The Journal of the Institute of Hospital Engineering December 1981

HOSPITAL ENGINEERING

International Federation Issue

Mayday Hospital, Croydon wins energy conservation award

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HOSPITAL ENGINEERING

The Journal of the Institute of Hospital Engineering

International Federation Issue No. 40

I.F.H.E.

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Front Cover:
The spray recuperator fitted to the boiler house exhaust at Mayday Hospital, Croydon, which has won the hospital a prize in a Gas Board energy saving competition — see story on page 5.

International Federation News

Report from the President

VINSON OVIATT

It has been my pleasure to serve as your President for the past one and a half years. During this time I have had the opportunity to meet with many of you at your national meetings and elsewhere. These personal contacts, discussions with Council members and a questionnaire circulated to the member societies have helped in developing a plan for the future of the IFHE.

This report is to inform you of what I perceive to be the needs of the Federation for the years to come, and of the actions your officers are taking to meet them. It seems quite clear that in order for the Federation to meet the needs and desires of its members, the following measures are necessary:

Employment of a full time professional General Secretary;
A global means of communication, and technical information exchange in the form of an expanded Journal and/or a newsletter;
A streamlined form of government
and
A financial base to support the foregoing.

The other officers and I have met the frustration of being 'part-time' officers. That is, we have other duties and obligations which take precedence over our commitment to the IFHE.

We can testify to the fact that it is a full time job for one person at this time to manage the Federation's affairs. A full-time paid General Secretary would have as his only obligation that of carrying out the desires and requirements of the Organisation. These would include organisation of essential committees, providing a centre for technology transfer, watching the finances, developing training courses, promoting the profession, visiting the various member societies on a rotating basis, supervising the printing of a journal and/or newsletter, etc. It is not financially feasible at this time to employ such a person, but we must look forward to the provision of such a post before the end of the decade, or sooner.

In my poll of the member organisations, the number one need was held to be that of improved communications. Not only was it felt that the current Journal should contain more technical information of international importance, but also that it should be printed in French and Spanish in addition to English.

There is also a keen desire for a news or circular letter containing news of the activities of the Council and its officers, and member organisations, as well as current technical information. The content of the current Journal can be readily improved if the membership will provide the Editor with papers and news items. There is currently a dearth of information arriving at the desk of the Editor to fulfill this desire. However, translation into other languages poses a financial problem which cannot be met with current revenues. Thus the alternatives are to raise fees, or for those with expertise to volunteer to provide translation of papers etc. for the Journal editors. The matter of a newsletter will be explored by the Council, but again, translation into languages other than those in which the material is presented will be a financial difficulty.

A committee of the Council is currently studying the governing structure of the Federation. In general, it proposes to form an executive committee, probably based on regional representation. The committee would meet in between the normal meetings of the Council and the congresses. Such a structure, to be effective, would require financing of travel for members of the executive committee to meet to carry out the affairs of the Federation.

Several proposals have been made for improving the finances of the Federation. These received considerable attention at the Council meeting in Zagreb, Yugoslavia. The Treasurer and the committee are currently preparing a report and a proposal for the Council to consider this coming May in Amsterdam. In general, it will broaden the base of the membership by providing for various levels of membership which would include those of national associations as at the present time, plus associates and subscribers. There would be different dues assessed for various levels of membership.

IFHE Council members will receive a package prior to the Amsterdam meeting containing suggestions for a change in the rules, to accommodate the establishment of an executive committee and means of conducting business at the Council meeting. They will also receive the study being prepared by the Treasurer and Financial Committee with suggested changes in levels of membership and other means for improving our financial base. These will arrive in Council members' hands in sufficient time for discussion within their own society so that appropriate action can be taken at Council meetings in Amsterdam.

At this point I hasten to add that all does not revolve around money. I am sure that in the next few years we shall continue to grow and become increasingly influential in all matters pertaining to patient care. Dedicated members and officers will continue to serve the Federation and provide innovative means of achieving our programmes. But with continued success, there will also be the added operational problems which must be met.

Being the President is not all work, of course. I have had the good fortune to meet with the French, Swiss, Danish and Spanish associations, making many new friends in these countries. The Council meeting in Zagreb further provided the opportunity to become acquainted with Yugoslavia and its health care system, and again to make new friendships. I only regret that there has not been the time available to visit all of the member societies of the Federation which have extended the invitation to visit with them. These visits have been the "icing on the cake".

Finally, I look forward to greeting many of you at the Seventh International Congress in Amsterdam this

A unique answer to the problems of H&V insulation– in one cost-effective material

Phenexpan Phenolic rigid insulation can be used for practically every application right across the whole H&V temperature range–including pipe and ductwork where extremely reliable insulation is critical.

Cape Insulation has applied the wide experience gained with Phenexpan in the process industries to develop a unique material which will solve many of the major insulation problems faced by engineers and contractors in H&V work.

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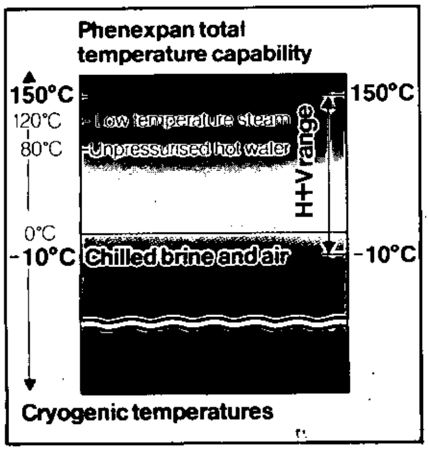

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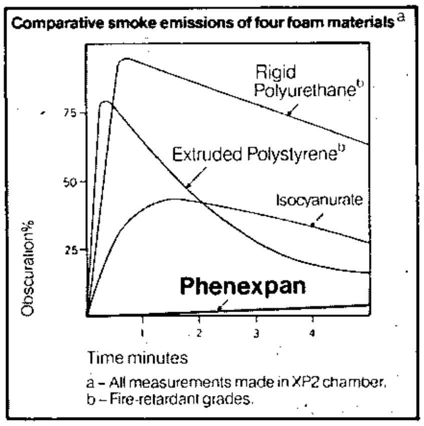

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Phenexpan is highly cost-effective

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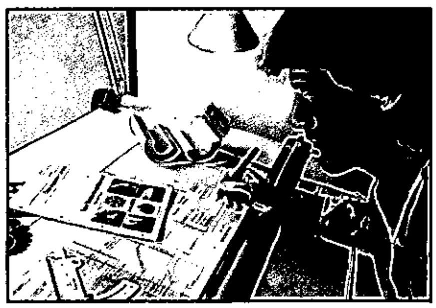


Get the facts

If you would like to know more about the unique advantages of Phenexpan pipe and duct insulation, contact Cape Insulation now.

coming May. The Nederlandse Vereniging van Ziekenhuis Technici are planning an excellent programme touching all aspects of hospital engineering. See you in Amsterdam!

Rapport du President

Cela a été pour moi un réel plaisir d'être votre Président au cours de l'année et demie écoulée. Pendant cette période, j'ai eu l'occasion de rencontrer nombreux d'entre vous lors de réunions nationales ou autres. Ces contacts personnels, ces discussions avec des membres du Conseil, ainsi qu'un questionnaire envoyé aux Sociétés membres ont contribué à la conception d'un plan pour l'avenir de la FIIH.

Je voudrais, dans ce rapport, vous donner un aperçu des besoins de la Fédération pour les années à venir, tels que je les perçois, et des actions entreprises par des membres responsables pour y répondre. Afin que la Fédération puisse combler les besoins et les désirs de ses membres, il semble indispensable que les mesures suivantes soient prises:

Engager un Secrétaire Général à plein temps et au niveau professionnel;
Développer un système global d'échange de communications et d'informations techniques par le biais d'une revue et/ou d'un bulletin d'information;
Etablir une forme de direction mieux structurée;
Trouver une source de financement qui puisse couvrir les frais des services mentionnés ci-dessus.

D'autres membres responsables, ainsi que moi-même, avons ressenti une certaine frustration de ne travailler qu'à "mi-temps" pour la Fédération, ayant inévitablement d'autres devoirs et obligations prioritaires par rapport à nos engagements envers la FIIH.
Nous pouvons donc affirmer qu' actuellement nous trouverions préférable d'avoir une seule personne responsable à plein temps pour administrer la Fédération. Le rôle d'un Secrétaire Général payé à plein temps serait d'exécuter les voeux et requêtes de l'organisation. Celles-ci comprendraient, entre autres, l'organisation des principaux comités, l'etablissement d'un centre de transfer de technologie, la surveillance des finances, l'organisation de cours de formation, la promotion de la profession, des visites à tour de rôle aux diverses societés membres, la supervision de l'impression de la revue et/ou bulletin, etc. Actuellement, il ne nous est pas permis financièrement d'engager une telle personne, mais c'est néanmoins un poste qu'il faudra bien parvenir à créer d'ici la fin des années '80, au *plus tard*.

Selon mon enquête faite auprès d'organisations membres, il est apparu que le besoin généralement ressenti comme le plus urgent était celui d'améliorer la communication entre membres. La revue que nous publions actuellement devrait contenir plus d'information technique d'interêt international, et devrait paraître en français et espagnol aussi bien qu'en anglais.

De plus, le désir a été fortement exprimé de recevoir un bulletin ou une lettre circulaire qui contiendrait des nouvelles sur les activités du Conseil, de ses membres responsables et des organisations membres ainsi que des informations techniques de dernière heure. Le contenu de la revue, dans sa forme actuelle, pourrait facilement être amélioré par l'envoi, de la part des membres, de documents et d'articles à la Rédaction. A l'heure actuelle, le rédacteur-en-chef reçoit bien trop peu de nouvelles pour pouvoir répondre effectivement à ce besoin d'information. De plus, il n'est pas possible actuellement de traduire l'information en d'autres langues, vu nos difficultés financières. Il faudrait donc soit augmenter les contributions, soit trouver des membres qui seraient disposés à traduire la documentation reçue par la Rédaction. Le Conseil étudiera de plus près la possibilité de publier une lettre circulaire d'information, mais, là encore, la traduction du matériel reçu representera inévitablement un problème financier.

Un comité du Conseil étudie actuellement la structure de direction de la Fédération. Il est d'avis qu'il serait souhaitable de créer un comité executif avec représentation régionale. Ce comité se réunirait entre les séances normales du Conseil et les Congrès. Pour qu'une telle structure fonctionne convenablement, il s'agirait de payer les frais de déplacement des membres du comité executif lors de réunion et d'activités liées à la Fédération.

Plusieurs solutions ont été proposées en vue d'améliorer la situation financière de la Fédération. Celles-ci ont été serieusement examinées lors de la réunion du Conseil qui s'est tenu à Zagreb, en Yougoslavie. A l'heure actuelle, le Trésorier et le Comité préparent un rapport et une proposition que devra être discutée par le Conseil lors de la réunion à Amsterdam en mai. Dans les grandes lignes il s'agit, selon cette proposition, d'augmenter le nombre de membres en établissant plusiéurs catégories de *membres; en plus des membres* d'associations nationales, il y aurait encore des membres associés et d'autres cotisants. Différents niveaux de cotisations seraient etablis selon les catégories de mebres.

Les membres du Conseil de la FIIH recevront une serie de documents, avant la réunion d'Amsterdam, contenant des propositions en vue de changer le règlement concernant l'établissement d'un comité executif et le déroulement de la réunion du Conseil. Ils recevront également l'étude, actuellement en préparation, faite par le Trésorier et le Comité des Finances, établissant les différentes catégories de membres et les diverses mesures à prendre pour amélorier notre situation financière. Les membres du Conseil recevront cette documentation bien à l'avance afin de pouvoir en discuter au sein de leur propre société et de pouvoir entreprendre une ligne d'action efficace lors des réunions du Conseil à Amsterdam.

Je m'empresse néanmoins de vous rassurer que tout n'est pas uniquement question d'argent. Je suis certain que dans les années à venir nous continuerons à nous développer et à occuper un rôle de plus en plus important dans le cadre de soins aux malades. Membres et cadres de la Fédération continueront à se dévouer et à chercher des nouvelles voies pour mener à bien nos programmes. Mais, inévitablement, au fur et à mesure que nos succès vont croissants, il nous faudra faire face à des problèmes opérationnels supplémentaires.

La tâche de Président n'est pas tout travail, bien entendu. J'ai eu l'occasion et la chance de rencontrer des membres des association françaises, suisses, danoises et espagnoles, et d'en faire des amis. Lors de la réunion du Conseil à Zagreb, j'ai appris à connaitre la Yougoslavie et son système de santé, tout en faisant de nouveaux amis. Je regrette seulement de ne pas avoir eu le temps en rendre visite à de nombreuses autres sociétés membres de la Fédération qui m'ont si gentiment invité. Ces visites ont été à chaque fois une des plus agréables parties de ma tâche — le "dessett".

En conclusion, je tiens à vous dire combien je me réjouies de vous voir au Septième Congrès International à Amsterdam en mai. Le Nederlandse Vereniging van Ziekenhuis Technici nous proposent un excellent programme qui couvrira tous les aspects du génie hospitalier. A bientôt a Amsterdam!

Relacion del Presidente

Ha constituido un placer para mí ocupar el cargo de Presidente durante el pasado año y medio. Durante ese tiempo he tenido la oportunidad de conocer a muchos de Vds. en sus reuniones nacionales y en otros sitios. Estos contactos personales, debates con miembros del Consejo y un cuestionario que ha circulado por las entidades asociadas ha ayudado a establecer un plan para el futuro del IFHE.

Este informe tiene como objeto expresar, lo que a mi paracer considero, las necesidades de la Federación en el futuro, y de la labor que sus directores están llevando a cabo para cubrirlas. Es evidente que para que la Federación satisfaga las necesidades y deseos se sus miembros son necesarias las medidas siguientes:

— Emplear un Secretario General profesional dedicado totalmente a su puesto.
— Disponer de un medio global de comunicación e información tecnica mediante un Periódico de divulgación y/o una hoja informativa.
— Una forma más coordinada de administración, y
— Una base financiera para realizar lo precedente.

Los demás directores y yo hemos experimentada la frustración de no poder dedicar el tiempo suficiente a nuestro cargo, por tener otras tareas y obligaciones que son de mayor prioridad que nuestros compromisos para con IFHE.

El hecho puede justificarse por ser un trabajo que exige total dedicación a cualquier persona para llevar los negocios de la Federación, en este momento. Un Secretario General subvencionado, dedicado por entero a su cargo, tendría como única obligación la de llevar a cabo los deseos y requerimientos de la Organización. Ello incluiría la coordinación de comités fundamentales, facilitar un centro tecnológico, vigilar las finanzas, promover cursos de entrenamiento, promoción de la profesión, visitar a las distintas entidades asociadas periódicamente, supervisar la impresión de un periódico y/u hoja informativa, etc. Por el momento no es factible economicamente emplear a una persona de tales características, pero debemos pensar en cubrir tal puesto antes de finales de esta década, o incluso mucho antes.

El sondeo en las entidades asociadas reveló que la necesidad primordial era la de mejorar las comunicaciones. Además, fue acordado que el Periódico actual deberia contener más información técnica de importancia internacional y deberiá ser impreso en francés y español, además de inglés.

Asimismo, existe un gran interés por un noticiero o carta circular que contenga noticias de las actividades del Consejo y sus directores, y organizaciones asociadas, así como por una información técnica actual. El contenido del presente Periódico puede ser mejorado facilmente si los socios facilitaran al Editor documentación y noticias. Actualmente, la información que llega al Editor es muy escasa para satisfacer tal deseo. Sin embargo, la traducción a otros idiomas supone un problema económico al que no se puede hacer frente con los ingresos actuales. Por consiguiente, las alternativas son elevar las cuotas o para aquellos con práctica facilitar voluntariamente la traducción de información, etc. a los editores del Periódico. El tema de una hoja informativa será examinado por el Consejo, aunque de nuevo, la traducción a otros idiomas, diferentes de los del material presentado, constituirá una dificultad económica.

Un comité del Consejo está actualmente estudiando la estructura de gobierno de la Federación. En general, se propone formar un comité ejecutivo, posiblemente basado en una representación regional. El comité se reuniría entre las reuniones normales del Consejo y la de los congresos. Para que sea efectiva tal estructura se necesitaría financiar los viajes de los miembros del comité ejecutivo para reunirse y llevar a cabo los negocios de le Federación.

Han sido formuladas varias propuestas para mejorar la economía de la Federación. Dichas propuestas recibieron una considerable atención en la reunión del Consejo en Zagreb (Yougoslavie). El Tesorero y el comité están actualmente preparando un informe y una propuesta para que sea considerada por el Consejo en Amsterdam, en mayo próximo. En general, será ampliada la base de los socios mediante varios niveles de socios, que comprenderían los de asociaciones nacionales, como hasta el momento, además de asociados y suscriptores. Serían aplicadas diferentes cuotas para los diversos niveles de socios.

Los miembros del Consejo de IFHE recibirán un envío con anterioridad a la reunión de Amsterdam conteniendo sugerencias para un cambio en las normas, para facilitar el establecimiento de un comité ejecutivo y tratar de la marcha del negocio en la reunión del Consejo. También recibirán el estudio que ha sido preparado por el Tesorero y el Comité de Finanzas con sugerencias para cambios en niveles de socios y otros recursos para mejorar nuestra base económica. Los miembros del Consejo lo recibirán con tiempo suficiente para discutirlo previamente, dentro de sus propias sociedades, y cuya resolución podrá ser considerada en las reuniones del Consejo en Amsterdam.

A tal punto, me atrevo a añadir que todo no depende del dinero. Estoy seguro que en los próximos años continuaremos crediendo y llegaremos a tener una influencia crediente en todo lo relacionado con el cuidado del paciente. Dedicados miembros y directores continuarán al servicio de la Federación y facilitarán medios innovadores para la realización de nuestros programas. Pero al éxito continuo habrá también que añadir los problemas administrativos, que deberán ser resueltos.

El ser Presidente no implica de hecho que sea todo trabajo. He tenido la suerte de relacionarme con las asociaciones francesas, suizas, denesas y españolas y he hecho muchos amigos en dichos países. La reunión del Consejo en Zagreb, además de facilitar la oportunidad de conocer Yougoslavie y su sistema sanitario, constituyó una ocasión para hacer nuevos amigos. Lo único que siento es no haber tenido el tiempo suficiente para visitar todas las entidades asociadas de la Federación que me han extendido su invitación para visitarlas. Dichas visitas han merecido realmente la pena.

Por último, espero saludar a muchos de Vds. en el Séptimo Congreso Internacional en Amsterdam, el próximo mayo. Los Nederlandse Vereniging van Ziekenhuis Technici esttán planeando un excelente programa que tratará todos los aspectos de la ingeniería hospitalaria. ¡Espero verle en Amsterdam!

Spanish Association Elections

During the III Annual Meeting of the Spanish Association of Hospital Engineering and Architecture, the following were elected to Council:
President: A. Bonnin;
Vice-Presidents: L.Gil Nebot and Dna. M. Perez Sheriff;
General Secretary: S. Sanchez Pagá;
Vice-Secretary: X. Soler Lupresti;
Treasurer: J. Gallostra;
Members: F. Castella Gimenez, C. Mejuto Pulleiro, M. Martorell Oller, F. Mestre Rossi, A. Sanchez Vaqué, J. Teijido Seoane, and L. Gonzalex Sterling.

International Federation Congress Australia — 1984

A committee has been formed by the Federal Council of the Institute of Hospital Engineers, Australia, to organise the 1984 International Congress in Melbourne, Australia. This very enthusiastic 7-man committee now has arrangments well in hand.

To enable delegates to the Australian Congress to gain the most advantage from their visit, Hospital tours will be arranged as part of the Congress, and a series of optional post-Congress tours will be offered.

Further information is available from 8th IFHE Congress Secretariat, PO Box 302, Prahran 3181, Australia.

Institute News

Mayday Hospital wins energy saving competition

The Mayday Hospital in Croydon, just south of London, has come top in a competition run by South Eastern Gas. The hospital achieved savings of 17 per cent saving in fuel bills largely by installing a spray recuperator to the boiler house exhaust, as shown on the front cover. The hospital, which is being developed as part of a new District General Hospital, has an annual consumption of around 11 million gallons of hot water. Croydon AHA, advised by SEGAS' Technical Consultancy Serice, decided to fit the recuperator. It consists of a closed circuit to spray water over a series of plates which extract heat from the exhaust gases, and then preheat the boiler feed water through a heat exchanger. The projected energy saving in the first year of the installation was to be 90,000 therms, saving around 112,500 therms of gas which would otherwise have been required to heat the water to the same extent.

An oxygen controller has also been fitted to the boilers. By flue-mounted sensors the unit measures the oxygen concentration of the exhaust gases. The information is fed into a processor, which automatically adjusts the air intake to keep the oxygen-to-gas ratio within predetermined limits.

Sadly, it has been necessary to go to press with this issue of *Hospital Engineering* before the results of British Gas' annual Gas Energy Management National Awards were announced, in which Mayday is the South East's entrant in the relevant category.

New Regional Appointments

The appointment of five new Regional Engineers was recently announced. They are:

A. Bristow — S. W. Thames RHA;
M. N. Lowsley — Yorkshire RHA;
R. G. Kensett — Welsh Health Technical Services Organisation;
J. Flynn — Mersey RHA;
C. Astley — Oxford RHA.

Our congratulations to all concerned.

New School of Water Sciences

As we mentioned briefly in the November issue of *Hospital Engineering* the first-ever academic institution devoted entirely to the study of water upgrading was opened on 16 November. It is The School of Water Sciences, run by the Lorch Foundation at Lane End, High Wycombe, Buckinghamshire, telephone High Wycombe (0494) 882390.

The Director of Studies is George Solt BSc CEng FIChemE FRIC, a chemical engineer who has specialised in water upgrading processes.

The school is mounting an ambitious programme of courses in the next few months, including some aimed directly at Hospital Engineers. These are under the title *Purified Water for Hospitals,* a two-day course on 15-16 March and 14-15 June 1982 (£150.40), and a one-day course, *Water for Hospital Boilers,* (£55.20), on 11 February 1982.

Annual Conference 1982

Dinner

As announced, the 1982 Annual Conference will be held at the Hilton International hotel at Stratford-upon-Avon from 19th to 21st May and, as usual the Annual Conference Dinner will be held on the middle evening, Thursday 20th May.

However, the function will not take the form of a Dinner Dance.

Instead, as a change and an experiment, the Dinner will be followed by an 'Entertainment'. The main entertainment will be provided by a Folk Group from Oxfordshire. Their programme, entitled *Folk from the Cotswolds,* will include displays by The Charlbury Dancers and Masons Apron Clog-Morris. There will also be some Folk Singing.

Ladies Programme

To avoid collecting cash from the ladies during the course of the programme it has been decided to introduce a Ladies Programme Registration Fee to cover the cost of lunches. The fee of £10 will be payable in advance at the same time as Conference Registration Fee and/or Dinner tickets but of course, will be returnable in the event of a lady being subsequently unable to participate.

Bursary Award Winner moves on

R. D. (David) Buckley is to leave the National Health Service at the end of this year to take up an appointment as the Manager, Works and Maintenance for British Caledonian.

Thus he sacrifices security for the somewhat harsher and colder climes of the commercial world but perhaps gains greater prospects and our good wishes go with him.

North Western Branch

A joint meeting was held between the Branch and the Institute of Plant Engineering on Tuesday, 13th October 1981. A talk was given by the Technical Manager of *Heenan Environmental Systems Limited*, on 'Controlled Air, Starved Air or Pyrolytic Incinerators'.

The event was well attended with a most interesting talk together with slides, culminating in a most interesting discussion afterwards. It was a meeting enjoyed by all those who attended.

Programme of Events 1981/82

Tuesday, 8th December, 1981
(12.00 noon to 2.00 pm)
This is a lunchtime meeting on Low Energy Hospitals at which we shall be the guests of the CIBS. This will be held at the Manchester Club, Spring Gardens, Manchester. The paper will be given by Messrs. John Ellis and Dave Allen, Senior Partners of *Building Design Partnership.* There will be a buffet lunch between 12.00 and 12.30 pm, a paper for approximately 1/2 hour and question time afterwards. There will be a charge for the buffet of approximately £1.50 and anyone wishing to have the lunch please contact the Secretary before the 8th November, 1981 so that the lunch will be booked.

Wednesday, 20th January, 1982
(6.00 pm for 6.30 pm)
This meeting will consist of a 30 minute film and a talk by Mr B Kendrick of the NWRHA on Energy Conservation. Refreshments will be provided from 6.00 pm onwards. The venue is the Lecture Theatre of St. Mary's Hospital, Hathersage Road, off Oxford Road, Manchester (adjacent the Manchester Royal Infirmary). Car parking is available on the opposite side of Hathersage Road to the hospital.

Wednesday, 17th February, 1982
(6.00 pm for 6.30 pm)
This meeting will consist of a talk by Mr J. Sunderland and Mr D. K. Morrell of the WRHA on the new SPC Telephone System and its comparison with the existing systems. The venue is Room 409 at the North Western Regional Headquarters, Piccadilly South, Manchester (at the side of Piccadilly Station). Car parking is available at the rear of the building. Refreshments will be provided from 6.00 pm onwards.

Annual General Meeting
Thursday, 18th March, 1982
(6.00 pm for 6.30 pm)
The AGM will commence at 6.30 pm (full details to be issued later). This will be followed at 7.00 pm approximately with a talk by *3M United Kingdom Ltd.* on the problems and solutions of static electricity pertaining to hospital engineering. The venue will be the Medical Institute of Bolton Royal Infirmary and is just off Chorley New Road, Bolton. Refreshments will be provided from 6.00 pm onwards and bar facilities will be available.

Wednesday, 21st April, 1982
(6.00 pm for 6.30 pm)
This will be a talk by staff of the hospital on the operation of the Peterborough All Electric Hospital and is a follow-up to a previous branch meeting in April 1978 when the concept was described and discussed. The venue for this meeting will be at the Headquarters of *Norweb* at Bolton or Manchester (exact details will be forwarded later).

Wednesday, 12th May, 1982
(6.00 pm for 6.30 pm)
This meeting will be a talk and film show by IMI Bailey Valves Ltd., in which they will demonstrate the importance and practical implications of the correct installation and maintenance of steam isolating valves and pressure reducing valve sets, together with examples of the results of the bad installation and maintenance. The venue for this meeting will be notified later.

Midlands Branch

A technical meeting of the Midlands Branch was held on 13th October 1981, when a very interesting and informative talk was given by Mr A. Egley on the subject of 'Electrical Safety'.

This talk covered similar aspects to the paper he presented at this year's annual conference. The meeting, held at the Dental Hospital, Birmingham, was well supported with approximately 40 members and guests present.

New Members

Fellows

BARRETT, Antony John, Hertfordshire Area Health Authority.
BROOKE, Gordon, Mersey Regional Health Authority.
ENTWISTLE, Geoffrey, Cramp and Frith.
HARDING, John Joseph Barry, Dudley Area Health Authority.
JAMES, John Frederick, R. W. Gregory and Partners.
MARSHALL, Clive, Derbyshire Area Health Authority.
PRITCHARD, Eric, Brian Webb Partnership.
SLATER, Gordon Henry Murdoch, Lothian Health Board.
TANNER, Anthony Roger, Wessex Regional Health Authority.
VAUGHAN, Peter Thomas, Kirklees Area Health Authority.
WILKES, Andrew Royston, Hoare Lea and Partners.

Members

ALCOCK, Frederick Paul, Staffordshire Area Health Authority.
ALLWORK, John David, Oldham Area Health Authority.
ANDREWS, Peter Frederick, Ealing Hammersmith and Hounslow Area Health Authority.
BENTHAM, Colin, Cleveland Area Health Authority.
BENTON, Gregory, Cheshire Area Health Authority.
BOSWELL, Andrew, Micheal A. Lenihan and Associates.
BROCK, Derek Herbert Thomas, BOC Medishield Pipelines.
CRAMPTON, Paul, Derbyshire Area Health Authority.
CULLINGFORD, Richard Geoffrey, South East Thames Regional Health Authority.
DEAKIN, John Paul, Radicon/HLW International, Saudi Arabia.
DICKENS, James Arthur, Llewelyn Davies Weeks.
FEARNS, Malcolm, Upton Associates.
GIBBONS, John Harry, Berkshire Area Health Authority.
GIBLIN, Peter, Cheshire Area Health Authority.
GREEN, Terence James, Upton Associates.
HARRISON, Harvey John, Derbyshire Area Health Authority.
HATFIELD, Raymond Reginald, Northaw Engineering Consultants Inc.
HILLS, Warren Gooding, Ealing Hammersmith and Hounslow Area Health Authority.
KING, Christopher, Camden and Islington Area Health Authority.

LANGFORD, Melvyn Richard, Surrey Area Health Authority.
LAYCOCK, David Arthur, Leeds Area Health Authority.
LOVE, Peter, McAuslan and Partners.
McCLEMENTS, William George, Eastern Health and Social Services Board.
MEARS, Richard Brian, City and East London Area Health Authority.
MILLER, Keith Virtue, Hertfordshire Area Health Authority.
MURRAY, Kevin Thomas, Hertfordshire Area Health Authority.
NORRIE, Keith Scott, Tayside Health Board.
O'DONNELL, John, Greater Glasgow Health Board.
OSWALD, William Henry, R.A.F. Wroughton.
PEERS, David, Sefton Area Health Authority.
PINN, Edward William, Eschmann Bros. and Walsh Ltd.
PITT, Barry Winston, C. J. Jefferies Ltd.
RADMALL, Richard James, Norfolk Area Health Authority.
RENNIE, William Alan, Western Health and Social Services Board.
SAUL, Lyndon Edwin, Ealing Hammersmith and Hounslow Area Health Authority.
SIMSON, Bryan William, Tuckey Ford.
SKELTON, Richard Ian, Surrey Area Health Authority.
SMITH, David John, H. W. Smith & Son (Contracting) Ltd.
TAIT, Ian Richardson, Lothian Health Board.
THORNEYCROFT, Peter Ernest Otto, Kent Area Health Authority.
TISCH, Norman Glen, Revall Hayward Partnership.
WAITE, John Walter, Trafford Area Health Authority.
WATSON, John Bruce, Ayrshire and Arran Health Board.
WHEELDON, Keith Dennis, Derbyshire Area Health Authority.
WILLIAMS, Howard Robert, Oxford Area Health Authority.
WILSON, Brent Frederick, R. W. Dinsdale and Partners.
WINNALL, Gilbert James, Salop Area Health Authority.

Graduates

EVANS, Michael John, L. J. Schwarz and Partners.

Associates

AGNEW, James Campbell, Medivent.
AHMAD, Jameel, Al Nayhan Military Hospital, Abu Dhabi.
ATHERTON, John Derek, Sefton Area Health Authority.
BLAKES, Leslie Frederick, Consolidated Medical Industries Ltd.
FETT, Andrew Peter, Beds. Area Health Authority.
HANCOCK, David Arthur, Hospital Estate Management and Engineering Centre.
HOSMER, Douglas Frank, Kent Area Health Authority.
HOWFORD, Ian, A. A. F. Ltd.
HUTSON, James Graham, Lanarkshire Health Board.
LEIGH, John, RDL International Ltd.
MATHEW, George, Farwaniya Hospital, Kuwait.
MAYCOCK, Stuart, British Steriliser Co. Ltd.
POOLEY, Albert William John, Ministry of Labour and Social Services, Zimbabwe.
SICHULA, Jonathan, Kasama Hospital, Zambia.
SQUIRE, Stuart, Static Systems Group.
WOOD, David Barrie Cecil, Brotherton and Partners.

Letter to the Editor

Incentive Bonus Scheme

I have read with interest the continuing debate in this journal concerning the Scheme, and especially the article by Mr Petty *(HE October 1981)*. There are a few questions, however, which I would like to point at other Senior Engineers, who might care to continue the discussion. They are:

If a Senior Engineer can imagine himself to be head of a small commercial maintenance company, employing say fifty staff, and with the requirement to make a profit, would he employ two Planner Estimators at an approximate cost of £16,000 pa to run a bonus scheme?

Why does Mr Petty, in his list of successful maintenance bonus schemes, not include any industrial profit-motivated organisation?

Can every Senior Engineer honestly say each job is fully inspected for workload, and that 'changes to work' were necessary?

What benefits have Works Departments and patients accrued from the bonus scheme?

Finally, I would like to point out that in my experience, industrial organisations apply bonus schemes to productive staff whose work patterns can be rigidly controlled, but not to maintenance departments where work is of a varied nature.

After all, who can tell whether those bolts had to be burnt off because of corrosion or whether it was a simple spanner job. The Foreman might if he had time to visit every job, but then 20% of his time spent in administering a bonus scheme.

D. Wellstead, BA MIHospE
Senior Engineer,
Powys Area Health Authority.

Sommaires en Français

Les techniques de la gestion des risques et de la fiabilité

Les décisions managériales en matière de conception et d'entretien

L'article étudie l'application des techniques de gestion des risques et de la fiabilité à la gestion hospitalière dans les services techniques, ainsi que la prise en compte de ces techniques au stade de la conception des nouveaux hôpitaux.
Page 8.

Un système d'information de management et d'un système d'entretien préventif

L'exposé est consacré à la mise en oeuvre d'un système d'entretien préventif dans un grand centre hospitalier en vue d'assurer l'efficacité des équipments et des appareils à l'utilisation. Il examine aussi les systèmes d'information de management que l'auteur estime indispensables pour assurer le rendement optimal des ressources humaines, c'est-à-dire des effectifs hospitaliers.
Page 15.

This paper was presented at the 6th International Congress in Washington in July 1980 by the authors. Dr Murray is Assistant Chief Engineer and Dr Green is a Professional and Technical Officer — both at the Department of Health and Social Security.

The paper's theme is that quantitative assessments of risk or performance are central to economic, technical and political engineering decision-making.

Risk and Reliability Techniques Applied to Design and Maintenance Management Decisions

K I MURRAY BSc(Eng) PhD CEng MIMechE FIHospE
M F GREEN BSc PhD CEng MIMechE MICE

Introduction

The estate of the National Health Service in the UK consists of buildings, plant and equipment whose age, efficiency and quality vary considerably. Many of the hospitals were built before the beginning of the century when engineering facilities accounted for probably less than 5% of the total cost. In the last 10 years the pattern of patient care has changed significantly and engineering facilities in new hospitals can now absorb as much as 50% of the capital cost. Furthermore, due to the rising complexity of engineering plant and equipment a high standard of performance is vital to the smooth running of a hospital.

Increased mechanisation and the introduction of increasingly sophisticated electro-medical equipment offers advantages to both staff and patients; however it also demands high availability of plant and equipment. At one time or another all the engineering installations in a hospital are critical to the treatment of a patient. For example, the cold water supply when feeding a renal dialysis unit, the steam supply to sterilisation facilities or the emergency electricity generator when the public utility supply fails. This, together with the scarcity of skilled labour and the ever increasing operational and maintenance costs of hospitals, means that engineering systems, plant, and equipment must be designed to be as safe and reliable as is economically viable, and that cost-effective management methods must be adopted in hospital maintenance organisations.

Risk and reliability analyses are increasingly being used in all spheres of engineering and technological development. The application of such techniques is well established in the nuclear power and petro-chemical industries where the consequences of failure are potentially lethal, and even catastrophic. The fundamental benefit of undertaking a reliability or risk analysis is that one obtains a detailed appreciation of how a particular adverse event such as an explosion, failure of a pump, or failure of a generator to start on demand, can occur, together with a quantitative estimate of the likelihood of occurrence.

Such an analysis might indicate the 'weak link' in an engineering system, and hence highlights how reliability might most effectively be improved. Quantitative information concerning possible risks, or the frequency of plant breakdowns is also a basic requirement for many forms of engineering economic analysis; for instance a cost benefit analysis of safety policy, a cost-in-use study of a boiler or pump, or decisions concerning operational policies.

Planned maintenance will only prove economically viable if the frequency, cost, and consequences of breakdowns outweigh the cost of the planned maintenance programme. This can only be investigated by considering the reliability of the plant (although with planned maintenance there are factors other than economics that need to be considered). As a consequence the Department of Health and Social Security (DHSS) is increasingly using risk analysis and reliability techniques — both to help establish policies for safety and maintenance, and in the design of hospital plant and services, particularly where the loss of service could have an effect on patient or staff safety.

One of the first fields to which reliability (and hence probabilistic) concepts were applied was structural engineering design. In the early 1950s the concept of structural safety, based upon a probabilistic approach to load and strength variability, was emerging in the academic arena; notable at this time was the work of *Freudenthal* (1956) and *Pugsley* (1966).

In subsequent years the development of probabilistic approaches to structural safety was undertaken primarily in North America, and recently there has been an international movement towards structural codes of practice based upon a probabilistic format. A number of these revised types of structural codes are now in general use in the United Kingdom, and should eventually allow the designer greater freedom to propose levels of structural safety, which are to some extent linked to the economic and social consequences of failure.

There is, in fact, a fundamental similarity between structural and building services design. Engineers in both fields have, in the past, tended to think of a design in terms of it being safe or unsafe, adequate or inadequate. Any uncertainties or deficiences in knowledge have been accounted for in structural design by using safety factors, and in building services design by either specifying the next largest standard plant or pipe 'size' or by using subjective, and hence generally conservative, diversity factors, (although back-up capacity for essential systems is frequently required).

However, when one or more of the factors which must be predicted for design purposes is uncertain or 'probabilistic' in nature, then there is a finite risk of 'design inadequacy' — no matter what value is ascribed to the probabilistic factor(s) for design purposes. Thus, in reality there is no such thing as an absolutely safe or adequate design solution. This is as true for building services design as it is for structural design.

To illustrate this fundamental similarity between structural and building services design, consider the design of a heating system. The required size of the boiler must be based upon an assumed acceptable internal room temperature, and what are often termed the 'design day' external climatic conditions. However, in the same way that there is a small but infinite risk of the load on a structural beam exceeding its strength and causing 'failure', there is similarly a risk of external climatic conditions being more onerous than the 'design day' conditions.

'Failure' for the heating system is represented by a lower than acceptable internal room temperature. This obviously oversimplifies thermal design and the many factors involved, but it serves to illustrate the point. Without resorting to a detailed account of each building service, it can be stated that in general there is at least one probabilistic variable associated with the design of almost all building services.

It might be logical to conceive that in years to come probabilistic concepts will spread to building and hospital services design procedures and codes, although this particular line of thought will not be expanded upon in this paper.

The principal objective of this paper is to illustrate the influence that risk and reliability techniques can have in operational management in hospital engineering. However, in many respects design and operational management are intrinsically linked, and hence many of the problems discussed are as applicable to the design of new hospitals as they are to the running of existing premises.

Reliability Assessments

No attempt is made in this paper to cover in any depth the theory of reliability technology. This is a subject which has been well documented in text books, conference proceedings and research papers, and the references given (*Green and Bourne*, 1972,) (*Carter*, 1972,) (*Martin*, 1976) are in no way exhaustive. There are, however, four formulae central to reliability assessments which are worthwhile stating here:

1. The failure frequency of a system, θ_s, is given by;
$\theta_s = \theta_1 + \theta_2 + \theta_3 \ldots$
where θ_1, θ_2, θ_3 etc are the random failure rates (faults per year or hour) of the individual components or sub-systems which are essential to the operation of the system.

2. The probability of failure, occurring before time 't' is given by;
$P_f = 1 - e^{\theta_s t}$

3. The mean fractional dead time (mfdt) of a system (proportion of time the system is likely to be out of service) due to random revealed faults of components is given by;
$\text{mfdt} = \theta_1 r_1 + \theta_2 r_2 + \theta_3 r_3 \ldots$etc
where r_1, r_2, r_3 etc are the mean repair times for each of the components or sub-systems involved.

4. The mean unavailability of a system which is on standby (proportion of time the system will not be available if required), μ, is given by;
$$\mu = \frac{\theta_s t}{2}$$
where τ is the test prove interval (test frequency for the standby equipment).

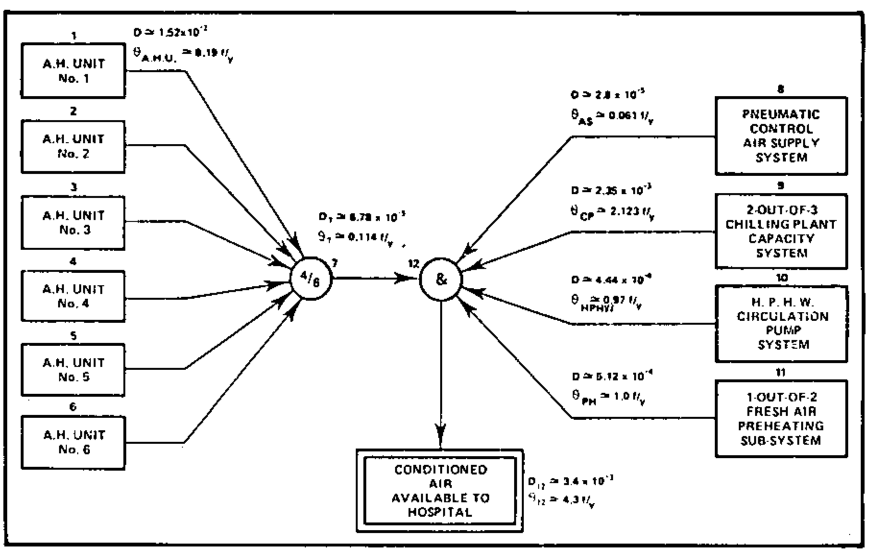
Three examples follow the way in which reliability assessments have been used in the UK health service to assess and improve performance.

A Hospital Air-Handling System

The system being investigated was divided into five sub-units (*See Figure 1*); and the system was deemed to satisfy requirements if the following operated:

4 out of 6 air handling units;
3 out of 4 HPHW circulating pumps;
2 out of 3 refrigeration chilling plants;
1 out of 2 fresh air inlet pre-heaters;
1 out of 2 pneumatic control compressed air supplies.

Figure 1: Shaft 2-Air handling Plant assessment logic diagram ('D' equates to the mean fractional dead time (m.f.d.t.)



Using the formulae given above, it was found that the mean fractional dead time (mfdt) of the system was 3.4×10^{-3} or 32 hours per year, and the failure frequency, θ_s, was equivalent to 4.3 faults per year (Basic equipment/ component reliability estimates were taken from the Data Bank of the National Centre of Systems Reliability, UKAEA *). This mfdt was felt to be compatible with the number and complexity of sub-systems involved.

However, closer examination of the likely types of faults revealed the relatively high proportion of faults directly attributable to the pneumatic control equipment and regulating components. As a consequence this study highlighted the importance of safeguarding against a common mode failure to the compressed air supply system (for instance accidental damage to the pipeline). The provision of facilities to be able to quickly provide a temporary air line (and hence reduce the repair time, 'r'), was recommended and implemented.

In addition, the two air compressors were both fed by the same single electrical supply circuit, and hence, to maintain the redundancy advantage of the duplex system, a second independent electrical supply was recommended. This study highlights the influence of repair time on the fractional dead time of a system, and consequently the importance of standard spares for, say, heater and cooler batteries, or dampers. Fault rate frequency will be much influenced by the standard of maintenance, and this particular analysis stressed the importance of regular checks on key components, such as the pneumatic control devices.

Hospital Emergency Generators

A reliability assessment was undertaken of a sample of hospital emergency generators which ranged in size from 80 KVA to 750 KVA. Such generators are installed in UK hospitals as a safeguard against disruptions to the mains supply which occur as a result of routine maintenance, technical faults, or industrial disputes. As a consequence, it is vitally important that these generators operate satisfactorily when required. The results of 4500 test start-ups were analysed and *Figure 2* illustrates the way in which the emergency power supply system was sub-divided in order to classify failures.

The results of this study illustrates that the majority of faults are associated with a 'vital few' components (*Figure 2*). The overall unavailability of hospital generators was estimated to be 0.02 (a one in fifty chance of failure to start and take up load when needed in an emergency). Considering the complexity of such systems, this is not unreasonable and is consistent with the estimated performance of similar systems in the UK and French Nuclear Power Industry (*Snaith* 1977) (*Magnon et al* 1977). Nevertheless, the DHSS is using the results of this study to suggest both practical and economic ways of improving reliability.

It is felt that by more careful maintenance, regular on-load testing, and improved specifications for batteries and chargers (the apparent 'weak link'- see *Figure 2*), the performance of hospital generators could be improved by a factor of two. The influence of the test proof interval on the availability of standby systems is indicated by equation 4 above, and the DHSS recommends that generators should be tested every six weeks. A more detailed report of this study can be found elsewhere (*Green* 1979).

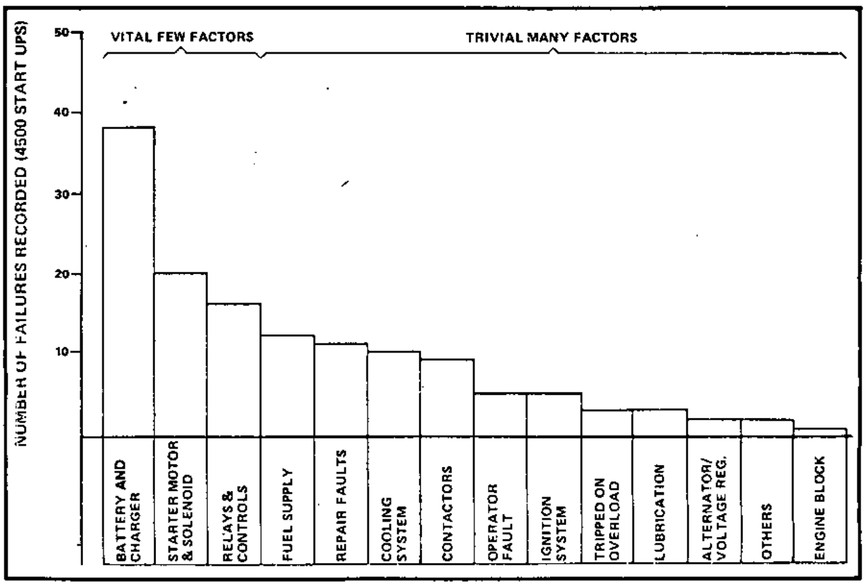
Multiplex Control Systems

Multiplex telemetry techniques are increasingly being used in UK hospitals to monitor and control fire alarm systems. The principal advantage of such systems is that a single cable can be used to transmit and receive signals from a number of fire zones. The technique can, and is being extended to use the cable to control and monitor plant, which can be of great value in maintenance management and in energy conservation. However, the DHSS commissioned a reliability assessment both to ensure that fire safety is not adversely affected by using telemetry techniques, and to evaluate the implications of incorporating plant monitoring and control facilities.

The results of this analysis suggested that conventional fire alarm control systems are probably associated with a lower overall fault rate than telemetry control systems. However, detector head faults have a dominating effect on the fractional dead time (loss of cover) of the complete fire alarm system (a factor of 6 to 1); as a consequence any difference in the reliability of the conventional and telemetry control system is probably relatively unimportant.

The incorporation of plant monitoring and control marginally increased the expected number of faults affecting the complete fire alarm system. However, these faults would be automatically detected, and the proportion of time the system is inoperative (mfdt) could be reduced to a minimum by ensuring that well documented fault diagnosis and maintenence procedures exist, hence reducing the repair time, 'r'.

Figure 2: Pareto Plot of diesel-engine generator system failures, illustrating the 'vital few' causes of failure.



* National Centre of Systems Reliability, United Kingdon Atomic Energy Authority, Wigshaw Lane, Culcheth, Warrington, Cheshire WA3 4HE.

Maintenance Management

As is common for all building and industrial estates, maintenance has extremely serious revenue implications in hospitals (current expenditure £220 million per annum in England). The DHSS has, for a number of years, been developing systems and procedures which should ensure that Works Departments are run efficiently. Such procedures include:

- the extensive use of planned maintenance in hospitals;
- a budgetary and financial control system for Works Departments;
- a system for measuring the standard of maintenance in hospitals and for monitoring maintenance performance;
- an energy audit system;
- an incentive bonus scheme to improve productivity.

The DHSS recognises that maintenance-management decision-making could be further improved in a number of ways, all of which involve the use of reliability and performance information about plant and services. A number of these ideas are discussed below.

Optimising Planned Maintenance Frequencies

The economics of planned maintenance is illustrated in *Figure 3.* The greater the frequency (and hence cost) of planned maintenance for any engineering system, the smaller should be the cost of breakdown repairs and vice versa. Now the optimum, (minimum), total cost frequency for planned maintenance will depend upon the following:

- the repair and penalty cost of a breakdown (penalty costs could be high for essential plant or equipment with life-risk implications);
- the cost of planned maintenance;
- the reliability (expected frequency of faults) for the plant or equipment.

The implications of optimising frequencies could be substantial in the UK Health Service, which spends approximately £20 million per annum on planned maintenance. Simple computer programs can be used to undertake the analyses for plant or engineering systems, although the key to the adoption of such techniques is the availability of performance (reliability) information about plant and equipment.

Economic Stock Levels in Central Stores

It has been estimated that approximately £10 million of capital is tied up in hospital maintenance stores in the UK. If unreasonably low spares-stock-levels are held, then there can be a considerable delay in repairing plant and equipment; the effect of repair time on the downtime (mdft) of plant has been discussed previously. Excessive high stock levels simply result in unnecessarily high undisposable capital. Mathematical techniques can be used to calculate optimum stock levels, but once again performance information about plant and equipment is a key factor in the analysis.

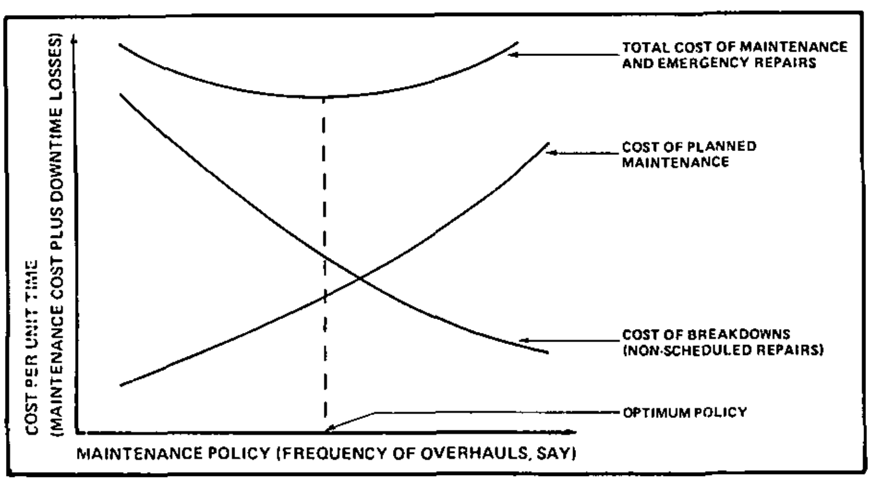
Procurement Policies

The feedback of performance information concerning plant and equipment to the designer or purchaser is a vital link in ensuring that we learn from experience, and that manufactures are encouraged to improve their products. Such reliability information can help a hospital engineer when purchasing replacement plant and equipment. For more complex plant such as sterilisers, air-handling plant, boilers etc, reliability assessments can assist designers in preparing equipment specifications.

In recent years there have been encouraging moves towards the incorporation of reliability clauses in procurement contracts; the manufacturer guaranteeing that the plant will meet the specified level of performance. This has occurred most frequently with defence contracts (particularly in the USA) where contracts have been substantial enough to encourage manufacturers to introduce reliability assessment techniques.

At this stage it is unrealistic to expect hospital equipment manufacturers to immediately accept reliability clauses. In the first instance, therefore, it is probably necessary for the client (purchasing authority) to undertake reliability assessments and use the results to write technical specifications. Gradually, manufacturers will want to have more freedom to choose the most cost-effective way of giving the customer the reliability he demands, and will thus be motivated to undertake reliability assessments themselves.

Figure 3: Optimum Maintenance Policy. (For illustrative purposes the effect of planned maintenance on running costs, output efficiency and prolongation of plant life have been ignored.)



Plant Replacement Schedules

From a budgetary control viewpoint it is vitally important that plans for plant replacement are thoroughly justified and well documented. Although this might involve the hospital engineeer in additional work, it is only right that he should justify a demand for capital which may, for example, prevent an additional renal dialysis unit being purchased for the hospital.

Once again, the only quantitative way of justifying capital requirements is to be able to detail the deteriorating performance of existing plant and the maintenance costs associated with continuing to repair that plant, as opposed to purchasing a replacement.

Cost-in-Use Studies

Reliability, performance and repair-cost information is the key to undertaking cost-in-use (life cycle cost) assessments of plant and equipment. Such assessments, using discount cash flow techniques, are essential in ensuring that maintenance managers make cost effective decisions concerning, for instance, the decision to continue to repair rather than replace a particular item of plant or engineering system.

Maintenance Management Information Systems

This section emphasises the importance of accurate reliability, performance and financial feedback information for plant and equipment if maintenance decision making is to be improved. Having recognised this need, and the impracticality of collating this type of information manually, the DHSS recently developed a mini-computer maintenance management system for a particular group of hospitals. The basic objective of this pilot scheme was:

'To investigate the type and extent of programs needed to record technical and financial information for all engineering and building assets, and to incorporate current DHSS Works Department procedures (and hence be applicable to Health Authorities throughout the country).'

The computer collates and analyses the information provided on a 'work docket' which is completed for each maintenance job undertaken. It was recognised that a system which would provide the exact management information required at the time it is needed, was essential. This led to the adoption of an interactive 'on-line' computer system with VDU/keyboard terminals, rather than a main-frame batch-processing computer which can result in substantial quantities of paper being produced at regular intervals, only a small part of which might prove of interest at any time. Further information about this project can be found elsewhere (*Knipe and Green* 1980).

Safety Policy

Society's concern about health and safety is reflected in the increasing frequency with which the question of risk is raised when technological developments are being discussed. This is highlighted by the moves towards greater community participation in the decision-making process, particularly when environmental impact is involved. At the same time there has been a general trend towards more comprehensive statutory policies concerning health and safety in buildings.

Two examples of this trend in the UK are the *Health and Safety at Work Act* and the *Fire Precautions Acts* (although there are many other statutory regulations affecting the design of buildings). There is nothing to suggest that this trend will not continue, and although in general the associated improvement in safety is to be applauded, it is suggested that because of political pressure such regulations or statutory requirements are not always rationally developed. For instance:

The actual improvement in safety may not always be estimated, or if it is estimated, it may not always be compared with the improvement in safety associated with other options.

The cost implications may not always be assessed or compared between options.

Levels of safety considered unacceptable on an intuitive basis, or because of emotive events may not always be compared in an objective manner with the risks accepted by the community in other spheres, such as in transport policy, in the domestic home, or associated with various occupations or leisure pursuits.

This is not to say that research has not been undertaken to improve the rationale of safety policy decision-making. Indeed a significant amount of research has been undertaken over the last 20 years. Fields which have been studied include:

Social attitudes towards risk, (*Green and Brown* 1978), (*McGinty and Atherley* 1977), (*Lord Ashby* 1977), (*Lord Rothchild* 1978).

Quantitative assessment or risks (*Gibson* 1976), (*Kletz* 1971).

The economic evaluation of life and injuries (*Melinek* 1972), (*Hayzelden* 1968).

The use of cost benefit techniques to rationalise safety and risk decision making. (*Sinclair* 1972), (*Melinek* 1974), (*Thedie and Abrahams* 1961).

The DHSS felt that it would only be able to promote a rational approach to risk management in hospitals if it had a detailed picture of the kind and extent of risks and hazardous events which occur in hospitals. As a consequence a unified method of collecting and analysing this type of information is currently under investigation by Aston University in England. In addition, it is hoped that analytical techniques will result which will be of value in presenting a constructive and effective contribution when discussing national policies concerning risk and safety aspects of hospital design and operation.

In essence this will involve cost-effective assessments of proposed polices. This type of rational approach is essential to ensure that finance used to improve safety in hospitals can be justified, bearing in mind alternative ways in which that money might be spent to save lives; for example on screening procedures or renal dialysis units. This approach to safety would not be necessary if unlimited resources were available. Unfortunately, as in many other countries this is not the case in the UK, nor will it be in the foreseeable future.

This approach to safety decision-making will generally involve hospital risks being evaluated in the context of the level of safety considered acceptable in other fields, such as in the home, or in various industries. This point is illustrated in the following example of how a risk analysis was used by the DHSS to clarify the chance of a gas explosion occurring in a hospital walkway.

A Hospital Walkway Design Problem (*Green* 1978)

In a recently built hospital the main underground service walkway was designed to accommodate a natural gas main and power cables in close proximity. As a consequence, concern was expressed at the risk and potential consequences of an explosion or fire in this walkway. The ever increasing electricity load of complex modern hospitals, and the general move towards the adoption of centralised service ducts and walkways, suggested that this problem was probably not confined to this one hospital; consequently the problem was worthy of a detailed investigation.

The occurrence of a gas explosion or a fire in a subway is dependent on a great number of events occurring simultaneously. It was felt that by using a fault tree to model this complex problem, together with generic fault-rate information for the factors involved, an order-of-magnitude estimate of the risk could be obtained.

If a gas explosion is to occur then four events must occur. These are:

a leakage of gas;
no detection of the gas;
inadequate ventilation;
the presence of an ignition source.

Each of these events can be subcategorised as illustrated in the fault tree (*Figure 4*).

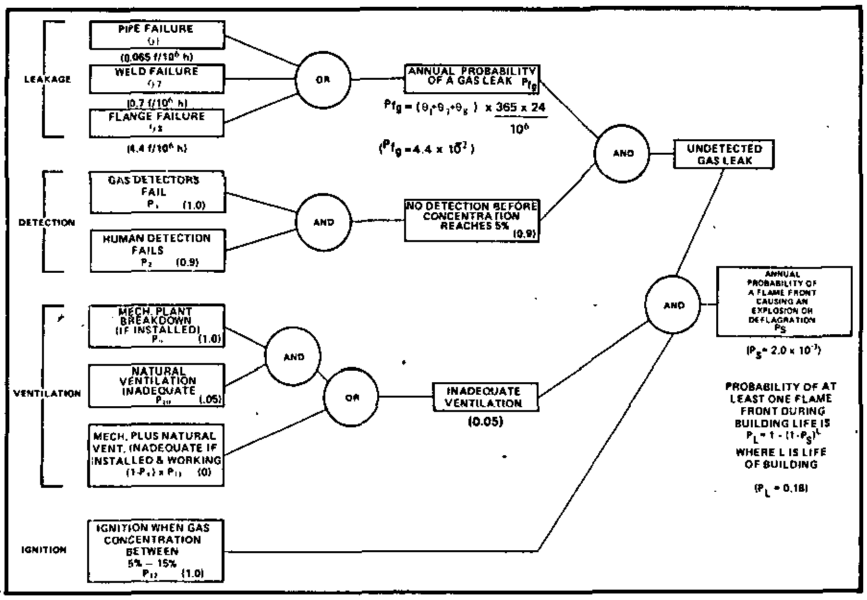


Figure 4: Fault Tree illustrating the requirements for an explosion when the Gas leak is caused by damage or deterioration to the pipe, or joint failure.

This analysis, which used probability values for each of the factors involved, and tended to err on the side of caution, suggested an approximately 20% chance of an explosion occurring at least once during the life of the hospital (prior to remedial work being undertaken), although such an event would not necessarily involve casualties or serious damage.

In order to evalutate the risk to occupants of the hospital, the Fatal Accident Frequency Rate (FAFR) was calculated for employees and patients. The risk per 10^8 exposed hours was estimated to be 11 and 0.01 respectively. Although not serious, this risk was felt to be an order of magnitude greater than the fatality rate that a craftsman might normally be exposed to in his working environment. By reducing the fatality rate by a factor of ten, the risk of an explosion during the life of the hospital would become 0.02, which was felt to be more acceptable.

It was felt that the introduction of an effective planned maintenance programme and a 'permit to work' system would probably meet the required improvement in safety. However, the analysis indicated that any additional improvement in safety could most effectively be obtained by concentrating on the risk arising from a joint failure in the gas main.

As a subsequent exercise the potential fire problem within this walkway was investigated. In this instance economic techniques were used, together with the results of the risk analysis, to identify the most cost-effective ways of improving fire safety.

Safety Audits

In the long term a 'safety audit system' is envisaged for use in individual hospitals. A safety audit would take the form of a detailed survey of the hospital to identify problem areas. By combining this type of information with national statistics concerning the risk and likely consequences, it would prove possible to identify areas of unacceptable high risks within that particular hospital.

Resources available to improve safety could then be channelled to those problems showing the greatest 'return on investment'. This philosophy would lead to a more flexible and cost-effective approach to safety in hospitals, with a tendency to treat each hospital individually, rather than by enforcing rigid, all-embracing national regulations.

Hospital Fire Policy

In the hospital fire precautions field the DHSS has, for a number of years, been promoting the need and desirability of adopting a cost-effective approach to fire precautions decision-making using risk analysis techniques (*Woolliscroft* 1976), (*Woolliscroft* 1979). By using cost-effective techniques, *Woolliscroft* (1979) has suggested that 'conventional UK fire precautions based primarily on compartmentation, and means of escape, compare unfavourably in cost-effectiveness with medical means of saving life.'

A Fault Tree technique, similar to that used in the gas explosion problem described previously, has been used by the DHSS to estimate the risk of multiple-fatality fires occurring in hospitals. An alternative approach to the fire safety decision-making, which the DHSS in conjunction with Edinburgh University is currently developing, involves a 'fire audit system' — the philosophy of which is similar to that of the 'safety audit' system described previously.

The approach, which was originally developed in the USA (*Benjamin* 1979), involves points being awarded for various fire safety 'components' within the building. For instance, general safety, containment safety, extinguishable safety and egress/rescue safety. By combining scores for each of these components, an assessment is obtained of the overall level of safety existing in that particular hospital. The system, although rather subjective in nature and less vigorous than the fault tree approach, is potentially more practical for assessing individual hospitals. It will hopefully help to highlight both the type of hospitals in the UK in greatest need of the scarce resources available, and the way in which fire safety in a particular hospital might most cost effectively be improved.

Conclusion

The principle aim of this paper has been to show both the need and potential for using simple risk and reliability techniques in management and engineering decision-making.

The range of problems which can be tackled using either risk/reliability assessments or plant reliability information are considerable, and there is no convenient way of summarising the potential field.

All that might be said is that the ultimate aim, whenever such techniques are used is to make more cost-effective design or maintenance decisions. It should be stressed that reliability or risk analyses need not necessarily be associated with complex mathematics. Certainly probabilistic and statistical concepts are involved, but the likely applications in the hospital engineering field will rarely justify a complex or extremely detailed study. Simple quantitative analyses are generally acceptable to assist decision making.

It is hoped that this paper will show that there is as much reason to consider reliability and performance concepts in operations and maintenance management as in design. Not only is reliability/performance information the key to more cost-effective maintenance decision-making, but maintenance policies and procedures can have profound effect on the reliability of plant and engineering systems.

In the future one might expect an extension of statutory regulations controlling health and safety in hospitals, greater public participation where safety is concerned, and yet greater demands from central and local government to justify public expenditure.

It is suggested that such conflicting demands can only be satisfied if both quantitative risk and reliability analysis techniques are adopted, and the necessary economic and risk/reliability information is available. In this respect it is essential that the taboo associated with attaching economic value to human life and injuries be overcome.

In the maintenance management field one might anticipate the widespread adoption of interactive computer facilities to collate and analyse technical and financial feedback information about plant and equipment, and to control central stores. One might also anticipate that plant and equipment manufacturers will need to become more familiar with reliability and life-cycle costing terminology as customers begin to demand a more objective (quantitative) basis upon which to make design and purchasing decisions.

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The Development of a Management Information System and a Preventive Maintenance System

C TANVERDI

Introduction

In recent years, the cost and complexity of maintaining a physical plant have been increasingly felt by hospital executives. Because of the rising costs of skilled labour, equipment, and energy, efficient utilisation of these resources has become a necessity. The increasing need for monitoring of resource utilisation has prompted managers to search for dependable information sources. However, available information is usually inadequate or inaccurate.

The informational needs of an engineering department may depend just as much upon management philosophy as the size and complexity of the institution. With the current emphasis on cost-containment in hospitals, not only has effective energy management become the vogue, but the efficient utilisation of all resources, particularly manpower, has become a necessity. In addition, there are certain exogenous factors which have been increasingly felt by hospitals.

For instance, the Joint Commission on Accreditation of Hospitals* has emphasised preventive maintenance programs, and has been requiring

* *A non-governmental body which accredits hospitals in the USA.*

more specific documentation in recent years. It has been demonstrated that proper preventive maintenance extends life expectancy of equipment. From a cost-containment viewpoint, preventive maintenance can contribute to increased productivity by allowing hospitals to do more with less.

If the reader is convinced or, at least, acknowledges that preventive maintenance leads to effective utilisation of equipment, he is undoubtedly interested in achieving effective utilisation of human resources. Of course, a motivating work atmosphere and an effective management style are the key factors that will lead to increased productivity. However, can a manager take it for granted that his people are effectively utilised, or that their time is properly allocated to satisfy various needs of the institution?

The answers to those questions may be affirmative for some cases — but as the size of the organisation gets larger, the task becomes more difficult without some monitoring mechanism such as a management information system (MIS). Conversely, a computerised MIS could be an overkill for a department with a few workers. At either extreme, however, there is a common need to accumulate useful information to monitor the departmental effectiveness and resource allocation.

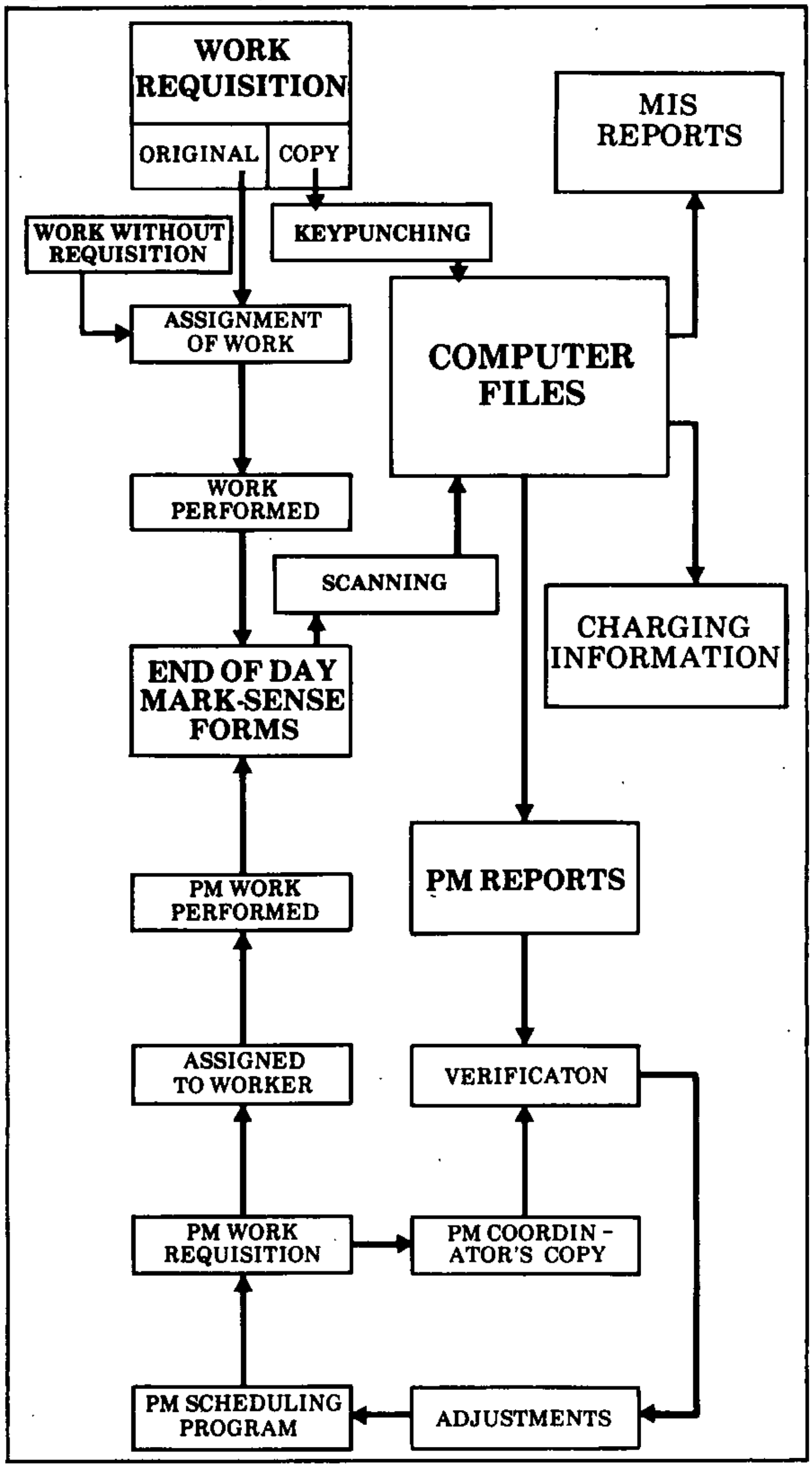
Without useful information, the maintenance of the physical plant and equipment poses problems for management. This is particularly true as the institution grows in size and complexity. In order to ensure proper coordination of maintenance activities, managers need accurate, up-to-date information to make decisions concerning allocation of manpower, employee performance, and utilisation of resources. In summary, managers can use Management Information Systems to attain their goals.

A Management Information System is as good as it is well-utilised to make decisions. It can be large or small, complex or simple, computerised or manual. Its scope and format depend on the particular application. Therefore, it is not the intent of this paper to describe a system which will suit everybody's needs and requirements. Rather, the objective is to provide guidelines, and to describe a general methodology which can be utilised by managers for the development of systems that satisfy their particular needs.

Overview

The paper will focus on providing hospitals with a reference document which describes various aspects of developing information systems for engineering and maintenance functions. In order to facilitate the presentation of the methodology, a system in operation at a large hospital will be described first. The primary benefit

Figure1: Basic Flow Diagram — MIS and PM system.



of presenting a large operational system is to illustrate certain characteristics that may satisfy differing needs. Another advantage is that the reader can utilise some of the detailed aspects of the system design in his own application.

In order to minimise redundancy, the detailed aspects of designing the system are integrated into the system description. Although the system to be described is computer-based, the emphasis will be on the informational content, not the manner with which information is collected and processed.

Finally, there will be a presentation of a recommended strategy for the development of a successful system.

Description of an Operational System

The objective of this section is to describe a system in operation at The Massachusetts General Hospital (MGH), where the Engineering Department with 200 employees supports nineteen buildings with two million square feet of space. At a large medical centre such as MGH, the maintenance of the physical plant and equipment poses significant problems for management.

Prior to the implementation of the computer-based management information system, information that was available to managers for decision-making was limited. Information was usually obtained through manual tabulation done by foremen and assistant foremen. In addition, work performed by maintenance department employees had to be accounted for, and charged on a weekly basis. The situation was representative of most hospital engineering departments.

The increasing demand upon the department's services had necessitated an evaluation of the information system requirements for management control. As a result of preliminary analysis, system parameters were established. These parameters, or system characteristics, were a set of constraints and requirements which reflected managment's desires, as well as practical considerations proposed by Management Engineering and Data Processing Departments. With well-defined system parameters, a project team designed and implemented the system that has been operational since 1977.

Engineering/Maintenance MIS

When a job requisition is received by the Engineering Department, a five-digit number is assigned to it. The numbers are divided into several categories to indicate different types of activity. One copy of the requistion is forwarded to the appropriate shop, while the other copy is kept in the office. At day's end, the copies accumulated in the office are sent to data processing to be keypunched. Once the keypunched information is fed into the computer, it forms the basis for charging and other processing.

At the shop level, workers perform their tasks and, at the day's end, each worker fills out a form summarising his work assignments for the day. The form requires some coding and is machine-readable. That is, these forms can be scanned by special equipment which feeds information directly into the computer. In this manner, information about departmental activity can be captured in detail and stored in computer files. From there on, it is simply a matter of tabulating and and printing reports in desired formats. *(See Figure 1)*

Input Data

There are two sets of information which constitute input into the system as mentioned above. The first set pertains to the description of work to be done; it identifies a job number and defines the following information for that number:

Five-digit job number
Accounting codes
Request date
Location/Department.
Description
Shop.

The second set of information identifies work performed by a worker on a given day, and defines the following information:

Form number (pre-coded)
Worker number
Date
Job number*
Work category*
Regular Hours*
Overtime*
Material category*
Material cost*
Job status*
Charge status*.

*Repeat four times per form, if needed.

A worker may work on more than one job, thus he can repeat the information listed after 'Date' above for each additional job performed.

As the reader can note, the job number is the common data-element between the two sets of data. Any job can be uniquely identified by that number as long as it remains in the computer. Certain sets of numbers remain on file indefinitely; others are temporary and are removed automatically three months after job completion. The sets of numbers are shown in *Figure 2.*

Series	Type	File Duration
10XXX	Unproductive/Overhead	Permanent
20XXX	Routine Maintenance	Permanent
30XXX	Emergency Work	Temporary
40000 — 79999	Work Requests	Temporary
80000 — 89999	Preventive Maintenance	Permanent
90XXX	Project Work	Temporary

Figure 2:

Output

The system produces daily, weekly, and monthly reports. Daily reports contain detailed information about work requests and tasks performed by workers. These reports are prepared for each of the eight shops separately. Another daily report is used as a control mechanism to verify total hours report by each employee for payroll purposes.

Weekly reports allow foremen and managers to monitor maintenance activities closely. These reports show which jobs have been completed by each shop during the most recent week and summarise the status of all outstanding work requests. Another report lists productive work categories and unproductive time for every employee and shop, as well as the department as a whole. This particular report, in connection with others, has been used extensively for monitoring and allocating available manpower. Also, the system produces payroll reports for nearly two hundred employees.

Monthly reports provide the managers with a broad view of departmental performance. Detailed information about resource allocation, trends in departmental productivity and performance are provided in these reports. Monthly reports are also accumulated to generate annual reports.

The system provides near-total accountability to the engineering department. All personnel hours are accounted for and charged to proper cost centres, projects or funds.

Preventive Maintenance System

Preventive maintenance (PM) is a major sub-system of the MIS described above. As mentioned earlier, one block of job numbers was set aside for preventive maintenance work (80000 through 89999). One of the ten thousand numbers is assigned to equipment included in the PM Program. Each week, the system produces PM work requisitions for every equipment due for maintenance during that week. For each equipment the requisition lists information such as specific tasks to be performed, equipment type, identification, and location.

These work requisitions are given to designated workers to be completed during that particular week. As PM work is performed, workers report it on their daily job summary forms (machine-readable forms described earlier). The information updates the status file and the cycle is completed. At that point, MIS and PM system interface with each other. That is, MIS keeps track of man-hours and materials devoted to PM activities as reported on daily jobs summary forms.

Generation of Pm Requisitions

The nature and frequency of preventive maintenance depends largely on the type or category of equipment. Therefore, if an equipment is known to be, say, a supply fan, it is possible to list a set of instructions to be carried out with a given frequency. Once a starting week is specified, it is simply a matter of invoking the same set of instructions on a periodic basis, e.g. monthly, quarterly, etc.

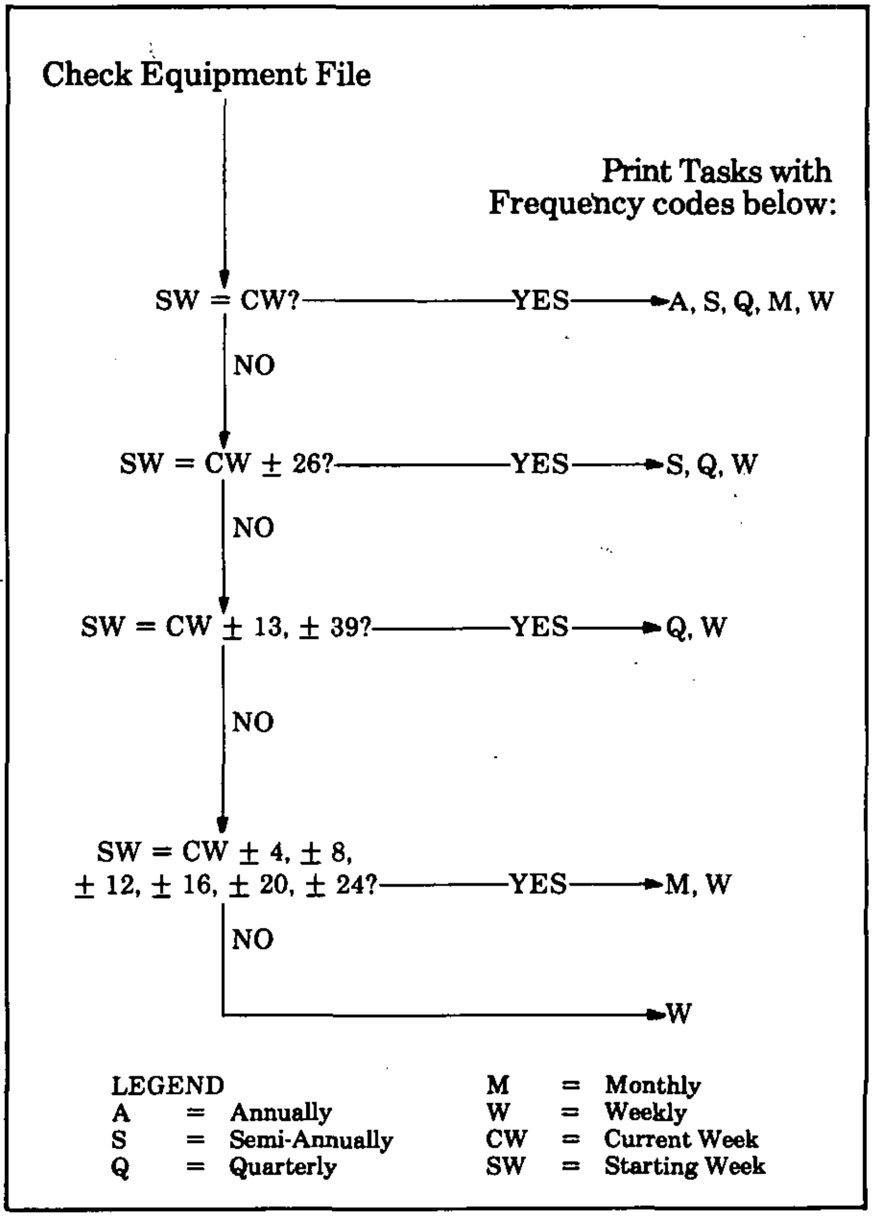
A category of equipment may specify a different set of instructions for each frequency. This presents no problem because multiple sets of instructions can be printed on the same work requisition in case they are due on the same week.

The PM program contains two major functions: Scheduling of equipment, and printing of worksheets which contain instructions. Scheduling and keeping track of different equipment with varying maintenance frequencies can be cumbersome if certain ground rules are not built into the system design. A number of alternatives exist, but it may be helpful to discuss the following points considered in designing the system at MGH:

a. A week was considered to be the basic time element for scheduling purposes. The weeks of the year are numbered from 1 through 52. If equipment is scheduled for a particular week number, it would remain assigned to the same week number, year-after-year.

b. The shortest cycle that can be assigned to an equipment is one week and the longest cycle is one year. Any other cycle has to be a whole factor of 52. That is, the cycles can be every week, every 2, 4, 13, 26, and 52 weeks. This is fine because they are quite similar to commonly used PM cycles, such as weekly (W), bi-weekly (B), monthly (M), quarterly (Q), semi-annually (S), and annually (A), in that order.

Figure 3: Scheduling Algorithm, Decision Diagram.



c. Any equipment that needs PM more than once a week should be handled separately to reduce printing requirements. Also, such equipment warrants fairly close attention of the operating engineers on a daily basis. On the other hand, any equipment requiring less frequent maintenance than once a year can be handled separately, as needed. Both types of equipment are excluded from the system, and are easier to maintain using a card file.

d. Once an equipment is assigned a starting week, the scheduling cycle commences and continues automatically unless it is reassigned another starting week.

e. Seasonality of equipment is considered when scheduling.

f. When an equipment is due for maintenance, it would be useful to know if it is a part of a larger system, or if it is to be shut down in conjunction with certain other equipment. If so, it makes sense to schedule them together in order to minimize maintenance down-time. Such related equipment can be considered parts of a single system, and a system number is assigned to them (89000 through 89999). When specifying starting week, it is not necessary to do so individually for each equipment. Indicating a particular starting week for a system automatically assigns all equipment within that system to the same starting week.

Scheduling Algorithm

As mentioned earlier, scheduling of equipment and keeping track of periodic maintenance activities is probably the most complex aspect of the PM program. However, the rules established earlier simplify the task considerably. A brief description of the algorithm is given below.

On a given week, called current week, the scheduling program has to note certain numbers of significance (1 through 52). One trivial such number is the current week number. That is, any equipment which has a starting week the same as the current week number is due for annual maintenance. Obviously, when annual maintenance is due, all other cycles, namely S, Q, M, and W, are also due on the same week. Similarly, the number obtained by subtracting 26 from, or adding 26 to, current week number is significant; i.e., any equipment with either one of those numbers assigned as starting week is due for semi-annual maintenance (as well as Q and W, of course).

The decision diagram, shown in *Figure 3*, illustrates the steps taken to determine the week numbers of significance, given a current week number. Before scanning the equipment file, the program determines the exact numbers and the frequency codes associated with each number. Then, it is simply a matter of scanning the file and flagging the equipment which has any one of those numbers assigned as starting week. That is, only those pieces of equipment are due for preventive maintenance for the upcoming week, and the program can begin printing PM worksheets.

Printing Worksheets

Once an equipment is scheduled for PM, the next step is to print requisitions. Typical information contained on a requisition is:

Equipment number;
Week number;
Location code;
System number;
Specific PM instructions.

The first four items are readily identified by the scheduling program. The last one, however, requires some file manipulation. Once an equipment is flagged for printing, its equipment category is noted. (The equipment category is alphabetically coded in four characters or less e.g. EF: Exhaust fan.)

Under each equipment category code, there is a file, which contains a list of task codes accompanied by frequency codes, e.g. 102-Q, which simply means that task number 102 will be printed quarterly for any equipment in that category, namely exhaust fans in this particular example.

Of course, one has to know what task number 102 stands for; and that can be found in the task file. The task file is a list of each number and the description of that task to be carried out, e.g:

102 — INSPECT BELTS ( ) REPLACE IF REQUIRED ( ).

The purpose of having such interconnecting filing structure is to provide system flexibility and to minimise input effort. For example, by separating task descriptions from the equipment category file, the task file becomes equally available to all equipment categories. That is, task number 102 can be used in any equipment category. An additional benefit is that one does not have to spell out each instruction every time it is needed. This capability is particularly useful when inputting certain tasks that are common in numerous equipment categories.

Developing a System

In the preceding sections, a description of an existing MIS and PM system was presented along with key issues related to system design. The objective was to illustrate the characteristics of an operational system that may satisfy differing needs, and to use it as a reference to facilitate the presentation of the material in this section. It is the objective of this section to discuss various phases of developing a system.

Specifically, the following topics are included in this section:

Determining needs;
Choosing the alternative;
Defining system parameters;
Implementation.

Determining Needs

The informational needs of an engineering department depend largely upon the philosophy of the manager. There are also other requirements imposed upon the department for additional information processing and storage. Internal requirements, such as accounting charges and external requirements — such as the Joint Commission on Accreditation of Hospitals — necessitate a certain amount of information handling anyway. Therefore, with some planning and effort, such information can be converted into a form of managerial use.

A manager has limited resources available to him. The needs of his institution may necessitate close monitoring of manpower. He may be able to achieve effective utilisation of resources without formal systems if the scope of the operation is small. His needs are likely to be as unique as the particular environment in which he works. Likewise, the manner with which he can satisfy those informational requirements will probably be different from others.

In summary, the manager has to assess the needs of his organisation as well as the avenues open to him. In doing so, it is necessary to balance the needs with available resources.

Information Collection

At the bottom of the information pyramid, there is a need to record a summary of each worker's daily activity. That is, each worker has to account for, say, eight man-hours during the course of each day he works. Therefore, a comprehensive set of activities must be well-defined. Such a set should include unproductive hours (e.g. vacation) as well as productive hours so that total paid hours for the department can be recorded. As a result, the ratio of productive hours to total hours can be monitored. The trend and variations in this ratio are significant aids to effective manpower utilisation. The total paid hours should be fairly stable, reflecting total available man-hours at any given time.

An alternative to keeping track of total paid hours is to record productive hours only. In fact, this method of reporting hours spent on particular jobs is fairly common. Its shortcoming is that the total hours reported can vary significantly without a reference value. Furthermore, it is not possible, with this method, to note variations in the unproductive hours among shops or workers. (The reader would surely appreciate the value of knowing sick-time usage patterns and trends throughout his department.)

Reporting

Daily information collection must result in usable, concise reports on a regular basis. An engineering manager is particularly interested in total number of productive hours, in a given week, spent on the following types of activities:

Emergency breakdown;
New construction (projects);
New construction (cost centres);
Refurbish/Repair;
Operating equipment checks;
Routine PM;
Special PM;
Other.

Furthermore, the hours should be separated by shop and preferably by worker. Unproductive hours can be reported by:

Sick time;
Vacation;
Holiday;
Other.

Overtime hours should also be included in the reports. Percentage of total hours for each category listed above can be revealing, and is useful in monitoring trends among shops and the department as a whole.

Among the productive work categories, refurbish/repair work usually constitutes a major portion of workload, and is considered important because it shapes the image of the department. Other members of the institution tend to judge the engineering department by how well it responds to specific job requests. (More often than not, other activities of the engineering department are taken for granted. Maintenance activities go on around the clock to keep all systems operational and are usually not noticed unless a malfunction affects someone adversely.)

Therefore, monitoring of job requests deserves special attention. For example, number of jobs completed during the previous week, and a list of outstanding job requests would provide such a monitoring mechanism. The status of each outstanding job can also be recorded (e.g., not started, in process).

Construction projects require close monitoring as well. They usually have budget limits and the manager needs to know the cost-to-date of each project as well as the remaining balance.

Adequate data collection can facilitate equipment replacement decisions based upon the frequency of failures and total resources devoted to certain equipment. Beyond a certain stage in the life of an equipment, neither routine PM nor breakdown maintenance is likely to be cost-effective. Recent trends indicate an emphasis on PM programs to reduce breakdowns to minimum levels. As a result, PM may become a major thrust of engineering activities.

Choosing the Alternative

The computerised system described earlier is probably capable of satisfying the needs of most institutions. However, many hospitals do not need such a system, nor can they afford one. In fact, up to a certain size, it would probably take more effort to maintain a computerised system than a manual one; although a computerised system would allow superior flexibility in its reporting and storage functions.

A manager has to work within resources available to him. He also needs to consider future requirements of his institution. The decision may be easier to make when the size of the institution is near either end of the spectrum. In the middle range, it may be practical to set up a manual system with provisions so that a future conversion may be smooth.

Defining System Parameters

Visualising the system prior to development may be a difficult task, but it probably is the most effective way to establish major guidelines and constraints within which it is to be developed. To visualise, a manager must ask himself what would be the most useful information he needs to do his job effectively. If he can visualise a few reports which could help him to make better decisions, he is ready to establish the basic parameters within which system specification can be established.

Such parameters may be desirable characteristics expressed in general terms. For example, the foundaton of the PM system described earlier had been a statement by the manager:

'To have a work requisition generated for each equipment due for preventive maintenance each week, and the requisitions would contain specific instructions to be carried out'.

Once the manager defines a set of desirable characteristics, and identifies his informational needs, a feasibility analysis is needed to define the system specifications expressed in more detail, and a practical alternative to achieve the objectives. During this stage, the manager may need the assistance of a management engineer, a system analyst or, if such resources are not available internally, an outside consultant. Depending on the scope of the system envisioned, the manager may be able to pursue the goal solely using resources in his department. In any case, the approach is from general characteristics to identifying specific detail, and from output requirements to defining input elements required.

For MIS design, the area of focus is the form to be prepared by each worker on a daily basis. The elements of information on such a form must be well-defined and uniquely identifiable; the forms must be simple to prepare and easy to tabulate.

The tabulation process may rapidly become the potential problem area as the institution expands. Indeed, manual tabulation is likely to require significant man-hours in most but the smallest hospitals. It is for this reason that the managers are urged to plan for possible future conversion to a computer-based system. The cost of man-hours is likely to outpace computer costs in the future if the current trends continue.

Implementation

The key to successful implementation is participation by supervisors and foremen in all phases of system development. Additional factors may be simplicity and an emphasis on reduction of overall effort spent on paperwork. A commitment by the manager to those guidelines is likely to enhance the chances of success.

Participation by key department personnel is essential in defining the informational needs of the organisation. The purpose is threefold:

To increase the likelihood of acceptance;

To improve the quality of the final product;

To satisfy the informational needs of key personnel.

It would also be advisable to designate a supervisory-level employee as the co-ordinator of system implementation. The co-ordinator would be responsible for the entire project. A co-ordinator is needed even if someone external to the department, such as a managment engineer, is conducting the project. In that case, the co-ordinator assumes a different role, yet remains essential for the system's success.

Prior to implementation, a realistic time schedule should be established. Changes which may effect other departments should be determined. Meetings should be held with the foremen and assistants to discuss operational details, so that they can train other personnel. Training sessions should also be held for employees to practice with new procedures.

Conclusions

Effective utilisation of resources, both human and equipment, depends largely upon the extent to which they are coordinated. For effective co-ordination, today's managers need useful information. Information presently available does not necessarily satisfy contemporary needs. Recently, major emphasis is being placed upon cost containment in hospitals. Therefore, engineering managers need to define their informational needs to contribute to the movement in that direction.

The needs are likely to vary as much as the organisations do. It is up to the manager to define those needs, and explore the avenues which would satisfy them. Some of the material presented in this paper may provide the reader with clues in his endeavour. More importantly, though, the author wishes to present the idea that the utilisation of resources can be improved by the availability of useful information. Thus, the engineering manager can contribute to current efforts to control hospital costs by defining his informational needs, and by attempting to satisfy those needs. Since a hospital's physical plant and equipment usually constitute its largest assets, he can play a significant role in hospital cost containment.

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Focus on Appropriate Technology

2nd International Seminar

At the request of the International Federation, The Institute of Hospital Engineering is to stage the Second International Seminar for Senior Hospital Engineering Managers. The residential Seminar will be held at the Hospital Estate Management and Engineering Centre, Falfield, near Bristol, England from 18th April to 7th May 1982 under the title 'Focus on Appropriate Technology', the theme being the application of appropriate technology to health care facilities.

The seminar is designed for senior graduate engineers with significant management responsibilities, who are employed by State or National Government to plan or co-ordinate health service facilities, or who are responsible for the management of services in health care facilities. It will provide an opportunity for delegates from various countries to meet and exchange ideas and experiences in a structural programme of lectures and projects.

Candidates must be officially recommended and sponsored by their own Government or by their employer.

The seminar will be conducted in English. A really good command of both spoken and written English is therefore essential if full benefits are to be realised.

Programme

Within the overall theme of the seminar the following topics will be discussed:

Problems of organisation;
Problems of meeting demand;
Problems of standards and design data;
Managing the maintenance function;
Planning for special care groups;
Controlling the internal environment;
Systematic approach to design and commissioning;
Preserving the environment for the community;
Advances in technology;
Advances in specialist medical requirements.

There will be an extensive programme of project work and visits to illustrate the lectures, a fully detailed timetable of which will be sent to all successful applicants.

The main speakers and tutors have considerable expertise in the fields of planning, design, operation and maintenance of health care facilities. They will generally be available to help any delegate with an individual technical problem. Delegates will also have the opportunity to present contributions.

Fees

The composite fee for the seminar will be £1200, and this will include the cost of accommodation and meals at the Centre and of official visits. Delegates or their sponsors will be responsible for the cost of travelling to the Centre. Any personal expenditure will be the responsibility of the delegate.

Application

Those wishing to attend should complete an application form (see specimen) and submit this as soon as possible to The Secretary, The Institute of Hospital Engineering, 20 Landport Terrace, Southsea PO1 2RG. England. (The final date for receipt being February 1, 1982).

The declaration by the sponsoring Authority, stating that the candidate has been certified medically fit and free from any infectious disease, must be duly signed. Each application should be accompanied by a deposit of £300 made payable to the Institute of Hospital Engineering, in sterling.

In the event of an application being unsuccessful the deposit will be returned in full, in all other instances the deposit is non-returnable. Successful candidates will be notified, and the full fee must be received, within one month of the date of notification. No place can be reserved for more than one month unless the full fee has been received.

Joining Instructions

These will be sent to each successful candidate by March 1, 1982.

Some comments on the First International Seminar held in 1979 reprinted from the December 1979 and March 1980 International Federation issues of Hospital Engineering.

From Sweden:
'We had a great variety of papers, from briefing through the whole planning process to commissioning and evaluation. In the project work we could use and test our theoretical and practical knowledge. The seminar is going to be of great value for my future work within the Swedish Planning Rationalisation Institute of the Health Service'.
Nils-Olof Einarsson
The Swedish Planning and Rationalisation Institute of the Health and Social Services, Fack, S-10250 Stockholm, Sweden.

From Pakistan:
'The seminar on Hospital Engineering was a resounding success as far as the under developed countries are concerned. Most of the under developed nations have little know-how about this technology and would like to utilise their strained finances economically so that proper utilisation can be made of their limited resources.'
Sher Mohammad
Engineering Adviser (Health), Pakistan.

From Nigeria:
'The seminar programmes were interesting, challenging, comprehensive and detailed. I commend it to all Hospital Engineers worldwide, especially those in the continent of Africa.'
S. Ade Musa
Principal Maintenance Superintendent,
Vaccine Production Laboratory,
Yaba-Lagos, Nigeria.

From Denmark:
'The Danish Hospital Institute would like to congratulate you on the successful arrangements and hopes that a second International Seminar for Hospital Engineers will become a reality.'
Niels Tinglev Christensen
Hospital Engineer,
Danish Hospital Institute.

Application Form for Second International Seminar for Senior Hospital Engineers

18th April—7th May, 1982

To be completed in block capitals and returned with the appropriate remittance to The Secretary, The Institute of Hospital Engineering, 20 Landport Terrace, Southsea, Hampshire, PO1 2RG, England, not later than 1st February, 1982.

Part A to be completed by the candidate.

1. FULL NAME (Please include title and underline the name by which you normally prefer to be addressed)
....
....

2. NATIONALITY ....

3. DATE OF BIRTH ....

4. EDUCATION (Brief details and qualifications)
....
....
....

5. PROFESSIONAL QUALIFICATIONS
....
....
....
....
....

6. EMPLOYING AUTHORITY AND OFFICE HELD
....
....

7. FULL ADDRESS FOR CORRESPONDENCE
....
....
....
....
....

8. NAME AND FULL ADDRESS OF PERSON TO BE NOTIFIED IN AN EMERGENCY
....
....
....
....

....
Signature of Candidate

Part B to be completed by the sponsoring Authority on behalf of the candidate.

I certify that:-

a) To the best of my knowledge and belief the information given by the candidate on this application is correct.

b) I have examined the medical certificate produced by the candidate, which states that he is medically fit and free from any infectious disease.

c) The candidate has a knowledge of spoken and written English sufficient to enable him to follow the seminar.

I nominate the candidate on behalf of ....
....

Signed .... Date ....
Position ....
Address ....
....

Tax Free Appointments

in the United Arab Emirates

Applications are invited for suitably qualified persons for the following posts to work in our Mafraq hospital in Abu Dhabi.
Salaries are tax free — at present there are approximately 7 Dirhams to £1 Sterling.
Mafraq hospital is a new 550 bed general hospital and plans are afoot to commission it in the very near future. Modern and sophisticated plant is installed for all the engineering services along with recent and up-to-date equipment in all departments.

Chief Hospital Engineer

Applicants should hold a recognised qualification and have at least 10 years hospital or similar experience, with at least 5 years in a senior position.
The chief hospital engineer will be responsible for all the maintenance in the hospital including mechanical, bio-medical, electrical and general maintenance services. **Salary Dirhams 8,000 per month.**

Air Conditioning (Mechanical) Engineer

Applicants should hold a recognised qualification in mechanical engineering and should have at least 5 years experience in this field, including experience in dealing with large, central air-conditioning systems. The person should also have experience at a senior level. **Salary Dirhams 7,600 per month.**

Bio-medical Engineer

Applicants should hold a recognised qualification, with at least 5 years experience in the bio-medical field of engineering. Applicants should also be familiar with recent and up-to-date developments in bio-medical equipment and should have experience at a senior level in either a hospital or a company. **Salary Dirhams 7,600 per month.**

Electrical Engineer

Applicants should hold a recognised qualification in electrical engineering and should have at least 5 years experience in this field at a senior level. **Salary Dirhams 7,600 per month.**

Maintenance Engineer

Applicants should hold a recognised qualification in either mechanical or electrical engineering, and have as least 5 years experience at a senior level. Applicants should be familiar with general maintenance requirements in a large general hospital. **Salary Dirhams 7,600 per month.**

Initial 2 year contracts are renewable, and include 60 days annual leave, plus public holidays, and a yearly return ticket to country of residence. Accommodation provided. Salaries are at present under review. Applicants may normally be accompanied by wife and up to 3 children.
Applications including curriculum vitae along with copies of credentials should be submitted to:

الإمارات العربية المتحدة
UNITED ARAB EMIRATES
Recruitment Section, Medical Department
U.A.E. Embassy, 71 Harley Street, London W1

Classified Advertisements

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Scottish Health Service
Common Services Agency
Building Division

DIVISIONAL ENGINEER

Applications are invited for the above post based in the Building Division Headquarters in Glasgow.

The successful candidate will be responsible to an Assistant Director for the direction and management for the design and construction of major health building projects in conjunction with private sector Consultants.

Applicants should possess a sound knowledge of Hospital Design Guidance, Building Standards and Cost Control Procedures supported by relevant experience of working within multi-disciplinary teams.

The officer will be a Chartered Engineer or a Corporate Member of one of the Institutions of Civil, Mechanical, Electrical or Electronic and Radio Engineers or the Chartered Institution of Building Services.

Salary scale £11,690 - £13,903 per annum.

Application form and job description are available from and returnable to The Appointments Section, Common Services Agency, Trinity Park House, South Trinity Road, Edinburgh EH5 3SE. Closing date for receipt of completed applications is 18 December 1981. Please quote reference Number U388.

Northumberland Area Health Authority
Prudhoe Hospital

Engineer

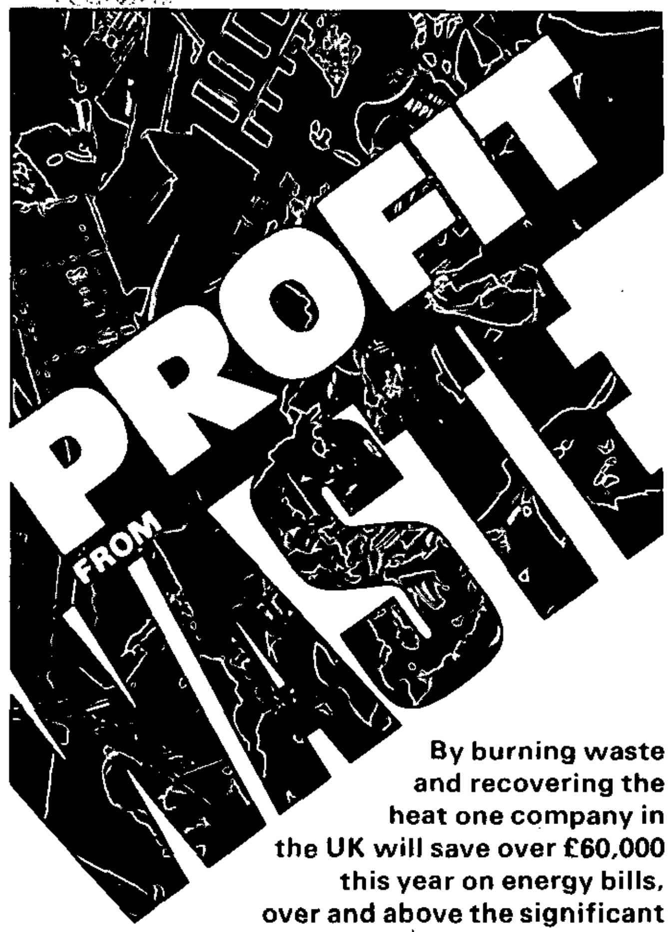
Salary scale: £7438 to £8390 per annum including 13% *bonus allowance.*

Required to assist the Senior Engineer in the efficient organisation and maintenance of the engineering services at the above hospital (1200 beds mental handicap).

Applicants must have completed an apprenticeship in mechanical or electrical engineering, have 5 years' relevant experience and hold an ONC in Engineering or equivalent qualification.

Application form and job description obtainable from, and returnable to, the Area Personnel Department, Northumberland Area Health Authority, East Cottingwood, Morpeth, Northumberland. Tel: Morpeth 514331 Ext. 10.

Closing date: 14 December.



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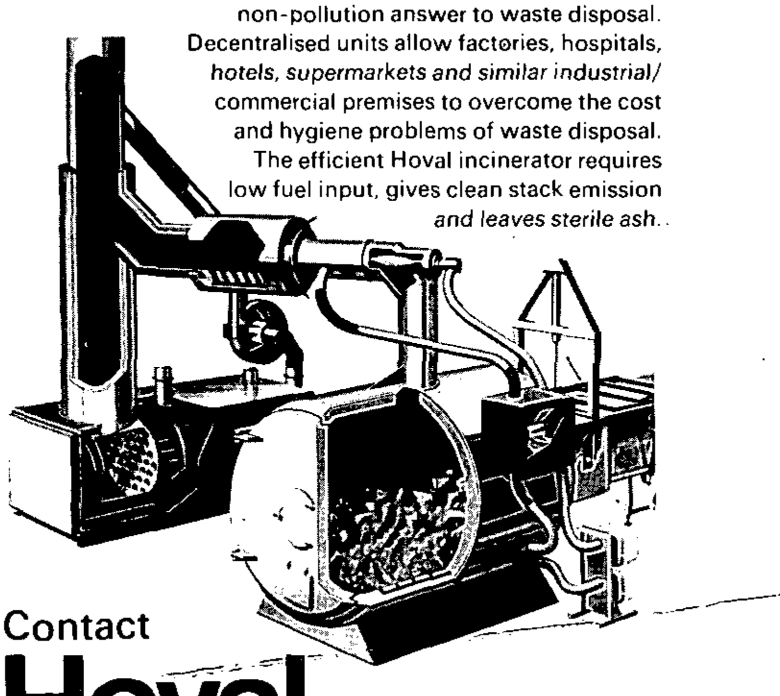

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