between each pair of charge wires is an earthed plate, and a strong electric filed is created by corona discharge between the wires and the plates.

The remaining particles of dust, bacteria, smoke, etc., in the air are positively charged by this strong ionisation field. These charged particles then enter the collector section of the cells which comprise the very closely-spaced plates which are alternatively earthed or positively charged. The charged particles are repelled by the positve plates and attracted on to the earthed plates where they adhere. The air is now cleaned of particulate matter but may still in certain well-known areas contain odours, which are primarily gaseous. To remove these, activated charcoal odour filters are fitted after the collector cells. The purified air is then vented back into the area clean, odour free and without heat loss, and generating a circulatory system for constant air purification. (The process is illustrated in Figure 3). The outlet grille has moveable louvre positions to direct the airflow in any one of four directions.

Figure 3 ESF 1500 flow diagram



Air conditioning

Air cleaners are a part of the field of air conditioning. Unfortunately the term 'air conditioning' is more commonly applied to systems which cool or heat the air, or adjust humidity levels. Too often other important aspects of air conditioning, especially ventilation and air cleaning, are forgotten.

In our climate it is difficult to justify the high capital and running costs of normal air conditioning. Air cooling is perhaps only needed for a few months of the year, or for places where large numbers of people congregate and generate excess body heat.

In this climate, therefore, air cleaners which recycle the air are often a lower cost, more useful alternative to air conditioning. They are particularly useful in existing buildings where centralised air conditioning systems cannot be fitted.

Some air conditioning systems do include panel filters to clean the air. However, even the most efficient panel filter can only remove particles down to 3 microns.

It is important to understand the relationship between particle size and particle volume/weight.

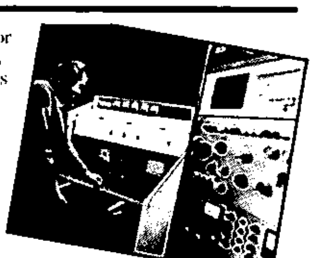
Typical air borne dust will contain 90% of the weight or volume of particles over 3 microns. However, these constitute only 10% OF THE NUMBER OF PARTICLES. Nine out of ten particles are invisible to the eye but are taken into the lungs. 90% of particles are the harmful small ones under 3 or 4 microns. Typical panel filters are totally ineffective against small particles such as tobacco smoke and viruses. They effectively do only the same limited job as our prefilters.

Servicing of ESF's

ESF's are necessarily highly efficient machines. Efficiency can be seriously impaired if the collector cells are not cleaned regularly or are distorted or damaged. In severe applications plate cleaning is required as often as every six weeks. Whilst cleaning is not difficult it is time consuming for user requirements. The manufacturer normally undertakes to make regular visits to the customers' premises, inserting clean collector cells and taking away dirty ones for cleaning.

The customer is thus guaranteed a continuous supply of fresh clean air.

The outer grids in the plenum chamber are easily removable for cleaning by the users' engineer. Substitute grids are provided so that the unit need never stop working.



Profile: Susan Lancashire

Where are all the women engineers? There aren't any – or very few at least – is the regrettable answer. However The Institute boast three women among its membership. And in the year of WISE (Women Into Science and Engineering) it seems a good time to focus on their careers and experience in a traditionally man's world.

Susan Lancashire

Susan Lancashire, BSc CEng MIMechE MIHospE, Executive Engineer at Project Management Partnership, is one of the few women in a male-dominated profession. 'Men sometimes find it a problem,' she says. 'I don't. Though I've been irritated at interviews when I've been told point-blank that as I was a woman I would leave to have babies. No-one minds if a man leaves to go to another job. It's illogical.'

Such small-minded attitudes she has overcome easily with her determination and ability, and most male colleagues have welcomed her as a fellow professional. Though she has had to prove herself as good as any man. She remembers feeling obliged to put on protective headgear and overalls and scramble inside a boiler to inspect for herself a thinning back plate. 'A man would have turned to his deputy. But as a woman I had to prove myself, once and for all, before I could delegate. But as you get further up the ladder, it does get easier. You have your track record to back you up.'

At school Susan Lancashire was fortunate to have been taught physics by an engineer. Her only real battle was with her father who would not differentiate between a mechanic and an engineer. 'But his opposition provided me with my motivation,' she says. She won the battle and enrolled at Manchester University in the Department of Mechanical Engineering – the only woman.

When she left university – she applied for 50 jobs. Her male fellow-graduates applied averagely for a dozen. In the end it was her own university, Manchester, who employed her as Planned Maintenance Engineer in the Mechanical Engineering Services Department. Her work was to plan and co-ordinate maintenance routines, using both contract and direct labour and to initiate and develop record systems for maintenance plant population. She worked there for two years but seeing no chance in the big department for promotion moved into local government in order to take advantage of the career structure.

Accordingly she became a mechanical engineer for the Bredbury & Romiley UDC in Cheshire. Here she was responsible for maintenance, and in some cases design, of ejector sewage and pumping sewage stations and H & V plant in council buildings. The authority was wiped out in local government re-organisations, and with it Susan's job. 'Anyway,' she says, 'I didn't want to design sewage plant all my life.'

She moved to become Mechanical Engineer to Portsmouth Polytecnic and College of Education. Susan was responsible for both the day-to-day running of mechanical plant and its maintenance. The work also involved some design work, when a complete boiler house was stripped-out and renewed, using direct labour. (It was at this time she became a member of The Institution of Mechanical Engineers and hence a Chartered Engineer.) It was time for a move. Susan explains 'Once I got the whole system working, and having proved that I could do it, I decided to join the hospital service.'

Kings College, the London teaching hospital, was where she became the Hospital Engineer. She found the job enormously interesting, and very demanding, and was responsible for a direct labour staff of 70 employed on day-to-day running and maintenance work. There were also minor capital works, where as Engineer Susan acted as project officer, co-ordinating both direct and contract labour to ensure smooth running of projects.

It was challenging work. 'So many emergencies,' Susan recalls. 'I was on call 24 hours a day. And had a "bleep" in my pocket one weekend in three.' Her husband was working for another hospital, and they were never without a bleeper between them. It was a worthwhile job. 'In a hospital there is a close link between engineering and people. I should have thought that this human contact would make hospital engineering particularly appealing to women,' says Susan.

In 1980 she was appointed Executive Engineer of Project Management Partnership, the consulting engineers. Her responsibility is for planning, development and installation of planned preventative maintenance schemes for clients in both the public and private sectors in the UK and abroad. Many of the clients are regional health authorities requiring detailed technical manuals to cover their maintenance schemes, other work Susan is involved in includes acting as expert witness in litigation cases, advising clients on energy conservation and supervising contracts on clients behalf from initial conception to handover.

Having established herself, the fact that she is a woman is irrelevant to her work (It always was of course). By visiting and lecturing to girls schools she hopes to encourage girls to think of a career in engineering. 'It has always been possible, but difficult for well-qualified women to succeed in professional jobs. What we've got to encourage too are the technicians. In a mechanised society this is vital.'

In the next issue we profile Belinda Hatton, Grade 3 Technician.

Dr Croome is Reader at the School of Architecture and Building Engineering, University of Bath. He is also Part-time Partner of Buro Happold. Ms Sinclair was formerly Research Assistant in the School of Architecture and Building Engineering at Bath.

The development of an energy conservation model related to estate management

DR DEREK J CROOME MSc PhD CEng FIHospE FCIBS MInstE MInst P MASHRAE FIOA

JANE V SINCLAIR BSc MSC

Basis for Decision model

The decision model described in this paper has been evolved to enable a standarised method of selecting an energy conservation programme to be use nationally which is also capable of being assembled as a computer package. In this way every factor in the process is taken into account whilst subjectivity is minimised. Interactions between the factors are considered so that flexibility is introduced in to what may be described as a mind-ordering process.

Co-ordinated decision-making

The common aspect of all decision-making is to rank a feasible set of alternatives according to their desirability. On the basis of this ranking it is then possible to decide which solution to adopt and which to reject. The eventual decision will only be as good as the range of alternatives considered and the method of ranking used. This structured view of decision-making forms the basis of cost-benefit analysis, as shown in Fig 1. The steps depicted here are the principal ones that have been used to formulate the decision model.

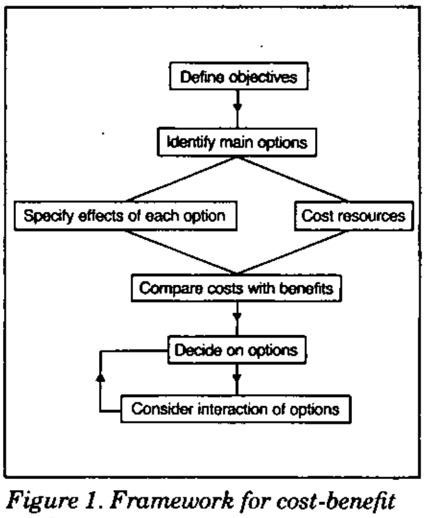


Figure 1. Framework for cost-benefit analysis

The objectives in this project are (i) to save fuel in the existing hospital estate throughout England and Wales by reducing overall consumption by about 25%. (ii) to co-ordinate and to systematise the decision-making as regards energy conservation throughout the hospital estate.

Possible energy conservation measures will differ from hospital to hospital and will also alter with time. To judge what is feasible one needs to take into account future, as well as current, plans for the particular group of buildings being considered.

Implementing options causes change and costs money. Desirable changes such as saving fuel, reducing maintenance and improving thermal comfort have to be balanced against undesirable changes like reduced boiler efficiency, and uncomfortable increase in warmth and /or decrease in fresh air and high capital expenditure. Each effect and cost in capital and revenue terms must be differentiated.

In practice benefits and costs are compared by the over simplified notion of a simple payback period in which the term 'benefits' is reduced to mean saving in fuel and 'costs' to mean the cost of the fuel-saving measure at the time of implementation. Benefits interact and energy cannot be considered without reviewing the effects that changes have on comfort. Benefits nearly always have some medium- or long-term economic value which can only be accounted for by using discounted cash-flow techniques. This is particularly important at a time when fuel costs are changing rapidly.

The energy conservation measures in the decision model are ordered by using a ranking matrix which compares the importance of the hospital's respective requirements. The requirements and their relative importance can vary from hospital to hospital and with NHS policy at the time. An achievement matrix is then used to test each measure against each requirement. Weighted values are derived using the product of ranking and achievement scores. This provides an interactive and flexible way of selecting and sorting out a programme for a series of energy conservation measures.

A continually up-dated data base is required to use the decision model effectively. As microprocessor-based energy audit systems are increasingly used, it will become easier for regional health authorities to keep abreast of the national picture and fine-tune their building stock accordingly.

Temperature requirements

Every degree Celsius reduction in the temperature differential across internal building elements is accompanied by an average of 7% decrease in the overall heat loss. it is important to set temperature standards which are compatible with human needs but which are not excessive because people can be too hot, as well as too cold, and high temperatures are wasteful.

In the past heating systems for many types of buildings, including hospitals, have been over-designed and produced temperatures of 21°-22°C whereas lower temperatures may be acceptable.

There has not been very much research on the temperature needs of the elderly and no documented account about any investigations that have been carried out in hospitals. It is generally assumed that older people need higher temperatures but recent research disputes this.

The conclusions of Langkilde (see the French Journal INSERM, *75*, 187-194, December 1977) were:

- Age has no significant effect on the ambient temperature preferred by a person or on the mean skin temperature when he/she is thermally comfortable.
- The evaporative loss during comfort decreases with age.
- There is no significant difference in the preferred ambient temperature, the mean skin temperature, the rectal temperature or the evaportative loss between elderly male and female subjects.

The experiments were carried out with 16 healthy subjects undertaking sedentary activity and having a mean age of 84 years.

The basal metabolic rate decreases with age. Any preference for higher temperatures is probably due to the fact that old people are often occupied at a lower activity level. Collins and Hoinville (BSERT,*1*, (4) 1980, 165-172) conclude that the mean comfort temperatures for old mobile healthy people (77-79 years old) with clothing insulation of 1.0 clo and a little activity (70 W/m^2) for two hours was 21.1°C and this also applies to young adults (27-28 years old). A range of values is shown in Table 1.

Skin temperatures were slightly lower in the elderly but there was a similar skin-clothed temperature gradient. There was also some evidence that changes in body temperature (oral, aural and urine temperatures were measured) were more quickly accommodated to different air temperatures in the young; urine temperatures were slightly higher in the elderly but aural and oral temperatures were a little lower than for young people. Similar work needs to be carried out for ill people in hospitals.

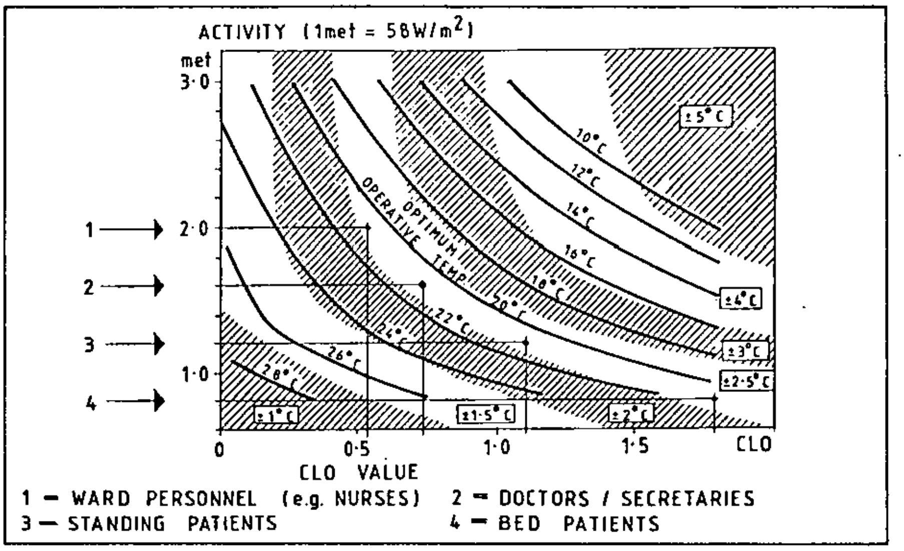


Figure 2. Optimum operative temperature as a function of clothing and activity

Activity	Dry bulb temperature (°C) (50 per cent RH; air velocity 0.1 m/sec)
Sitting at rest (58 W/m^2):	
1.0 clo (normal Uk indoor winter wear)	23.2
1.5 clo (heavy winter wear)	20.6
Sitting reading, occasional light activity (70 W/m^2):	
1.0 clo	21.1
1.5 clo	18.4
Light domestic work (80 W/m^2):	
1.0 clo	19.8
1.5 clo	16.2

Table 1. Mean thermal comfort temperatures for healthy elderly people (Collins and Hoinville 1980)

Fanger's comfort model (see 'Thermal Comfort' by Fanger, McGraw-Hill 1972) is the basis of the draft ISO/DIS Standard 7730. Since October 1982 Danish Hospitals have used this work as a basis for hospital design.

The aspects of this study which are applicable to hospitals are shown in Fig 2 based on the conditions shown in Table 2 for an operative temperature of 21°C (Note that this temperature combines the effects of air and mean radiant temperatures).

ISO/DIS 7730 tabulates the variation in comfort response for people using predicted mean vote values and indicates the effects of relative humidity and air velocity.

Energy saving options

Energy savings in buildings can be effected by the application of a number of conservation measures together. The mistake has often been made of attempting to estimate total energy savings as the sum of the effects of individual measures. However, energy conservation measure can both interact and overlap.

The decision model is a method of assessment intended to simplify the correct choice of conservation measures so that the optimum savings effect is obtained.

Some measures must be linked to each other. An example of such a pair of measures is the application of

Table 2 Occupant conditions in hospitals (Danish Hospital Standards)

Occupant	Activity (Mets)	Clo Value
Ward personnel (eg nurses)	2	0.55
Doctors, secretaries	1.6	0.70
Standing patients	1.2	1.1
Bed patients	0.8	1.7

Note: 1 met is equivalent ot 58 W/m² and 1 clo to a thermal resistance of 0.155 m²°C/W.

additional thermal insulation and temperature control. If additional thermal insulation is applied, indoor temperatures will rise in many cases and there will be no net energy saving. It is not until the extra insultation measure is linked to temperature control that energy can be saved by maintaining the indoor temperature at the same level, or possibly even by reducing the indoor temperature. Temperature control alone can save energy if indoor temperatures have previously been too high. there are several other examples of measures which should be linked.

Energy costs and targets

In order to achieve complete control of energy costs, it is necessary to regard objectives as being in two categories:

- How to control *present costs.*
- How to influence *future costs.*

Energy auditing and monitoring satisfies the first of these two objectives by providing the tabulations and statements which can answer the following questions:

– How much is spent in which periods and on which fuels?

– How much do premises vary in their rate of consumption?

– Are fuel purchasing opportunities being optimized?

Budgeting is a financial control interest, whereas determining the optimum use of fuels is more of an engineering operations consideration. Both facets are concerned with setting targets and can result in savings of 10 to 20%.

Controlling present costs is wholly dependent on a continuous flow of meaningful information which must show both the individual hospital and its place in the regional picture. It is then possible to analyse frequently a number of key activities which will include:

- Correct application of tariffs.
- Changing patterns of consumption.
- Cost relationships between fuels.
- Consumption relationships between premises.
- Cost and consumption relationships over time periods.
- Real cost trends and energy performances.

Having established that energy costs can be adequately controlled, by continuous monitoring and analysis, the opportunity exists for planning future requirements.

The extent to which hospitals involve themselves in planning for future energy requirements can vary considerably, but the use of the decision model can enable future plans to be developed quickly and thoroughly.

The model must have a continually up-dated data base. it is then possible to cover a number of management planning areas including:

- Budget forecasts for each fuel.
- Budget forecasts for each location.
- Forecasts of energy cash flow requirements.
- Setting achievable targets for each location.
- Comparing actual with target consumptions.
- Comparing the total energy consumed by similar hosptials.
- Modelling the effects of inordinate fuel price increase.

This project does not attempt to set energy targets but, if the decision model is used nationally, there should be a trend downwards from the current average annual consumption of 83.5 GJ/100m³ There should also be some contraction of the range which presently extends from 57 to 107 GJ/100m³. The age and wide variety of use make it unlikely that a single figure energy index can be set. An annual consumption of 150KWh/m² has been proposed for new offices (see Energy in Buildings, October 1982, page 7). Some work by King (MSc Dissertation 'Efficient use of Energy in Hospitals', Bradford University 1980), based on five case studies, suggests target levels of 0.1GJ/1000m³ per degree-day for new buildings and 0.15GJ/1000m³ per degree-day for old ones.

Most energy conservation measures will achieve a pay-back period on

Energy Input category	Guideline Annual energy input*	Interpretation
A	< 65 GJ/100m³	new buildings to latest standards and management techniques
B	65 – 80 GJ/100m³	good planning; roof insulation to Building Regulations standards; good controls; planned maintenance
C	80 – 100 GJ/100m³	ad hoc conservation (note: average consumption is 85 GJ/100m³)
D	> 100 GJ/100m³	no conservation measures effected

Table 3. Strategy for energy conservation
**DHSS are at present revising these figures.*

investment of five years or less and assuming that 15% of the captial investment may be credited to the revenue account each year, a general pay-back period of 6.6 years results. In order to assess if the decision model will be helpful the energy figures in Table 3 can be used for guideline purposes only. These figures are currently being revised by the DHSS and they relate to the whole hospital.

When each building has been classified the cost to bring it to category B is estimated. This then gives the planners an overall cost for improving the energy performance of the whole hospital. Although the level of information is quite different from that required for the Decision Model this strategic broad-brush approach may well be the catalyst for making the planners decide upon an energy conservation programme to improve performance – and then the Model should be applied for the tactical planning.

Classifications A, B, C, D and X are awarded to each building on the following basis:

A – The whole hospital energy input amounts to less than 65 GJ/100m^3.
This indicates buildings which are constructed in accordance with part FF of the Building Regulations; heating and hot water services have controls; boilers installed and utilised for maximum efficiency; heat recovery employed wherever possible; lighting and electric power have the latest control techniques; the whole organisation would have a record of very good management as far as energy is concerned.

B – Buildings with energy input within the range 65-80 GJ/100m^3.
Such building would have undergone a co-ordinated and planned energy conservation programme that has resulted in:

(i) buildings thermally insulated (including draught proofing to economic limits with effective modern controls for heating

(ii) all services would have been examined and changed if necessary to maximise efficiency

(iii) equipment regularly maintained and a record of reasonable energy management.

C – Buildings with energy input within the range 80-100 GJ/100m^3.
Some energy measure may have been incorporated but these would be largely on an ad hoc basis; low level maintenance and management.

D – Energy input greater than 100 GJ/100m^3.
No energy conservation has been carried out for whatever reason; energy management non-existent; typical untreated EMS huts would usually fall into this category.

X – This letter added to any mark (eg CX) would indicate that because of the nature of the building structure, improvement is either impractical or just too expensive to be tenable; this classification also applies to heating services and controls.

In Report 1 (The Development of an Energy Conservation Model Related to the Hospital Estate by Croome and Sinclair, March 1982) the list of energy consumption and expenditure figures shown in Table 4 were given for all hospitals throughout England and Wales.

Using this data and the classifications in Table 3 it is clear that most hospitals fall into classifications B and C thus the Decision Model should be used for most of the estate as summarised in Table 5.

Table 5. Energy input classification for hospitals in England and Wales (1979 – 80 data)

Energy input classification (GJ/100m^3)	No. hospitals (England & Wales)	Heated volume (100m^3)	Action
A < 65	25	2506	
B 65 – 80	270	209072	USE DECISION MODEL (B – D)
C 80 – 100	1641	600300	
D >100	18	2623	

Table 4. Annual energy consumption and expenditure by hospital type for 1979/80

Type Code	Number of hospitals	Total heated volume (100m^3)	Average unit consumption (GJ/100m^3)	Hospital unit expenditure (£/100m^3)	Type
01	531	200,965	84·03	204·373	Acute
02	131	109,973	90·23	203·930	Mainly acute
03	66	41,829	93·58	190·384	Partialy acute
04	77	20,170	88·84	197·502	Mainly long stay
05	76	20,676	89·61	191·450	Long stay
06	43	2,276	69·06	179·379	Preconvalescent
07	13	850	59·69	168·594	Convalescent
08	12	1,656	57·63	133·415	Rehabilitation
09	5	337	66·98	159·754	Isolation
10	96	9,503	86·96	206·951	Maternity
11	162	143,335	75·57	159·175	Mental illness
12	227	62,576	82·24	187·201	Mental handicap
13	24	6,359	83·44	180·794	Orthopaedic
14	15	2,369	106·87	266·753	TB & chest
15	3	254	101·37	268·012	TB & chest isolation
16	19	4,956	89·75	201·847	Children's acute
17	16	1,703	66·04	190·060	Eye
18	334	48,881	81·;2	197·014	Geriatric & chronic
19	44	61,401	73·87	196·169	London teaching
20	60	74,462	89·27	200·151	Provincial teaching

The Decision Model

Key steps for energy conservation

For effective energy conservation it is important to monitor existing energy use patterns; an energy target needs to be defined; a systematic method is needed for assessing what measures should be adopted. An energy decision model is necessary to act as a guideline; to give an algorithm for quick action; to ensure co-ordination of action between all the hospital regions throughout England and Wales. In the words of one District Works Officer, 'We do a lot of energy conservation but it is all decided in a random way.'

The model has been developed to

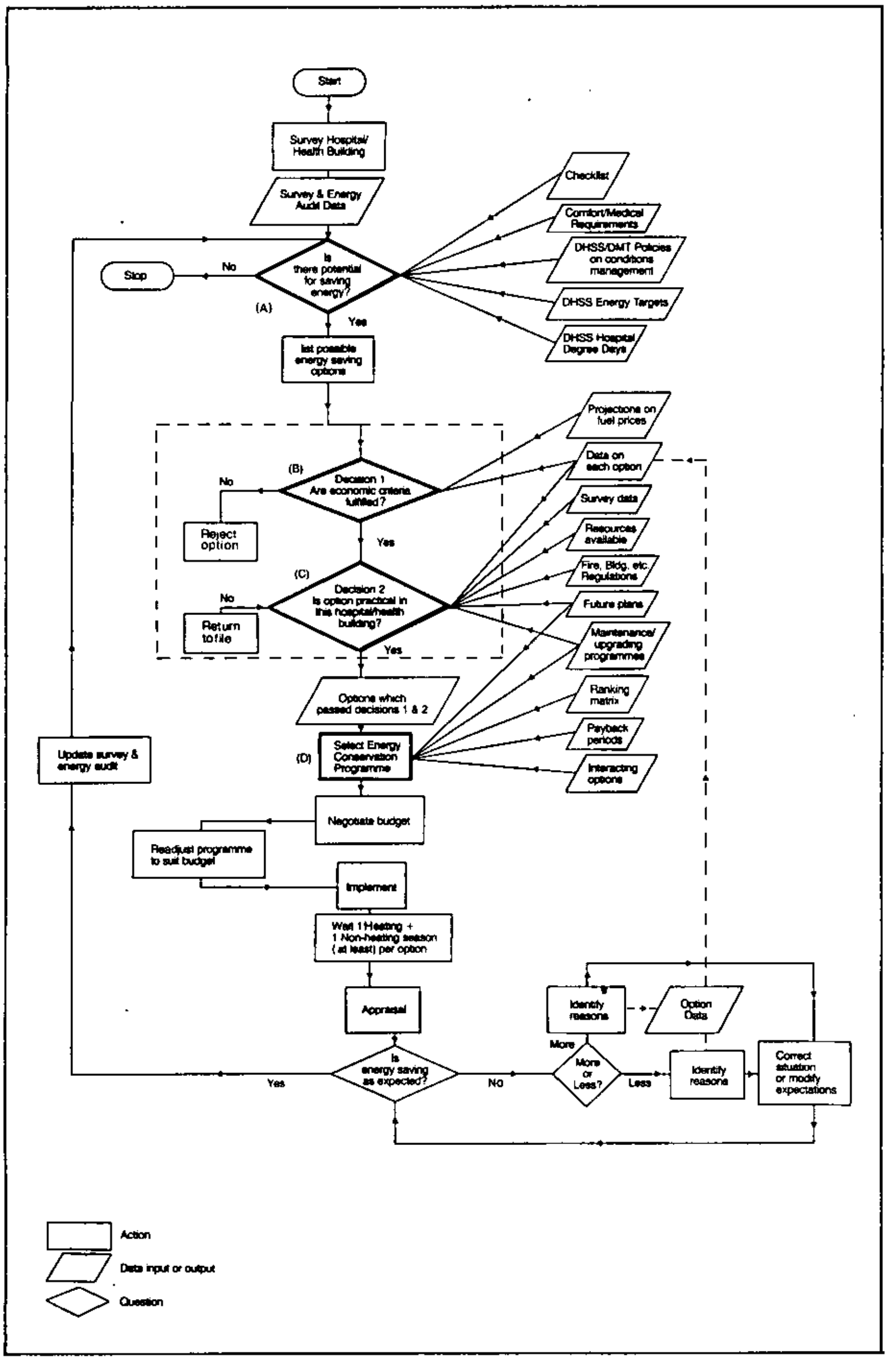


Fig 3. Energy conservation algorithm

enable an energy conservation programme to be planned for the known conditions of a particular hospital. 'Known' conditions mean that monitored surveys have taken place and this will include some measurements as well as general surveys of how systems are being used. Fuel consumption records must also be analysed.

Fig. 3 shows the energy conservation decision algorithm. There are four key steps and each of these has a planning algorithm. (These are not shown here).

A List possible energy saving options

B Check that the economic criteria are fulfilled by each option

C Check that each option is practical for the particular hospital

D Select the energy conservation programme.

Operating the decision model

The decision model is used to select an energy conservation programme for a hospital by breaking down the decision-making process into a series of simple decisions (see Fig 3). A useful decision can only be reached if the relevant information is available. Each decision node in the model has an input box which details the necessary information to make that decision. The output from each simple decision leads on to the next. Many decision nodes ask for a yes/no response and can be worked through quickly.

The first *decision-making area A* is the potential for saving energy in the hospital. A survey and energy audit, detailed in the back-up material, provide the input data. A list of energy conservation measures is compiled for consideration. The user is helped by a checklist of possibilities (provided as back-up material to the model).

The energy-saving options are each investigated for their suitability. The key questions are:

(i) does the option fulful the economic criteria?

and (ii) is the option practical in this hospital?

Information about the option is fed into *area B* together with economic data. The worth of an option can be judged by its payback period or by discounted cash flow techniques.

Area C also requires information on the option plus hospital data.

When each option has been investigated, the output is a list of options which are both economic and practical for the hospital. In *Area D* the list is ordered by the length of payback period or by a ranking system in which a score is assigned to economic and other criteria. The best options are picked out and any conflicts or effects on each other are noted and considered. Some conflicting options are eliminated; for example, only one of a group of mutually exclusive measures can be selected.

The remaining list is arranged in a time sequence to fit in with the hospital plans; the best options are carried out as early as possible. Implementation may be immediate or several years in the future. This list is the fundamental energy conservation programme.

The next step is to negotiate a budget to allow the commencement of the programme; in some instances some rescheduling may be necessary.

The model begins with a survey and ends with a feedback loop so that an iterative information system results. Both of these actions are important. After carrying out an energy conservation measure, conditions and fuel consumption are monitored for at least one heating and one non-heating season. The results are fed back into the model as further 'option data' (see Fig 3).

The model should be run through regularly (say, annually) to allow changes in plans, technology and the economy (plus feedback) to update the energy conservation programme.

The model's database comprises:

- Data about the hospital
- Data about energy conservation measures
- Economic or financial information
- Standards for patient care, conditions and the hospital's construction

A survey and energy audit provides the input data about the particular hospital under consideration. They consist of the hospital's energy consumption and the resulting environmetal conditions; the state of its existing fabric, plant and controls; its management policies and any special needs. The collection of data need not be a long process. In many hospitals the information will be available already and the energy manager need only gather together the relevant items. In other hospitals a survey and audit will give a baseline of information which can be periodically updated with little extra effort. The act of carrying out a survey has been found to be very constructive. It may point out obvious energy losses which could be corrected immediately, at minimal cost, to start saving energy from that moment.

Data on energy conservation measures can be derived from manufacturers, research bodies, journals and the personal experience of hospital engineers. The data are to include expected savings, present and future costs and the effect of the measure on environmental conditions and the state of the building.

Economic or financial information is needed to assess the economic viability of each energy conservation measure. This includes fuel costs, interest rates (present and projected), any special tariffs available to the hospital and other operating costs (eg salaries of maintenance staff).

Any energy conservation work undertaken must satisfy DHSS standards set for patient welfare and any national regulations, such as Fire and Building Regulations. All this information should be currently available to NHS Works Oficers.

The database should be as comprehensive and precise as possible, since the quality of the output from the model will reflect the quality of the input.

Building use studies

Observers were employed at St Margarets Hospital in Epping for one week each month from February until August 1982. Records were made up of temperature, radiator and window uses in three similar adjacent wards built in the 1940s. All had roof insulation but Almond Ward was double glazed and Rowan Ward had external insulation whilst Beech Ward acted as a control. The following conclusions are evident from fig 4.

(i) The external temperature range varied from 11 deg C in February (−4° to +7°C) to 18 deg C in July (11° to 29°C).

(ii) Rowan was the warmest ward so that the effect of external insulation was to decrease the U value but increase the temperature by about 2°C hence the energy saving was limited. This effect can be overcome by using a more sensitive temperature control system.

During winter months the external insulation gave an increased swing of internal temperature (4 to 5 deg C) whereas double glazing permitted a lower average swing (2 to 4 deg C). The control ward had a swing of 3 to 5 deg C and had a similar average temperature to that in the double glazed ward.

(iii) The heating was switched off in June so that the internal temperature conditions followed and were similar to the external ones. May was a transition month.

(iv) Radiators were categorised as hot, warm or cold. During February to April the control ward had the largest percentage of warm radiators but the lowest number of hot or cold radiators. The insulated wards have the highest percentage of cold radiators and also the highest number of hot radiators. There is a higher proportion of fanlights opened in the insulated wards and consequently the draughts are more likely. Hence, depending on local conditions near to each patient, radiators may be turned fully on or off, whereas in the control ward fewer windows are open and there is a general overall warmth achieved by most radiators being on i.e. thermal conditions are more uniform.

(v) Very few casement windows are opened until May whereas a significant number of fanlights are opened even in February. Although the highest temperatures were measured in July the maximum window opening was recorded in June. Fanlights are more difficult to open and shut besides they are more distant from the patient, hence draughts are less likely to be sensed; it seems that these provide the basic fresh air requirement.

(vi) During February, March and April the warmest ward (externally insulated) has the highest proportion of fanlights open; the double glazed ward has fewer windows open but the control ward has fewest. From May onwards the differences in window opening are small except that occasionally large effects will show due to special circumstances in a ward at the time of observation or due to particulary windy or rainy weather.

Energy meter readings taken during the winters of 1981/82 and 1982/83 gave the following energy consumption figures.

		1981/82 (severe)	1982/83 (mild)
		MWh	MWh
Rowan Ward	External insulation	1010	753
Almond Ward	Double glazing	579	570
Beech Ward	Control	998	740

The double glazing showed a saving of 42% during the severe winter but only 23% during the mild one. Possibly because people open windows more during milder weather. Double glazing can reduce the effect of drafts as well as decreasing the U value; people are less likely to increase radiator output to counter the chilling effect of infiltrated air. Allowing for measurement errors, Rowan and Beech Wards have effectively the same energy consumption. Since the temperature in the externally insulated ward is always about 2 deg C higher than in the Control Ward during the heating season, the effect of reducing the U value appears to be cancelled out by an increased temperature difference and also increased window opening to relieve the warm and stuffy conditions as temperatures increase. People generally prefer to open or close windows rather than adjust the radiator valve.

This result confirms the opinion stated earlier that increased insulation levels require control systems which ensure that heating is reduced when design temperatures are exceeded. The theoretical savings for external insulation and double glazing are about 24% in each case. Large differences arise between practice and prediction although the difference was small for double glazing when the weather was very cold. People's reactions tend to converge in extreme hot or cold conditions. Even though the accuracy of prediction methods can be questioned the interaction between the Control system and the fabric is important and the patient – staff variation means that everyday routine can greatly effect energy consumption. This is especially true of window opening patterns but there is also a great deal to be improved regarding air temperature distribution in wards.

Recent Swedish hospitals have non-opening windows but manually damper controlled fresh air slots or perforations down the side of each window. Good mechanical warm air ventilation systems could also be used in preference to radiator systems where the walls and the windows were well insulated to prevent downdraughts. These would ensure that the fresh air supply was controlled but the standard of design and the system components would have to be much higher than encountered in general practice. It would also be more economical and effective to consider using flexibly based air supplies to each bed. Many ventilation problems occur because central air distribution terminals are too distant to have any appreciable effect on the patient.

Some general conclusions are:

- The human influence on energy consumption is high.
- It often inadvertently negates energy conservation methods.
- The most important human involvement is the opening and closing of windows.
- Radiators are very rarely turned off to control temperature; instead, windows are opened.
- The wards are prone to overheating when outside temperature rises. As windows are opened the radiators use more energy to compensate.
- The wards in which windows are used for ventilation purposes tend to make the highest use of radiators.
- Numerous variables determine window opening patterns. These include ward stuffiness, smells, even time.

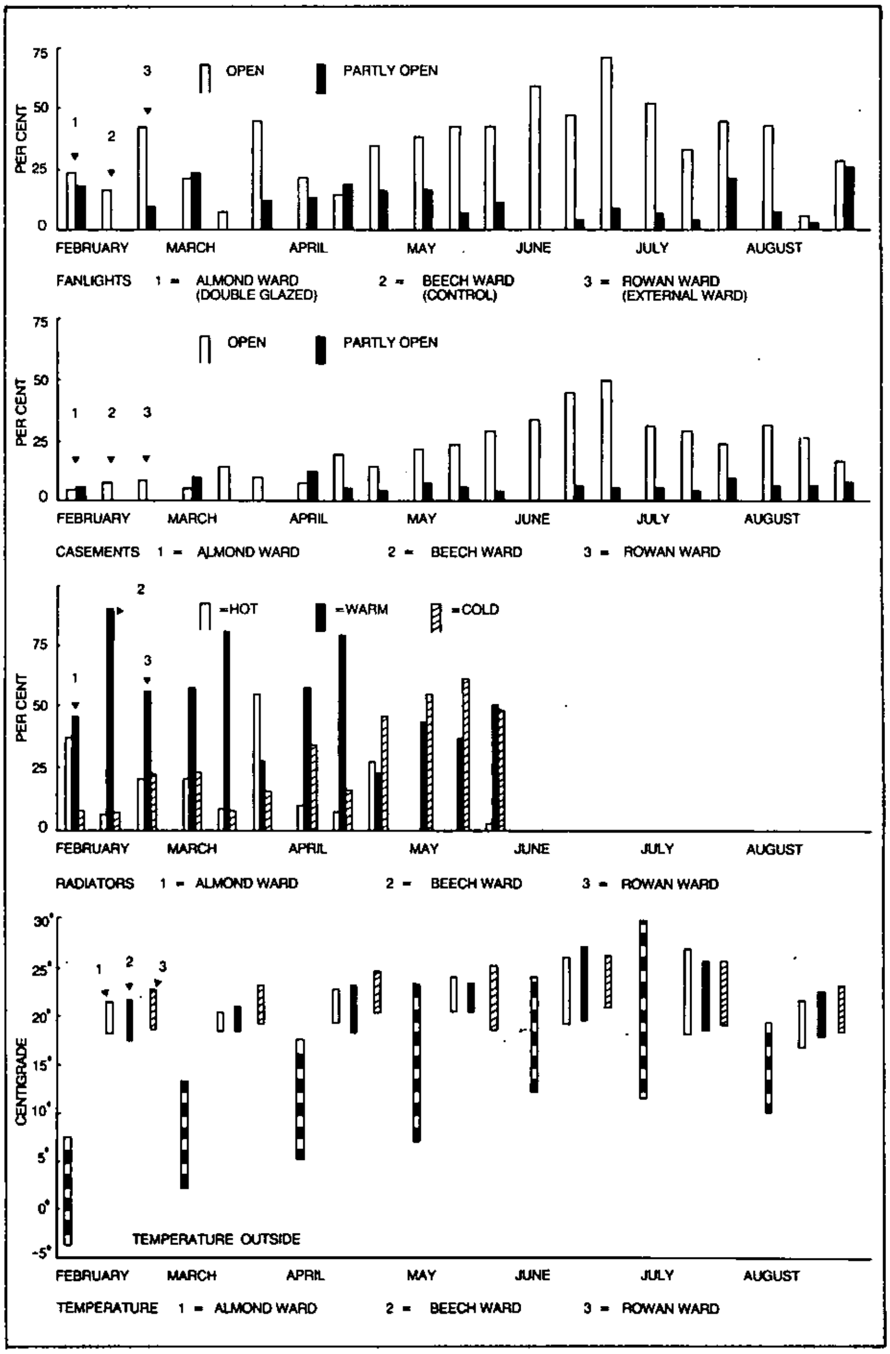


Figure 4

■ There is some correlation between window opening patterns and weather.

■ When patients complained that the wards were 'hot' they were often merely 'stufffy' and better ventilation would have eased the problem.

■ The *majority of windows opened* over the cold months of the survey were in the peripheral area of the ward and used for natural ventilation. A more efficient form of ventilation is required.

■ Electric bar fires were frequently in use in the day room often in preference *to a radiator. This is a highly wasteful* form of energy.

■ Insulating wards does not guarantee that there will be any energy saving unless good housekeeping aspects of energy management are enforced.

Conclusions

The most important result is that the decision model will save money for the National Health Service. It will do this by providing every Works Officer with a simple, systematic and objective method of planning energy conservation. Hence, energy conservation funds will be spent in measures with the best returns. In addition, many Works Officers will be encouraged to conserve more energy, when previously they would not have attempted it, because they lacked knowledge or encouragement. Energy conservation will become an area which is readily approached by all Works Officers, instead of being the province of a highly motivated élite.

Another important aspect of the model is that it provides the NHS with a standardised system for energy conservation planning. Decisions will be made by the same criteria in hospitals across the whole country, hence they will acquire credibility and *should attract confident investment.*

By carrying out the survey and energy audit the hospital staff will acquire or update detailed information about the hospital and its services. This may well have further application, for instance, in the fields of management and maintenance. If the model is used consistently it will bring hospitals up to the same standard of energy conservation and narrow the range of energy consumption per hospital. It will encourage the DHSS to set realistic energy targets for hospitals, related to their patient type, construction or geographical area. The targets should feed back into the model and help Works Officers to decide whether *their energy consumption could be* improved.

A greater awareness of energy costs and conservation will favour investment in good quality fabric, plant and controls; items which have a low running cost and long life.

A central data bank or library at the DHSS would be a great asset to the decision model. Information about individual energy conservation measures could be collected and made available to each user.

Computers are being introduced into hospitals as building management systems. A useful development for the model would be to translate the flow chart into an interactive programme suitable for a typical hospital computer. The survey and energy audit would also benefit. Computerised management systems collect data, at regular intervals, from many sensors around the hospital. Some of the data are useful survey and audit material. The decision model database could therefore be continually updated.

However good the decision algorithms, the ultimate effectiveness of energy conservation depends on people. The building may be highly insulated and well sealed against the ingress of cold air; the heating plant and distribution system might be efficient too but the building and services demand not only good control systems but also good management.

Doctors, nurses and patients as well as the district engineering teams use the hospital and all need to have an awareness and commitment towards energy saving. Building energy *management systems have a part to* play but, without motivation, all the monitoring to produce reliable feedback data will be wasted.

Future work

This project has shown that many assumptions made about energy consumption are not true in practice. Research and development in the future need to concentrate on:

■ reducing the energy demands;

■ using the systems of heat generation and transmission efficiently, employing heat recovery methods wherever possible;

■ building energy management systems using computer and human resources.

About 70 per cent of the hospital energy consumption is used to heat up spaces and people. The sizes of spaces and the number of people are unlikely to change significantly. The character of spaces and the thermal needs of people need more understanding. Research is required to assess:

■ *airchange rates;*

■ temperature levels

required by patients and staff and to see if, for example, the Danish work shown in Fig. 2 is valid in the UK.

Any research and development programme needs to be selective. Certain aspects, such as research on heat recovery systems, are of interest to all types of building. Worthwhile work is that which is specific to hospitals and is not being undertaken elsewhere and this will cover:

■ thermal comfort in health buildings;

■ the use of heat pumps to interrelate base and space heating loads;

■ economic assessment of energy saving methods;

■ building energy management;

■ monitoring of buildings, systems, plant and human behaviour patterns in health buildings.

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This paper was first given at the one-day seminar The Efficient Use of NHS Estate at the Barbican in October 1983. Dr Green is Principal Engineer in the Works Group of DHSS, with a special interest for developing estate management procedures for the NHS.

Estate control plan

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Synopsis

The Report of the Davies Enquiry* recommended that an estate control plan be prepared for each hospital site. This paper will outline the possible content and format of estate control plans. It is suggested that an estate control plan can only be prepared following an estate rationalisation exercise for the district as a whole along the lines of the 'Mereworth' initiatives.

It is further suggested that an estate control plan for each site should include the following:

a. Outline plan of the present hospital with details of surplus land, new boundaries, 'status' of each building and major engineering services.

b. For those building and services to be retained and which are in need of upgrading or whose use is to be altered, details of the remaining life, cost to upgrade and target dates for completion of the necessary work.

c. Budget estimates of the annual maintenance funds required to ensure that the rationalised site is retained at an acceptable condition.

A procedure for the preparation and formal adoption of state control plans by both regional and district authorities is proposed and the important process of converting estate control plan recommendation into detailed 'worth' programmes and their inclusion in the district's 3 year operational plan is discussed.

**Underused and surplus Property in the NHS HMSO 1983*

The planning process

It is vitally important that the estate control plan for each hospital site be based on the agreed long term health care plan. The planning process is very much a multi-disciplinary interactive activity and it is important that the estate resources are considered and utilised in an effective manner as part of that process and considered along side the manpower and finance resources. If the estate resource is to be taken into consideration during the health care planning cycle then estate information must be available in the right form. The key point in this respect is to limit detail to that which is essential for strategic planning. For the sake of clarity, Figure 1 shows this information as the 'estate planning data base'. it is not the purpose of this paper to describe this 'data base' in detail, but current view based on the Davies report recommendations are that grading and cost estimates should be prepared for the following aspect of any health care block of building.

a. Physical Condition

b. Functional suitability

c. Space utilisation

d. Energy effectiveness

e. Statutory requirements and fire precautions

f. Valuation and general estate information.

Other papers from this seminar will discuss conditions and funtional suitability in greater detail and those who have attended Mereworth 1 courses will be aware of this terminology, survey techniques and recommeded procedures for preparing each of these aspects of the estate data base which have been or are being prepared by the advisory group on estate management (AGEM). it should, however, be realised that functional suitability and space utilisation assessments can only be undertaken in collaboration with, and the support of, other health care disciplines.

Those health authorities who are making use of the Works Information and Management System (WIMS) will know that computer software is available to assist with the storage and analysis of condition appraisal data and basic property information, and plans are in hand to extend the software further.

It is intended that this data-base should be the estate contribution to health care planning, the process of manipulating this data with other clinical, finance and manpower information is complex and the development of the Mereworth 3 multi-disciplinary training course is intended to form the basis for these district planning exercises.

An essential part of an interactive multi-disciplinary ('Mereworth') planning exercise as described in the Davies report will be the identification and appraisal of each of the principle options (of which estate management is only a part) checked out in sufficient detail to ensure their functional, financial and technical practicabilities. The exercise can only be undertaken in partnership between District and Region; where necessary the region providing particular expertise in planning and estate management.

The estate control plan

Following the strategic planning stage (Stage 2, Figure 1) the resulting district plan would need to be formally presented to, and approved by, the Health Authorities and it is following formal approval of the plan that the District Works Officer should extract the estate implications of the district plan and prepare estate control plans for each site. This is likely to be undertaken in collaboration with region who would hold much valuable information concerning sites which are already subject to development.

The object of the estate control plan is to encapsulate in one document all the key factors which, when taken together, constitute an approved strategy relating to time for all matters of estate direction including for example the future use, development (including disposals) and maintenance of all property on each major hospital site. Following approval by the authority, the estate control plan would become the key reference document for the Works Officer against which progress is monitored and control exercised.

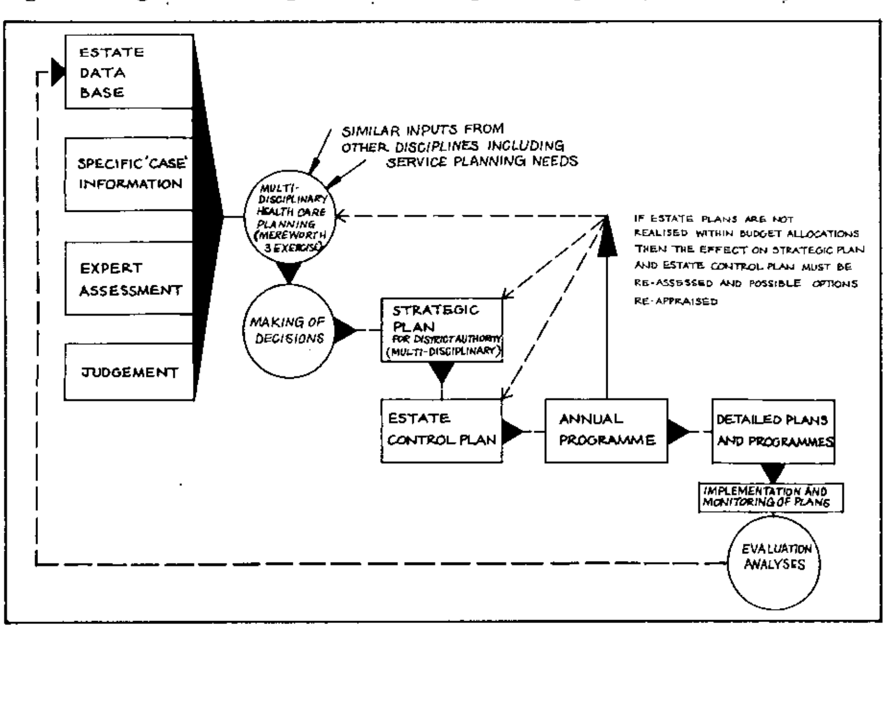
Essentially therefore the Control Plan constitutes the estate management policy statement for each specific major hospital site. Its preparation follows and results directly from the interactive rationalisation exercise described earlier and thus much of the detailed information contained within the estate control plan will be based on the data base (functional suitability, condition, space utilisation, energy and statutory surveys) used in the rationalisation exercise. If the Plan is prepared before, or in the absence of, such an exercise or based on inadequate information, it will result inevitably in an unsatisfactory outcome lacking the authority it requires for implementation. It is therefore important to be clear about the activities and their sequence leading up to the preparation of the estate control plan as illustrated in Figure 1.

The estate control plan, derived from the above, should include the following:

a. A statement on the future use of the site as agreed by the Authority together with priorities and the consequent time and cost targets for implementation.

b. An outline plan of the present hospital indicating the position and configuration of all buildings (identified by Code), roads, parking areas together with all major changes that are required to be undertaken.

Figure 1 Diagram outlining the estate management aspects of health care planning.



Changes to the existing will include:
(i) Revised site boundaries indicating those portions of the site which are (or can be made) surplus to requirements.
(ii) Revised road and access layouts.
(iii) Indication which buildings are to be retained, refurbished, reused for a different function, upgraded, demolished or sold.
(iv) indication which of the major engineering services are to be upgraded, removed or retained.

c. For the buildings and services to be retained a block by block summary on a form possibly similar to that shown as Figure 2, should be produced. The form summarises the following information:

a. Existing facilities contained within each block.

b. Proposed changes.

c. Floor area.

d. The cost to upgrade to acceptable standards if there is no change in use.

e. Additional costs if change of use is planned.

f. The target date for completion of the necessary work.

g. An estimate of remaining life once proposed work has been completed, if that information is significant ie the remaining life is less than 10 years.

h. The spare capacity once the proposed plans have been implemented.

In addition it is important to estimate the revenue consequences for operating the estate once upgrading, reuse and rationalisation measures have been completed. In this respect one might consider identifying maintenance costs, energy and utility service costs, rent and rates.

It is envisaged that one further approval stage is necessary following the preparation of the estate control plan. This is to ensure that there will be an agreed commitment to the Estate Plan and the implied resource in terms both of timescale for change and cost. In addition, the revenue required adequately to maintain the estate should be approved at this stage.

Implementation of the plan

An estate control plan is intended as a statement of the intended broad

ESTATE CONTROL PLAN
Hardy Hospital
Mereworth Health Authority

SUMMARY

Cost Base Date 7/79

BLOCK REF. No.	EXISTING FACILITY	PROPOSED ACTION	GROSS AREA m^2	COST TO UPGRADE EXISTING USE TO B's or otherwise as stated	COST OF CHANGE OF USE (+or−)	TOTAL COST - in £'000s	TARGET DATE FOR COMPLETION	CONSEQUENCES OF PROPOSED ACTION: REMAINING LIFE	SPARE CAPACITY m^2	ANNUAL OPERATING COSTS in £'000's: MAINTEN-ANCE	ENERGY	RATES	OTHER
'B'	Maternity Wing	Surgical Wards	1873	–	+75	75	10 82	60 yrs	0				
'A'	Two Surgical Wards	Geriatric Wards	1250	50	+75	125	10'82	60 yrs	0				
'A'	One Surgical Ward	Part of Day Hospital	412	20	+ 5	25	10'82	60 yrs	0				
'B'	Redundant Delivery Unit	Gynaecology Wards Operating Theatre Suite	468	100	+200	300	10 82	60 yrs	0				
'A'	Old O/T Suite	Part of Day Hospital	100	Not possible	+100	100	10 82	60 yrs	0				
'A'	Staff Bedrooms, Stores & Offices	To remain	575	–	–	–	–	60 yrs	0				
'B'	Kitchen & Dining	To remain	300	–	–	–	–	60 yrs	0				
'A'	X-Ray	To upgrade	630					60 yrs	0				
'B' N H	A.N. Clinic Nurses Home	To remain	535	–	–	–	–	60 yrs	200				
Blendan	Physiotherapy & Staff Accommodation	Eventual replacement not yet planned	600	(200)	–	–	–	5 yrs	400				
TOTALS			6743	170	455	625	10 82	–	600				

Figure 2 Example of a form used by Mereworth Health Authority to summarise buildings and services to be retained on a block by block basis.

strategy for any hospital site, for example the cost data contained within the plan is only based on broad estimates. It is therfore essential that the complete estate control plan (including the site block diagram) be contained on one or two A3 sheets which indicates the summarised nature of the information. The estate control plan should provide the basic information upon which the estate management annual programme is based, and via which formal budgetary approval from the health authority is obtained.

The annual programme should reflect the agreed estate strategy as defined by the estate control plan. It is at this stage of introducing schemes of work into the budgetary annual programme that a Works Officer should complete the design, tender and contract process which, as it progresses will improve the accuracy of the cost estimates. Normal authority scheme approval procedures will need to be followed as firm annual budgets are set and finances allocated. Estate control plans will, however, provide a tool to allow a works officer, and indeed the district authority, to monitor its performance in meeting objectives. The estate control Plan must, however, be a flexible tool continually being updated to reflect health care needs and available resources.

Conclusions

An estate control plan should:

1. be a statement of intent for each site
2. be a method of controlling and monitoring estate strategic performance
3. be a method by which a health authority can set and agree estate priorities
4. be a basis for preparing operational plans in the full knowledge that the longer term utilisation patterns for the estate have been agreed by the authority
5. be a result of the interactive rationalisation exercise ie 'Mereworth III'.

Estate control plans must be prepared as part of a sequence of events which interact at every stage with all other aspects of resource planning.

In conclusion it is argued that short-term operational plans for the estate must be based on longer term goals if resources are to be used effectively, and a works officer's longer term goals should be contained within the Estate control plan. In this way a works officer will share in the responsibility for ensuring that the most effective and efficient use is made of the health care estate; a great challenge but a great potential reward for the NHS.

Acknowledgements

I should like to express my thanks to Mr M Smith (DWO Gateshead), Mr A Hipsley (Estate Surveyor, Trent RHA), and Mr C Davies (Works Group DHSS) for their help and advice in the preparation of this paper.

This paper was presented at the Institute's One-day Updating seminar held at Kensington Town Hall in March 1984. Mr. Long is Principal Assistant Architect of the South West Thames RHA, and a member of DHSS Study Group 14. He has worked in the NHS for some 27 years, but recently has concentrated on buildings for psychiatric and geriatric specialities.

Fire precautions in health care premises

M R LONG ARICS, Registered Architect

1982 was the safest year in the history of the railways in Britain. For the fourth time in seven years not a single passenger was killed in a train collision.

■ A case for rigid conformity to stringent controls.

72 years ago the Titanic sank with a loss of 1,500 lives – 2 out of every 3 aboard – due to lack of 'means of escape'. There was time but no adequate facilities.

■ A case against the total lack of control.
A fire in a store at Wythenshaw Hospital where excessive smoke logging led to the total evacuation of 900 patients, fortuitously without loss of life.

■ A case for the consideration of how much control.

It has been said that 'The first few seconds of fire-fighting are crucial, and will decide whether an outbreak is a simple incident or the beginning of a catastrophe.' This danger has increased during the last two decades. The stages of fire development concern
OUTBREAK
SPREAD
EXTINCTION

In this article, it is intended to summarise what has happened up to the present, what is taking place to control and reduce the hazards of fire, smoke & toxic fumes to eliminate as far as possible the number of times that those first few crucial seconds arise, and the possible solution to the problem by further research and guidance and the options open to us in the most important area of purpose Group II buildings.

In 1968 at Shelton, 24 girls perished in a fire in which the smoke and toxic fumes were able to spread so rapidly as to deny the chance of escape. The turning point was perhaps the Coldharbour fire in 1972 when 30 out of 36 psychiatric patients lost their lives due to the rapid spread of fire leading to flash over in a very short space of time. Again in 1979 there was the fire at St. Crispins – Northampton, a psychiatric hospital where 6 lives were lost as the result of a patient setting fire to a bed. More recently in February 1982 there was a fire at Warlingham Park Hospital in which 7 patients died. It is worthy of note that the coroner made three recommendations:

a) That not less than two people should be on nursing duty at all times;

b) That some form of smoke detectors be installed;

c) The separation of night nurse and patients by glass in a nursing station was deprecated.

As a result DHSS issued HC(82)12 which makes specific reference to both

1

CAUSES OF FIRES IN HOSPITALS

Smokers' materials	29%
Malicious ignition	21%
Cooking appliances	8%
Electrical	6%
Rubbish burning	3%
Other known causes	25%
Unknown causes	8%

2

FIRES AND DEATHS IN HOSPITALS IN THE UNITED KINGDOM (reported to fire brigades)

Year	Fires	Deaths	
1971	1349 (1)	12	
1972	1639 (1)	41	30 at one incident (Coldharbour Hospital)
1973	2044	15	
1974	2047	13	
1975	2200 (2)	7	
1976	2219	7	
1977	2148	9	
1978	1878	9	
1979	2055	20	
1980	2106	3	
1981	2081	18	
1982	2213	7	

(1) The lower level of these figures is attributable to lower reporting to fire brigades rather than fewer actual fires in hospitals in these years.

(2) Estimated figure

the St. Crispins and Warlingham Park fires.

These four fires alone are examples which emphasise the particular hazard that exists in the case of psychiatric mentally ill and geriatric patients where fires may be deliberately started. (Fig.1.)

Although the number of hospital fires over the last 5 years averages 2,067 p.a. and the fatality rate is as low as 11 p.a. and injuries 75, and most of these occur in Psychiatric or Geriatric Units, the possibility of a multi-fatal tragedy is ever present. In 1976 a concerted effort to identify the true position and financial implications, DHSS with NHS cooperation carried out the cost exercise. At 1978 prices some £400m. would have been required to meet current recommendations. To deal with essentials the sum was £65m. The Home Secretary stated on 23rd April, 1980 'that he did not intend immediately that any hospital should be the subject of a designation order under the Fire Precautions Act 1971 but will keep the possibility under review'. This Act is now currently under review.

To give some idea of the fires that have occurred the table (Fig.2) gives the number of incidents since 1971 and deaths on an annual basis – up to 1982. Most of these fires occurred in Psychiatric or Geriatric hospitals which has given cause for such great concern. Although the annual average of fatalities is about 11, there is no room for complacency.

We are all too aware of the increasing hazards with which we are confronted today, chief of which must now be the use of polyurethane foam materials leading to rapid spread of flame, smoke and toxic fumes. At Wythenshaw Hospital in 1977 smoke from a fire in a store spread with great rapidity. Again in Manchester in 1979 at the Woolworths fire vast quantities of smoke & toxic fumes spread with remarkable speed. At the Dublin Disco Club in 1982 furniture burnt rapidly with intense heat. More recently at the Belfast Leisure Centre burning mats killed people 30 metres away. It matters not that these examples are in different fields – they all point in one direction; P.U. foam is costing more and more lives. We cannot allow patients to be put in greater and unnecessary peril by the irresponsible use of materials of proven lethal potential.

When considering how dangerous smoke and toxic fumes are, particularly with patients, many of whom will have impaired mobility, two facts stand out that will put these dangers into perspective. Firstly, smoke, apart from its choking effect, is an extreme irritant. The body has two nervous systems, one of which, the autonomic system, is not under the control of the will. When smoke attacks the eyes this system will automatically close the eyes which cannot then be opened. Disorientation and panic quickly follows. Secondly when toxic fumes are generated such as Hydrogen Cyanide it is so lethal that to inhale it once is crippling, twice causes irreversible lung damage, while the third is inevitably fatal. How far can one travel under stress holding one's breath? The Woolworths fire illustrates this point clearly.

With the hazards of smoke and toxic fumes as well as fire in mind, much thought and research has been given to this problem by such as: British Aerospace, British Rail – following the Taunton fire, DHSS/NHS, Property Services Agency, The Navy – following the loss of HMS Sheffield.

At the present time the situation is as follows:

The Home Office has produced two draft guides.

DHSS – has set up working groups;
- has produced HTM and other guidance with more to follow;
- has carried out tests with further research planned;
- has implemented the 'Black Spot Exercise' – a 23 part questionnaire to determine the worst situations among psychiatric, mentally ill and geriatric Units.

There is legislation and other sources of guidance.

Legislation

In 1976, at the request of the Regional Architects Association, DHSS set up the Building Legislation Working Group, which concerns itself with problems and interpretation of the Building Regulations & other legislation. It is relevant in that Part 'E' of the Building Regulations concerns 'Safety in Fire'.

One of the group's main tasks has been to produce a guide to Part 'E' which was published at the end of 1983. There are several other guides produced on the Building Regulations such as Knights and Elders. These works do not clarify the Regulations in relation to Health care premises but this new NHS guide relates Part'E' to health buildings and is cross-referenced to other DHSS publications. Other guidance exists from DOE and the GLC and this guidance should be used in appropriate cases.

The Home Office Guidance

The Aberfan disaster created the Health & Safety at Work Etc. Act

3

PACKAGE FOR FIRE SAFETY

1974 and the Flixborough inferno put it on the statute book. With this in mind it is easy to visualise a multi-fatal fire leading to the designation of hospitals. The Home Office provides, at present, guidance for 3 groups of designated premises, i.e.

a) Hotels & Boarding houses

b) Factories

c) Offices, shops and railway premises

In the Home Secretary's statement of the 23rd April, 1980, to which I have referred, mention was made to further guidance for health care premises and the Home Office has prepared and now published draft guides to:–

a) Fire precautions in hospitals

b) Fire precautions in existing residential care premises.

Currently in course of preparation is a further guide to: 'Fire precautions in houses for multi-occupancy'.

DHSS guidance

In the 1970's the DHSS formed the 'Inter Authority Study Group 14' in order to produce better and up to date guidance for the health service. The group comprises representatives from several authorities:– DHSS, of course; Health Authorities; Notts County Council; Scottish Development Dept; FRS; DOE; Home Office. There are 3 sub-groups. Planning & design; fire alarms; and fire research. A considerable amount of research and tests on the behaviour of fire and smoke have been arranged & co-ordinated through the groups.

Research & development

Study Group 14 has produced a considerable sequence of guidance documents under the general title **Fire safety in health care premises,**

The Red Fire Engine Document – September 78 *(Fire Safety in Health Buildings).*

This guidance was produced in September 1978 and, pending the issue of HTM.81 **Fire Safety in New Health Buildings,** remains the current Health Technical Memorandum for the design of hospitals, superseding HDN2 and the relevant parts of HTM 16 and was issued to regions for distribution to areas and districts. Consultant architects working for the NHS were issued with copies direct from DHSS.

HTM 82 'Fire Alarms & Detection Systems'.

As it implies, guidance chiefly for engineers. However it should be read in conjunction with the document above because the two HTM are read as a package. Issued under HC(82)12.

HTM 83 'Fire Safety in Health Care Premises – General Fire Precautions'.

Guidance mainly for Administrators and Fire Officers and should be referred to by all departments which are listed. Section 6.35 refers to Works Departments. Issued under HC(82)12.

HTM 84 'Fire Safety in Personal Social Services Premises – Planning & Design of New Residential Accommodation for the Elderly'.

This is a guide to fire safety requirements for designers of new residential accommodation for the elderly – Being drafted.

HTM 85 'Fire Safety in Health Care Premises – Means of Escape in Existing Buildings'.

Comprehensive guidance on requirements for means of escape in existing health buildings covering all parts of hospitals including industrial areas, staff residential accommodation and associated buildings comprising a hospital complex – Being drafted.

HTM 86 'Fire Safety Evaluation (Points) Scheme for Patient Areas within Hospitals'.

This guide will provide a simple method of evaluating the fire safety of patient areas within hospitals – Being drafted.

HTM 87 'Fire Safety in Health Care Premises – Furniture, Furnishings, Bed Assemblies, Apparel'.

This guide has been completed and issued with HN(83)18. It has now been printed by HMSO as per HTM 82 & 83 and is now available. Advance copy issued with HN(83)18.

For nucleus schemes there is the special fire precautions package. However its use for Nucleus type projects must first be approved by DHSS in case any proposed variations compromise the original package.

On the training and education side there is now THE FIRE PRECAUTIONS DEVELOPMENT PROGRAMME. It consists of a comprehensive 'package' which has been developed for the NHS and is available from the NHS Training Aids Unit. A second edition to the 'INFORMATION FOR TRAINING' section was issued in January 1984.

There is therefore a very comprehensive library of guidance relating to the subject of **'Fire Safety in Health Care Premises'** either issued or to be published. (Fig.3) Observance of this guidance should ensure that, in the event of a designation order being made, a relevant fire certificate would be issued on a scheme with which it complied. Furthermore, health authorities will be seen to be complying with HC(78)4, perhaps one of the most important health circulars relating to fire precautions. It is the main policy circular supplemented by HC(82)12. The 'Fire Research Group' was set up originally as the 'Smoke Group' to consider and recommend what control, for the want of a better word, could be found to regulate the spread of smoke and toxic fumes.

This is, perhaps, the corner stone of all our problems and a solution could doubtless lead to less onerous conditions on the designer. Smoke and toxic fumes are the killers in fires and it follows that the less smoke the fewer deaths will occur. With the increased use of PU Foam the quantities of smoke and toxic fumes generated have risen enormously and as a result DHSS, along with other departments, has mounted numerous tests directed at these materials and their behaviour under fire conditions. The first series of tests were held at Moston in Chesire. Initially 12 tests were carried out – the first 11 on single beds and the final one being the well known '6 bed burn' from which a full length film was made called 'The Big Burn'. These tests and the further 7 or 8 which followed including sprinkler tests all pointed in one direction – that fires are most likely to spread very rapidly indeed where PU Foam was present and, furthermore, that the mattress, pillows and bed side chair made of this material formed an unmistakeable fire path.

A year ago DHSS, in conjunction with South East Thames Regional Health Authority, set up a further series of tests at the Royal Herbert Hospital, an old hospital built in time for the wounded Crimean soldiers and therefore comprised authentic Nightingale wards. Six bed assemblies were set up in a 28 bed Nightingale Ward to test standard DHSS supplies ie fire retardant covers on a PU Foam mattress and without. Tests were also carried out in a single bedroom and a very long Hospital Street. The use of a fire retardant cover around a mattress is very effective and, briefly, it was found that the cover's retardant qualities will double the evacuation time, lessen the quantity and density of smoke and restrict the spread of flame. It is therefore imperative to use these covers until the foam itself can be made retardant. Treated counterpanes are also most effective in protecting beds. During the next few weeks a further series of tests on bed assemblies and furnishing will take place at Cardington which will include full 6 bed ward situations and the sprinkler element will be included. One conclusion has become clear. To remove, control or contain smoke generated by PU foam would go a long way towards the elimination of fires of this type and the dangerous lethal fumes they emit, allowing for better design and less restrictive and costly construction. Considerable research has gone into providing a foam which is fire resistant and although advances have been made, a solution that satisfies all requirements still eludes us but the retardant cover has partially raised the safety factor with the mattress.

The options at present are to :

a) Solve the fire resistance problem of furnishings & furniture.

b) Provide greater protection by smoke containment.

c) Reduction or dispersal of smoke.

d) The use of sprinklers.

e) Organisation of staff & training provided by the hospital in compliance with HC(78)4.

To return to the Home Office's Draft Guides to Fire Precautions in Hospitals and in Existing Residential Care Premises, although it does not say so, the first guide refers to EXISTING buildings. For the present, therefore, the NHS and Fire Authorities have guidance to which to refer for work in connection with these types of premises. It is important to remember that if a new hospital building does not conform to the standards of the relevant HTM then, after handover the guide for existing hospitals would apply and the right of exemption, should designation come about, might be forfeit. It is imperative therefore that the maintenance manual should state which documents have been used.

For instance, a pure nucleus hospital would be in accordance with the special fire precautions package for that design. However if a project is based on the Nucleus concept and the package is used but without DHSS prior approval then the Home Office guide would apply and its requirements would then have to be met before a Fire Certificate was granted in the event of designation. It is imperative that the guidance used on a project is known as any future alterations may conflict with the requirements of the document applicable to the project at the time.

Returning now to HTM 81 the title of which will be : **"Fire safety in health care premises – planning & design of new buildings"**

All new schemes or major alterations are, at present, built in accordance with the September 78 document. This guidance had a running in period of a year after which comments were received, many of which have been incorporated in drafts for the final document HTM 81. A considerable amount of re-writing has taken place in order to produce this HTM but there remains one major item yet to be resolved – enclosure of wards.

At present all wards in geriatric, psychiatric & mentally ill units must have ½ hour fire resisting enclosures. It is proposed that other wards such as acute, paediatric etc. should be enclosed for smoke only. On this there are diverse points of view, namely:

a) Many nursing staff say that observation and general attention to patients will be made difficult. Therefore obstructive.

b) To enclose wards will protect other areas in the event of a fire occurring in a ward.

c) As the Home Office will stress, enclosure will ensure that fire & smoke will be prevented from reaching wards when it occurs in circulation areas etc.

d) If the risks from the devastating effects of burning mattresses, pillows and chairs can be controlled, reduced or otherwise made fire resistant, ward enclosure would not be necessary.

It is interesting to note that the PSA has resolved the mattress problem and now use one that has a far greater fire resistance than hitherto achieved – unfortunately it is suitable only for use in HM Prisons and not for patient care where the equally as great a hazard to patient's well-being – the pressure sore – must be considered. However DHSS are still carrying out their investigations.

The use of sprinkler heads has come under consideration as a positive step towards the control and spread of fire. During the Moston tests a trial sprinkler head was activated in the single bed situation and there was little doubt that it was effective. However it is essential that the atomised spray produced is such that it does not cause the smoke to fall.

In 1982 DHSS was represented at a series of tests run in North America to study the effects of different sources of ignition and the use of sprinklers which are found in the USA. It is interesting to note from the report

ONE DAY SYMPOSIUM

Thursday 5th July 1984
at The Institute of Marine Engineers, 76 Mark Lane, London EC

TELECOMMUNICATIONS 1984

This Symposium will consider the impact of modern electronic apparatus, new statute rulings and improved management techniques on hospital telecommunications.

The convergence of computing and telecommunications technology has brought about major changes to equipment, with associated improvements to facilities and services.

Telephone exchanges installed in hospitals pre 1980 have rapidly become obsolete, creating problems affecting the future availability of spare components and extension equipment.

Apparatus primarily designed for voice transmission does not readily accept incorporation of computer data traffic.

With the projected growth of data transmission and increasing telephone penetration into hospitals, the complete replacement of all existing facilities within the next decade is inevitable.

The passing of the British Telecommunications Act, and subsequent Bills, has radically altered the structure and marketing position for British Telecom, private manufacturers, suppliers and consumers alike.

Correct management of hospital telecommunications is essential to ensure the relatively large demands on capital and revenue expenditure are utilised to obtain the best value.

This Symposium provides an opportunity to examine the future effect of these developments on hospital design, maintenance and operation.

PROGRAMME

10.00 Coffee

10.30 OFFICIAL OPENING by L.G.HADLEY ESQ CEng, FIMechE, FInstE, FCIBS, MConsE, FIHospE
President, The Institute of Hospital Engineering
CHAIRMAN for the day: PROFESSOR JOHN FLOD BSc (Eng), PhD. DSc, CGIA, CEng, FIEE, FIERE
Head of Department Electrical and Electronic Engineering
University of Aston in Birmingham
Chairman British Standards TCL/–Committee (Telecommunications).

10.35 TELECOMMUNICATIONS IN THE HEALTH SERVICE
Speaker: G.C.McCONKEY ESQ CEng, MIEE
Superintending Engineer
DHSS Northern Ireland
Chairman, DHSS Working Group 7 (Telecommunications)
The current trends and demands for telecommunications by an NHS Hospital.

11.20 LIBERALISATION/RINGING THE CHANGES.
Speaker: J. COMPTON ESQ
Head of Attachments Section, Telecommunications Division, Department of Trade and Industry.
The current situation, approvals, procedures, guidance on regulation as it affects the user.

12.05 THE PRIVATE SECTOR/THE AVAILABLE ALTERNATIVE
Speaker: N.G.M. NEWTON ESQ MCIBS
Principal Assistant Engineer
South West Thames Regional Health Authority
Member of DHSS Working Group 7 (Telecommunications)
Broad presentation referring to private companies now able to offer a

service for supply, installation and maintenance on telecommunications equipment.

12.45 MERCURY COMMUNICATIONS
Speaker: L. NASH ESQ CEng, MRAeS
Manager
Government Sales, Mercury Digital Telecommunications Service.

13.00 Lunch

14.15 DATA TRANSMISSION
Speaker: J.S. BARNES ESQ BA
Regional Computer Installation Manager
East Anglian Regional Health Authority
Current and future developments in Data Transmission, District, Regional and National levels.

15.00 MANAGEMENT OF TELECOMMUNICATIONS
Speaker: D.V. HODGSON ESQ MInstAM
Telecommunications Manager
Victoria Health Authority
Management Techniques, call data logging, controlling revenue costs.

15.40 BRITISH TELECOM AT YOUR SERVICE
Speaker: J. BARNARD ESQ
Major Account Manager
Major Customer Marketing, British Telecom.
National Networks, Local Communications Services, Consumer Products, Exchange/transmission equipment, Satellite communications.

16.30 Close.

TICKET APPLICATIONS

To: The Secretary, The Institute of Hospital Engineering, 20 Landport Terrace, Southsea, PO1 2RG.

Please send to me______ ticket(s) for the ONE DAY SYMPOSIUM to be held on Thursday 5th July 1984. I enclose £____ to cover the cost.

Ticket to include morning coffee and lunch and VAT
Member: £40.25.
Non Member: £46.

No fees will be returned for cancellations (in writing please) received after midday on Thursday 28th June 1984.

VAT Registration No. 339 3963 20

NAME (in capitals please)____________

ADDRESS____________

____

____

Position____________

Non member (please tick)

NB. Please note that tickets are available ONLY from The Institute of Hospital Engineering (Tel. Portsmouth (0705) 823186).

that *"Hospitals experience no medical or nursing resistance to their use and in many instances staff are not consciously aware of them"*.

To summarise the position today and the prospects for the future:

a) Results from the Cardington tests on bed assemblies including single bed and 6 bed ward full scale tests leading to a solution of the currently hazardous mattress.

b) A solution to the problem of smoke containment or dispersal.

c) A suitable sprinkler head for overbed positions.

d) A decision on whether all wards are enclosed or not.

e) The issue of HTM 81 for the design of new buildings which is urgently required by the NHS.

Research will continue and guidance information on fire safety will increase and become available to those designing new buildings, altering existing ones or maintaining the stock generally – it is very comprehensive and will become more detailed as the further tests produce answers to our problems unless the use of hazardous materials is allowed to go unchecked.

BLACKBURN HYNDBURN AND RIBBLE VALLEY HEALTH AUTHORITY

SENIOR ENGINEER

Salary Scale — £8,010-£9,271
plus 15% Supervisory Bonus

Based at Brockhall Hospital, the successful candidate will be responsible to the District Engineer for the management of the Engineering Services at the Hospital and associated properties.

The site is one of the largest Mental Illness hospitals in the country and includes a modern laundry.

Applicants should have served an Engineering apprenticeship and be qualified to at least HNC/HTC level with appropriate endorsements and managerial qualifications.

Extensive knowledge of engineering operations and maintenance is required together with proven managerial skills. Previous Health Service experience is desireable.

Informal enquiries to Mr A H Morris, District Engineer. Telephone: 0254 661311 Ext: 230.

Application forms and job descriptions obtainable from the District Peronnel Officer, District Offices, Queen's Park Hospital, Blackburn. Telephone: 0254 661311 Ext: 223.

Closing date: 20th April 1984.

Royal Marsden Hospital
London & Surrey

Group Works Officer

(Chief Works Officer grade)
Salary £12,547-£15,065 per annum

This new and challenging post offers suitably qualified professionals an opportunity to demonstrate their capabilities and broaden their experience within a postgraduate teaching hospital.

The successful candidate will be responsible for the provision, co-ordination and management of all works services to a high standard throughout the group, and should be able to give expert advice to management on works matters.

For further information, please contact Mr. A. C. McDougall, General Administrator, Tel: 01-352 8171 Ext. 205. Application form and job description from the Personnel Department, Royal Marsden Hospital, Fulham Road, London SW3.
Tel: 01-352 8171 Ext 446/447.
Closing date: 30th April 1984.

UNIVERSITY OF KENT AT CANTERBURY

MAINTENANCE MANAGER

Salary Grade II of the Administrative Scale
£11,160-£14,125

This is a new post linking both the Building and Services elements of the Maintenance operations on campus. The successful candidate will be responsible for a multi-disciplined work force of 67, and for outside contractors employed for specialist services maintenance and for minor and major schemes of repair and redecoration.

Applicants should possess appropriate qualifications and have had relevant experience in a large organisation.

Further particulars are available from the Estates and Buildings Officer, The Registry, University of Kent at Canterbury, Canterbury, Kent, CT2 7NZ. Telephone Canterbury 66822, Ext. 609.

Closing date for receipt of applications: 27 APRIL 1984.

Unit Works Officer Grade 6

(OPEN COMPETITION)

Applications are invited for this new post which includes District wide responsibilities for engineering services together with Unit Works management responsibilities for four small hospitals.

Qualifications required are Corporate membership of I.Mech.E., I.Civil.E., I.E.E., I.E.R.E. or C.I.B.S. or otherwise be exempted in accordance with Whitley Council Circulars GC1/82 and PTB 4/82.

Wide experience in Hospital Engineering is required and experience in the design and supervision of engineering contract works would be an advantage.

Salary scale £13,084 to £15,531

Previous applicants need not re-apply.

Application form and job description available from the District Personnel Officer, Gt. Yarmouth & Waveney Health Authority, Havenbridge House, North Quay, Gt. Yarmouth, Norfolk, telephone number Gt. Yarmouth 50411 ext. 45.

Gt. Yarmouth and Waveney Health Authority

SENIOR ENGINEER

Do you want to work for an enthusiastic and forward-looking organisation? THE EAST BIRMINGHAM HEALTH AUTHORITY is looking for an enthusiastic Senior Engineer who wishes to expand his experience in the field of Health Care.

Due to promotion we are seeking someone of the right calibre to join our Unit Works team at East Birmingham Hospital, General Unit.

Your duties and responsibilities at this large busy District General Hospital will include practical and managerial aspects of maintaining, installing and operating both electrical and mechanical services and for co-ordinating the activities of three Unit Engineers.

Through your Unit Engineers you will be responsible for the control of direct labour and contract staff in the execution of both maintenance and devolved special revenue works.

The Works Department at East Birmingham Hospital, General Unit, is an integrated part of the Hospital Management structure. Our philosophy is to work closely as a team both within the works organisation and across all disciplines as a whole.

If you have already had some managerial experience and wish to develop your skills and widen your experience, then you are the person we are looking for.

Qualifications required are an engineering apprenticeship and an approved PTB qualification.

SALARY SCALE: £8,010-£9,271 per annum, plus I.B.S. allowances.

For further details please contact Mr M Crapper, Unit Works Officer on 021 772 4311, Ext. 4215.

For Job Description and application form please contact Mrs J Abbiss, District Works Department, East Birmingham Health Authority, 45 Bordesley Green East, Birmingham B9 5ST. Telephone 021 772 2564, Ext. 32.

Closing date 16th April 1984.

EAST BIRMINGHAM HEALTH AUTHORITY

16-17 MAY

First-time ever hospital engineering exhibition held in association with the 40th Annual Conference of the Institute of Hospital Engineering.
16 May 09.00 – 17.30
17 May 08.30 – 14.00
Dragonara Hotel, Bristol.

Keep pace with the latest developments in hospital engineering from patient hygiene and communications to design, construction of operating theatres and energy management systems.

Further information from: T Jarvis (Exhibitions) Limited 75 Masons Hill Bromley Kent BR2 9HP.
Telephone: 01-464 4129

make a date with IHEX '84

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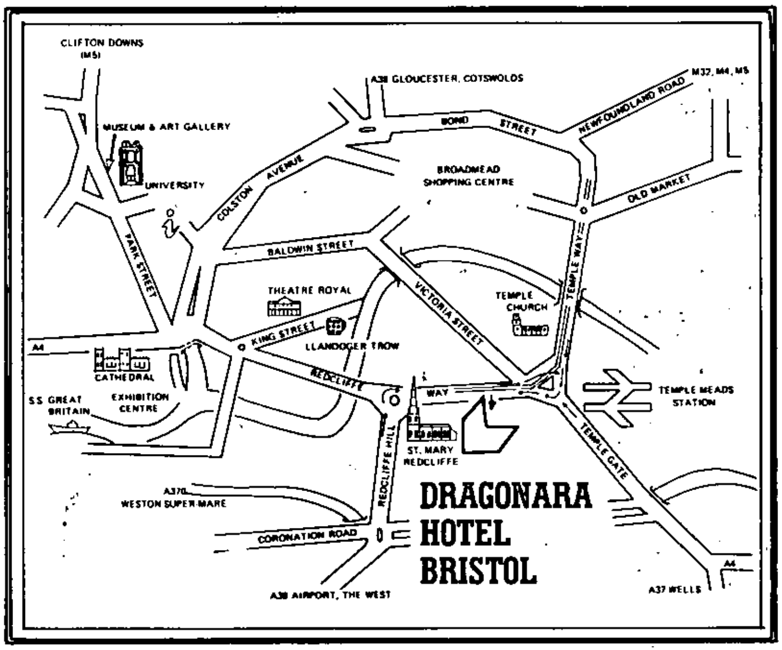

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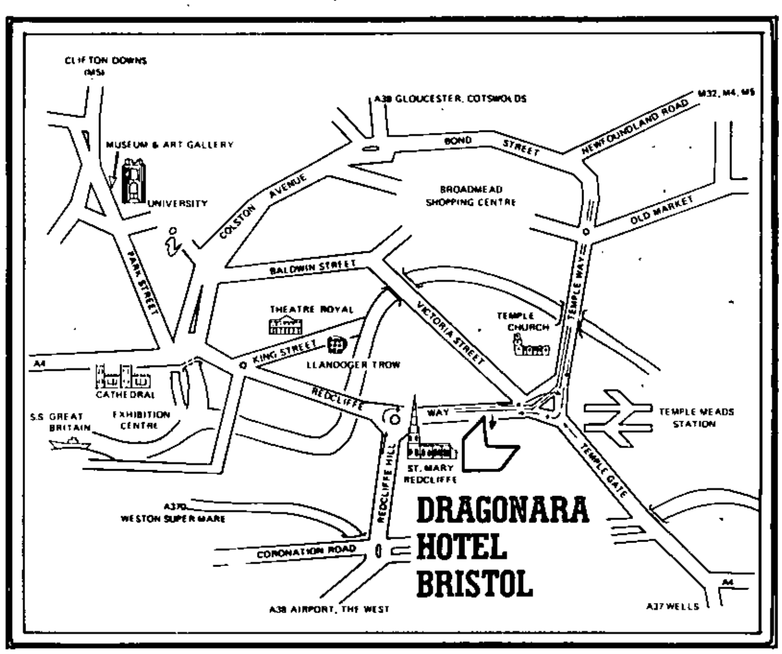

IHEX '84

16-17 MAY

IHEX '84

VISITORS REGISTRATION

Name

Position

Authority/Company

Address

Post code | Country other than UK

Telephone

PLEASE COMPLETE & HAND THIS CARD IN AT THE RECEPTION DESK

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