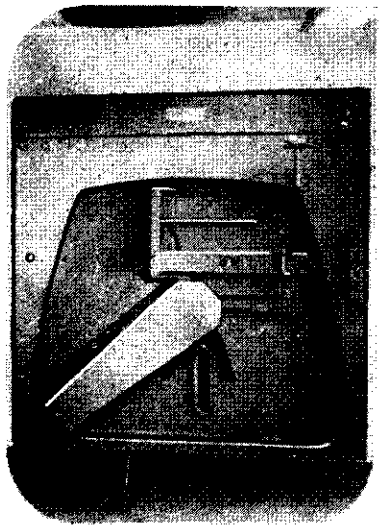
HOSPITAL ENGINEERING

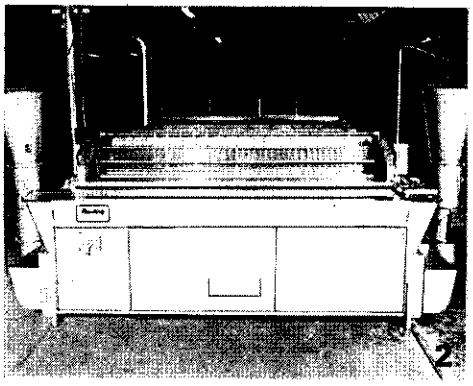
June 1977

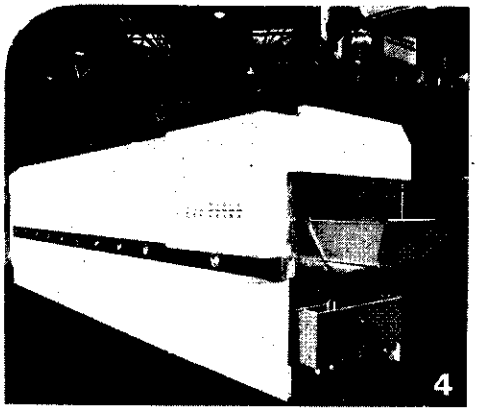
International Federation Issue

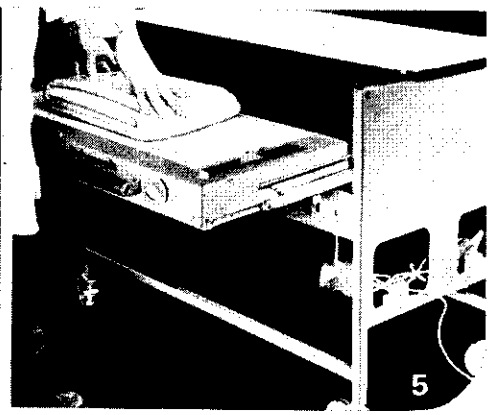
The Journal of the Institute of Hospital Engineering

Dealing with Asbestos Dust









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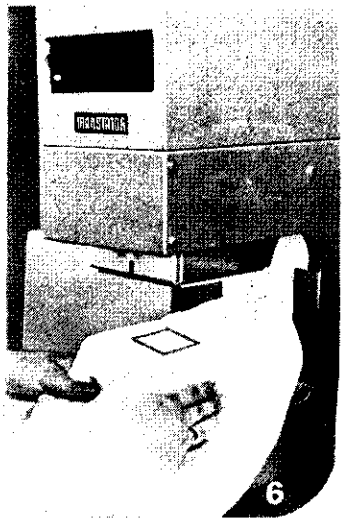

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HOSPITAL ENGINEERING

June 1977 **Vol. 31 No. 5**

The Journal of the Institute of Hospital Engineering

International Federation Issue No. 22

Contents

Institute News

International Congress '78

The Fifth International Congress of Hospital Engineering will be held in Lisbon, Portugal from May 28 to June 2 1978. It is sponsored by the International Federation, and by the Ministry of Health and the Ministry of Works.

A very full programme is planned; the call for papers was published in detail in the May 1977 issue of *Hospital Engineering*. Readers are reminded that the closing date for the submission of detailed synopses is July 1 1977.

Further information will be given in future issues of *Hospital Engineering*. In the meantime a leaflet giving information is available from Comissão Organizadora do 5 Congresso, Assoçiacão Portuguesa de Engineering Hospitalar, Av. Miguel Bombarda 133-5°B, Lisboa, Portugal.

AGM Report

The Tenth Annual General Meeting of the Institute was held in Atholl Palace Hotel, Pitlochry, on Friday, April 29 1977. The President, Mr. F. H. Howorth presided.

The proceedings commenced with the Secretary reading the Notice convening the meeting.

Council Report and Financial Accounts

The President then proposed, with the consent of the meeting, that the Report of the Auditors be taken as read. Agreed unanimously.

The President proposed that the Report of the Council and the audited Accounts of the Institute for the year ended December 31 1976, be received and adopted. Dr. B. G. B. Lucas seconded. Agreed unanimously.

Elections of Council Members

a. The President reported that in accordance with the Articles of Association the following members of Council would retire at the conclusion of the Annual General Meeting:
D. L. Davies, Area Member—London Branch; D. Scott, Area Member — North East and Yorkshire Branches; K. I. Murray, Nominated Member; P. C. Vedast, General Member.
b. The President announced that the following being the sole nominees in their respective categories were elected to Council unopposed:
K. I. Murray, Nominated Member; D. L. Davies, Area Member—London Branch; K. B. Worsell, Area Member —North East and Yorkshire Branches.
c. The President then called upon the Secretary to open the sealed envelope received from Auditors which contained the result of the ballot for a General Member and this revealed that Mr. P. C. Vedast was the successful candidate.

President's remarks

Mr. F. H. Howorth recalled his remarks on installation as President, when he had appealed for a period of innovation and progress and he hoped that these wishes had been realised. Mr. Howorth spoke of the Institute's disappointment at the termination of the Courses previously held at the University of Keele, but at the pleasure at the invitation of DHSS for the Institute to continue to be involved in the Courses in certain ways on their transfer to the NHS Engineering Training Centre at Falfield.

The President referred to the inceased number of one-day Symposia staged by the Institute at such venues as the Institution of Electrical Engineers, the Institution of Mechanical Engineers and the Imperial College of Science and Technology, London, these events proving highly popular and attracting strong support.

Mr. Howorth then spoke of his immense pleasure at being succeeded as President by Mr. Richard Harrison, who was so well known to so many members and who, already, had contributed much to the Institute's affairs. Mr. Howorth then invested his successor with the President's Jewel of Office.

Mr. Richard Harrison spoke of the real honour he felt at being invited to become President and of the trepidation which was concomitant with accepting the office. Mr. Harrison said, however, that his trepidation was dispelled, at least to a very large extent, by the knowledge of the great support that he would receive from his many friends and colleagues in the Institute. Mr. Harrison said that he did not wish to forecast anything specific in regard to his term of office but he would promise one thing — that he would give of his best.

Vote of thanks

Dr. B. G. B. Lucas moved a vote of thanks to Mr. Howorth for his tremendous contribution during his term of office and Mr. K. J. Eatwell in seconding endorsed that Mr. Howorth had given much in the councils of the Institute. Whereas each President had left his own particular mark and might be remembered for a special contribution in a certain field, Mr. Howorth would be remembered not least for his initiative, enthusiasm and boundless energy which had resulted, in one instance, in the Institute obtaining the various Jewels of Office for Past Presidents and Branch Chairmen, some of which had been seen at the Annual Conference Dinner held on the previous evening.

There being no other business the President, Mr. J. R. Harrison declared the meeting closed.

One of the new jewels of office.

Mr. J. S. Bindra

Mr. Bindra, author of the article *The Trajectory of Garments in Washing Machines*, published in our March 1977 issue, has informed us that he is now working in the USA, and that he would be pleased to hear from any reader who has comments on his article.

Jageet S. Bindra, Research Engineer, Chevron Research Company, 576 Standard Avenue, P.O. Box 1627, Richmond, California 94802, USA.

Ken Howells

We regret to record the sudden death of K. C. 'Ken' Howells of Llwynypia Hospital, Rhondda.

Ken Howells was an active member of long standing and our sympathy is extended to Mrs. Howells.

Council Member's new appointment

Mr. K. W. Wilson, Assistant Director, Scottish Health Services, Common Services Agency, Building Division and a Member of Council of the Institute, has been appointed Regional Works Officer, Northern Regional Health Authority. Mr. Wilson will take up his new appointment in August.

Mr. K. W. Wilson.

Branch Officers 1977

East Anglia

Chairman: R. G. Kidsley; Vice-Chairman: F. D. Blackburn; Hon. Secretary/Hon. Treasurer: M. Brooke, District Works Officer, Great Yarmouth and Waveney Health District, Havenbridge House, North Quay, Great Yarmouth NR30 IH2.

London

Chairman: D. L. Davies; Vice-Chairman: W. A. Askew; Hon. Secretary: P. C. Vedast, 59 Oakfield Gardens, Edmonton, London N18 1NY; Treasurer: W. L. Lawrence.

Midlands

Chairman: R. J. Chatwin; Hon. Secretary: C. Smith, 'Blue Shutters', 120 Myton Road, Warwick.

North West

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Southern

Chairman: N. McNeil; Vice-Chairman: A. Round; Hon. Secretary/Treasurer: J. Walker, 182 Salisbury Road, Totton, Nr. Southampton, Hampshire.

Yorkshire

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West of Scotland

Chairman: D. Bradley; Vice-Chairman: W. M. Jack; Hon. Secretary: T. M. Sinclair, 3 Morven Way, Kirkintilloch; Hon. Treasurer: D. E. Moss.

Welsh Branch

Chairman: E. A. Johnson; Vice-Chairman: T. Roche; Hon. Secretary: A. Grundy, 18 Chartist Road, Penygawsi, Llantrisant, Mid-Glamorgan; Hon. Treasurer: B. V. Williams.

Letters to the Editor

BSI Representative Report Technical Committee LEL/ 103 Medical Electrical and Radiological Equipment

Dear Sir,

A five-day meeting of Panel LEL/ 103/-/4 Safety (of the above technical committee) is just completing its task of going through the 'Draft Standard Specification for the Safety of Electrical Equipment used in Medical Practice' line by line.

This document, BSI ref. 76/30975 DC, is a draft for Public comment and the panel met to consider same prior to our IEC delegate's visit to Moscow for the next round of talks on the identical IEC document (62A (Secretariat) 8).

The writer could only spend two days at the meetings but the following points arose which are relevant to the Institute:

1. Since servicing of equipment is being carried out by Hospital Engineers a knowledge of the document is highly desirable within the Institute Membership.
2. Mr. Bob Brennand, of DHSS, 14 Russell Square, London WC1, who is Panel Chairman has drawn the document to the attention of Hospital Authorities in the UK, and is prepared to answer questions on it.

If people wish to purchase a copy of this 244-page draft document they are available from 'British Standards Institution' General Office, 101 Pentonville Road, London N1 9ND if accompanied by an addressed label and a remittance of £1.50 per copy.

Yours faithfully,
G. C. BUSHILL, Chief Engineer,
Hospital Equipment and Engineering Systems,
BOC Medishield, Harlow, Essex.

Branch Members apathetic?

Dear Sir,

As a member of the Institute for ten years and a Committee Member of the North West Branch for six years, I find it increasingly frustrating to be involved in arranging meetings and works visits and finding that out of a total membership of about 200, 7 to 10 members usually attend.

Over the years the Committee have listened to members who said 'Why meet on Saturdays? We need the time with our families'. So we tried evening meetings — result lower attendances.

We asked again, the answer: 'Why can't we meet in normal working time? After all, other disciplines do'.

The result, attendances as disappointing as ever. Back to the members we went — 'couldn't spare the time, Hospital will shut down if I'm off for half a day' — 'Assistants just not capable of looking after the Hospital'.

From these replies, each one a near verbatim quote, it would seem that all our Hospital Engineers never sleep or take holidays.

The Committee Members of the North West Branch have made attempts to generate interest but have met a blank wall of indifference.

So here is a challenge to you members of the North West Branch, get out of the rut, and take an interest in your Institute; if you can't come to the meetings impress on the younger members the importance of a thriving branch.

If you don't like what the Branch Committee are doing, tell us, but for the sake of the Institute's future, progress and your own self-advancement, *get involved.*

Yours faithfully,
A. W. SCHAFFEL
Parbold, nr. Wigan.

Annual Conference–Pitlochry

Nearly 150 members of the Institute and their wives attended the 33rd Annual Conference of the Institute, held at the Atholl Palace Hotel, Pitlochry, in Scotland, from April 27 to 29.

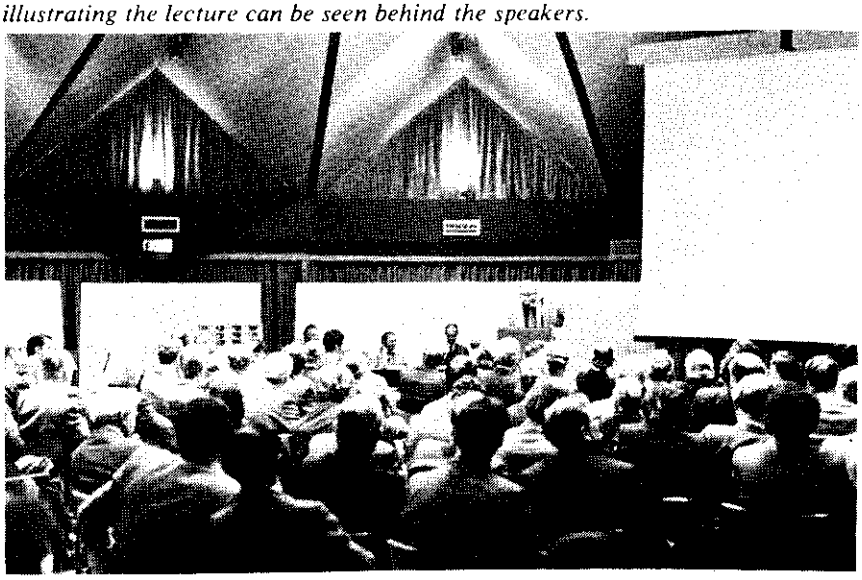
The mixture of work and social events made for a very successful and relaxed three days, with plenty of technical and professional food for thought, leavened by the less serious moments. While their husbands attended the lecture sessions, the ladies went on a number of excursions. These included a visit to the local whisky distillery, to a tweed mill, and a mystery coach trip which ended up, perhaps rather tamely, in Marks and Spencer in Perth!

The technical sessions

After the conference had been formally opened on the Wednesday morning by the President, Mr. F. H. Howorth, the first day's papers were on the subject 'The DHSS Health Building System'. The first speaker was Mr. S. Ratcliffe, who spoke upon the system as a whole, putting into context the more detailed presentations which followed, from Mr. B. C. Oliver on the Systems Engineering Components with particular reference to the Design and Commissioning subsystems, from Mr. R. J. Tuthill on the Maintenance and Operation subsystems, and from Mr. A. C. Selman on Specialist Services. Chairman for the day was Mr. John Bolton, the recently appointed Chief Works Officer of the DHSS.

On Thursday, attention turned to a case study of the construction of Paisley District General Hospital, which is employing an industrialised building system. Under the chairmanship of Mr. B. P. Beckett, Chief Architect to the Scottish Development Department, speakers from the various professional firms who formed part of the project team each spoke on their particular part in the planning and erection of the Hospital. They were Mr. W. N. Bewick (R. W. Gregory & Partners), Mr. I. Penteleith (Baxter Clark & Paul), J. MacFarlane (D. M. Doig & Smith), E. R. Manson

The banqueting suite of the hotel pressed into service for the case study on the new Paisley District General Hospital. Just a few of the copious wall charts illustrating the lecture can be seen behind the speakers.



(T. Harley Haddow & Partners). Our photograph shows part of this presentation, which was so abundantly illustrated with slides, photographs and a huge selection of wallcharts that it had to be moved into the hotel's banqueting suite from the originally planned lecture room.

On Thursday afternoon the subject was Computer Aided Design and Operation of Hospitals, under the chairmanship of Mr. T. D. W. Astorga, Director of the Scottish Health Services Common Services Agency. Speakers were Mr. R. Walters who introduced PHASE: A Computer Model for Building Design and Operation, Mr. D. Kernohan on the Use of PHASE in Practice, and Mr. J. Clarke who spoke on ESP: Developments in Environmental Systems Performance.

The last day of the conference started with the Annual General Meeting of the Institute, of which a report appears on page two of this issue. There then followed the final session of the conference, on The Application of Quantified Reliability Techniques to Systems used to Provide Environmental Control in Public Buildings. This mammoth title was handled with great skill by Mr. L. H. Burgess of the UKAEA Systems Reliability Service, under the chairmanship of Mr. A. Wotherspoon, Assistant Chief Engineer of the Scottish Development Department.

Back row: *Dr. B. G. B. Lucas, F. H. Howorth, Harry Ewing MP, A. Wotherspoon OBE, K. W. Wilson, J. R. Harrison CBE.*
Front Row: *Mrs. B. G. B. Lucas, Mrs. Wotherspoon, Mrs. Howorth, Mrs. Harrison, Mrs. K. W. Wilson.*

Dinner Dance

The conference dinner dance was held on Thursday evening, and was the occasion of much goodwill and cheerfulness. Mr. Howorth presided, on the eve of handing over the presidency to Mr. Richard Harrison, and the guest of honour was Mr. Harry Ewing MP, Paliamentary Under Secretary of State at the Scottish Office. In proposing the Toast to the Institute, Mr. Ewing made some very kind remarks about it and its members, telling them that if they did find themselves sometimes taken for granted by some health service administrators that this in itself was a compliment. However, he was confident that this attitude was shortlived — when annual budgets were prepared the value of the engineer was graphically illustrated, with £8m being allocated to maintenance engineering in Scotland alone.

A cheerful moment after the dinner dance. Mr. Howorth presents his predecessor as President, Dr. B. G. B. Lucas, with his jewel denoting his status as a Past President. Those looking on appreciatively include (from left): Mr. Richard Harrison, Mrs. Howorth, Mr. Harry Ewing MP, Mr. John Bolton and Mrs. Harrison.

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Jan Beijer, Oude Hoeverweg 61, Alkmaar

American Society for Hospital Engineers — USA

Vern Atwater, St. Luke's Hospital, 44th and Wornall Road, Kansas City (Missouri 64111)

Vinson R. Oviatt, Public Health Service, Building 13, Room 3K-04, Bethesda (Maryland 20014)

New Zealand Hospital Engineers Association — New Zealand

George W. Parker, Waikato Hospital, Private Bag, Hamilton

J. D. Jones, North Canterbury Hospital, Private Bag, Christchurch

Institute of Hospital Engineers — Australia

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South African Federation of Hospital Engineering — South Africa

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Massoud Soheili, 30 Dolfan Avenue, Upper Pres. Roosevelt Avenue, Tehran, Iran

This article covers the discovery of asbestos dust contamination in the central boiler house at a British Hospital, and the measures taken to deal with it. It has been prepared by Hospital Engineering staff with the co-operation of all their Works Department colleagues and presents events as they occurred. The conclusions drawn are given in good faith based on personal experience on site.

Asbestos Dust Contamination and its Removal

In April 197- asbestos samples were taken from all areas of the hospital including the Central Boiler House and sent to the Wolfson Bio-analytical Centre at Surrey University for analysis.

Later in the month the results of some of the asbestos samples were received by phone from the University. Included in these results were the Central Boiler House samples.

Upon receipt of this information the District Works Officer arranged for a firm of Industrial Cleaners to vacuum out and wash down all areas within the Central Boiler House, also to make good any damaged lagging and re-paint the asbestos with PVC emulsion paint. The Hospital Engineers were also instructed at this time to prepare the area and to arrange for all necessary safety equipment to be purchased, decontamination chambers to be constructed and safety procedures to be implemented prior to commencement of the contract.

Decontamination procedure

In order to decide a method of working which would be safe, practical and economic, the following points were considered in detail: -

a. Protection of all personnel directly involved in contaminated areas;
b. Security at the Boiler House with regard to unauthorised entry;
c. Design and construction of decontamination areas;
d. Decontamination procedures for staff.

Protection of personnel

The Factory Inspectorate and Asbestos Information Council were both contacted with regard to the type of protective clothing to be worn when dealing with Crocidolite Asbestos (see equipment list).

At this stage a preliminary exercise was carried out, in conjunction with the Staff Health Department, to ascertain if there would be any adverse effects on staff wearing this equipment in temperatures between 80°F and 114°F at floor level and 130°F+ at high level.

As there is a particular problem with security at the Central Boiler House, eg locked doors to prevent intruders etc., the louvred doors were thought to be insufficient as the temperatures proved to be excessive.

The Building Department were, therefore, asked to provide full sized open mesh screens to cover the door openings, thus allowing a maximum air intake and completely halting the entry of any unauthorised personnel.

(A special release door was fitted at the fire exit point.)

It was found after carrying out the exercise, wearing full equipment on all shifts, that the average safe working time was in the region of 90 minutes. A system of double manning was brought into operation to combat the problems of fatigue and short working durations, eg one stoker resting, one stoker on duty. (Stokers alternating at the end of each 90 minute period.)

A further problem which had to be considered was should any of the stokers on duty become incapacitated immediate back up facilities must be forthcoming. To this end the Assistant Engineer and Hospital Engineer would be in attendance on a 24 hour basis throughout the duration of the contract. This was achieved by working a shift system of 12 hours on and 12 hours off duty.

It was also found that there would be no means of contacting either the engineer or relief stoker (who would be situated outside the Boiler House) without passing through the decontamination areas, consideration therefore had to be given to some form of emergency alarm warning. It was decided to install an alarm buzzer external to the Boiler House, also an external line pressure gauge which would give a general indication of the state of the Boiler House.

In addition to the wire mesh screens on doors 'No Entry' notices were posted.

Design and construction of de-contamination areas

Decontamination areas would need to consist of four totally separate areas and it was decided for economic reasons to utilise the existing shower facilities as part of the de-contamination section which therefore dictated its location.

a. **Vacuuming Area** — to allow staff whilst still wearing full protective clothing and equipment to vacuum down to remove loose asbestos dust;

b. **Showering Area** — to allow members of the staff whilst still wearing full protective clothing and equipment to completely douche down to wash off any remaining asbestos fibre;

c. **'Clean' Changing Area** — where staff could remove protective clothing and change as necessary;

d. **Rest Area** — a completely separate area to be used as a rest room/dining area.

As there was only sufficient room for sections a, b and c internally at the Boiler House, a Portakabin was hired for use as a rest room/dining area and located in the Boiler House yard adjacent to the main oil tanks.

The Hospital Building Department gave immediate priority to constructing doors, screens and notices to form a decontamination area.

Decontamination procedure for staff

To comply with the Factory Inspector's directive only a minimum number of staff must be on duty at any one time. This meant that Fitting staff would be re-deployed elsewhere for the duration of the contract, but should be fully instructed in the use of protective clothing and be available if necessary for emergency repairs.

The following procedures were implemented for the duration of the contract: -

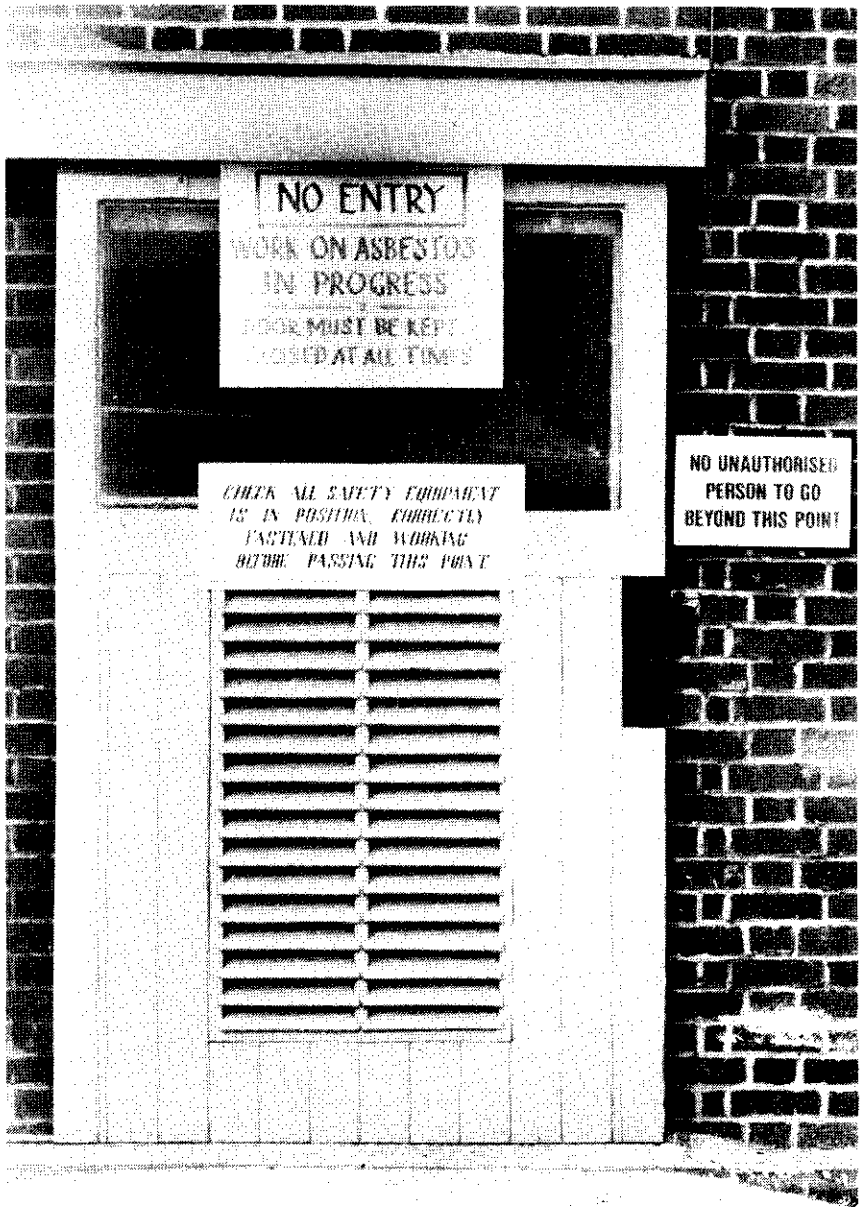
a. When ENTERING the Boiler House contamination area:

(i) Before entering the outer door of the Boiler House the stoker should check all protective clothing and equipment is in position and working;

(ii) Entrance to the Boiler House should only be through the door leading to the oil pump section. This was done so a close control of entry could be kept by the engineer.

b. When INSIDE the Boiler House contamination area:

(i) The stoker entering the Boiler House should check with the stoker



on duty the state of the Boiler House (this will only be possible in writing);
(ii) Relieve the stoker on duty;
(iii) The stoker on duty should carry out the minimum of stoking duties necessary to maintain the Boiler House in a safe and efficient condition.

If for any reason a stoker on duty felt he could not carry out his duties effectively he should ring the emergency bell, installed adjacent to the entrance door, this will indicate to the stoker or engineer in the rest area that assistance is required.

The stoker in the rest area should immediately put on protective clothing and enter the Boiler House to check with the stoker the problem which has arisen.

If further assistance is required, a second ring of the emergency bell will call the engineer who is permanently on duty in the Portakabin. He will then put on protective clothing and enter the Boiler House.

It is vital that the following instructions are followed to the letter if decontamination procedure is to be effective: -

a. Exit from the Boiler House should only be achieved through the decontamination chambers;
b. The stoker should enter the vacuum area, close the door immediately upon entry, then vacuum down thoroughly from head to toe;
c. The shower area door should be opened and immediately closed upon entry. The stoker should enter the shower and ensure that he is fully washed down without removing any of the protective clothing:
d. The door to the changing area should now be opened and closed immediately upon entry. At this point all protective clothing may be remove. The stoker may now change and retire to the rest area.

Note:

Under no circumstances should this sequence be broken as the cleaning area may become contaminated.

An instruction sheet to this effect was issued to all personnel who may require entry into the Boiler House (see Appendix A).

Problems incurred

Hospital

Very few problems were experienced from the hospital side of the exercise, listed below are minor points which arose: -

a. Fatigue was the major problem encountered. It was necessary to have staff regularly checked by the Staff Health Doctor and his staff. The staff were put on a course of salt tablets to help combat excessive perspiration and in some instances cramp.
It was also found after four days of shift working in these conditions that tiredness was becoming evident;
b. There was a tendancy when wearing positive pressure respirators to over breathe, which resulted in giddiness in some instances until the staff became fully orientated with the equipment.
It should also be noted that it is essential that no member of staff suffering from respiratory or heart conditions should be allowed to use this equipment. (A full check was carried out on all personnel before commencement):
c. Voice boxes should be purchased for use with Ciebe Gorman positive pressure respirators, as some difficulty was experienced with communication;
d. Soot blowing of Boilers was found to be a particular strenuous task and was cut to a minimum for the duration of the contract;
e. It was found that staff who were not used to wearing this equipment tended to have difficulty when wearing the face masks, in observing anything which was not directly in line with the visor. Hence working in confined spaces resulted in a number of knocks and bangs which would not normally be encountered.

Contractors

Numerous problems arose concerning the contracting staff, listed below are the major points: -

a. The staff on site had had no instructions of the dangers associated when working with asbestos materials;
b. The contracting staff had been given no clear instructions as to the method of decontamination of the Boiler House;
c. Contractors concerned had no previous experience of working with asbestos materials;
d. Contractors arrived with virtually no equipment;
e. Vacuum cleaners used by contractors were found by the engineer to be not suitable for use on asbestos materials.
One vacuum cleaner at one stage ejected asbestos waste from the exhaust side of the cleaner over the Boiler House and stoking staff, therein resulting in the engineer insisting that the Boiler House be completely washed down, free of charge, for a second time, also all vacuuming work was stopped until such time as the firm were able to provide vacuum cleaners of the approved type;
f. In several instances, after inspection by the Hospital Engineer, the contractors were instructed to re-clean areas which were not cleaned to a sufficient standard;
g. The engineer requested District to cancel the cleaning contract when the sealing off of the lagging was carried out in such a manner as to be totally ineffective and using materials which were completely inadequate for the purpose (sealing off of asbestos in the Boiler House is now being carried out by direct labour);
h. Virtually no site supervision by the firm was carried out on staff employed to decontaminate the Boiler House;

NOTE: Any District or Area which is contemplating or organising any form of asbestos cleaning should be exceedingly careful in choosing companies to be employed as the particular company in question gave firm assurances that they were competent to deal with, and indeed had dealt with, asbestos problems prior to commencement of this contract.

Comments

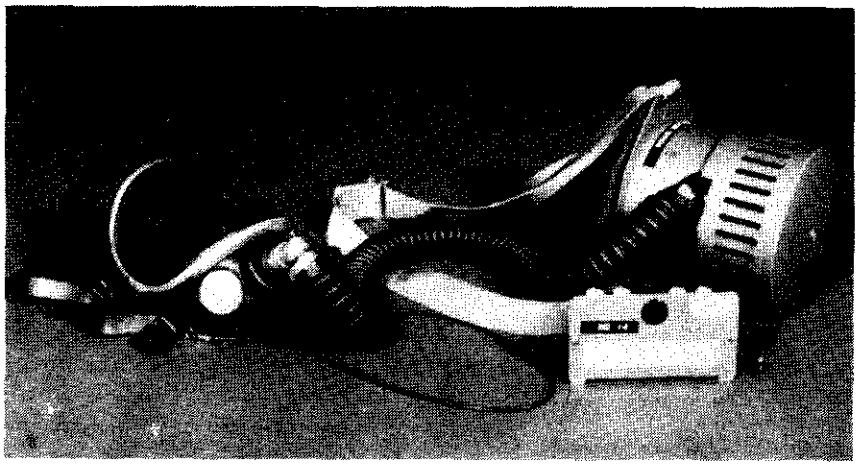
Full praise should be given to the stoking staff who at all times carried out their duties with the utmost diligence under extreme conditions, particularly as it was through no fault of their own that this decontamination was necessary.

Praise should also be given to the following:

All members of the District Works Department involved.
Staff Health Department.
Catering Department.
Clothing Department.
Supplies Department.

In conclusion, it must be emphasised that prompt action was only possible by: -

a. Prior knowledge at District level of the dangers from Asbestos dust by advance technical publicity from the Area Works Officer and his staff;
b. Maximum co-operation from the District Management Team, through the District Administrator, in making immediate finances available to meet the expenditure involved to carry out work detailed in the foregoing pages, which amounted to just over £8,000.



Appendix A

Notice to all stokers and boiler house staff

As you are aware cleaning of the Central Boiler House to remove asbestos dust etc., will commence on X May (for an approximate duration of one week).

To comply with the Factory Inspectorate's directive the minimum number of staff must be on duty at any one time. This will mean that Mr. A. and Mr. P. will not be based at the Central Boiler House during this cleaning period, and will only enter the Boiler House if an emergency arises which cannot wait until after the cleaning period. Any such emergencies should be reported to Mr. C. or Mr. G., who will instruct the maintenance staff on the correct procedure to adopt with regard to the wearing of protective clothing etc.

It will be necessary during this cleaning period for all stokers to wear full protective clothing and to adopt the procedure set out below when leaving or entering the Central Boiler House contaminated area.

Equipment to be worn in the Central Boiler House Contaminated Area

a. Positive Pressure Respirator;
b. All-in-one Boiler Suit (Plastic or Nylon type with hood);
c. Rubber Gloves and Boots.

NOTE: Instruction will be given to all staff on the correct use of the above clothing.

When entering the Central Boiler House Contaminated Area

a. Before entering the outer door of the Boiler House all protective equipment must be checked and positive pressure masks fitted to the face and tested;
b. Entrance to the Boiler House should only be through the door leading to the oil pumping section.

When inside the Central Boiler House Contaminated Area

a. Check with the stoker on duty the state of the Boiler House (this will only be possible in writing);
b. Relieve the stoker of his duties;
c. Carry out the minimum of stoking duties necessary to maintain the Boiler House in a safe and efficient condition.

If for any reason the stoker on duty does not feel he can carry out his duties effectively he is to ring the emergency bell which will be installed adjacent to the entrance door, this will indicate to the stoker in the rest area that there is a problem. He will immediately put on protective clothing and enter the Boiler House to check with the stoker the problem concerned.

If further assistance is required the engineers will be permanently on duty in the rest area, this will necessitate a second ring of the emergency bell to alert the engineer.

Leaving the Central Boiler House Contaminated Area

It is vital that the following instructions are followed to the letter: -

a. Exit may only be achieved through the rest room passage area of the Boiler House;
b. Enter the vacuum area, close the door immediately upon entry, vacuum down thoroughly from head to toe;
c. Open shower area door, close the door immediately upon entry, turn on shower and fully immerse yourself under the shower without removing any of the protective clothing;
d. Open the door to the non-contaminated area, close the door immediately upon entry, remove all protective clothing and retire to the rest cabin in the Boiler House yard for the duration of the rest period.

***Under no circumstances is this* sequence to be broken as clean areas may become contaminated**

If there is any uncertainty or problems associated with these instructions please contact the Hospital Engineer immediately.

The existing shift rota will cease on X May 197- and the rota shown on the Notice Board must be adhered to from the date stated and until further notice.

When shower or toilet facilities are required it will be necessary to use the Cricket Pavilion, a key for which will be hung in the rest area.

Appendix B

Equipment list

The following equipment was purchased, or drawn from stores, to comply with recommendations from both the Factory Inspectorate and the Asbestos Information Council.

a. 10 × CIEBE GORMAN Positive Pressure Power Masks;
b. 18 × Re-chargeable SOGA Silver Zinc Batteries;
c. 'North' Hygesan elasticated plastic/cotton gloves;
d. Eight pairs Polyurethane coated nylon hooded Boiler Suits (elasticated hoods, waists, wrists and anklets);
e. Eight pairs Wellington Boots;
f. A number of Simonsen Anti-Mist Sticks (for use on visors of power masks);
g. 1 × Nilfisk vacuum cleaner, fitted with micron filter, suitable for use on asbestos. Model No. GA.71 (for use of vacuuming staff-contaminated boiler suits prior to showering);
h. A large number of 200 gauge double sealed 'Red' coloured plastic bags, marked: 'FOR ASBESTOS WASTE';
i. Salt tablets plus additional liquid refreshments as suggested by the Staff Health Department.

Intensive care units are highly specialised areas within the hospital. Their design must be such that optimal services can be performed maintaining good economy. The ten most common mistakes in the design of these units are discussed in detail.

Professor von der Mosel is Head of the Department of Biomedical Engineering, College of Medicine, University of Lagos.

Common Mistakes in Planning Intensive Care Units

Professor HANS A. VON DER MOSEL MSc Pharmacol MScEE PLE FNYAS

Before the planning of Intensive Care Units (ICUs) and the possible pitfalls in such planning can be discussed, the term ICU must be defined. The quite numerous literature in the field of intensive care gives many more or less accurate definitions[1, 2, 3, 4, 5] but we believe that the definition of what an ICU is and what purpose it serves can be quite simply expressed as 'a special unit within a hospital which serves the purpose of providing highly specialised intensive care, ie, intensive observation, assistance and therapy for the very ill who, without such a unit, would have little chance of surviving'. We believe that it is impractical and uneconomic to differentiate between 'intensive care' and 'intensive observation' for the borderline between these two is commonly hard to draw, and the financial situation of most hospitals makes it unwise to create too many different specialised units. With good planning of the facilities, proper selection of the necessary equipment and properly trained staff, one unit can serve both purposes very well and transfer of patients from one unit to the other can be avoided.

There are today many highly specialised types of intensive care unit, such as cardiac care units, neurosurgical intensive care units, acute hemodialysis units, pain units, burn units, etc. All of them have a basic concept in common and are, as a rule, only different from each other in the equipment for patient care and in the special training of the staff.

The first ICUs were established in 1958 by P. Safar in Baltimore, and in 1960 by J. M. Silver in Chicago. For the planning and first month of operation of the latter unit, the author had the honour to be heavily involved. Since then many changes and different approaches have been tried, and publications on this topic both giving opinions and describing experiences exist in such abundance that it will be very difficult for those trying the planning of an ICU for the first time to separate the right from the wrong or the good from the better. Although many different approaches are possible and good, a number of mistakes have repeatedly been made in the past. It is the purpose of this article to bring the most common mistakes in such planning to the attention of the reader, for the creation of an ICU is an expensive enterprise. Large sums of money should not be invested on something which, in the end, may prove itself to be useless or of questionable value.

Mistake No. 1

Creation of an ICU for a specialty which is not represented otherwise in the hospital

The first question to be answered before any planning is done must be, what kind of an ICU the hospital in question intends to provide? The range of possibilities can go from a small general unit to large, highly specialised ones. It has to be borne in mind, however, that intensive care can be provided only for such disciplines which are normally practised in the particular hospital for which the plans are made.[4]

It is absolutely useless, for instance, to plan a neurosurgical ICU for a hospital which does not have a regular department of neurosurgery, since the supporting services which are so necessary for the proper operation of this unit do not exist, and it will be at least doubtful that the hospital can secure the services of a skilled and experienced neurosurgeon for the ICU only.

Mistake No. 2

Incorrect amount of ICU beds

The next question to be decided is the number of beds in the ICU or, if there are several specialised units, for each of them. Usually, ICUs are planned too large or too small. If they are too small, proper scheduling will become impossible[4] and the value of having an ICU will become questionable since only a few of the patients requiring intensive care will be able to obtain it, while others may die because no bed was available for them in the ICU.[6] If they are, on the other hand planned too large, much money is spent unnecessarily which could be used somewhere else in the hospital for better purposes, and the ICU may be used for patients who do not require intensive care, ie, in case of bed shortage in another department of the hospital. The result of this can possibly be that no bed will be available to a patient who needs intensive care.[7]

As a general rule, the amount of ICU beds should be 5% of the total amount of beds of a hospital, or 5% of the total amount of beds of the specialised department the ICU is planned for. There are, however, exceptions to this rule. For example, if a neurosurgical ICU is planned for a hospital located near a major highway, where one can expect to have many patients who are victims of severe traffic accidents, one has to keep in mind that a number of such patients may be brought in with severe trauma, brain damage, spinal cord injuries and the like. In order to

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survive, these patients will need intensive care over probably a much longer period of time than, for instance, patients in an acute hemodialysis unit or the ordinary cardiac care patient. It is not uncommon for neurosurgical patients to remain unconscious for many weeks. Therefore, because the turnover of patients is not as fast as it is in other types of ICUs, more beds must be provided for this unit, say 10% or even more of the total amount of beds in the neurosurgical department.

Looking through the case histories of this department for the previous five years, as well as studying the other statistical material available, may give you some good insight into the frequency of such cases, and also may permit you to make some predictions of the rate of increase of such frequencies for the years to follow.

Mistake No. 3

Choosing the wrong location for the ICU

Having cleared the previous questions, the next step should be to select the proper location of the ICU or ICUs.

During the last few years, there has been a trend to concentrate all ICUs of a hospital in one area, thereby creating an Intensive Care Department, usually under the jurisdiction and responsibility of the department of anaesthesiology.[8] There are, however, many good and valid reasons against such concentration of severely ill patients.

One never can exclude completely the possibility of catastrophes such as fire, explosion, damage from water, hurricanes, earthquakes, structural failures of buildings and others. If any one of these should occur in the area of such an Intensive Care Department where there is a large concentration of severely ill patients, many of them connected to an extensive array of life saving equipment, evacuation might become a serious problem, if not an altogether impossible task.

Since oxygen, anaesthetic gases, electricity and the like are extensively used in intensive care, the possibility of such catastrophes is usually greater than in a regular patient ward, and the consequences can be much more severe.

Spreading of infectious diseases and hospitalism is more difficult to control, and can cause disastrous consequences in an area of high concentration of severely ill patients.[9]

Creating specialised ICUs remote from the respective specialty department will cause, as a rule, serious shortcomings, such as the need to employ more specialist physicians, because it would probably take too long for the doctor to go from his department to the ICU in response to an emergency call. Further, special equipment otherwise available from the department will have to be purchased in duplicate for the department and for the ICU. Hence, the economy attempted by concentration of ICUs is, to say the least, highly questionable.[10]

There is also a psychological reason for avoiding such a concentration of severely ill patients. Since the fatality rate of ICUs is generally considerably higher than in other units of a hospital, this area will quickly become known among the patients and their relatives as 'the morgue', and patients brought into this area will become unnecessarily nervous, anxious and excited, all of which a severely ill patient certainly should not be exposed to.[11]

Mistake No. 4

Wrong size of the ICU

Generally, ICUs should never exceed 24 beds overall, with not more than 12 beds under one supervising nurse,[4, 5, 7] ie, a 24-bed ICU should be divided into two autonomous, self-contained units of 12 beds each. Larger units become unmanageable and will expose patients and personnel to too much stress.[12] That a specialised ICU should be located adjacent or, at least, very close to the relevant specialty department has been mentioned before, but should be stressed once again.

Mistake No. 5

Insufficient floor space provided

Once it is decided where the ICU will be located and how many beds it will contain one will have to begin with the actual layout design of this unit. Most ICUs the author has seen have been provided with an absolutely insufficient amount of floor space, making operation of the unit very difficult. Absolute minimum values for calculating floor space are as follows:

Floor space around the patient bed is 18m², for acute dialysis beds 22m²;

The area for the nurses' working area is calculated by multiplying the number of patient beds of the ICU by 6; thus, a 12-bed ICU must provide for the nurses' working area at least $12 \times 6 = 72m^2$;

There must be one doctor's office/treatment room for every 12 beds, which has to provide at least 20m² working space.

In addition to the values mentioned above, the following rooms must be provided, the size of which can be conventional but should not be too small:

Locker room for personnel;
Patients' bath (with bath tub, shower and toilet);
Personnel shower/toilet;
Personnel common room;
Tea kitchen;
Equipment storage room;
Nursing supervisor's office;
Space for visitors (relatives of patients).

Remember to provide doors to all rooms, to which patients can be brought, wide enough that the patient can be brought in with his bed or a wheel chair.

Mistake No. 6

Wrong physical layout of the patient area

Although not absolutely necessary, it is highly recommended to plan ICUs as a single-bed-boot arrangement, ie, each one of the patient beds should have a room to itself. There are many good reasons for this:

Severely ill patients are, as a rule, not very sociable persons; they rather like to have their privacy. If a patient should go into an acute state where emergency measures become necessary, the often unavoidable turmoil around the patient's bed might cause so much excitement to the patients in the neighbouring beds that staff may find themselves suddenly with not only one but three or four emergency situations all at the same time. A patient crying or screaming in pain will disturb the other patients of the unit. Spreading of infectious diseases throughout the entire unit can be controlled easier in single-bed-boot units than in open area units. A fatality will not be recognised by the other patients of the ICU in the single-bed-boot unit. Visits from close relatives of the patient will not disturb the other patients or the routine work of the ICU personnel. In an emergency situation, surgery can be done right on the patient in his bed, without

the necessity of disconnecting him from all the life supporting equipment he might be connected to.

The list could be continued, but the reasons mentioned should indicate sufficiently the advantages of the single-bed-boot ICU.

Mistake No. 7

Wrong physical arrangement of the area around the bed and of the bed itself

This mistake is probably the most common. It is entirely wrong to place the bed with the headside against the wall. In emergency situations it must be possible to move around the bed without any restriction. Pulling the bed away from the wall in an emergency situation is, as a rule, not possible if the patient is connected to life-supporting and monitoring equipment placed on shelves on the wall.

The bed should stand diagonally to the room, leaving at least 1m open space between the wall and any furniture, and the headboard of the bed. Monitoring equipment and the like should be installed into cabinets fixed to the wall, connecting cables to the patient from such equipment should be brought to the patient through a trough in the floor, ending underneath the bed of the patient. The same is valid for medical gases, suction, etc. No cable or hose should obstruct any space around the patient's bed.

In case of emergency surgery, the place of the anaesthetist at the head end of the bed is thus kept free, and the entire physical arrangement is, in effect, the same as it would be around the table in an operating room. The bed itself must be the type which can be raised to table height, either electrically or by mechanical means.

The walls of a single-bed-boot should be solid up to a height of 1.30m. From there on they should be clear glass with an arrangement to pull down curtains to the neighbouring boots in case of an emergency. There should be a door towards the nurses' working area which is usually left open but can be closed in case of emergency and for noisy patients. Again, this door must be wide enough to wheel the patient bed through. Ideally, there should be another door on the opposite wall leading to a corridor through which visiting relatives can enter the patient's boot without having to go through any other part of the ICU.

Mistake No. 8

Insufficient electrical outlets

The usual four electrical outlets per patient bed are entirely insufficient for the ICU. Considering that a patient can be, under certain conditions, connected to up to 12 different pieces of life-supporting and monitoring equipment, a minimum of 12 electrical outlets with an overall capacity of at least 20 amperes must be provided at the bed side. In order to prove this point, a list of such equipment, which can be connected at the same time to one patient, together with the corresponding electrical consumption is given below:

Monitor (40W)	2 Suction Pumps (2 × 250 = 500W)
Cardiac Pacemaker (70W)	Nebuliser (250W)
Defibrillator (2200 Watts)	Heating Pad (350W)
Respirator (350W)	Undulating Mattress (200W)
Respiration Monitor (40W)	Examination Lamp (100W)

During the transition from oxygen to normal respiration, a respiration gas mixing device may be necessary, consuming approximately 300W.

It is, therefore, possible that 12 pieces of equipment are used at the same time for one patient. The total consumption of electricity in this case can be as high as 4400 watts.

One additional electrical outlet for portable X-ray equipment and another additional outlet for housekeeping equipment (vacuum cleaner, etc) must be provided; both these outlets must be well separated from the line feeding the outlets at bedside, in order to avoid surge currents reaching the patient. All regulations and safety provisions are as laid down in *International Electrotechnical Commission 62A: Safety requirements for medically used rooms*[13], which must be strictly adhered to.

Mistake No. 9

Use of fluorescent light

Fluorescent lamps are entirely unsuitable for the illumination of ICUs. The ballast transformator emits. a magnetic field strong enough to cause interference in monitoring and life support equipment, and to block the demand circuit of demand pacemakers so that they can fail to turn on if the need arises. The light produced by fluorescent lamps distorts colour and makes it difficult if not impossible to recognise colour changes in skin, lips, etc of the patient, which may be an indication for the nurse that a life threatening situation is building up in the patient. Further, fluorescent light is cycling light, not continuous. At 50 Hz power line frequency, a fluorescent light source changes 100 times per second from light to dark and back to light. Time lapse cine pictures of the human eye have clearly indicated that the eye follows these changes, thereby causing tiring and headache. This is certainly not what a patient or the personnel of an ICU should be exposed to.[14]

Mistake No. 10

Over-instrumentation

There is no question that there is quite a lot of valuable and often life-supporting or life-saving equipment offered on the market today. As a rule, this equipment is quite expensive. In planning an ICU, one has to consider very carefully what is really needed for the ICU concerned, since the equipment needs will vary from specialty to specialty. We should also never forget that it is not only the money that is necessary to purchase the equipment; special installation and wiring might add 100% to the purchase price. Further, maintenance and repair have to be provided for, and will cost an average of 10% of the purchase price per year. These expenses are usually overlooked in planning.

An ICU is *not* a museum of technology. Only such equipment which truly supports the purpose of an ICU, ie, to save the life of the patient, should be used. The author has seen ICUs which were health factories jammed with fantastic amounts of equipment. The patient was observed through closed circuit television from a central console, all vital functions of the patient were constantly registered via remote control at the same central console, from which even the light could be turned on and off, and dimmed, the room temperature and ventilation could be controlled, the defibrillator activated, and what not.

In my opinion, such a unit does not deserve the designation 'Intensive Care Unit' any longer, for no-one will really care for the human being called the patient any more. His bodily functions only are controlled and the patient, not seeing any nurse for hours since she knows everything about him from her controls, must come to the conclusion that no-one cares about him, and will suffer psychologically.

Conclusion

The list of possible mistakes in the planning of an ICU could be continued. This, however, would go beyond the frame of this article. I have, therefore, limited myself to the ten most common mistakes. I hope that I have succeeded in demonstrating that the planning of an ICU, as much as the planning of every other branch of a hospital, is a very complex enterprise. It should be done extremely carefully and only by highly experienced specialists, if the results are not to be unfortunate.

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This article is based on the paper given by Mr. Walton to the Institute's symposium on Transport in the Health Service.

The author illustrates vividly how to manage a widely dispersed fleet by describing his own problems as Chief Officer of the London Ambulance Service.

Managing a Dispersed Fleet of Vehicles

T. R. WALTON FASI

The London Ambulance Service looks after the ambulance needs of approximately eight million people who live within its 610 square miles, or who visit or come to work in the capital each day. To do so it has to deploy some 1,000 vehicles, and 2,700 operational and control staff based at 75 stations. This represents one sixth of the total ambulance resources in England and Wales.

The work of the service falls basically into two main categories:
the 999 accident and emergency service; and
the less publicised, but nevertheless just as important function of taking sick people, most of them outpatients, to and from hospitals or clinics for treatment.

An average of 1,500 emergency calls are dealt with daily and some 9,000 journeys are undertaken each day for the less urgent ones.

The emergency aspect naturally attracts most public interest and, if I may say so, some misconceptions too.

The ambulance you see with blue lights flashing and horn sounding is not necessarily responding to a traffic accident — only one case in 12 arises from such an incident. The rest covers a wide range of human need, for example, maternities, assaults, drug addictions and overdoses, cardiac attacks, suicides and many others besides.

During the average year the service carries just over three million patients, and in doing so covers some 14 million miles or approximately 38,000 a day. The annual revenue cost is some £17½ million.

Having given you some indication of the scale of operations, may I now move on to the management of the service.

Management of the service

It will, I feel, be recognised that by the very nature of the services provided, it is necessary to operate from units which are fairly widely dispersed. The siting and manning of these units is critical, bearing in mind that the national standards of emergency ambulance services recommended to Health Authorities by the Department of Health and Social Security are a three-minute activation time, and a maximum of 14 minutes response time

to the scene of an emergency. These standards are measured and monitored on a regular basis and any times recorded outside these parameters are investigated. In determining the site of an ambulance station it is necessary to consider several relevant factors, such as density of population, high risk areas such as airports (Heathrow, for example), large chemical plants, motorways, distance to nearest hospitals, etc.

For both managerial and operational purposes the service area of 610 square miles is divided into four divisions: North-East, North-West, South-East and South-West, each division having a headquarters building housing a small administration unit, a divisional control and an operational ambulance unit. A main headquarters building which, in addition to housing the central administration staff, accommodates the central Accident and Emergency control for the whole area, and a training school, is sited in Waterloo Road, SE1.

The four divisional controls deal with the bulk demand on the service which is for outpatient and non-urgent work, the 9,000 patients per day mentioned earlier. They operate from 8 am to 8 pm Monday to Friday and close at 3 pm on Saturday for the weekend. The Central Ambulance Control based at headquarters operates 24 hours a day. It receives and deals with all emergency calls. When the divisional controls close it becomes the control and communications centre for the whole service.

Communications are vital

I will go into a little more detail of this central control as it is clearly the nerve centre for the operational control of the whole accident and emergency service.

It has four sectors, three of which deal with emergency demand: Eastern, Southern and Western. The Western sector operates 24 hours a day, the Southern 16 and the Eastern 10 hours. Staff gradually build up to meet the daytime peak and decrease as the day demand subsides. The fourth sector plans and mobilises the non-urgent requirements of the inner London teaching hospitals and deals with all ambulance-train-ambulance journeys. It also co-ordinates and arranges all long-distance journeys in liaison with other ambulance authorities throughout the country.

No doubt it will be recognised that for an organisation of this description it is absolutely essential to have effective, highly efficient and in some instances sophisticated communications equipment. The ambulance service, when integrated into the unified health services in April 1974, brought with it this kind of communication system, which in my opinion could be developed to the benefit of many other sections of the Health Service.

All accident and emergency ambulances are fitted with multi-channel radio telephones which enable immediate two-way contact with control. In addition, should the crew of any ambulance wish to seek advice from a doctor, or inform a hospital of any special circumstances regarding a patient, they can be switched onto a direct radio telephone link with that hospital. For major accident purposes a special national radio frequency has been allocated, known as the ERC. This provides for all ambulance vehicles, including those from neighbouring authorities called in for support, to operate and be controlled through this special channel. This additional facility allows the day-to-day accident and emergency work to continue uninterrupted.

Direct line electrowriters link the control with the major hospitals and in addition to direct telephone lines to all stations, a telex system relays the planned routine work and provides a direct link to the majority of other ambulance services in the country.

To cope with the ever-changing face of London's new roads, estates, flats, the quick and accurate selection of an ambulance, too often complicated by sparse information, demands some reference. For the senior controllers this is provided by a mobile street index, which, in a matter of seconds, can be used to identify any street location within the Greater London Area.

A bank of microfilm strips contains details of over 75,000 locations, street names, postal districts and codes, nearest major roads, local district names, map references, the four nearest ambulance stations and the distance from the location of the incident.

The aim of an ambulance service is to preserve life, promote recovery and prevent deterioration of all its patients. The conditions under which the patient travels and the care he receives on the way are important, and sometimes crucial to his recovery. It is therefore essential to have skilled and highly competent staff who have at their disposal reliable and efficient equipment and vehicles.

The training of staff in all aspects of patient care is considered to be a priority. In this respect all recruits into the service are required to qualify for the full range of ambulance duties by attending a six-week basic training course, and by completing 12 months on full operational duties. Included in basic training also are periods of instruction on driving techniques. A recruit must be capable of driving at high speeds on occasions, through heavy traffic and in all weather conditions, in order to get his vehicle to the scene of an incident as quickly and safely as possible, and then to modify his techniques to suit the patient's needs and comfort for the journey to hospital.

It will be recognised that in the management of this widely dispersed service, communication on personnel matters is imperative. Situations arise, rumour spreads, facts are few, and the position can all too quickly be reached where management is regarded as incompetent because it is too remote from the day-to-day work.

To surmount this difficulty it is necessary to provide comprehensive staff-management consultative and negotiating machinery, where management officers can consult and negotiate directly with staff who have been elected as representatives by their colleagues. The importance of an effective personnel department cannot be over-emphasised in the management of this type of service.

Managing available resources

I will now move on to the management responsibility for the provision of the necessary resources of manpower, vehicles and equipment. With the type of service provided it is accepted that there is literally no control over the demand on the service. As indicated by the number of calls received, any member of the public can and does call on the service at any hour of the 24 expecting to get an immediate response.

With this fluctuating demand it is necessary to establish maximum and minimum resource availability by regularly monitoring and analysing demands and trends. For example, it is recognised that accident and emergency calls increase on Friday and

Saturday evenings from 2200 hours until approximately 0030 hours. I feel sure I need not elaborate on the reasons why, but suffice it to say that in the very early days of the breathalyser, statistics showed a marked decrease in the number of emergency calls during this period. Unfortunately, this trend is now reversed. Increased demand occurs during the long school holidays. Varying road and weather conditions and distance from hospitals are all factors that have to be taken into account when determining the numbers of vehicles and staff required on the stations.

Changes in the environment also affect future demand. Information must be sought out on new areas of development or redevelopment, proposals for motorways and other main routes, changes to airports, railways and docks and other areas of high risk.

Hospital plans are, of course, of particular importance. Not infrequently the service has been faced with a demand for transport of twenty patients to a new day unit opening a week later with no previous notice. No doubt a cost benefit analysis had been carried out by the hospital authorities on the day hospital proposal but no-one had thought to include the cost, practicability or effect on the outpatients of such an increase in demand.

Happily, however, there are signs that with increased liaison with the service in the very early stages of planning the situation is much improved.

Equipment

The all-important item of equipment is, of course, the ambulance. The modern ambulance is essentially a compromise. There is no purpose-built ambulance available, and ambulance authorities have over the years had no alternative but to fit purpose-designed bodies on what are basically goods-carrying commercial chassis. Other countries, notably the USA, have developed their ambulances on the estate car or station-wagon type of vehicle.

Because no purpose-built vehicle is available in this country, the modern ambulance, like its forerunners, is a composite vehicle, the chassis and body being manufactured separately. While considerable development has been possible on the body, the development of the chassis has been limited by the constraints imposed by its major use as a goods vehicle.

As a result the body is considerably more expensive than the chassis. Because it is largely constructed of glass reinforced plastic, it is not subject to corrosion, and therefore has a longer life potential than the chassis, which over the years has tended to be less robustly constructed. During the last few years, development on both the Bedford CF and Ford Transit chassis has provided a better vehicle for patient carrying purposes than the earlier, heavier commercial types which were used. The vehicles have independent suspension on the front wheels, are adequately powered, and the chassis have been increased in length by some 15-18 inches, thus allowing the patient to be carried within the wheelbase and not, as on pevious models, over the rear wheels. Body development has been able to go ahead without the constraints imposed on chassis development and as a result we now have for the service a recommended standard body specification.

Medical opinion has become increasingly critical of the ride capability of ambulances in general use, as more and more evidence has been forthcoming of the detrimental effects on patients of the journey to hospital. Much has been done, particularly between 1968 and 1974, to develop and improve the suspension of the vehicles aimed at improving the quality of ride. This is clearly an area where we in management would welcome the technical expertise that is now available to the service through the engineering division. As the service at all times requires the maximum availability of vehicles, it is without doubt important in the first instance to have vehicles of quality and reliability and even more important it is absolutely essential to have efficient and effective back-up care and maintenance systems.

I should however say that as manager of this service I am perhaps more fortunate in that I have at my disposal an automotive engineer who over the last 12 months or so has been establishing and developing the essential care and maintenance system throughout the service. Many of my colleagues and, if my information is correct, many of the hospital transport units, are not so fortunate in this respect and even nearly three years after reorganisation still have to rely on contractual arrangements with local garages, sometimes with little or no quality or cost control. Vehicles are often purchased in comparatively small numbers, based on questionable specifications, when clearly contracts on perhaps a Regional basis with professionally drafted specifications could provide technical and economic advantages to the health authorities.

Legal responsibilities

I think I should add just a few words about the legal responsibilities of operating these vehicles.

In the first instance the health authorities are not required to pay road fund licence fees and, as agents of the Secretary of State, insurance cover is provided centrally.

Drivers are required to comply with the Road Traffic Act but have certain exemptions, eg, they can use discretion at road junctions controlled by traffic lights when proceeding on emergency calls, and are not required to maintain the statutory driver's log book records in respect of the drivers' hours regulations.

It may surprise many people that the statutory requirements for the care and maintenance of PSV and HGV operators in the private sector do not apply. Fortunately, however, ambulance management have always recognised their responsibility in this matter and have, generally speaking, established standards at least equivalent and in some instances much higher than required by law.

Time unfortunately does not permit me to go into the all-important question of costs. No doubt, however, you will appreciate that when managing an emergency and very personal service like this it is sometimes most difficult to equate cost-effectiveness when dealing, as we have to daily, with human life and suffering. Nevertheless, I and all my colleagues charged with managing this type of service are most conscious of the need not only to provide a highly efficient service, but also an economic service.

In April 1974 the reorganised and unified NHS inherited a very large transport organisation. It has not always been easy to convince hospital orientated administration that, to be effective and economic, transport not only requires professional management, but also the essential expertise of technical and engineering services. I suggest that many hospital engineers have a key role to play in this transport organisation.

Testing Low Temperature Steam-formaldehyde with B. Stearothermophilus Spores

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The search for a method of low temperature sterilisation which is microbiologically reliable and does not leave tissue irritants in the sterilised load has become urgent as more sophisticated, temperature sensitive materials and instruments are used. Three methods appear to fulfil, at least in part, the necessary criteria for sterilisation of delicate or heat sensitive materials. These are gamma radiation, ethylene oxide and steam with formaldehyde. Gamma radiation is reliable and efficient but slow, expensive and not easily available. Ethylene oxide gas, either pure or diluted with an inert vehicle to prevent explosions, is considered to be an unreliable sterilising agent when used under hospital conditions. It may also leave toxic residues in the materials. Low temperature steam at temperatures between 60° and 80°C with variable amounts of formaldehyde vapour is thought to be more reliable than ethylene oxide, and does not leave toxic residues.

Reports of the effectiveness of low temperature steam-formaldehyde in various sterilisation cycles have shown considerable variation. The measurement of physical parameters associated with sterilisation by steam-formaldehyde method is difficult, and the only practical method of monitoring sterilisation is by testing the ability of the system to kill spores. Some authors report a consistently successful killing of B stearothermophilus spores,[1, 2, 3, 4] while others using similar B stearothermophilus spore tests have found the method unreliable.[5]

Recent tests carried out at the Eastman Dental Hospital on two sterilisers working on slightly different low temperature steam-formaldehyde cycles have failed to kill all B stearothermophilus spores openly exposed in different parts of the chamber. Also, spores placed at the closed end of a stainless steel tube, 3mm internal diameter and 455cm long[6] (British Steriliser Company 'Test Helix') were sometimes killed, when similar spore preparations were not killed in the chamber.

During these tests differences were noted in the results obtained with different B stearothermophilus spore preparations. The spore tests were therefore repeated using spores from known sources and of known concentrations on the test papers.

Materials and methods

Sterilising cycles

The tests were made using two porous load sterilisers manufactured by British Steriliser Co. Ltd., each provided with a different low temperature steam-formaldehyde cycle.

One steriliser had a 15 cu ft square chamber. Air was first eliminated from the chamber by flushing with steam at a pressure of 0.31 bar, and then maintaining 0.08 bar for 12 minutes. 400 cc of a 40% formaldehyde solution was then injected in eight equally divided doses over a thirty minute period. The formaldehyde solution was first drawn into a vapourising tube, then carried into the chamber by steam passing through the tube. Throughout this period of the cycle, the chamber temperature was allowed to fluctuate between 68° and 75°C at a varying sub-atmospheric pressure (*Figure 1*).

After the sterilising period, the formaldehyde vapour was removed by a combination of steam flushing and reduced pressure over 25 minutes.

The second steriliser had a cylindrical chamber of five cu ft. Before the admission of formaldehyde, air was eliminated as in the square chamber steriliser. 200 cc of 40% formaldehyde with steam at sub-atmospheric pressure was admitted into the chamber in four equal amounts over a ten minute period, followed by a period of 25 minutes when a steady temperature of 74°C was maintained at a reduced pressure of approximately 0.38 bar.

During the formaldehyde admission period the pressure in the chamber varied in four short pulses — from 0.30 bar to 0.31 bar while the temperture varied from 30° to 75°C (*Figure 2*). The formaldehyde solution was admitted at the lowest pressure of each pulse.

In both sterilisers the pressure of the jacket steam was reduced so that the jacket temperature corresponded to the temperature of the steam in the chamber during the sterilising period.

Spores

The test spores used were B stearothermophilus spores NCIB 8919 cultured from commercially available spore test papers supplied by Oxoid, and NCTC 10003 cultured from spore test papers supplied by Southern Group Laboratories. Spore preparations were made from both sources by harvesting spores from tryptone agar slopes. After culture for 24 hours

at 59°C, they were washed in water, and suspended for storage in 90% methanol at a concentration of 10^6 spores per cc estimated by the method of Miles and Misra.[7]

When required for use, the bottles containing the methanol spore suspension were centrifuged, supernatent methanol pipetted off, and replaced by sterile water or 50% inactivated horse serum, reconstituting the suspension at 10^6 spores per cc.

Spore papers were prepared by dropping the spore suspension onto sterile absorbent paper. Papers containing different numbers of spores were prepared by pipetting 1, 2, 3, 6 or 8 drops onto an absorbent paper disc, allowing the paper to dry at 60°C between each drop.

This gave two series of spore papers; one prepared in water, and one in serum, each paper carrying between 10^4 and 10^5 spores per paper. All spore test preparations were duplicated in each test. Commercially prepared spore papers of NCTC 10003 (Southern Group Laboratories) and NCIB 8919 (Oxoid) were also included in each test run. During tests spore papers were placed on a wire grid in the centre of the chamber in paper envelopes, and at the closed end of the 3mm stainless steel tube.

After exposure in the steriliser, the spore papers were transferred to 15cc typtone dextrose broth and incubated at 56°C until a growth of B stearothermophilus was seen. Where no growth had appeared within 14 days, the culture was reported sterile. All positive growths were confirmed by inspection of a stained film.

Results

The number of days of incubation of the spore test paper before growth was observed by inspection is shown in the table. Where no growth was seen within 14 days the culture was considered sterile and reported as no growth (NG) in the table.

The results show that Oxoid spores, commercially supplied as well as those sub-cultured from this strain, are considerably easier to kill than Southern Group spores. The commercially prepared spore papers (Oxoid) were sterilised on all occasions when exposed in the middle of the chambers, as well as at the closed end of the 3mm tube. In contrast, none of the Southern Group Laboratories spore papers were sterilised in the same tests. The results obtained using our own preparations lie between these extremes; not all spores derived from Oxoid were killed, and not all spores derived from Southern Group Laboratories survived. However, there were more than twice as many negative growths using Oxoid derived spores than were obtained with Southern Group derived spores in two comparable series of tests.

Spores coated with serum during the preparation of the spore papers were neither easier nor more difficult to kill than those prepared from water suspensions. There was no evidence in these tests of resistance to formalin sterilisation in the presence of serum.

It is clear from the results obtained that spore papers should be incubated for at least 14 days, as has been recommended previously.[5] In this series of tests, 21% of the positive growths were observed between 7 and 14 days.

Discussion

B stearothermophilus spores for sterility testing of low temperature steam formaldehyde systems followed the satisfactory use of these spores for testing pressure steam sterilisers. As test organisms, the spores have the advantage of being unusual in the laboratory environment. Growing at an optimum temperature (56°C) they are well removed from the optimum growth temperature of possible media contaminants. They are also difficult to kill by moist heat, and are therefore ideal for routine testing of steam sterilisers. It is clear, however, from the results reported here that the low temperature steam formaldehyde steriliser does not kill B stearothermophilus spores as consistently or with the same facility as the pressure steam

The table shows the number of days before growth of B stearothermophilus spores was observed after exposure to low temperature steam-formaldehyde. Results from two different runs in each steriliser.
NG = No growth.

	DAYS BEFORE GROWTH							
	SQUARE CHAMBER AUTOCLAVE				ROUND CHAMBER AUTOCLAVE			
SPORES	From Water		From Serum		From Water		From Serum	
	Spores in centre of chamber							
NCTC 10003								
1×10^4	13	NG	NG	NG	4	5	5	5
2×10^4	13	13	2	4	4	4	5	5
3×10^4	2	7	2	2	4	5	6	7
6×10^4	4	NG	2	2	5	6	5	8
8×10^4	2	4	2	2	6	7	3	6
NCTC 10003 (Southern Group)	6	5			3	3		
NCIB 8919								
1×10^4	NG	NG	NG	NG	5	6	NG	NG
2×10^4	NG	NG	1	1	6	10	NG	NG
3×10^4	NG	NG	1	1	4	5	NG	NG
6×10^4	NG	NG	1	1	5	NG	NG	NG
8×10^4	NG	NG	1	1	4	5	NG	NG
NCIB 8919 (Oxoid)	NG	NG			NG	NG		
	Spores at end of 455 cm x 3 mm tube "Test Helix"							
NCTC 10003 8×10^4 in serum	2		NG		NG	NG	2	4
NCTC 10003 (Southern Group)	4		6		4	3	2	4
NCIB 8919 8×10^4 in serum	1		NG		5	NG	3	NG
NCIB 8919 (Oxoid)	NG		NG		NG	NG	NG	NG

steriliser. The unsatisfactory results reported here are due either to inherently poor performance of the low temperature steam formaldehyde sterilisers, or to the unsuitability of B stearothermophilus spores as a test organism for this method.

Most reports of successful sterilisation by the steam-formaldehyde method have made use of commercially prepared spore papers (Oxoid) which have been recommended[4] for this purpose, and in our own tests, spores on these test papers were more easily killed than any other spore preparations. The different results shown with other spore preparations suggest that there is a considerable variability in the resistance of different strains of B stearothermophilus to low temperature steam-formaldehyde, and that the method of preparation and number of spores present may be critical.

It is not known how many viable spores there are per test spore paper as supplied commercially. In our experiments we have prepared papers with known numbers of spores, and it has been shown that the number of positive growths tends to decrease with the decreased number of spores present. This effect was more marked with the Oxoid derived spores than with the Southern Group derived spores.

Whatever the explanation, there is an evident lack of consistency between the two commonly available preparations of B stearothermophilus spores, NCTC 10003 (Southern Group Laboratories) and NCIB 8919 (Oxoid).

Figure 1
The temperature record from the base of the 15 cu ft chamber.

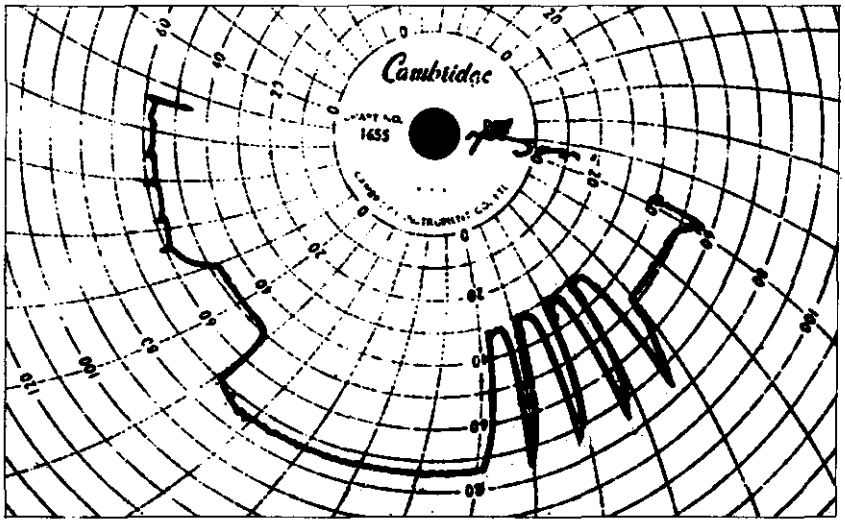
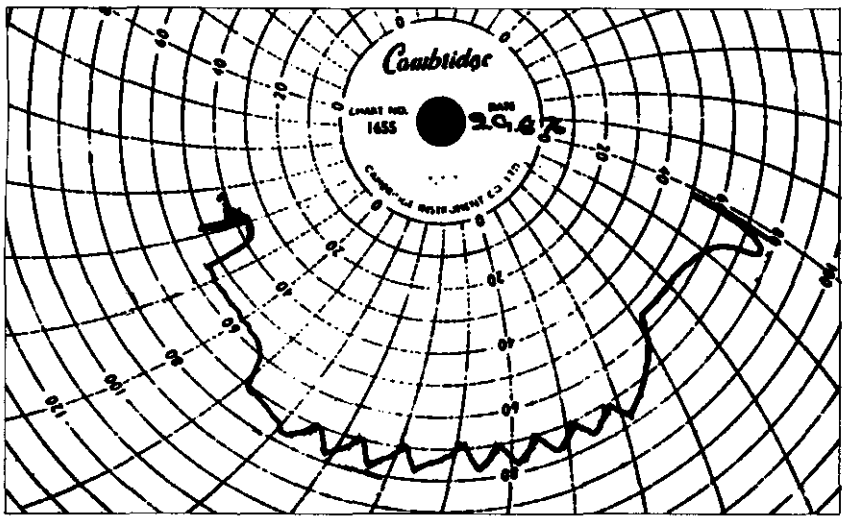


Figure 2
The temperature record from the base of the 5 cu ft chamber.



There appears to be urgent need for standardisation of spore test papers, of the strain used, the method of preparation and the number of spores present. Until all spore tests are standardised, results from different centres are not comparable, and the good results reported from tests on low temperature steam-formaldehyde sterilising systems seem to depend largely on the widespread use of 'Oxoid spore strips' and are not supported by tests using other spore preparations.

The purpose of this paper is not to deny the possible usefulness of the low temperature steam-formaldehyde method of sterilisation, but to point out that present methods of spore testing are insufficiently standardised, and do not offer a reliable method for monitoring instrument sterilisation by the low temperature steam-formaldehyde method.

Summary

Two strains of B stearothermophilus spores have been tested for monitoring low temperature steam-formaldehyde sterilisation. The effect of the number of spores used in each test, and the number of days of culture of the spores after use, has been examined. The results show important variation in the results obtained with different preparations, in particular the commonly used 'test spore strip' (Oxoid) appears to give consistently more sterile results than any other preparation examined. The results suggest the need for standardisation of B stearothermophilus spore test preparations, and a re-examination of sterility test criteria for low temperature steam-formaldehyde. The previously reported good results obtained with low temperature steam-formaldehyde sterilisers tested with 'test spore strip' (Oxoid) are not confirmed when other spore preparations are used.

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Product News

Frozen Food Down-Under

A revolutionary facility being built at Dudley Park, Adelaide, in June this year begins producing 25,000 meals every working day for 17 different hospitals throughout Adelaide and its suburbs. It is Australia's first, large-scale, centralised, frozen food system.

The South Australian Hospitals Department established the feasibility of the Dudley Park frozen food facility after two successful pilot operations and several years of intensive investigations conducted in Australia as well as overseas.

The designers, engineers and construction managers are Austin-Anderson, Australasian representatives of The Austin Company of Cleveland, Ohio. Austin, which has extensive food industry experience, was first selected in 1975 to carry out preliminary engineering, and to provide cost estimates for the new facility.

Bulk purchases of raw meat, fish, vegetables, baked goods and similar items are prepared, cooked and cryogenically frozen. The frozen food is then taken by refrigerated trucks to the participating hospitals, where the food is made up into meals. A menu of 152 items provides the total dietary requirements of patients ranging from young children to geriatrics.

Benefits of the new system include lower operating costs, resulting from centralisation and the use of high-volume cooking, packaging and handling equipment. Improved food quality is gained from close control at one production centre. There is increased patient and staff satisfaction because of better meal arrangements; greater ease in dealing with fluctuating demand and a consequent reduction in the amount of food wasted. An additional benefit is the provision of a community emergency food supply.

The arrangement of the facility is based on the 'straight-through' layout. Austin chose this approach in order to simplify positioning of tunnel freezers, eliminate production cross-flows and facilitate future plant extension. The process sequence is: receiving raw materials, preparing them for processing, cooking or baking, portioning the food and filling trays, cryogenic freezing, packaging, storage and, finally, distribution. These main functions are augmented by quality control, recipe development, equipment cleaning, maintenance and garbage disposal. The 25,000-meal daily output is based on one eight-hour shift. Production can be doubled by the introduction of a second shift.

Incoming raw materials are check-weighed by a forty-tonne weighbridge before being unloaded at covered or open docks. After quality checks, all raw materials are stored on pallets. Frozen goods are kept at −30°C and all other goods at +4°C.

Vegetables are prepared in the 200m² vegetable preparation room; meat and fish is pre-cut/filleted before delivery. There is provision for mincing and cubing, as well as making pasties, meatballs and fishcakes in the 85m² meat and fish preparation room.

Automatic cooking equipment includes four 1500-litre and five 760-litre steam kettles, deep fryers, a continuous broiler, two rotary rack ovens, six small steam kettles, an oven range and a smaller fryer. A one-tonne capacity vegetable pressure steamer will be manually operated and have vacuum cooling. This equipment is capable of cooking up to 3,727 kilograms (8,200 pounds) of food per hour.

A two-tonne gantry crane is installed to traverse above the steam kettle area.

Bakery equipment includes a rotary rack oven, two 380-litre steam kettles, a large baking oven, dough brake and two large mixers.

Cooked and baked food moves on the four conveyor-belted production lines or the one special diet/sweet line. The polypropylene-coated board trays are filled automatically, or by operatives seated beside the conveyor belts. Every tray of food undergoes metal detection and weight checks.

Snap cryogenic freezing has been selected because of its speed, which retains the food's nutritional value, flavour, texture and appearance. From 'fill' to 'freeze' takes less than half an hour.

Full trays of food pass through a liquid-nitrogen gas freezer tunnel before going to a mechanical tray-lid sealing machine at the end of each line. Each of the freezer-tunnels can handle up to 4,070 kilograms (9,076 pounds) per eight-hour shift.

Packed cartons of newly frozen food are elevated by belt conveyors to gravity roller conveyors on which the cartons move into the cold storage area. A 600-kilogram 13 metre high stacker crane maintains the 'first produced — first used' live-storage system. This high density system has space for 34,000 food cartons containing 400,000 meals.

Each food order is manually selected from the cold storage racks and placed on a pallet carried by a 600-kilogram picker crane, which is interchangeable with the stacker crane.

Single and multi-pallet consignments are assembled in the order make-up and shipping room. In reverse delivery order, they are then conveyor-loaded into refrigerated trucks for transportation. On delivery to the destinations, the food, after reheating in pantries near wards or in staff canteens, is made up into individual meals.

The process equipment has been obtained from worldwide sources, including refrigeration equipment from the USA, materials handling equipment from Germany, steam kettles from Australia, steam kettle drives from Australia, ovens from Sweden, bakery equipment from Sweden and Germany, packaging equipment from Sweden, grilling and frying equipment from the USA and meatball formers from Switzerland.

The Austin Company is represented in this country by *The Austin Company of UK Ltd., Station House, Harrow Road, Wembley, Middlesex HA9 6EG. Tel. 01-902 9701.*

Hospital protection system

Because of the risk of unauthorised entry to areas of the building complex, Harold Wood Hospital in Essex have specified a Tann Synchronome Access Control System, utilising an RS30 console with IDEK readers.

All authorised staff hold a Tanncard, similar to a credit card, but with an invisible, unbreakable code. By inserting the Tanncard into a reader, a doorway will unlock, providing the Tanncard contains the correct command coding. The IDEK variation is that a system keyboard is positioned alongside the reader and each Tanncard holder has to tap out a personal memorised code, to ensure positive individual identification. Automatic

print-out records are provided of every Tanncard entry and of any unauthorised attempts at entry, which are printed out in red.

Separate Tanncards can be eliminated from the system in the event of loss, theft or when an employee leaves; these cards being invalidated immediately at the central console.

Further information: *R. Washbourne, Tann Synchronome Limited, Station Road, Westbury, Wilts. Tel. 01-953 2021.*

New fire control equipment with all BS 3116 facilities

Tann Synchronome have also launched a single zone alarm panel the Firecheck Compact giving all the necessary functions called for under BS 3116 Part 4.

Red, amber and green indicator lights on the panel front give warnings of fire alarms, line faults, battery disconnection, mains failure and other functions required under the British Standard. A keyswitch isolates all switches until operated; the key can only be removed in the 'isolate' position.

The associated sensing line is suitable for smoke detectors, heat detectors and break glass call points, whilst the alarm line can incorporate up to 15 alarm bells.

The Firecheck Compact measures 12in × 8¼in × 3¼in (305 × 216 × 84mm) and weighs 8kg complete with batteries.

Further information: *L. Stokes, Tann Synchronome Limited, Stirling Corner, Borehamwood, Herts. Tel. 01-953 2021.*

Cryogenic Valve Division formed by HNH

The cryogenic valve expertise of three Pegler Hattersley companies — Woodhall Engineering, Shipham and Co. and Daytona Butterfly Valves — has now been combined to form what is probably Europe's largest cryogenic valve marketing organisation — HNH Cryogenics. Export sales will be handled by the overseas selling section NHI Cryogenics.

Heading the new organisation is Woodhall Engineering Managing Director Gordon Ducker, with Adrian Ducker as Sales Manager. Supporting them is Sales Office Manager John Bryan and a team of cryogenic valve specialists who will be able to offer customers an unrivalled range of valves for every conceivable application down to minus 196°F, from one source.

Among the range of cryogenic valves they will market are Woodhall Engineering stainless steel gate, globe and check valves from half inch to 24 inch and pressures up to 2,500 lbf/in^2; Shipham bronze gate and globe valves from quarter inch to 18 inches; and Daytona Butterfly valves in stainless, alloy steels and bronze in sizes from two inches to 48 inches. In addition to manual operation, the new specialist HNH Cryogenics Division will be available to advise customers on installations involving pneumatic, hydraulic or electric actuators.

HNH Cryogenics, New Street, Pudsey, Yorkshire.

Automatic TDS Control

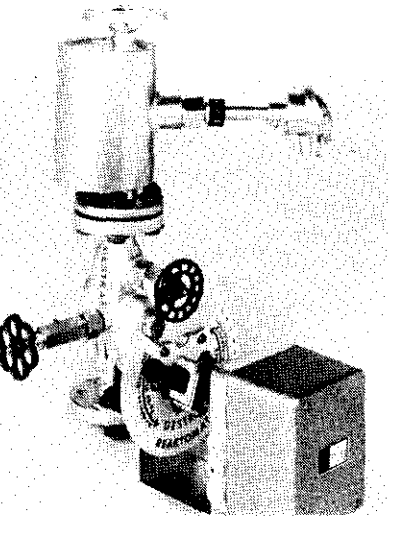
Gestra have added automatic TDS (Totally Dissolved Solids) control to their range of Boiler Blowdown Equipment.

These are the first automatic TDS systems to be able to incorporate a full Heat Recovery System. In these days of energy conservation to be able to control boiler water quality accurately, with its consequent improved purity of steam, whilst at the same time recovering enough heat and water to pay for the system and installation within one year to 18 months (dependent upon per cent of continuous blowdown) seems too good to believe.

But this is what Gestra claim to have achieved with their motorised continuous blowdown valve, with its revolutionary stage nozzle that eliminates wire drawing, and gives control down to 50 lb/hr flow rate. The conductivity electrode capable of being installed at boiler pressure (up to 19 bar g) and the controller are manufactured to the same high standards.

Further information: *Gestra (UK) Ltd., 9-11 Bancroft Court, Hitchin, Herts. Telephone: Hitchin 50026.*

The Gestra blowdown valve.



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Salary: £3,915-£4,381 incl.

An Assistant Engineer is required to aid the District Engineer in the provision of engineering services for the *Brent District.*

Duties will involve the preparation of drawings and specifications for minor capital works, etc, particularly in the electrical engineering field.

Interested applicants would be expected to have served an apprenticeship in mechanical or electrical engineering and will need to have an ONC in engineering or a *suitable alternative qualification. It is* possible that attendance at day release courses will be allowed.

Informal discussion of the post is welcome and those interested should contact Mr. M. Woodroofe, District Engineer, on 01-965 5733, Ext. 223.

An application form and job description are available from District Personnel Department, Central Middlesex Hospital, Acton Lane, London NW10 7NS. Tel. 01-965 5733, Ext. 601.

Suffolk Area Health Authority
Bury St. Edmunds Health District

Hospital Engineer

24½ points and above

Salary £4,658-£5,236 (inclusive of extra responsibility allowance, bonus allowance and earnings supplements).

Based at the West Suffolk Hospital, Bury St. Edmunds, a District General Hospital with 580 beds which was the first 'Best Buy' Hospital to open.

Bury St. Edmunds is a developing town in an attractive rural environment with low cost housing. Assistance with accommodation on a temporary basis may be possible.

The appointment is in advance of the retirement of the present *Hospital Engineer. The successful applicant* will have considerable experience in a similar position and be a superior engineer with substantial managerial ability and initiative.

Qualifications required are those for Hospital Engineer 24½ points and above.

***For further information,* job description and application form, telephone the District Works Officer, Bury St. Edmunds 63131, or write to the District Personnel Officer, Bury St. Edmunds Health District, 36 Mill Road, Bury St. Edmunds IP33 3NR.**

Closing date for applications is June 24 1977.

Suffolk Area Health Authority
Works Organisation

Assistant District Engineer

Salary scale £4,371-£5,262 plus Government Pay Awards £291 and £208 p.a.

Ipswich Health District, District Works Department — Ipswich (Relocation Assistance will be available in certain cases).

This is a third-in-line post assisting the District Engineer throughout the whole range of his duties, covering all engineering aspects in the general field of maintenance, operation of plant, and the design and specification of minor works.

The successful applicant will be given every opportunity to participate fully in a forward looking, fully integrated Works Organisation and will become involved in all hospitals, clinics, health centres, ambulance stations and residential accommodation within a District located in a most attractive part of Suffolk.

Previous experience in Hospital Engineering is absolutely *essential and qualifications must be as set out in* paragraph 1(c) of PTB 261.

Application form, job description and further details obtainable from: The Area Personnel Officer, Suffolk Area Health Authority, PO Box 55 Ipswich. Tel. 72272, ext. 229.

Closing date: June 22 1977.

TEHRAN
HOSPITAL NOTRE DAME DE FATIMA

Applications are invited for the post of

Hospital Engineer

at the above 160-bed hospital

The successful applicant will be responsible to the Chief Engineer for all Hospital and allied engineering services including the care of planned preventive maintenance.

Applicants should be appropriately qualified and have *sound experience in all aspects of* mechanical and electrical engineering and be able to demonstrate managerial and supervisory ability.

It is envisaged that after approximately one *year the successful applicant will replace the* present chief engineer who will be retiring from his position.

Salary is £7,000 per annum and fully furnished accommodation is available. Return air fares and *generous leave allowances.*

Application forms from Norma Sutton, 4 Fitzroy Square, London W1P 6JA. Telephone: 01-387 0541.

CLASSIFIED ADVERTISEMENTS

— continued from previous page

APPOINTMENTS AND SITUATIONS VACANT

Ipswich Health District
(Suffolk Area Health Authority)

HOSPITAL ENGINEER

required for the Anglesea Road Wing of the Ipswich Hospital.

Salary scale including pay awards £3,850 to £4,441 per annum, plus bonus (currently 10% of basic salary) plus £108 responsibility allowance.

The successful candidate will be responsible to the District Works Officer for the management of the works department of this 344-bed acute hospital and other small hospitals within the District.

Applicants must have served an engineering apprenticeship, have wide experience in maintenance of buildings and mechanical and electrical engineering plant, and hold a Higher National Certificate in mechanical or electrical engineering or an equivalent approved qualification.

Application forms and further details can be obtained from the District Personnel Officer, Ipswich Health District, P.O. Box 7, Foxhall Road, Ipswich, Suffolk IP3 8NJ.

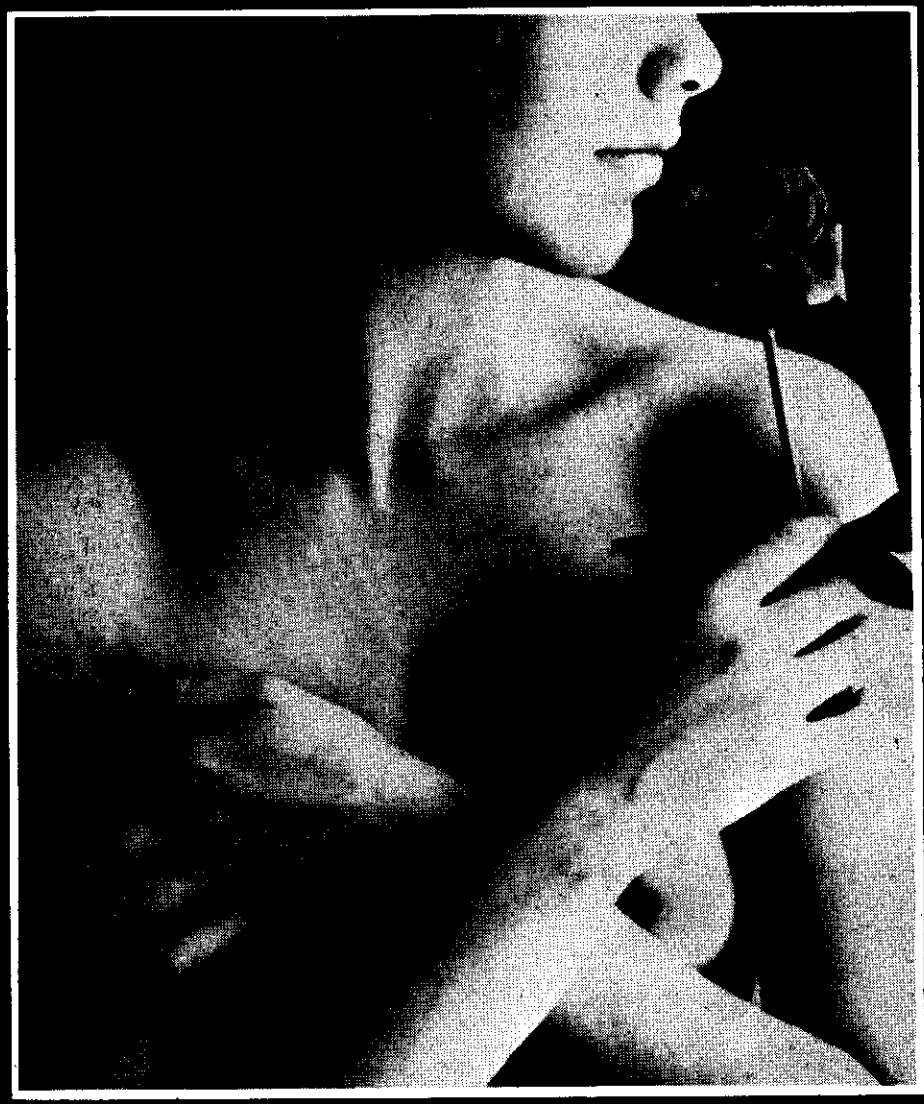
Completed application forms to be received by June 24 1977.

To place an advertisement in the next issue of
HOSPITAL ENGINEERING
appearing on
AUGUST 5 1977,
please contact:
Sue Cartwright,
EARLSPORT LIMITED,
33 Ludgate Hill,
London EC4
Telephone: 01-248 0148
by **July 25 1977** latest

Closing dates

Recruitment advertisers are requested to set closing dates no earlier than three weeks after publication date of the Journal.

Monthly publications do not receive preferential treatment by the Post Office and circulation lists in hospitals also delay receipt of the Journal by many potential applicants.



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