ANESTHESIA GAS UPDATE

In the July 1978 issue, the Medical Waste Gas Surveillance Program offered by the Technical Services Program (TSP) at the University of Vermont was described. This service was designed to aid hospitals in exposing faulty anesthesia and gas sterilization equipment, and to help the hospitals protect workers in locations where anesthetics and Ethylene Oxide are employed. The preliminary surveys of sixteen hospitals in Vermont and New York have been completed. These initial surveys were intended to inform the hospitals about the condition of their equipment as well as reviewing the policies and procedures regarding the use of the equipment. Almost as important has been the educational effort that goes along with the services. Programs designed to inform hospital personnel of the potential hazards and the steps of regulation have cleared up many questions on the minds of employees working in these areas.

The results of the first round of testing showed considerable variations in the working conditions in the OR and gas sterilization areas. Of the fifteen operating suites investigated, nine had made an attempt at scavenging waste anesthetics, at the time of the survey not a single OR had a completely effective scavenging system. This was not because the scavenging devices themselves were inefficient, although in some cases they were. Most often, the effects of the scavenging devices were masked by leakage in other parts of the system. Of forty-eight anesthesia systems, nineteen had high pressure leaks in the central gas supply connections or portable gas supply tank yokes. These types of leakage alone can elevate the baseline concentration of nitrous oxide to levels above the recommended limit.

Nitrous oxide levels in working rooms frequently exceed 250 parts per million, ten times the proposed time weighted average exposure limit. Average levels range from thirteen ppm in a well scavenged room to over 250 ppm, the maximum measurable concentration of the spectrophotometer, in an unscavenged OR. Most intraoperative levels varied between 50 and 250 ppm. The most common low pressure leakages sources were swivel-type patient yoke connectors, disposable breathing systems, loose CO2 absorbers and vaporizer filler caps. Cracked and rotting hoses were found even on machines that had recently been serviced. Many of the problems were corrected on the spot, and the next round of testing should show improvement in many areas. Scavenging systems were recommended for those OR's not so equipped, and corrections made to improperly operating systems.

Ten gas sterilizer installations were evaluated. Most units were in mechanical- ly sound condition and only a few have significant leakage problems during the sterilization cycle. The major weakness in almost all of the installations were procedural ones. In most installations, the greatest potential for exposure to harmful levels of ethylene oxide exists at the end of the sterilization cycle when the operator opens the door of the sterilization chamber. At that time, any residual ETO in the chamber will spill out into the work area. Even though many sterilizers have a vacuum flush at the end of the cycle, potentially hazardous amounts of gas may remain in the chamber.

The widespread practice of using latex examination gloves for protection in handling recently sterilized items is also to be discouraged, since they are permeable to ETO. Thicker cloth or polyvinyl alcohol gloves are recommended instead. Good ventilation (6-10 air exchanges per hour) of the sterilizer area is strongly recommended even for units vented to the outside. One hospital surrounded its tabletop sterilizer and aerator with a simple hood and exhaust-fan (cost less than $100) and achieved a remarkable reduction in ambient ETO concentrations.

To summarize, TSP's Medical Waste Gas Surveillance Program has provided valuable insights into current conditions in the hospitals and provided the data necessary to correct the problems. The anesthetic waste gas surveys showed that many of the problems in the OR are maintenance-related and that as manufacturers and users of the equipment, become more knowledgeable and aware of the potential hazards, more attention will be paid to the mechanics of anesthetic waste gas disposal. Maintenance of gas sterilization equipment seems to be up to par, and in most cases, reducing exposure to ETO is merely a matter of setting up the appropriate procedures and adhering strictly to them.

David T. Punia,
Clinical Engineer
Technical Services Program
University of Vermont

SPRING SEMINAR

Your Coordinators of the Spring Seminar are Cornelius Keating, Director of Engineering & Maintenance, New England Deaconess Hospital and Donald Mason, Plant Engineer, New England Baptist Hospital. Information on the seminar and hotel reservations are being mailed separately so that you will have time to make reservations. The seminar will be March 27, 1979 at the Copley Plaza.

The three speakers for the program are: Robert DeVore, Vice President of Health Systems, Inc., of Boston, Massachusetts. Mr. DeVore is a graduate of Harvard, majoring in Business Administration and his topic will be government bureaucracy and controls as it affects hospitals. We would like Bob to cover the latest information on government grants for energy conservation as it stands now and to peer into the future if possible.

Eugene Bord, President of BR & A, Inc., a Boston consulting firm, will talk on energy and energy surveying and how it relates to obtaining government grant money.

Our third speaker will be Mr. Albert Platt, Project Director and Director of code administration of the Richie Organization. Mr. Platt is an expert on hospital codes that relate to buildings and mechanical systems. He has published a book which divides buildings into allocated spaces such as patient rooms or surgical suites and spells out all the codes that affect that area and references them. It is a tool that should be extremely valuable to every hospital engineer. It is hoped that we may have enough of these books to give each attending member a copy.

BETH ISRAEL’S TASTEFUL STORAGE TANK
See Jim Menadue for details
NEHES FALL CONFERENCE
Plans are going well for the 1979 Fall conference in Rhode Island under Coordinators John Deamico, Miriam Hospital, Providence and Leonard Hayward, Newport Hospital. They welcome any suggestions, but hope to clear their program with your NEHES Board of Directors very soon.

The 1979 Edition has only minor revisions in the sections in which we are most directly affected: Buildings and Grounds Safety and Functional Safety and Sanitation.

In regards to the Buildings and Grounds Safety Section, the 1973 version of N.F.P.A. 101 is used as a key reference. It should be noted, as in the previous editions, that this section provides for equivalencies. Also, the prime means for detecting the variation from the Standards is the Statement of Construction. Therefore, when filling out the questionnaire, one should qualify the information provided. For instance, in regards to questions dealing with elevator fireman’s call and house water pumps, a simple negative answer has resulted in the J.C.A.H. Surveyor listing these items as deficiencies. On the other hand, if it had been noted that the particular question (standard) did not apply along with the reason(s) why, it could have saved several hospitals the trouble of formally applying for an “Equivalency”.

In regards to the Functional Safety and Sanitation Section, it also refers to the older versions of the Standards, (i.e., NFPA 56A, 1973; NFPA 101, 1973; NFPA 76A, 1973). It should be noted that there have been exceptions made which are not indicated in the Accreditation Manual. For instance,

1. **Annual** rather than monthly testing of conductive floors in non-flammable anesthetizing locations.
2. Furniture in non-flammable locations do not require testing.
3. LIM’s may be tested **monthly**, rather than weekly.
4. Emergency power generators may be tested **monthly**, rather than weekly.
5. Thermographic or infra-red studies are an acceptable method of inspecting main circuit breakers.

As for other acceptable variances, it is recommended that the reader refer to the AHA/ASH  “J.C.A.H. Facility Standards Update”, Newsletter dated October 13, 1978.

John C. Deamico

JOB OPENINGS
This is a reminder that if you know of, or are interested in any job openings for Hospital Engineers or positions qualifying for membership in NEHES, you should contact your State Representative. This information is reviewed at the monthly meetings of your Board of Directors and is coordinated by your President, Jim Gleason.

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HELP REQUESTED ON VACUUM SURVEY

NFPA 56A, the proposed recommended practice for Medical-Surgical Vacuum Systems was returned to Committee after considerable discussion at the 1978 Fall Meeting of NFPA. The Recommended Practice Document was rejected because of numerous concerns expressed regarding the validity of the new proposed formulation for sizing of the system.

A joint survey was conducted by ASHE and members of the Committee in early 1978 to determine empirically the validity of the formulation. The survey results were not conclusive. The number of surveys returned to ASHE were very few and the acceptable surveys were even fewer. The poor returns were possibly attributed to the presentation of the survey and a lack of understanding of the implication of the 56K document.

The contents of the survey are currently being restudied and, hopefully, the new presentation will encourage an acceptable response. The implication of the document is simply stated — if the sizing formulation is mistrusted the resulting systems will be inadequate to handle the specified function.

LIGHTING HAZARD

During the Christmas holiday lowered the Lawrence Memorial Hospital of Medford closed one floor to save staffing. It offered an excellent opportunity to make a detailed inspection of that floor. Electricians were surprised when they opened a bathroom light to check wiring. The McPhiliben oversink light, catalog No. 37-61A installed since 1967 has two 60 watt incandescent bulbs in a socket made by Leviton rated for 600 watts. In two thirds of the units the insulation had been cooked off the wiring (marked A.I.W.R. A.W.M. 105 C T.E.W.). The heat build-up in the metal band concentrated on the threaded unit. Miraculously no breaker had tripped and fortunately the lights were well grounded. Refer to the photo below showing the socket assembly removed.

MORE EFFECTIVE CONTRACTING

Warren Marble, Director of Engineering, Danbury Hospital, Danbury, Connecticut learned a good lesson which he called, "The Team Approach to Design and Build Utilizing the Fast-Track Method". This information constituted Mr. Marble's project submission for the ASHE Senior Level of Membership.

Owners should analyze the method they wish to use for a new facility. They should document their objectives and clearly outline their responsibilities. Based on numerous successful negotiated contracts, this "Team" approach should be considered.

Owners objective: Success has more to do with the owner's management and the level of competence exercised by participants than the actual method used, but most owners will reach the following objectives:

1. Competent professionals he can trust, who have proven reputations for performance and will serve owner's interest.

2. Maintain complete control of entire operation by involving knowledgeable staff member to manage project. He should attend all meetings to ascertain all decisions are in owner's best interest.

3. Owner must identify responsibilities of all participants and be assured that all responsibilities required have been accounted for early in the project.

4. Functional facility that can be used for intended purpose. Too often owner sacrifices function for cost when same function could have been done another way for same cost.

5. Reasonable cost consistent with other goals.

6. Workable schedule to meet owner's objective and include both owner and contractor's resources on an acceptable basis.

7. Appropriate image of facility as seen by community, employees and governing agencies.

8. Quality consistent with all objectives, including long-term maint. and operating costs.

9. Results — what owners want, when he wants it and for what he can afford.

Continued on page 4
ONE ENGINEER’S SOLUTION

In the past five years a great deal has been said about the need for conserving energy. Generally our free enterprise system has recognized a market and responded with a multitude of products which can be used to address the problem. The products available range from energy efficient lamps to the “Black Boxes” that are used to control energy consuming devices. Every individual responsible for the operation of a physical plant is obligated to evaluate the products available. However, the prime consideration should be the cost of the product versus the reduction in the cost of energy effected by the subject product. I.e. How long will it take for the savings effected to pay for the product utilized?

Consider fluorescent lamps. Lamp manufacturers have made available 35 watt fluorescent lamps that can be used in place of 40 watt fluorescent lamps. Over the 20,000 hrs. life of the average lamp (Depending on the frequency of which is turned on and off). The energy saved by the use of the 35 watt lamp amounts to a cost reduction, at 5 cents per KWH, of $7.00 over the life of the lamp.

Typically 35 watt fluorescent lamps cost anywhere from twenty to fifty cents more per lamp than a F40CW. Is there anyone who would not like to have a return on an investment of 14 to 1 over the life of a fluorescent lamp?

One word of caution: consideration must be given to the task being performed in an area before a switch to 35 watt fluorescent lamp is made. If personnel working in the area must examine colors, i.e. skin tone, it may be inadvisable to make the change. However, even with that reservation there may still be many areas where the switch can be made.

Similar savings can be realized utilizing lower wattage elliptical reflector lamps in most recessed light fixtures. The aforementioned savings are realized by the simple process of changing a lamp in a fixture. A routine maintenance function.

When installing outside lighting serious consideration should be given to the use of high pressure sodium lighting. This lighting offers approximately twice the light output of mercury vapor for the same wattage lamps. However, one must consider the use of the area served by the lighting and should consult with a reputable salesperson.

Other techniques require the installation of a device or devices that will allow control of energy consuming devices. There is no end to the number of sales personnel who have devices that will cut costs by 5 to 20 percent. Careful analysis must be made of the offered device and the loads controlled.

At the Bon Secours Hospital in Methuen, Mass. we are able to duty cycle 205 incremental air conditioners with a cam timer costing under $200. This is done by dividing the controlled units into three groups and designing a control system that allows only two of the groups to operate at any given time. The Duty Cycle chart indicates the on and off time of each group. Each group load is approximately 100 kw of load. Each cycle is eight minutes long. Notice that any given group is on for sixteen minutes. Each incremental air conditioner in the controlled system is equipped with a random start relay that will turn units on anywhere from 0 to 90 seconds after the power is applied. This prevents all the units in a group from coming on line at the same time.

Only the compressor in the above units are controlled. The circulating fans run on will. Personnel utilizing the areas cooled by the controlled incremental units can hear and feel the blower running and are content even though the temperature may swing a little more than it would if the incremental units were not controlled. Because all the units serve areas with windows they are all controlled by an enthalpy control which does not allow them to operate if ambient conditions are such that the windows can be opened.

Additionally, if a determined demand level is approached the incremental units along with all the mechanical loads are picked up by the hospital’s emergency generators. This is accomplished with the use of a demand limiting meter. However, should a power failure occur all air conditioning systems being operated by the generator are immediately disconnected.

While a great deal of time and effort went into the installation of the described system the controlling device is an inexpensive timer. Everything else that was done would have had to have been done no matter what type control was used.

Sales personnel have told this writer that their device can save more. However, pay back for any offered device must not be based on the total energy cost reduction, but on the cost reduction in excess of what has already been achieved.

It is this writer’s belief that the question that must be asked when considering the purchase of a device that will control energy consuming loads is: Shall an expensive device saving “X” dollars be purchased or an inexpensive device or devices that will allow a savings of “Y” dollars? The point is that the pay back should not be based on a savings of X dollars but rather on the difference in cost of the controlling methods available, namely X-Y dollars.

It is not this writer’s intention to suggest that we at the Bon Secours Hospital have done all there is to do or that we will not utilize an expensive device to do more. We are once again considering the use of a computer. However, the recommendation of the purchase of a computer must be based not only on energy costs, (where pay back could be over five years), but on what the computer has to offer; such as: 1) Fire Alarm System that offers detailed reporting, 2) Increased Security, 3) Data feed back from Energy Controlled areas, 4) Preventive Maintenance scheduling and record keeping, 5) Monitoring of critical motors and bearings.

MORE EFFECTIVE CONTRACTING

Owner has final authority for major decisions and is responsible for success or failure of the job. Someone must insure adequate planning, organization, leadership and controls. This should be a knowledgeable hospital staff member but it could be architect, contractor or other consultant.

Maintenance engineer, knowing his facility and utilities and how connections can be made with least disruption, must inform the architect of preliminary plans and specs. are started.

Team approach has produced designs more reflective of owner’s desires, at earlier date with better quality materials and workmanship and — with proper incentives — lower cost. Construction duration is critical as material costs escalate. Thus, core of building team must be selected early and value engineering started as early as possible to involve all parties in common goal of producing desired facility in shortest time period.

Team selection is critical and should be based on the following:

1. Communication effectiveness. 2. Ability to understand owner’s organization and concepts. 3. Ability to perform as a member of the team. 4. Understanding and experience with the team approach utilizing the design/build fast track methods. 5. Performance ability and record of completing hospital jobs on time and at a reasonable cost. 6. Design creativity and innovation. 7. Experience and stability. 8. Current workload and staff. 9. References for recent hospital projects.

Due to high rate for average construction worker, mechanical/electrical contractors should become part of team early to contribute their experience. These contractors should have thorough knowledge of details well in advance of use of field personnel.

All contracts should encourage the following:

1. Firms must work together using collective talents in best interest of the owner. 2. Owner should be team leader. 3. Value engineering and pre-final design estimating. 4. Early fee decisions for each firm. 5. Proper incentives for planned productivity of field manpower to hold down crew size. 6. Elimination of peak crew sizes. 7. Guaranteed maximum price at a predetermined time in preparation of plans and specs. 8. Earliest material procurement. 9. Start of construction as soon as possible.

Project manager (owner) should set targets and assess progress periodically in team meetings. Deviations should be rectified quickly. Cost control and accountability systems are maintained by owner for monitoring, analyzing, evaluating, control of costs, authorizing progress payments and final release of retainages.

—Editor summarized Mr. Marble’s submission.