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Details the findings and recommendations of an AID tour of inspection undertaken to identify, and suggest remedies for, maintenance problems in representative Honduras hospitals. This report contains a brief review of the project's history and overall development, a general summary of findings and recommendations, and a step-by-step account of the inspection tours. Inspections were conducted at the Maternity Hospital, the Chest Disease Hospital, San Felipe General Hospital, and the Comayagua Regional Hospital and Health Center. The final section discusses the report's recommendations in detail. Appendices list people interviewed, provide photographs and catalog cuttings illustrating hospital equipment, and present sample job description forms for hospital maintenance staff.

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A REPORT OF A SURVEY OF HOSPITAL MAINTENANCE

IN

HONDURAS HOSPITALS

From December 8-19, 1974

Submitted by:

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and

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INTRODUCTION AND BACKGROUND

The Engineering Division of the United States Agency for International Development (A.I.D.) received a request from their branch in Honduras to recruit a Hospital Engineer who could both identify maintenance problems of representative hospitals of the Ministry of Public Health and Social Welfare in Honduras, and at the same time, implement required corrective action and teaching programs for the Ministry's personnel. The staffing requirement indicated a mission of about two month's duration with the added specification that the person selected be bilingual in Spanish and English.

Because of difficulties in locating an individual with such a background A.I.D., in November of 1974, turned to the American Hospital Association for advise and assistance. The Association was fortunate in locating a qualified and experienced Hospital Engineer who offered to cooperate on this project. The Engineer however was not bilingual. Because of the two month time requirement in the staffing pattern it was suggested to A.I.D. that an alternate approach to their request be considered, i.e., that a two man team make a short term survey to inspect physical hospital facilities, identify the problems, and then, in conjunction with Honduras Ministry officials, establish a basis for treatment.

This alternate proposal was accepted by the United States A.I.D. Mission, and the two man team which was selected included Mr. By A. Bershad, a licensed Professional Engineer and Assistant Vice-President of the Lutheran Medical Center of Brooklyn, N. Y. and Dr. Jose Gonzalez who is a Physician Administrator and Project Director of the International Program of the American Hospital Association and who speaks Spanish and English fluently.

The team arrived in Tegucigalpa Honduras on December 9, 1974 and reported to both Dr. Jacobo Santos, Director of the Hospital Division of the Ministry of Public Health and Miss Barbara Sandoval, of United States A.I.D., to formulate and plan the scope of work. The team remained in Honduras for almost two weeks during which time inspections of hospitals and clinics were conducted and conferences were held. Several meetings took place with a number of officials of the Ministry of Public Health, including the Vice-Minister, and with representatives of the teaching hospital, presently under construction, for the purpose of providing some preliminary help in the selection of medical and surgical equipment. Prior to departure, the team held a conference with ministry officials to generally review their findings and recommendations which they indicated would be submitted in written form at a later date.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

A. In each hospital visited there was evidence of serious, and in some cases potentially hazardous, problems resulting from inadequate maintenance of plant and equipment. Patient care was severely curtailed by inability to use costly diagnostic or therapeutic equipment lying idle because of a lack of spare parts and or trained operators.

B. Personnel assigned the responsibility of performing maintenance functions were in every case too few in number to properly meet the requirements of the institution. In a great many instances maintenance personnel are inadequately trained and seek solutions to problems by "trial and error". There is no one in government service who could properly be called a Bio-medical Equipment Technician with the responsibility of maintaining and repairing sophisticated electronic equipment such as Cardiac Monitors, EKG Machines, Defibrillators, Laboratory Equipment, etc.

C. A beginning is being made on the national level to establish a central engineering and maintenance department to help meet the maintenance needs of the country. An inventory of existing equipment is being prepared and a proposed table of organization is being developed in order to provide trained personnel

in needed disciplines. These trained individuals will have to be brought into the Ministry from the engineering faculty or student body of the university or from private industry. If this is not feasible the only alternative is to provide substantial training so that existing maintenance personnel can upgrade their skills.

D. The problem of providing adequate maintenance for existing plant and equipment must be seen as a long term problem requiring a phased approach. It is hoped that certain initial suggestions can be implemented immediately while other recommendations may be put into effect over a period of several years.

E. The key to the successful development of a National Hospital Engineering and Maintenance Center is the commitment by the Ministry of Public Health to allocate adequate resources for personnel, tools and space and the national planning of equipment purchases. Alterations to existing health care facilities and the construction of new institutions in line with developed national standards or guidelines will greatly improve the ability of this National Hospital Engineering and Maintenance Center to maintain Honduran hospitals.

F. We suggest that consideration be given to the setting up of a national center for the training of Hospital

Engineering and Maintenance Technicians in the new teaching hospital. Adequate workshop space could be set aside for maintenance and training and the shops should be well equipped with the instrumentation and tools which will be necessary to maintain this new sophisticated facility.

IMPRESSIONS AND FINDINGS

A. Preliminary Meeting

Shortly after we arrived in Honduras a meeting was arranged for us with Dr. Jacobo Santos, the Director of the Hospital Division of the Ministry of Public Health. We met with Dr. Santos and his Director of Engineering, Hector Zuñiga. The following items were reviewed:

1. The original intention had been for us to visit only one hospital. The intention of the Ministry is to now have us visit a large number of hospitals to try helping in the development of a national policy regarding engineering and maintenance practices. A tentative itinerary was set up to include visits to hospitals in Tegucigalpa and in rural areas. We will be accompanied by Mr. Zuñiga and other health officers.

2. During the discussion it was suggested that we prepare a report for an engineering seminar to be held prior to our departure. We were provided with a prior report written by a Professional Engineering Consultant from the Pan American Health Organization who had visited Honduras recently. Mr. Zuñiga also provided us with other written material.

3. The Director of Engineering, who appears to be a dedicated and capable young man, stated that only one X-ray Repairman and one other skilled technician exist in the entire country. (I assume he means within the framework of the Ministry of Public Health). These men are assigned to specific hospitals because there is at the present time no organized Central Bureau of Maintenance and Engineering. Mr. Zuñiga also mentioned that the country is divided into seven general Health Districts and that there is very little communication between them on an engineering level. It would seem that if this talent is so rare it should certainly be centralized and shared by all of the hospitals in the country through some sort of a central facility. the X-ray Repairman, for example might select one individual in each hospital who could work with him performing repairs at that hospital and, in this way at least be given some indication of how to effect simple or minor repairs.

4. We are told that electrical power is provided through 4160 volts, 3 phase, Y-type configuration and that there are frequent power outages. Dr. Santos mentioned that all hospitals now have emergency electrical generators but we do not know what the capacities are, which areas they serve and how loads are transferred. Mr. Zuñiga said that he has

started to create, or is in the process of creating, standards for emergency power so that each hospital would be assured that electrical service could be provided to critical areas during a power outage.

5. The question of Codes or Standards was thus raised obliquely. It seemed to us that in both the construction of new hospitals and in the operation of existing institutions that there must be some sort of minimum standards to conform to.

6. The Director of Engineering mentioned that his major problems seemed to be the following:

   a. Lack of information about existing equipment including wiring diagrams and operation and/or maintenance manuals. In addition he said that there was a lack of response by the companies to whom he had written in an attempt to attain this material.

   b. The lack of trained personnel and insufficient money to set up any sort of an in-depth training program for existing maintenance people.

   c. The necessity of having the people at the very top level recognize the importance of Hospital

engineering and maintenance and to provide the necessary support for these functions.

7. Mr. Zuñiga has been in his present position for about one year and is a graduate Civil Engineer. He showed us some of the positive steps he has taken to improve the maintenance and engineering function. He has started an inventory of all of the hospital equipment in the country. He has also developed a new coding system for cost centers and for allocation of personnel.

8. He mentioned that they had had a problem at the maternity hospital because their boiler water supply included a lot of sediment. He mentioned that some sort of a filter was devised to help eliminate this problem but that the water was very hard. He mentioned a figure of 394 parts per million of solids. We are unclear because 394 parts per million (ppm) of total disolved solids is not at all a bad figure but 394 ppm of hardness is an extraordinary large reading and can be very harmful to boilers.

9. The map of the country shows that it is divided into eight specific areas but only seven Health Districts. We have found out that there are

private institutions as well as government run hospitals in Honduras and this leads us to question how these private institutions cope with their problems of equipment maintenance and repair. We wonder whether there are outside service companies that provide service for elevators since there are a number of tall buildings, including hospitals, throughout Tegucigalpa.

10. At the conclusion of our meeting we agreed that we would try to look into the following areas:

    a. The Boiler Plant
    b. Electrical Distribution Systems
    c. X-Ray Areas including shielding
    d. ICU/CCU Areas
    e. Emergency Room Areas
    f. Bio-medical equipment maintenance
    g. Air Conditioning and Refrigeration Systems
    h. Elevators and other transportation systems
    i. Operating and Delivery Suites
    j. Laboratories

11. We wonder whether they would be agreeable to arranging with some local water testing company, if such exists, a monthly or bi-monthly check of the boiler water supply together with an analysis and program of treatment.

B. Visit to the Maternity Hospital of Tegucigalpa

The very next day we had an opportunity to visit the maternity hospital in Tegucigalpa (Hospital Materno Infantil). This institution is the newest hospital in the Ministry and adjacent to it is a school of nursing. Facing the school of nursing and this hospital is a very large construction site where a new thousand bed teaching hospital is presently under construction. We were told that the maternity hospital was completed about 10 years ago but has been occupied for only the past five years. We met with Dr. Carlos Medina, Director of the maternity hospital, and Engineer, Manuel Rosales, who is the Chief Engineer at the maternity hospital. All of us, together with Mr. Zuñiga, toured the hospital and we noted the following:

1. We visited the elevator machine room on the roof of the building. All four elevators are working and the hoisting equipment appears to be in good condition. They appear to have been lubricated recently. The elevators are of Swedish make and the hospital has no parts lists or manuals available.

2. We next went into the kitchen area and were immediately made aware of the peeling paint in the walk-in refrigerator and freezer boxes. We suggest that the loose material be scraped off

and that either asbestos or stainless steel pads be fastened to ceiling and wall areas to try to reduce condensation and peeling. We also noticed ventillation hoods over the range area with washable filters which we were told are cleaned each month. There are no fire dampers in the duct-work at all and the fluorescent light fixtures which are directly over the food preparation areas have no shields or lenses.

3. We then walked to the electrical service room which is nearby and noticed that soiled and steam lines were routed over the main distribution panel. We suggested that some sort of drip pan protection be provided above the main distribution panel just in case any leaks should develop in the piping. We checked the transfer switch in the emergency generator. We were told that it is energized upon the utility company failure but that it does not automatically switch back to normal power when the utility company comes back on the line. Dr. Medina mentioned that it only takes about 17 seconds for emergency power to be provided when a power outage occurs. The switch directions are in English and on Friday the hospital electrician and I hope to check out the solenoid

switch and relays. Each section of the main distribution panel appears to be tagged with the area that it serves.

4. We visited the equipment repair shop where some men were repairing a hinge on an incubator. They have a nice test bench but absolutely no test equipment for extensive Bio-medical equipment testing.

5. Next we went to the boiler room where they have two York boilers. We were told by Dr. Medina that he was informed that the ph of the water was very high and that this had not been tested in a long time. In Summer, when surface water is not available, they are forced to rely on very hard well water. This has naturally caused problems so they have contracted with a water softening company to reactivate a softening system for their boiler feed water.

6. Near the boilers is the emergency generator which appears to be a small unit (perhaps about 40 kva) with an air cooled radiator which supplies emergency electrical power to the Operating Suite and a few other selected areas. Dr. Medina mentioned that he is planning to buy battery powered emergency lights for the Operating and Delivery Suites.

He said that he would appreciate any suggestions that we had regarding manufacturers and/or model numbers.

7. We were told by Mr. Carlos Davila, who is the Supervisor of Electro-Mechanical Maintenance that the utility company provided only two transformers instead of three in the boiler room and that, as a result, certain circuits were overloaded. He mentioned that fluctuations in voltage, particularly on the high side, were destroying some equipment and causing substantial problems.

8. We were then taken to the laundry room where much of the equipment was of Swedish make. Again there were no manuals or wiring diagrams. Eventually, we were told, this equipment will be replaced by United States equipment, hopefully with all required manuals, parts lists and diagrams. Mr. Davila showed us fused circuits he had set up for each machine to prevent motor damage in the event of voltage rises. It appeared to be a good, well thought out attempt to cope with this problem. We suggested installing recording voltmeters on the utility company service entrance to see whether or not it was the utility company (as the hospital claimed) or the hospital (as the utility company claimed) which was responsible for the voltage

fluctuations. Dr. Medina indicated that he or his Engineer, would try to reach the utility company to borrow their recording voltmeters for this purpose.

9. We were told that the maintenance staff changes about 300 circular fluorescent lamps each month. This is certainly excessive and may very well be due to voltage overloads. We also mentioned that their light fixture ballasts can start to fail after 8 to 10 years of operation and that they can expect some smoky ballast fires in the near future. We mentioned that we would try to check on General Electric Circline lamps that might be used with these fixtures to produce a longer lamp life and we will try to get the catalog number of the existing light fixtures.

10. Next we visited the storeroom which was clean, well lit and well stocked with neat metal shelving properly tagged and numbered. It appeared to be a well kept supply area with good record keeping.

11. We then went to the Central Sterile Supply area and found a number of pieces of American Sterilizer Co. (AMSCO) equipment lying unused because of a lack of manuals or instruction booklets. There was a large AMSCO gas sterilizer that had not worked

since its installation almost 10 years ago. We were told that an AMSCO representative had visited the hospital and said that nothing could be done to put this unit into operating condition. We agreed to return on Friday in order to test an old AMSCO bottle washer and to collect any available data on the AMSCO hypodermic needle washer and gas sterilizer. This information might help us to obtain necessary instruction booklets and other material which we could then send back to the hospital.

12. When we visited the laboratory we were told that they cannot use much of their equipment when the X-ray Department, which is directly below them, is shooting. We hoped to be able to check out internal circuit loads later on, possibly on Friday. They also have about a dozen pieces of other equipment, possibly $50,000 worth, which is stored unused in a large room since they are not certain just what this equipment does or how to use it. Again we found no manuals, instructions, etc. and it appears that much of this equipment is U. S. made.

13. Next we visited the X-Ray Department where they have two diagnostic rooms. One room was not

being used since the horizontal tube holder on the vertical arm had broken the day before. Both Dr. Medina and Mr. Rosales were surprised since this breakdown had not been reported. Control booths do not have leaded glass although it does appear that the walls and doors are lead lined. We do not know whether they keep the outside doors connecting the X-ray rooms to the waiting area closed while shooting since there is no electrical interlock between the X-ray control and the door.

14. Oxygen control valves are visible and available on each floor but there are no signs indicating what they are or which rooms they control the flow to.

15. Fire extinguishers are not maintained. We saw a soda acid unit that had not been checked for almost three years and would probably not work. There were very few extinguishers anywhere and we did not see any CO^2 units, either in the kitchen, laboratory, or radiology. We were also told that the fire alarm signal system within the hospital does not work.

16. We noticed that the wrist blade handles on almost all the lavatories are so badly offset that to operate them would require someone using their fingers. We thought that we should check to see

whether or not each fixture is valved separately and whether or not they replace washers on faucets periodically because there were a large number of leaky faucets.

17. We visited the Operating Room which is the Delivery Suite and noted many potential problems. The nurses call system, an Executone Unit, was out of order. Doctors, Nurses, etc. use expensive conductive shoe covers but we did not see a Conductometer to check on whether or not personnel are correctly dressed before entering the Delivery Area. We were told that the floors in some of the Operating Rooms were of conductive material. It appeared to be a conductive linoleum or sheet material which was terribly worn in certain areas. Some of the rooms had in fact replaced the worn conductive material with a non-conductive floor tile. No tests are performed on conductivity of floors since there is no test meter available. In addition no one checks the casters or wheels of movable equipment to guarantee conductivity.

It appears that many movable items of equipment are not conductive and this can be a serious problem in a Delivery Suite where Cyclopropane is used, as it is here, as an anesthetic. The nurse in charge pointed out a ground fault detection system, which,

when turned on, alarmed for each of two settings. When the red pilot light came on and the buzzer sounded the Head Nurse simply turned the system off. At first we thought that there might be ground faults in the system that should be checked out by the electrician. We were told, however, that the power system to each Delivery Room or Operating Room is not via an isolation transformer and, if that is so, the ground fault detectors would be absolutely useless and, in fact, should alarm for a grounded system. This item will have to be checked further.

In addition several of the Operating or Delivery Rooms have very large surgical lights which are ceiling mounted. We were told that none of them work and this seems very surprising. If, as was mentioned by the hospital personnel, it is impossible to obtain parts from the German company that manufactured these lights it would still appear to be possible to cannibalize possibly two of these units so that the others can be put into proper working order. This Delivery Suite also has a crash cart with a defibrillator and an EKG machine and it is stored, covered with canvas, in a room with tanks of oxygen and cyclopropane. We were told that the defibrillator has been tested and that they have never used it on a patient.

18. We also visited the Nursery Area where normal infants, after the first six hours, room-in with their mothers. We noticed no isolettes, but we did see three incubators and one hyperbilirubinemia unit with standard day light fluorescent lamps. The Nursery appeared to be in good shape and the nurses certainly seemed conscientious.

19. At the conclusion of our inspection we remembered that there were certain questions that we had forgotten to ask and that they included such things as:

a. Do they have a written work order or work request program?

b. Do they keep written records of tests or inspections?

c. Does the Engineering Department have a Table of Organization and how many people does it include? Are there any night maintenance men?

d. Does the hospital have valve charts indicating where each valve is, what it controls (water, Medical gas, steam, etc.)?

After the inspection of the hospital facility we reviewed the concern that had been expressed to

us regarding the teaching hospital presently under construction. The Ministry of Public Health has absolutely no on-site personnel to review plans, check installations and coordinate the needs of the proposed medical staff with the construction process. In effect medical and engineering personnel will be handed a complete 1,000 bed teaching hospital with sophisticated systems and equipment. It could be a medical and engineering nightmare. Dr. Medina told us that in his hospital the contractor had run electrical cable right next to the O_2 riser without encasing the cable in conduit or pipe. The wire short circuited directly against the O_2 piping causing a fire which they had great difficulty in extinguishing. This new hospital could have similar kinds of problems. In addition there does not appear to be anyone coordinating equipment purchases so that the possibility exists that equipment can be bought for which no built in services are provided. We would strongly recommend an on-site Engineer during construction who would be able to take over the engineering and maintenance function in this new hospital when it is finished. We are also of the opinion that there must be continuous input by the medical staff and engineering people at the upper level of the Ministry.

It also seems to us that it might be a good idea,

in view of the many electrical problems, to have an Electrical Engineer spend some time here. He could probably correct some of the problems, set up maintenance recommendations, suggest corrective action for the Operating Room Area, etc.

C. Chest Diseases Hospital, Tegucigalpa

Our next visit was to the Chest Diseases Hospital in Tegucigalpa. We were given to understand that this hospital had been built during the 1940's and had originally included maternity functions which were transferred to the Hospital Materno Infantil when that institution opened about five years ago. We met with Dr. Mencia, the Director of the hospital, who told us that this facility is primarily used for the treatment of diseases of the chest, such as tuberculosis, and that there are about 400 occupied beds and six or seven maintenance men, including a supervisor. This maintenance crew is responsible for buildings and grounds of which there are about ten acres! The crew does everything including the trimming of shrubs and cutting of grass, painting, carpentry and general maintenance. The grounds look very attractive and is evident that a good portion of the men's time is spent outdoors. We believe that the staffing for this hospital is grossly inadequate. The Hospital Executive Engineers Association of Greater New York recommends a minimum of five to ten

maintenance men for each 100 beds. After meeting with Dr. Mencia we started our tour of the hospital facility and noted the following:

1. The Electrical Maintenance Shop was the first place that we visited. To get there the maintenance supervisor had to reach in to an open elevator shaftway so that he could manually yank on the control cable to activate the elevator motor. The hoistway door is always open and represents a hazard. The Electrical Maintenance Shop is about 5' by 6' and includes a small work bench, a large electrical distribution panel, and appears to have absolutely no test equipment. Parts are hand made for equipment repairs when possible.

2. In the corridors we noted many incandescent ceiling fixtures and a few fluorescent fixtures. The Maintenance Supervisor said that the fluorescents last him about six months while he changes the incandescents about every eight days. This must be an over voltage situation. We suggest a substitution of 20 watt fluorescent strips for the 60 watt incandescents. This would not only give more light but it would reduce the energy consumed and save money by sharply cutting lamp replacement time. We're told that the hospital has no money

for fixture replacements. It was pointed out that the cost of replacements would be more than made up by savings within a few months.

3. We then visited the Kitchen Area where we found that almost all of the refrigerator and freezer walk-in boxes are out of order. The two boxes in use are mouldy on their wall surfaces and there is some peeling of paint. The boxes do not appear to be clean.

The Kitchen generally is a disaster area and appears to be ready for total replacement. Sinks are old, are corroded and are germ catchers as are all of the food preparation work tables which are made of wood. There is a juxtaposition of very old poor equipment and some few shiny new pieces. We can't begin to suggest palliative measures of preventive maintenance here when what is really needed in this area is radical surgery. Some of the things that are required include new flooring to replace the old chipped, cracked, eaten floor, new lights, new equipment, such as sinks and tables, etc.

Some time in the past it was decided to close up an open patio adjacent to the kitchen in order to expand the staff dining area. When the roofing was

extended no provision was made for storm water drainage and there was consequent flooding. Eventually leaders and gutters were installed but they are unable to handle heavy runoffs during the rainy season. Roof leaks are one result.

4. We next visited the emergency generator area where a small 75 kva Caterpillar unit appears to be in good condition. It is obviously too small for this hospital and it takes about 1/2 hour before it can be used in a power outage because they have to run around and turn everything electrical off by hand if they expect the generator to pick up the load in the Operating Suite.

They are planning to open a new Coronary Care Unit next month and that is not on emergency power. They do not test their generators since fuel is expensive and in short supply. In the same area with the emergency generator is a pressurized water tank which delivers water throughout the hospital complex. The tank is fed by an open cistern with a small cover over it. It is open to the elements and exposed to waste and bacteria. The piping is quite old and some of it appears to be lead.

5. We then visited the "Boiler Room". It is really a large open shed with a big old fashioned wood burning

boiler that provides steam only for the laundry, which is adjacent to it, and the kitchen. The pressure gauge read 80 psig but Dr. Mencia said that the gauge isn't correct and I am certain that it isn't. There was a small supplementary oil fired boiler that is used when the large wood burning unit is shut down for repairs or cleaning. Fuel (wood) is purchased locally. There are very few controls or indicating instruments on either boiler. No hot water is provided to the Operating Suite or, in fact, to any treatment or patient area.

6. Next we passed through some patient rooms. They were busy preparing two large wards for a cardiac catheterization laboratory which they planned to open shortly. The wards were clean, airy, and adequate in size but there was no nurses call, no overbed lights and a bare minimum of furniture.

7. One large room near the vacant wards had been converted into a cardiac catheterization laboratory. The equipment included new General Electric radiographic equipment and a large Hewlett Packard Sanborn diagnostic and monitoring unit. The only problem that Dr. Mencia told us about was that the doctor who knows all about the operation of this equipment had recently died and no one else in the hospital knows how to use these items. Dr. Mencia mentioned that he is presently trying to obtain

the operating manuals that this recently deceased physician had taken home with him. If he does not obtain them we believe that it would be possible to approach Hewlett Packard Co. and obtain the manuals for him. We think that it would be extremely helpful if a Hewlett Packard representative, or a very experienced Bio-medical Equipment Technician, spent some time here to train personnel in the operation and maintenance of this equipment. If this is not done this entire laboratory may soon not be usable. The general appearance of the laboratory is clean, well lit and large enought for special procedures.

8. Next to the cardiac catheterization area is a small hematology laboratory with a few small rooms. A couple of pieces of laboratory equipment were out of order and not working. The laboratory technician tries to maintain the equipment to the best of his ability but he complained to us that one company refused to send him a spare thermostat without an "open" purchase order. He told us that his ph meter, made in Copenhagen, Denmark, requires new tanks of gas with concentrations of O_2 and CO_2 mixtures. (The unit is an Astrup Micro-Equipment Radiometer). He has evidently purchased some O_2-CO_2 mixtures from the U.S. but he told us he was unable to purchase a tank of 96% O_2 and 4% CO_2 which he also needs for his ph meter.

9. We then visited the Operating Room Suite which consists of two rooms, one for major surgery and the other for minor surgery. The rooms have no emergency battery powered lights and we are told that it usually takes about 30 minutes to restore some lighting whenever there is a power outage. The Operating Rooms have explosion proof outlets below 5' which is a safety feature since they use both cyclopropane and ether for anesthesia. It would, of course, be very much safer for both this hospital and the maternity hospital if both institutions substituted non-flammable anesthetic gases. The Operating Rooms are clean and the major room has a through-wall air conditioner which is similar to the Operating Rooms that we have seen in the Hospital Materno Infantil. Dr. Mencia said that they can only use the minor room for about 1/2 hour at a time because this room is not air conditioned. The filtration of air through window air conditioning is certainly of a low quality and we did not ask about the frequency of filter changes. Conductivity of flooring and equipment does not appear to be maintained. Each Operating Room does contain piped in O_2 and suction.

10. Next to the Operating Suite a small Central Sterile Supply Area opens into a large courtyard. There is one old Castle sterilizer and distilled water still, both of which are electrically operated.

A new sterilizer is also in this area but Dr. Mencia explained that he does not want it connected at this time because he is planning to expand the Central Supply area into the courtyard. All the cleaning procedures are performed by hand.

11. The Recovery Room is next to the major Operating Room and appears to be large, clean and airy. There is no nurses call system but they do have piped in O_2 and vacuum. The bank of O_2 presently consists of one full tank in use and one tank in reserve although we are told that the O_2 banks will be expanded.

12. Next to the Recovery Room is the soon-to-open Coronary Care Unit. It presently consists of four beds plus one crib with a capability of six total stations. The unit is clean, spacious and quite modern and is well equipped with General Electric Monitoring Equipment and an American Optical Cardioverter that Dr. Mencia had himself salvaged. As a result of his effort this Coronary Care Unit had an extraordinarily low cost and despite minor deficiencies such as a lack of I.V. tracks, cubicle curtains, nurses call, elapsed time clock, etc., the overall unit is really quite excellent. One problem is that

it is not supplied through an emergency electrical distribution system and it is also susceptible to the voltage fluctuations that affect this hospital. A second problem is that there are no manuals or spare parts, such as fuses, styli, paper, etc., which will be required to keep this unit operative.

It might make sense to consider, since space is available, a small (possibly 10 kva) electrical generator for providing emergency power to the entire Operating Suite, Coronary Care Unit, Catheterization Laboratory and ancillary areas. The doctor says that the government would never approve this expenditure. Training was provided by a United States nurse to the Coronary Care Unit personnel but there is no one on the hospital staff who can, or is assigned to, maintain this sophisticated equipment.

13. Dr. Mencia then took us to another laboratory area where specimens were kept. This area is being altered in order to extend the laboratory rooms and provide additional services. Rooms are also being taken away from pediatric play areas, which are on the same floor, for conversion to laboratories. We notice that children play every where with no supervision or control and one six or seven year

old walked into an unattended treatment area where a hot electric bottle steriliser with a defective plug was in operation. We asked whether the kids try to push things into the electric receptacles in Pediatrics and we were told that all electricity there is turned off. The children are crowded into large rooms with absolutely nothing but cots or bunk beds. There are no lights, furniture, no T.V., no toys. The toilet areas are centrally placed on the floor so that children have to get up at night and walk out into the cold air to search for the right place to go.

14. The general adult rooms are similar to the Pediatric Area although they are not as crowded. There is some furniture and an occasional electrical outlet but there are no nurses call systems, overbed lights, T.V., etc.

15. We also noticed during rounds that there were no fire extinguishers. We could see that there had been some at one time but they had evidently been removed and never replaced. We also noticed in the Coronary Care Unit Area that there appeared to be some very fine wood particles resting on an O_2 tent and when we asked were there termites we were told that there very well could be.

The contrast between this hospital and the Hospital Materno Infantil was quite striking, mostly because of the very different physical plant. The interesting thing is that each hospital director recognizes the importance of trying to obtain adequate maintenance of plant and equipment. It seems to us, once again, that there has to be some long term concern with the setting up of standards of construction and operation of hospitals to try to guarantee that essential services are provided and maintained. For example we wonder if each hospital has some sort of a minimum number of square feet per patient bed as a guideline. Shouldn't there be a written guideline indicating exactly which areas in a hospital should be served by an emergency generator? It is possible that we could simplify some State Hospital Code as a guide in order to achieve a beginning. Possibly some other Central American countries may have such a guide that could be adapted for use here.

D. San Felipe General Hospital in Tegucigalpa

We visited the San Felipe hospital which is an acute care general teaching hospital of 725 beds, 525 of which are currently in use. The hospital is about 80 years old and there have been a number of alterations over the past years. Some alterations appear to be taking place at the present time.

The facility is large and airy and generally one story high with wide courtyards. We met with Mr. Miguel Angel Silva the Administrator of San Felipe and toured the facility, noting the following:

1. First we visited the kitchen area which was very old. There were corroded sinks, wood tables for food preparation, poor natural ventilation and light, juxtaposed with some few stainless steel food delivery carts. The flooring appeared to be in good condition but the wood tables and the sinks are serious potential sources of infection. The Administrator had salvaged a food tray conveyor with eight wells and had set the unit up in the cafeteria. It appears that the unit was designed for the preparation of patient trays but it lacks eight stainless steel food pans, each about 20" x 12", and they are not using it. We believe that we can obtain the food pans for the hospital and they can then use this conveyor, which does work, to semi-automate the preparation of patient meals. This should save a substantial amount of time.

2. While we were in the kitchen we were also told that the hospital has many electrical problems and that every day bulbs burn out. Mr. Silva

also mentioned that it takes about five minutes for emergency power to be provided in the event of an outage and that the emergency generator is a small one that operates with a manual switch. Before turning the emergency electrical generator on it is necessary for the maintenance men to run around and turn everything else off by hand.

3. We then visited a small clinical laboratory which the Administrator said is temporary. A Leeds and Northrup ph meter and a Coleman Spectrophotometer were not being used because there were no instruction and operation manuals. We found that the pipette shaker is also broken and is unused.

4. We next visited the Pharmacy where we were surprised with the sight of two relatively new CO_2 fire extinguishers. They are about one year old, according to Mr. Silva. They have not been checked and, in another year or so, might be useless in fighting a fire. Replacement CO_2 cartridges have to be ordered from the vendor if replacement is necessary. First, of course, there must be some procedure for weighing these units periodically.

5. We visited the Operating Room Suite where there are five functioning rooms. They appeared to be of adequate size and each had surgical lights with piped in oxygen and suction. We were told that

they have conductive flooring although no one tests the flooring or the equipment. Once again we feel that non-flammable anesthetics would be considerably safer and cheaper since they would not need items such as the expensive conductive shoe covers which they presently use. The through-wall air conditioner in at least one of the rooms appears to have no filter.

6. The Recovery area has six beds and is about the minimum size for a Recovery Room with five Operatories. It seemed to be clean and bright and contains piped in oxygen and suction.

7. There are no boilers and there is no hot water provided to any hospital area. The laundry for San Felipe is done at the adjoining Chest Diseases hospital which is directly adjacent to this hospital.

8. We next visited the X-ray Suite and were told that none of the three X-ray Rooms is fully operative. One room has an image intensifier that cannot be used because of a faulty motor. A second room also has a burned out motor and, as a result, cannot use its tomography equipment. All of the X-ray units are General Electric. We were told that there are no spare parts and, as a result of not replacing two inexpensive motors, tens of

thousands of dollars of expensive X-ray equipment cannot be used. This equipment, if not repaired, will eventually not be repairable and will thus be wasted.

9. There is also in the Radiology Department a Cobalt Therapy Room, the only one of its kind in the country. It appears to be in good condition and has been in operation for about three years. The shielding appeared to be adequate. Here too we find other unchecked or un-maintained fire extinguishers.

10. We next visited a newly altered section where the medical school had set up a frozen section laboratory and autopsy room. The Pathologist complained of power outages which ruined his specimens but I can't believe that continuous power would be provided to prevent this occasional occurence. We inspected the Lipsky autopsy table and found no vacuum breaker on the water supply plus an aspirator which could possibly lead to contamination of the hospital water by way of infectious material being syphoned into the potable water supply. We had seen potentially hazardous smilar connections in other locations including laboratories. We would strongly recommend the immediate installation of vacuum breakers at all autopsy tables and laboratory

sinks where hose connections or aspirators are used. Vacuum breakers incidentally, are quite inexpensive and should cost something like $4.00 U. S. currency.

11. We then visited the emergency generator room which is directly adjacent to the emergency generator room of the Chest Diseases hospital. This is a Caterpillar 104 kva, 75 kw, unit and the men on duty say that they experience outages about once a week, usually on week ends, of about 1/2 hour duration. The hospital keeps one man on duty at the emergency generator seven days a week, 24 hours per day. The maintenance man told us that before he can turn this unit on he has to call the Cobalt Room and have them turn off all their power so that his generator can pick up the load. He mentioned that there are at least two separate electrical services to the hospital from the utility company but we did not see either one of them.

12. Mr. Silva then took us to visit a newly renovated area where they have started to set up a Central Sterile Supply room. There is only one autoclave, an AMSCO electric unit, and if that should fail they could have a serious problem. We could not find out whether they have manuals for this equipment.

13. We then went to an area where I.V. solutions are put together. The area is a large open room screened off from the courtyard. The personnel have two stills for distilled water but one is not working. We were told that a heating element or rheostat is out of order. They do not have maintenance or operating manuals and they call upon a technician in some other department who helps them repair their equipment. The entire area is clean and neat but the equipment is quite old and is never serviced.

14. Finally we visited a Urology ward which we were told is fairly typical of patient areas. There were 26 beds with less than 2' between them jammed into an area that should have had about 16 beds. The room was clean and airy and there was no apparent odor. There are no patient overbed lights, no nurses call, no electrical outlets and very little furniture.

We left with the impression that technicians in laboratory and other areas frequently try to repair or maintain the equipment that they use without ever calling upon the Engineering or Maintenance Department. This appears to be true particularly of the Chest Diseases hospital and of San Felipe. We were told that the San Felipe hospital currently uses about 550 beds and has a maintenance staff of

about 22 people, including porters, gardeners, painters, etc.

D. We paid a brief visit to a privately run hospital in order to try to get some comparisons. The hospital that we visited was in the midst of a building program and the new areas looked quite modern with recessed ceiling lights, cubicle curtains and bright clean semi-private room areas. It would compare very favorably in terms of physical plant with most of the hospitals in the United States. The Administrator showed us the blueprints for his hospital and we noticed that the piping was very sensibly laid out. Interestingly enough, the Chest Hospital and San Felipe did not have any blueprints available which might help in planning alterations. For the existing 75 beds they have two maintenance men but the Administrator said that they do rely upon outside contractors for difficult repairs. It appears that the private hospital probably caters to the middle or upper class people who can afford their rates.

E. Review Meeting

At the end of our first week we had a meeting arranged with officials from the Ministry of Public Health, U. S. A.I.D., and maintenance and administrative staffs of the three hospitals that we had visited. Unfortunately our meeting started

quite late and Barbara Sandoval, whom we had hoped would attend, was away. The Vice-Minister of Public Health sat in at the tail end of the meeting which lasted until about noon and included a substantial amount of discussion about our findings. The Vice-Minister was interested in learning what kind of specific help we could provide to solve the maintenance and engineering problems of the various hospitals, of which he seemed very cognizant.

We gave our original notes to Engineer Hector Zuñiga who intends to have them copied and then returned to us. Dr. Santos asked us if we could review an equipment list for the new teaching hospital and we set up an appointment to do so.

The next day, with Dr. Jacobo Santos, we met with Dr. Jorge Haddad, the Pan American Health Organization consultant for medical education requirements for the new teaching hospital currently under construction. Both Dr. Haddad and Dr. Santos requested us to advise them regarding the selection of equipment for this new hospital. This list includes two main groupings.

1. <u>Medical and Surgical Equipment</u>

This includes the O.R. Areas, Recovery, ICU/CCU

and Specialty areas.

2. Radiology and Laboratory Equipment

This includes Nuclear Medicine, X-ray and Radiotherapy equipment, Pathology, Cytology, Microscopy, etc. Dr. Gonzalez suggested that there were equipment specialists attached to the American Hospital Association and that possibly they might be of some help in this area. Specific requirements for consultants were outlined by Dr. Haddad and Dr. Santos and we were asked to recommend individuals with a bilingual background in addition to their professional extertise.

F. Follow-Up Visit

After our meeting with Dr. Haddad and Dr. Santos we returned to the Hospital Materno Infantil to check out their defective automatic transfer switch. We checked the relay coils and the solenoid valves but we were unable to find the cause of the problem. We believe that a main solenoid switch is defective. We took all the pertinent data from this switch so that we could obtain the necessary part in the United States and send it here for installation. Although we had also hoped to check out the operation of a bottle washer in the Central Sterile Supply area, we found that we simply did not have enough time

to do this. We were told that this bottle washer works except that when it operates it succeeds in breaking all the bottles in addition to washing them.

G. Comavagua Regional Hospital and Health Center

Today we visited both the Regional Hospital and the Health Center in Comayagua. This hospital is the only inpatient facility for about 380,000 people in the provinces of Comayagua and Paz. Our first stop was at the Health Center which was built by PANI, a private foundation set up to aid children. This group also operates the Health Center and we found the following items of interest as we went through this facility.

1. The Center is a large, airy, well kept simple facility with a minimum of equipment. There is one old X-ray machine which was operative, a couple of examining tables, floor mounted examining lights and other minor miscellaneous items. There is no sophisticated equipment.

2. We were told that there is no maintenance help included in their staff of 38. We noticed a number of fluorescent tubes which are missing and/or burned out and they probably remain that way for months. When repairs are necessary they call to Tegucigalpa for help.

After we left the Health Center we then drove to the Hospital which is about a 1/2 mile distance. The Hospital is a large square building with a central courtyard with trees and plants. The Director of the Hospital, Dr. Bendaño, explained that the building is very old and that it was converted from a residence into a hospital. It has 98 beds and they have just one all-around handy man-painter-driver who is responsible for the maintenance and housekeeping functions. We were told that they have no porters or maids and that sometimes patients or nurses clean their own areas. Occasionally they call for cleaning help from the outside. We made a brief visit to the following hospital areas:

1. The X-ray Department was the first area that we went to. We were told that the X-ray machine has been out of order for two years and a short while ago they spent 4,000 lempiras in an attempt to restore it to use. The X-ray machine is a very old Picker unit and we believe that its usable life is at an end. They are constructing a wooden control booth in this room and when we expressed concern regarding shielding the Director did say that they intended to cover it with lead. The area is very poorly lit and poorly kept.

2. We then walked through their Emergency Room which

has almost no equipment and, in fact, compares unfavorably with the Health Center that we had just visited. The examination rooms are small, not clean, and there is inadequate light. No sterile procedures are followed since these rooms have no wash basin and we discovered an old instrument sterilizer under one of the examination cots where it has been unused for four years.

3. We asked whether or not the Hospital experiences power failures and there was a difference of opinion with some of the staff saying that they had experienced no problems in the last 9 months while others told us that outages occur frequently, especially on week ends.

4. We next visited the male surgical ward where patients are forced to stay in their own clothes because the hospital evidently has no clothing to provide for them. They are in old beds very close together with no lights and poor ventilation. The maintenance man has evidently made up some I.V. poles of wood upon which the solutions are hung when necessary. Again there were no hand washing facilities.

5. Directly outside of the ward area Dr. Bendaño told us that the roof leaks badly and he is afraid that

some day it may collapse. We can see evidence of water damage through the bottom of the eaves.

6. We then visited the pediatric area where cribs are crowded together. There is one large isolation area toward the rear of the ward with one crib and no hand washing facilities. The entire ward is very dimly lit and poorly ventilated. There is one large T.V. set near the front of the ward but when the Director was asked by us to turn it on we found that it did not work and has not been working for a period of time. The maintenance man said that the antenna was defective but when we pressed him on this point he admitted that some tubes needed replacement. All the partitions are of wood, including the nurses station, and there are no fire extinguishers.

7. We then went to the women's surgical ward and found a situation identical to that in the men's ward. Beds are very close together, street clothes on patients, homemade unadjustable I.V. poles of wood, and no hand washing facilities.

8. Next we saw the maternity area ard here it is very apparent that the roof does leak. Only a very few beds are occupied here and the nursery, immediately adjacent to the maternity ward, had two infants,

one of which was premature. There was one old incubator that does not work and, as a result, they use a floor mounted incandescent goose neck lamp for heating a bassinet.

9. The delivery area has one room for normal births only. There is no air conditioning and the Director explained that it is very difficult for the staff to work there, especially during hot days. They use ether only occasionally and usually need no anesthetic in this area except a local anesthetic. The room is fairly large and has two old fashioned delivery tables, neither of which is fully operative.

10. Outside of the operating suite is a small X-ray area with a portable unit. This is the only functioning X-ray machine in the hospital and it is a very old unit. Outside of this room is a second portable X-ray machine, which appears to be newer, that has not been working for a very long time.

11. Sandwiched between this small X-ray area and the operating suite is a small central sterile supply with two old steam autoclaves. The steam is electrically generated. One unit does not work at all and the second unit works only partially.

Since the pressure gauge does not work and because there are no pressure or temperature recorders it is difficult to make certain that sterility is achieved. We were told that electrical heating elements are burned out on one unit and we can see that the operating unit has a part missing.

12. The operating suite consists of one major room with good surgical lighting. There is an air conditioner in the window and one portable Gomco suction machine that is used for the entire hospital. Dr. Bendaño explained that occasionally he has to use that machine for two patients at the same time and thus it must be shifted from one patient to the other periodically. There are no piped in medical gases and there is a very small scrub area. There is no indication of conductive flooring or equipment. We again believe that it would be much safer if ether were not used and non-flammable anesthetics were used instead.

13. We next visited the laundry area. It is a fairly small area which contains an oil burner on a hot water storage tank for heating water to wash and rinse. We found the oil burner was out of order and we were told that the unit needs a new motor. As a result there is no hot water for laundry purposes and it appears that there has not been any for a

substantial period of time. We found that the clothes drier is also not working so linens and items of clothing are now dried outside by the sun.

14. From the laundry we walked to the kitchen where we found a large wood burning stove which is used for food preparation. There is no refrigerator or freezer in this small area and the sink and other equipment is very old and the area directly opens to the courtyard without any screening. There is one relatively new stainless steel food cart for patient food delivery. It has an electric food warming coil but this coil cannot be used.

The storeroom for the kitchen is nearby across the pathway and it contains a large home type horizontal food freezer that they cannot use because it does not work properly. It freezes at the top only and not at the bottom and may have either a pinched refrigerant tube, defective temperature control or lack of refrigerant gas. It has not been looked at by the refrigeration mechanic in Tegucigalpa. It was mentioned that the meat that had been stored in this freezer had spoiled and that, therefore, it is no longer used.

15. We then saw the emergency generator which is an old very small German unit of about 6 kva. It is properly located where the electric service comes into the building, according to the maintenance man, and it is manually turned on. When a power failure occurs by the utility company we assume that the situation here is very much like that at San Felipe.

16. We next went to the laboratory and found this area to be in fairly good condition with almost all instruments operative. There seems to be adequate staff here and no real maintenance problems. Lighting here is far better than elsewhere. We noted that the refrigerators have no internal thermometers for verifying temperatures.

17. The Director pointed out to us two areas where small renovations are planned. We did not ask how renovations are decided upon and how repair priorities are set. It would seem to us that roof repairs might be considered a very high priority item.

18. Our conclusion is that this institution is certainly a very marginal facility and is not providing adequate patient care. The failure

of the one portable X-ray machine or the one portable vacuum pump or the one steam sterilizer, all of which are very old, would absolutely prevent any sort of patient care except the most basic first aid. It would seem imperative that the Ministry develop some plan for this institution; either a total replacement in the near future or a planned series of well thought out alterations and modernization of physical plant and equipment. Without such a plan we believe that this hospital will be unable to provide true patient care over the next decade.

One very distinct impression that we get from the personnel here, as at other hospitals, is that they are truly attempting to take care of patients despite severe handicaps but there is universal pessimism about obtaining necessary help from the Ministry of Public Health in Tegucigalpa.

The Comayagua hospital compares unfavorably with the Health Center in this city in terms of area, cleanliness, ventilation and light. Maintenance of existing equipment in this hospital can only be thought of as a temporary stopgap measure until new equipment and improved facilities are provided.

RECOMMENDATIONS

While we are prepared to make specific recommendations it would be of inestimable help if we had some knowledge of long range plans and proposed budgets for the Honduran Ministry of Public Health. It should be recognized that our recommendations are based upon a very brief survey with little opportunity to develop in-depth knowledge of the operation of the Ministry of Public Health.

A. General

1. It would be suggested that some sort of an overall national plan of proposed new construction, alterations and renovations, and replacements be prepared spanning the next 10 years. This would provide some sort of a framework within which to set certain priorities and, of course, such a plan would be continually modified as required.

   Within the framework of such a plan some basic standards or guidelines could be prepared which would refer to both construction and operation.

   For example, a standard might indicate a specific requirement that fire extinguishers should be provided for every 10,000 sq. ft. of hospital space and that such extinguishers should be inspected at least once per year. The standard

and/or guideline might stipulate that certain hand washing facilities are to be provided within each examination room or that an emergency generator must supply specific critical hospital areas in the event of a power failure. In short it is necessary that basic, simple standards of hygiene, safety, maintenance and engineering be established.

2. The United States and other countries can provide substantial help in the area of standards and guidelines. There are literally scores of volumes of material that already exists and has been proven effective throughout the United States. Some of this material, if translated into Spanish, could provide a basis for the development of Honduran standards by the Ministry of Public Health. The Agency for International Development is in the process of supporting, through financing, the translation into Spanish of the American Hospital Association Hospital Engineering Handbook at its Mexico City translation center.

3. We strongly recommend continuation of the effort presently underway to set up an effective national maintenance and engineering division of the Ministry of Public Health. It must be recognized that this will not be successful without a planned, long term commitment on the part of the leading

officials of the Ministry. The following programs which have been initiated or suggested by Engineer Hector Zuñiga should be continued and implemented. These programs include:

a. An inventory of all hospital based equipment that exists in the country, including manuals and wiring diagrams where available.

b. An inventory of all existing maintenance and engineering personnel, including their locations and job titles. The firming up of a required table of organization to meet hospital maintenance and engineering needs.

c. An inventory of all existing tools and instruments which are used by the engineering and maintenance personnel.

B. Specific Recommendations

1. Our investigation indicates a need for a phased approach to solving the problems of engineering and maintenance within Honduran hospitals. We believe that some recommendations can be implemented in the immediate future (within the next six months), others in a relatively short period of time (six months to two years) while certain recommendations must be long range goals which are periodically reviewed and

up-dated. We would hope that some of our recommendations have sufficient merit to receive serious consideration from the top officials of the Ministry.

2. Our suggestions for the immediate future include the following:

a. The development of a simple valve chart showing, on a line diagram, where all valves throughout the hospital are located for each piping system. Thus if there is a leak or a fire maintenance men will know exactly which valve can be turned off or on.

b. The installation of vacuum breakers at every location where back syphonage of water into the drinking supply is possible. This would include autopsy tables and sinks where direct hose connections are made.

c. Immediate inspection of fire extinguishers and replacement of missing units.

d. The development of a very simple fire plan for each hospital.

e. The initiation in each hospital of a <u>simple</u> written work order request procedure. In some

cases this can be used to document the enormous amount of repair work needed and the inability of the maintenance and engineering department to cope with these requests because of inadequate manpower, tools, spare parts, etc.

f. The initiation of a direct telephone communication system between the Honduran Ministry of Public Health and the American Hospital Association in Washington and/or New York City. This direct communication can be used to expedite the forwarding of operation and maintenance manuals, small parts, etc.

3. Additional specific recommendations that can be implemented in the immediate future include the following items:

a. At the Hospital Materno Infantil we would strongly recommend that a sheet metal drip pan be provided over their electrical main distribution panel to prevent the possibility of an explosion and loss of power. In addition we urge that all cold boxes, such as walk-in refrigerators, be scraped to remove peeling paint.

b. We suggest that, where possible, high voltage incandescent lamps be used, particularly at

San Felipe and the Chest Diseases hospital. The replacement of incandescents with fluorescents is recommended.

c. Where possible we would urge that blueprints of each hospital be obtained so that sets can be kept by Mr. Zuñiga's office for future reference.

4. Either within the immediate future or, if this is not possible, in the relatively near future we recommend the setting up of at least two seminars and work shops in Honduras to train existing or new personnel in the development of a basic preventive maintenance program and to illustrate how to perform emergency maintenance. We strongly recommend that initial consideration be given to providing an electrical engineering group and also a bio-medical engineering group. We would hope that United States A.I.D. funds could be made available to bring two-man teams from the U. S. to Honduras for this purpose. The Hospital Executive Engineers Association of Greater New York, an affiliate of the American Hospital Association through the American Society for Hospital Engineers, has a number of very well qualified Engineers who would be willing to contribute their time for this purpose.

From a short range viewpoint (six months to two years) we consider the following recommendations worthy of implementation:

a. We believe that each hospital should start to develop a very simple written preventive maintenance program. We have attached sample forms to indicate some of the areas that should be dealt with.

b. There should be a firming up of a table of organization for the central engineering and maintenance division of the Ministry of Public Health with a job description for each position indicating educational requirements and job responsibilities. We are attaching some samples which might have applicability.

c. The development of a central engineering and maintenance division requires that these central maintenance files include:

   1. Copies of all equipment manuals for new and existing equipment.

   2. Wiring diagrams and operating instructions for new and existing equipment.

3. Blueprints of all existing hospitals.

4. Shop drawings of equipment for new hospitals.

d. There must be a comitment, on a national level, to allow this central engineering and maintenance division to provide some input into the location of purchases of equipment so that:

1. Standardization of equipment can be started.

2. Necessary manuals and diagrams required for maintenance can be obtained.

3. A program can be developed of beginning to stock small relatively inexpensive spare parts.

5. Our final recommendations concern themselves with long term efforts. They include the following:

a. The national or central engineering and maintenance should be involved in the planning of new institutions and the alteration of existing institutions.

b. A comitment must be made by the Ministry of Public Health to consider the selection

of necessary resources to support this central engineering division.

c. We suggest that serious consideration be given to the physical establishment of the central engineering and maintenance division within the new teaching hospital.

C. Conclusion

We recognize that there are many problems that a country such as Honduras faces. Yet we are certain that the individuals that we have met and spoken with are aware of the importance of providing the best possible health care to the people of their country. If there is one feature that will help the Ministry of Public Health to achieve its goal that feature is planning. If the Honduran Ministry develops an overall planned approach to the problem of maintenance it will most certainly help to reduce the drain on its economy while improving patient care.

APPENDIX I

People Interviewed

John Lovaas, Program Officer, AID
Barbara Sandoval, Public Health Advisor, AID
Dr. Jacobo Santos, Division of Hospital Facilities, Ministry of Health
Ing. Hector Zuñiga, Chief Engineer, Ministry of Health
Dr. Carlos Medina, Director of Maternity Hospital
Ing. Manuel Rosales, Chief Engineer, Maternity Hospital
Mr. Nuñez, Administrator, Maternity Hospital
Mr. Carlos Dávila, Chief Electro-Medical Maintenance Maternity Hospital
Mr. Serapio Navas, Chief Electrician, Maternity Hospital
Dr. Daniel Mencia, Director of Chest Diseases Hospital
Dr. Jesus Castillo, Jefe del Centro Salud Comayagua
Dr. Luis Tirso Bendaño, Director, Hospital Santa Teresa, Comayagua
Dr. Rigoberto Alvarado, Vice-Minister of Health
Sr. Miguel Angel Silva, Administrator, San Felipe Hospital
Sr. Nuñez, Maternity Infantil
Dr. Jorge Haddad, Consultant, New Teaching Hospital
Sr. Manuel Matos, Jefe de Mantenimiento, San Felipe Hospital
Norma Nava de Morales, Maternity Hospital
Luis Alonso Cruz, Chief of Maintenance, Chest Diseases Hospital
Señorita Gloria Ocon, Ac. Psychiatric Hospital
Mr. Hilton Troches, Chief Planner, Ministry of Health
Mr. Octavio Pineda, Division of Hospitals, Ministry of Health

APPENDIX II

Possible Engineering Tasks for an Electrical Program *

A. Develop for each hospital a line diagram of internal power distribution.

B. Set up simple guidelines or standards for the wiring of emergency power system and care of emergency generators.

C. Check on existing electrical problems and perform repairs or suggest changes.

D. Set up guidelines for internal wiring (cable size, grounding, etc.)

E. Set up simple electrical maintenance forms.

F. Set up lists of needed tools and equipment for electrical maintenance and assign priorities. Check on space for workshop.

G. Assess existing manpower and suggest No. of electrical maintenance people needed both centrally and locally.

H. Introduce ground fault interruption for wet areas.

I. Review plans of new teaching hospital and suggest possible items to consider.

J. Suggest standards or guidelines for future.

* We would suggest a two-man training team for two or three weeks.

APPENDIX II

Possible Engineering Tasks for a Biomedical Equipment Training Program

A. Set up and conduct central classes in BME maintenance with hands-on training.

B. Help each institution develop an inventory of equipment.

C. Set up a hands-on workshop, at the Maternity Hospital, for all hospitals in the region. Specific equipment, such as a monitor or an EKG machine, can be taken apart and put together.

D. Compile a list of critical manuals, wiring diagrams and parts needed for maintenance.

E. Set up a simple Preventive Maintenance program for equipment in detail in each hospital.

F. Review test equipment available and prepare list of needed items with priorities. Review space allocations for equipment, workshop in each hospital and recommendations.

* We would suggest a two-man training team for two weeks.

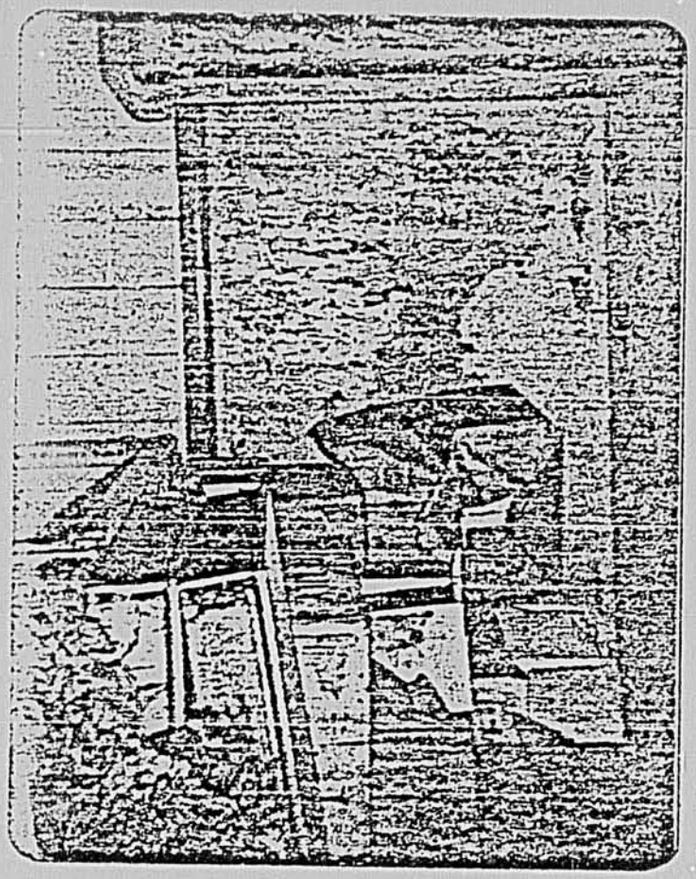


Photo No. 1 - Walk-in Refrigerator
(Hospital Materno Infantil)

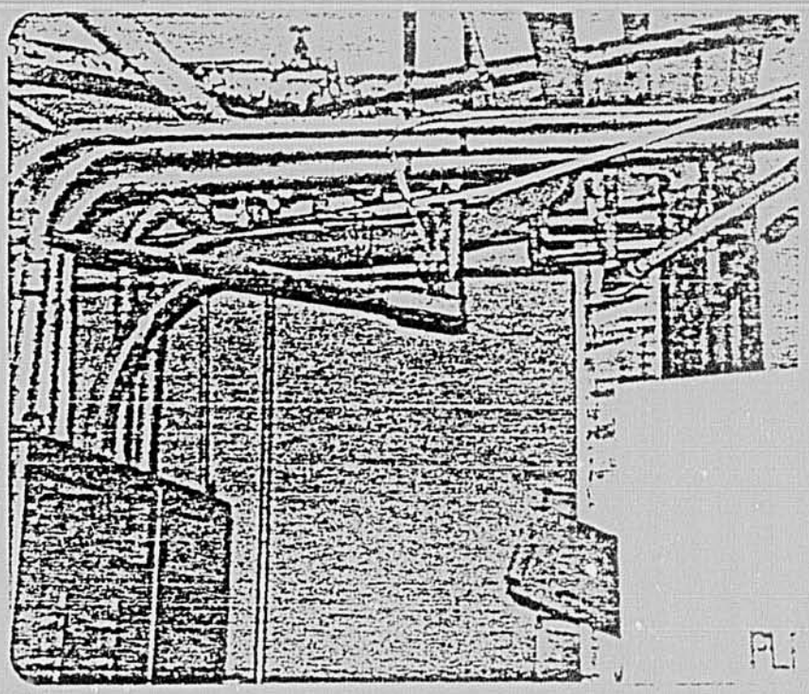


Photo No. 2 - Electrical Service Room (Hospital Materno Infantil)

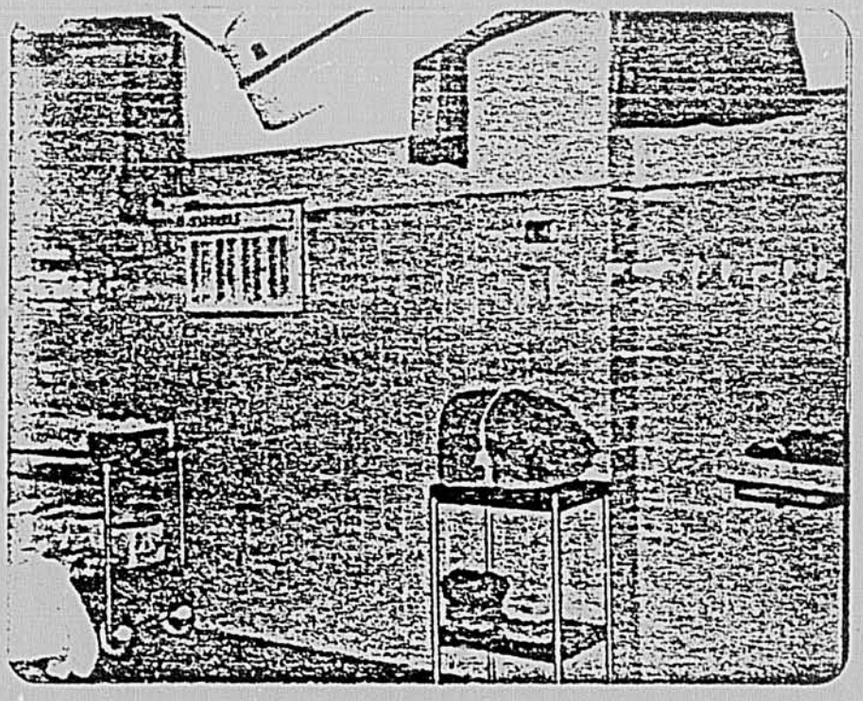


Photo No. 3 - Operating Room
(Hospital Materno Infantil)

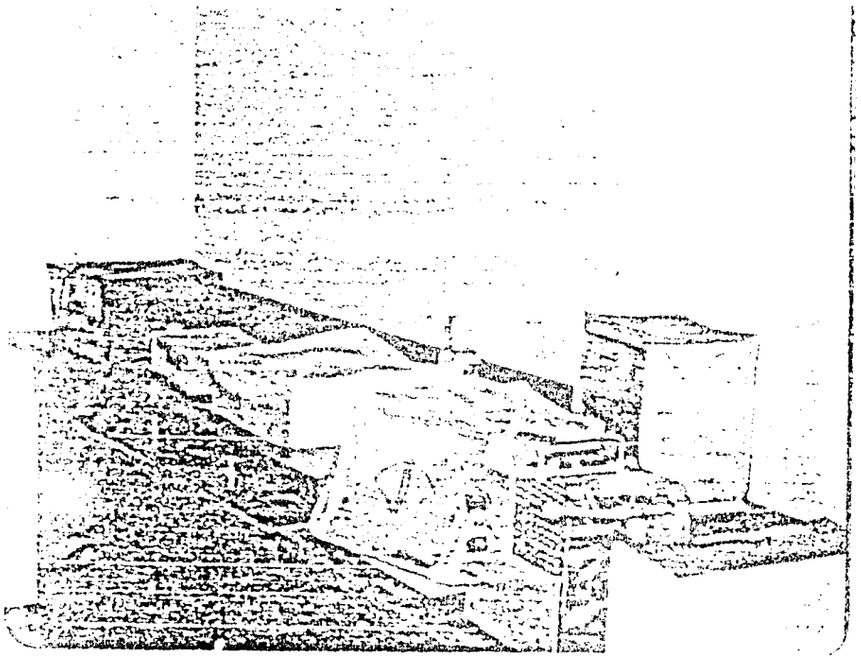


Photo No. 4 - Unused Lab Equipment (Hospital Materno Infantil)

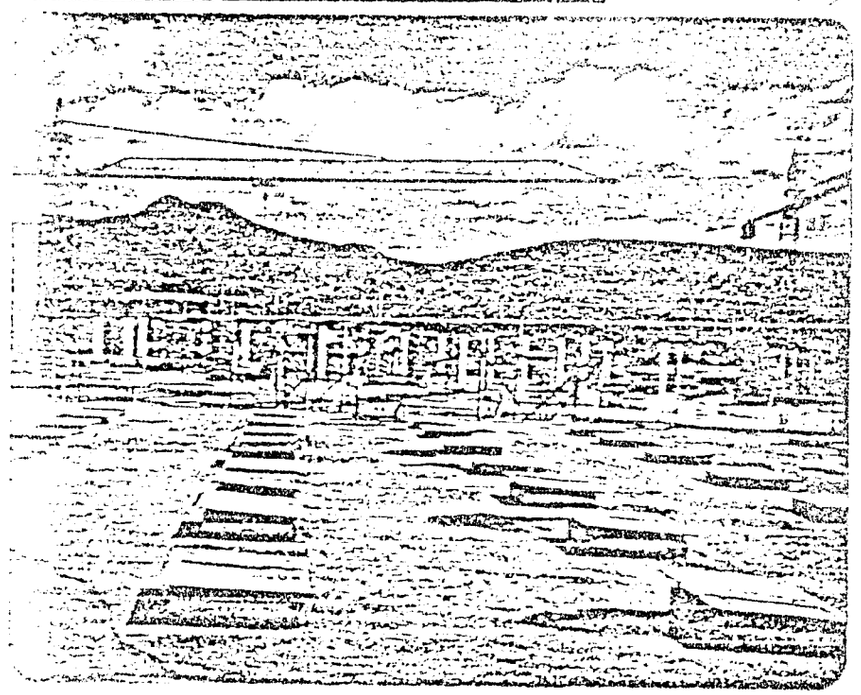


Photo No. 5 - Construction Sit of New Teaching Hospital

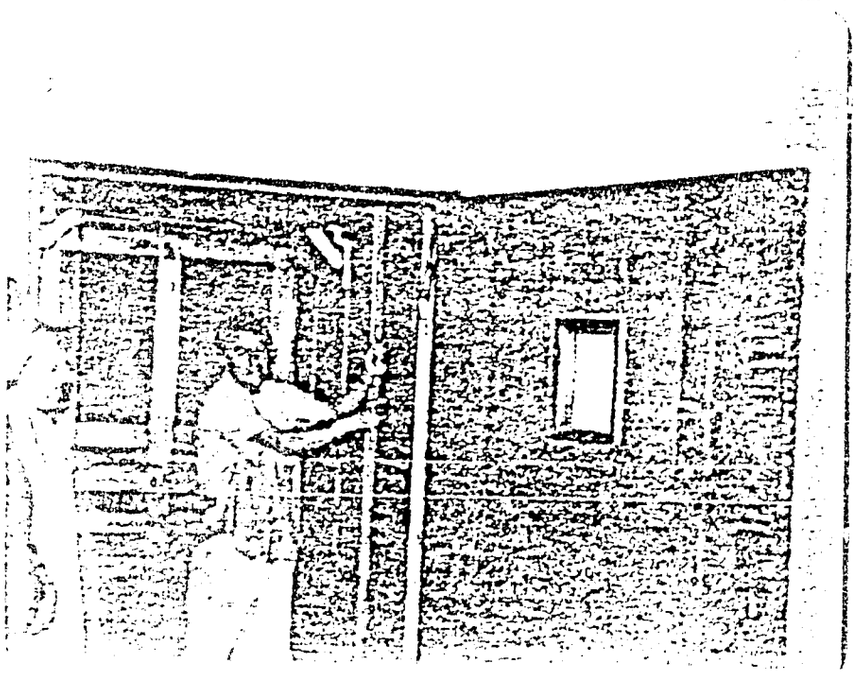
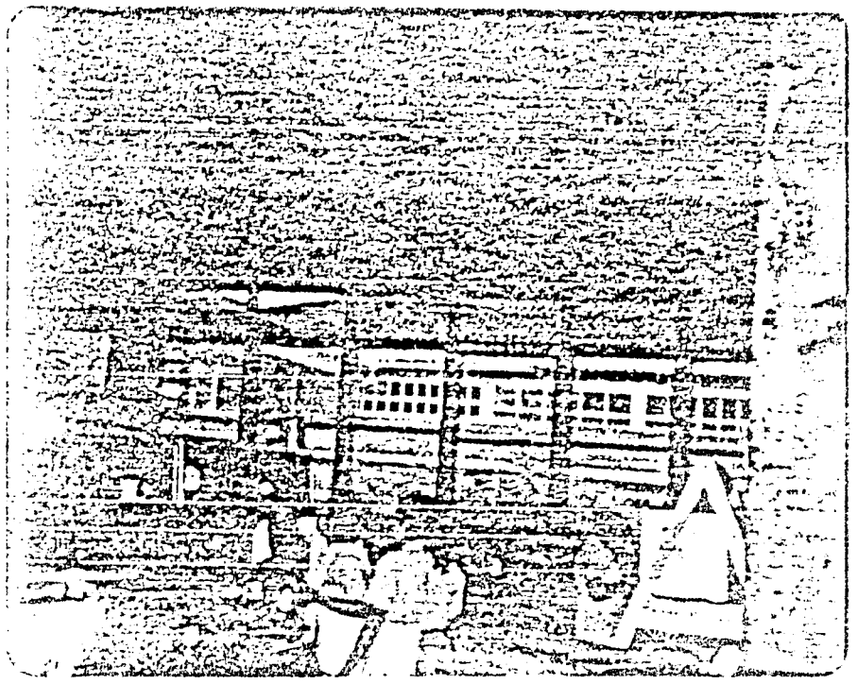


Photo No. 6 - Elevator Hoistway - (Chest Hospital)

Photo No. 7 - Kitchen Area
(Chest Hospital)



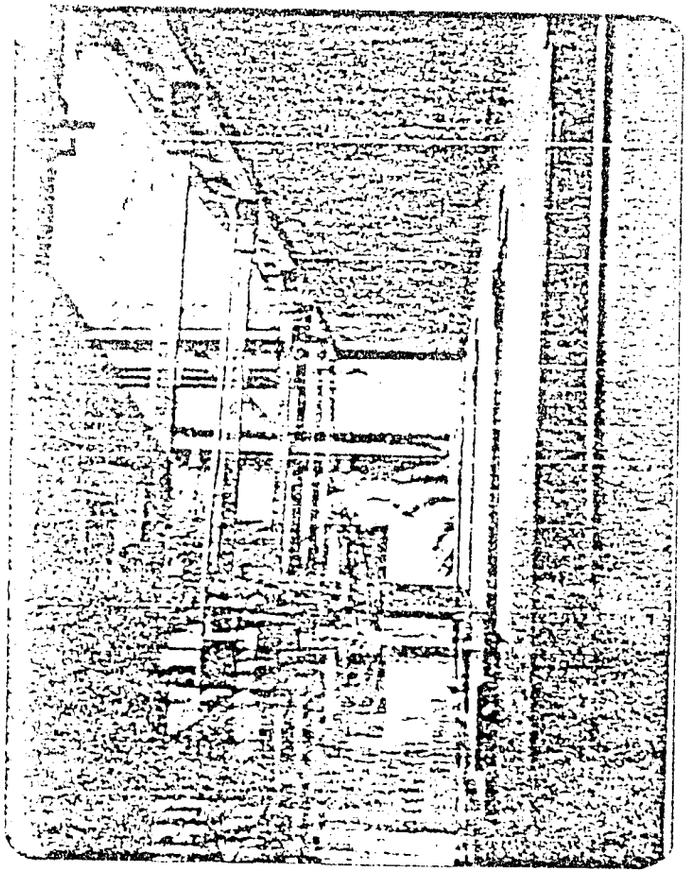


Photo No. 8 - Courtyard
(Chest Hospital)

Photo No. 9 - Boiler
(Chest Hospital

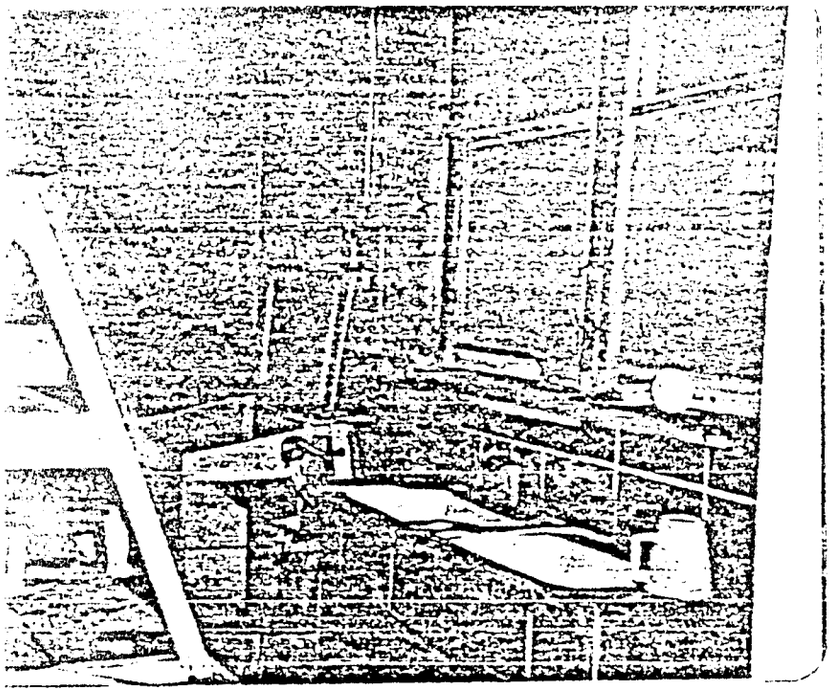


Photo No. 10 - Kitchen Sinks
(Chest Hospital)

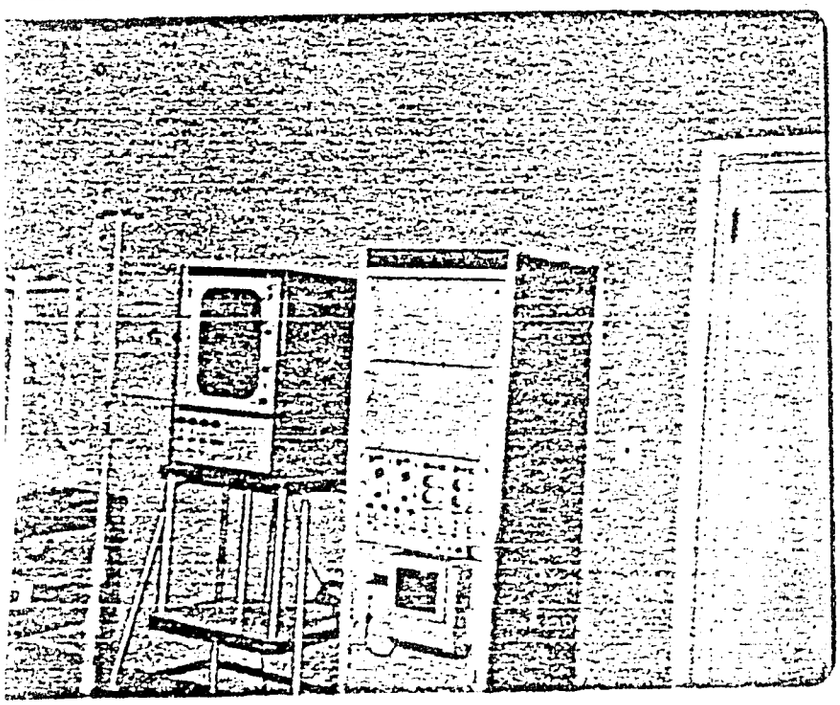


Photo No. 11 - Cardiac Cath. Lab
(Chest Hospital)

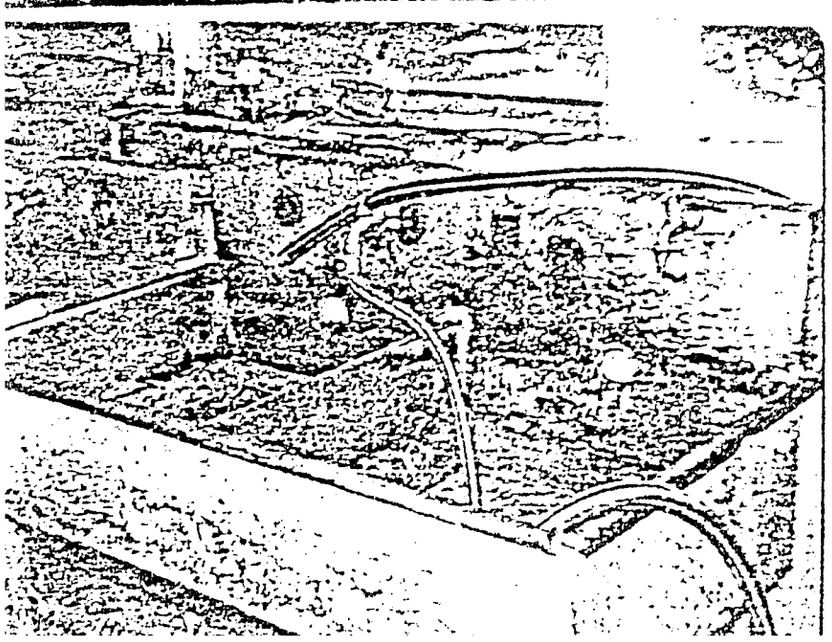


Photo No. 12 - Lab, Sink Area
(San Felipe)

Note absence of vacuum breaker

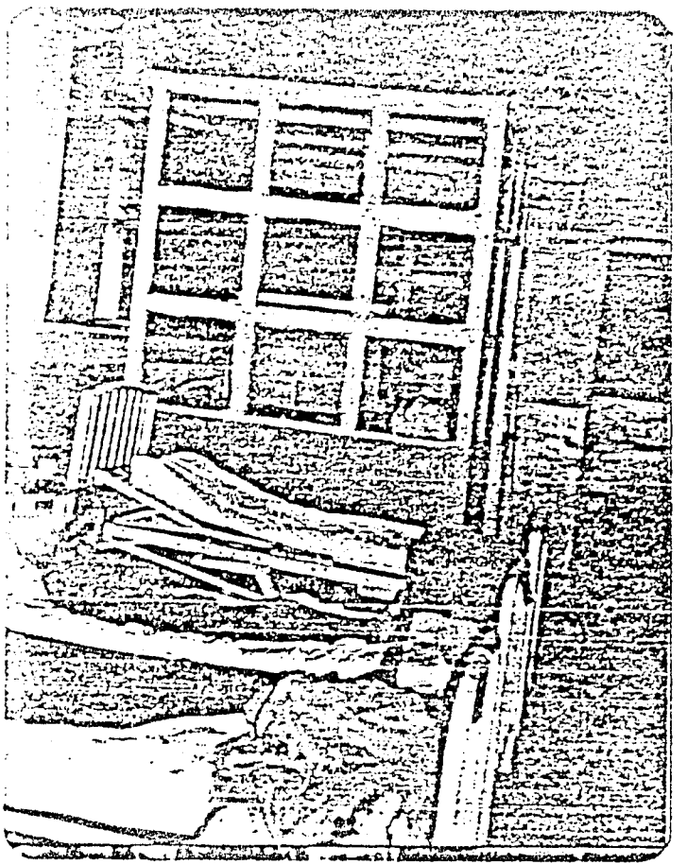


Photo No. 13 - Men's Surgical ward (San Felipe)

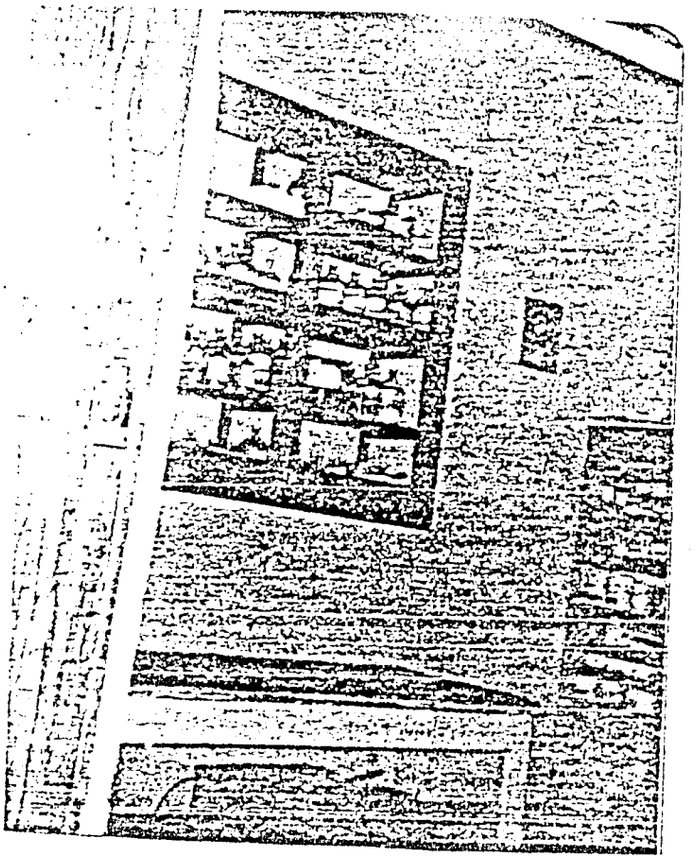


Photo No. 14 - Emergency Room (Comayagua)
Note unused steriliser under examination table

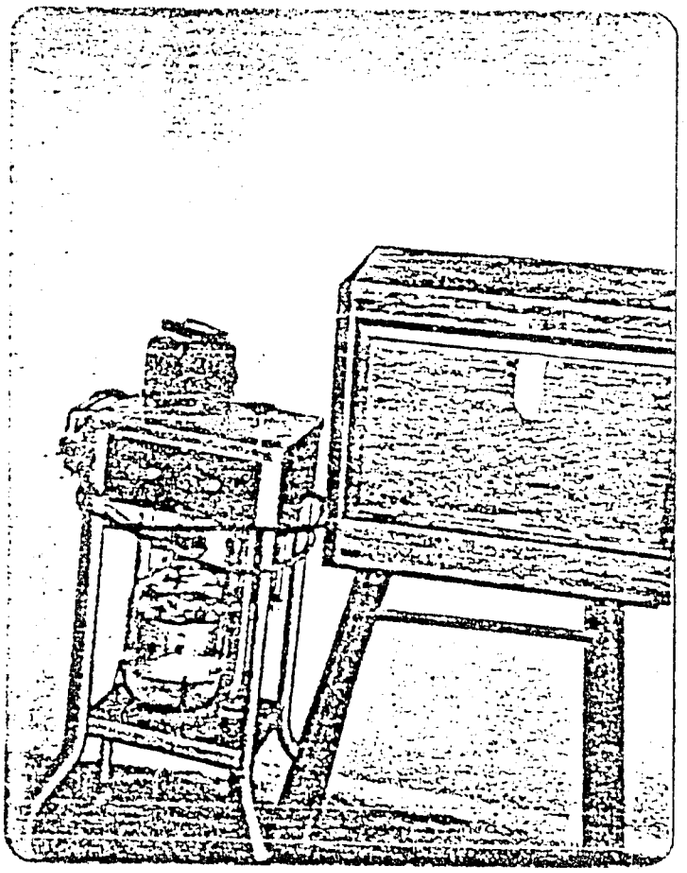


Photo No. 15 - Only operative suction equipment (portable Gomco) at

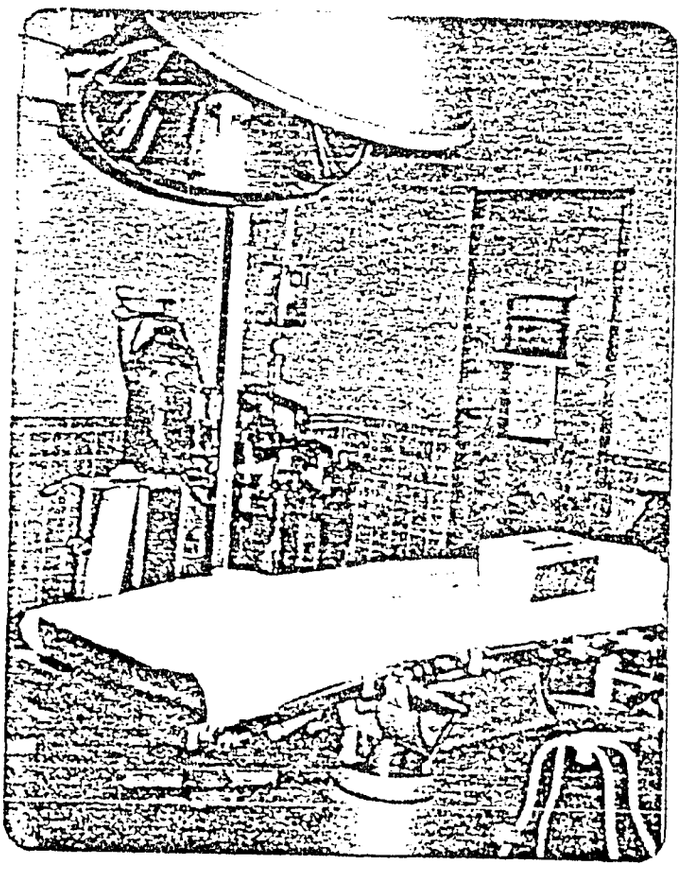


Photo No. 16 - Operating Room (Comayagua)

LIGHTING SYSTEMS

When the Power Goes Out, the Beacon-Pak® Goes On!

Beacon-Pak® lights will activate within one second after power failure to eliminate potential dangers of areawide blackouts. Provides 2½ hour minimum burn time protection. Costs only pennies per month to operate. Twin sealed beams with a total of 3,000 candlepower, measured at 25-ft. 36 watts power. Hermetically sealed, maintenance-free 6V, 8-ampere-hour battery has anticipated life of 11 years, is guaranteed 7 years, pro-rated. Self-monitoring, solid state battery charger. Designed for 115V ac, 60 cycle operation. Has external "Push to Test" button. UL and CSA approved and listed. Also meets applicable National Electrical Code and National Fire Protection — Life Safety Code requirements. 15 day shipment.

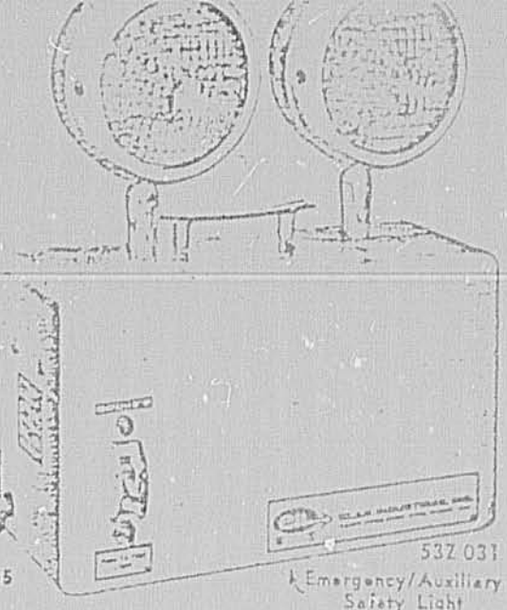
A New Concept in Emergency Lighting

Self-Contained Units Simple to Install

Solid State Circuitry Space Age Energy Cell

Ultra-Reliable Maintenance-Free

53Z 031 Beacon-Pak Light with Two Spot Lamps Permanently Attached to Control Box. Shpg. wt. 14 lbs. ea. $149.55



53Z 031
Emergency/Auxiliary Safety Light

Self-Powered Exit Lights

Automatically switches over to own battery power when power fails. And switches back when power is restored. Maintenance free, rechargeable 6V battery with anticipated life of 10 yrs, has 5 yr. warranty prorated. Automatic solid state battery charger. 120V 60HZ operation. Easily mounted on standard 3½ octal electrical box. Formed steel case, beige finish, 6" red letters, knock-outs for arrows. Includes two 120V 25 watt bulbs and two 6V bulbs.

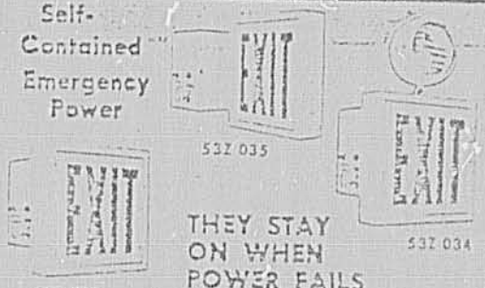
53Z 033 Single Face Exit Light. Operates 5 hrs. during power failure. Shpg. wt. 11½ lbs. ea. $119.50

53Z 034 Single Face Exit Light with Attached Spotlight. Operates 4 hr. during power failure. Shpg. wt. 12½ lbs. ea. $129.45

53Z 035 Double Face Exit Light. Operates 5 hrs. during power failure. Shpg. wt. 11½ lbs. ea. $123.00

15 Day Shipment

Self-Contained Emergency Power



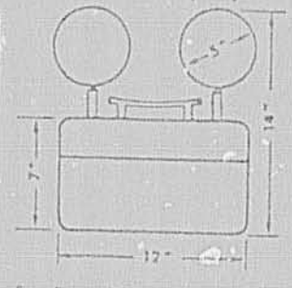
53Z 033

53Z 035

53Z 034

THEY STAY ON WHEN POWER FAILS

Meets Latest OSHA Requirements



See Page 55 For Other Emergency Lights

PORTABLE BEACON-PAK®

Lightweight, Fully-Rechargeable Emergency Light

53Z 030
Beacon-Pak Light
Shpg. wt. 12 lbs.
ea.
$97.50

Comes on when the power fails. Goes wherever you want to take it. One second after regular power is disrupted, beam snaps on. Provides 4000 candlepower at 25-ft. for up to 15 hours. Recharges automatically. Hermetically sealed 6V energy cell has rated life of 5 years. No maintenance required. Lamp swivels up and down and rotates 360 degrees. Meets applicable National Electrical Code and National Fire Protection/Life Safety code requirements. Rugged compact steel case, large carrying handle. 13"H, 9"L, 4"deep. 110V AC. Allow 15 days for shipment.

YOUR SATISFACTION IS GUARANTEED AT SA-SO

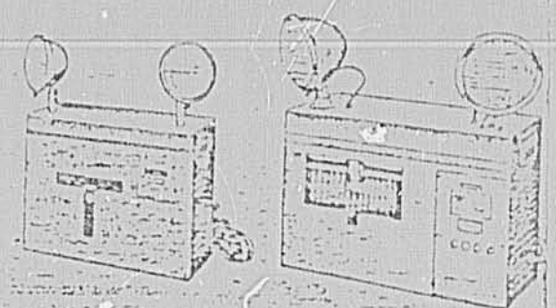
BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 24, GRAND PRAIRIE, TEXAS

SA-SO, INC.
1185 108th St.
Grand Prairie, Texas 75050

EMERGENCY POWER FAILURE LIGHTING UNITS

Battery-Operated—Turns on Automatically. Solid State Charger, Lead Acid Battery

Instant illumination automatically for power failure, open fuse or circuit breaker. Floods 10,000 sq. ft. from two adjustable sealed beam lamps. Units will operate a total of 5 lamps, will accept No. 2V397 remote lamp and No. 2V398 exit sign. 6-volt lead acid battery with three colored hydrometer indicating discs to show state of charge. Transparent, high impact, heat resistant battery case allows visual inspection of electrolyte level. 120V and 6V fuses for full circuit protection. AC power supply light, test switch, 3 cond. SJ cord set, wall mounting shelf. Meets OSHA requirements when installed with junction box for permanent conduit connection. 120V, 60 Hz. UL listed.



$98.82 38 Amp/Hr No. 7V127 — $171.84 100 Amp/Hr No. 7V129

No. 7V120. Emergency Lighting Unit with 100 Amp/Hr Battery operates two lamps up to 13¾ hours. Solid state hermetically sealed triple rate continuous charger has no relay or moving parts, is impervious to dust, dirt, moisture, etc. Will not over- or undercharge battery. Constant reading DC voltmeter, slideout chassis. 1 year guarantee on unit. Prorated 5 year charger guarantee, 7 year battery guarantee.

No. 7V127. Emergency Lighting Unit with 3 Amp/Hr Battery operates two lamps up to 33 hours. Silicon diode controlled tapering singl rate charger. Solid state components, automati relay switching. 1 year warranty on unit, 3 yea prorated battery warranty.

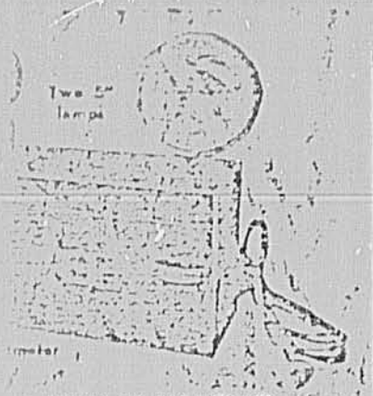
Battery Amp/Hr.	Model No.	Maximum Light Output (Hours) No. of Lamps* 2	3	4	6	Overall Dimensions L	W	H	Stock No.	Retail	Each	Shpg. Wt.
38	2T30	33¼	22	16½	11	15⅜"	6¾"	16⅛"	7V127	$122.00	$98.82	41
100	2TC6L100P2BRT	13¾	7⅞	5½	4	21	9	20	7V120	212.15	171.84	74

(*) 2 exit signs equal 1 lamp load in determining lighting time.

SEE SALES, PREPAID FREIGHT, AND WARRANTY POLICIES IN INDEX ON PAGE 607

Be Prepared! Save on Teledyne Big Beam Emergency Lighting at C&H Now

MEETS OSHA REQUIREMENTS



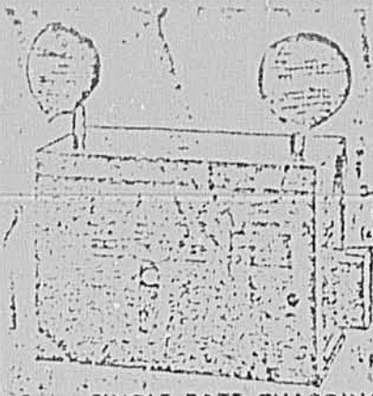
AUXILIARY LIGHTING
/O-LIGHT DRY CELL UNIT

lights—each throws penetrating beam ...ft. Voltmeter tells state of battery ...ady to keep ready! Momentary contact ...testing voltage. Lifesaver when power ...volt dry cell battery (order below) burns ... Unit measures 12x5x15" ht., with 3-wire ...and plug.
...A—10 lbs. Net ea. $34.87. ... $31.78
...2) $32.98. Ea. (lots/6) ...
...ttery for unit above ...
...—Wt. 6 lbs. Net each ... $7.22

-STATE AUTOMATIC LIGHTS

...sealed beam lamp heads throw a power- ... Automatic switching! Always depend- ...completely sealed solid-state charger mod- ...arges 6-volt lead-acid batte-y to full ca- ...in 12 hours. Automatic battery recycling ...s equalizing charge, better performance. ...resures 22x9x20" ht. FOB Ill.

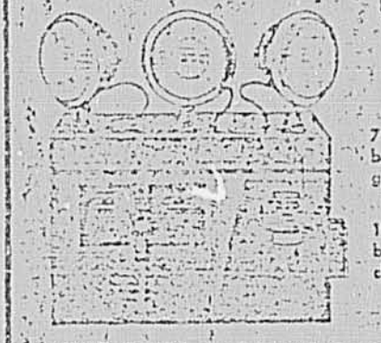
...er	Amp.	Hr. Life	Wt. Lbs.	Net Each	Each (lots/2)
...2D	40	5½	49	$170.98	$168.78
...7D	100	13¾	67	186.20	179.98



SINGLE RATE CHARGING SOLID STATE EMERGENCY LIGHT

Automatic charger—restores battery to full capacity. 30-amp.-hr. plastic jar lead acid battery has visible hydrometer indicating discs. Handy test switch. 6-volt lead acid battery has automatic relay switching and single rate charger. Pilot light glows when heads are ready for service. Built-in wall mounting bracket. Wt. 42 lbs. FOB Ill.

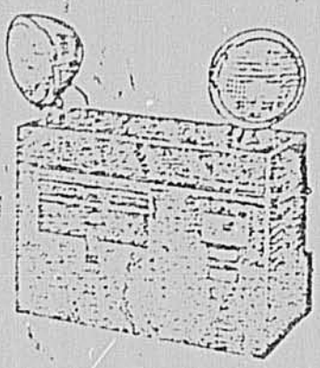
Stock No.	No. of Lamps	Burning Time	Net Each
46-222/6D	2	3¾ hr.	$107.25
46-223/4D	3	2 hr.	116.46



SOLID-STATE AUTOMATIC LIGHTS

Three six-inch sealed beam lamp heads give a very powerful beam! Always dependable! Automatic switching! Complete sealed solid-state charger module recharges 6-volt lead-acid battery to full capacity in 12 hours. Automatic battery recycling provides equalizing charge for better performance. 22x9x20" ht. FOB Ill

Stock Number	Amps.	Hr. Life	Wt. Lbs.	Net Each	Each (lots/2)
46-136/6D	40	3½	54	$199.96	$194.88
46-137/6D	100	7½	72	208.40	203.95



Automatic Two-Rate Charging Emergency Light

Light turns on instantly when power fails! Two 6" lamps, each lights 5000 sq. ft. area. 40-amp. unit has 4¾-hour life. Comes with 6-volt lead acid battery; recharges itself, switches to trickle. 5-year battery guarantee (straight line pro-rata).
46-028/7A—Net each $138.95. Wt. 58 lbs.
Each (lots/2) $135.76. Each (lots/6) ... $130.4
100-AMP. UNIT. 12¾-hr. life. Wt. 68 lbs.
46-029/5A—Net each $146.46.
Each (lots/2) $142.78. Each (lots/6) ... $137.8

MOUNTING SHELF for lights above.
46-030/3A—Wt. 1 lb. Net each ... $7.9

EMERGENCY LIGHT
For operation with lamp units on this page

RECESSED "EXIT" LIGHT FIXTURE has two 25 sockets. Red on white. 12½x3-9/32x8⅛" ht. FO
46-229/1D—5 lbs. Net each ... $
46-230/9D—Surface mount. 5 lbs. Net ea. ... $

APPENDIX IV

Sample Forms and Job Descriptions

LUTHERAN MEDICAL CENTER – BROOKLYN, NEW YORK 11220

WORK REQUEST

PLANT OPERATIONS DEPARTMENT NO. 13533

REQUESTOR COMPLETES FOLLOWING:

DATE _____

DATE REQUIRED _____

DEPARTMENT OF REQUESTOR _____

WHAT NEEDS DOING? _____

WHERE IS IT? _____

WHO IS REQUESTING? _____

APPROVAL _____
SIGNATURE AND TITLE

DEPARTMENT HEAD APPROVAL

PROCEDURE: COMPLETE IN THREE PARTS – KEEP BLUE PART FOR FILE AND FOLLOW UP – SEND WHITE AND YELLOW PARTS TO PLANT OPERATIONS DEPARTMENT.

FORM #556

ADMINISTRATION APPROVAL IF REQUIRED

APPROVAL _____
SIGNATURE

COMMENTS _____

ROUGH COST ESTIMATE _____

PLANT OPERATIONS COMPLETES FOLLOWING:

DATE RECEIVED _____

WORK ASSIGNED TO _____

DATE _____

MATERIALS & SUPPLIES:	COSTS

TOTAL MANHOURS _____

WORK COMPLETED BY:

_____
SIGNATURE

DATE ___/___/___

LUTHERAN MEDICAL CENTER

Engineering and Maintenance Department

FOREMANS DAILY WORK REPORT

PM 101-70

SHOP _____ DATE _____

REMARKS _____

NAMES	DESCRIPTION OF WORK DONE
1. FOREMAN	
2.	
3.	
4.	
5.	
6.	

NOTE BELOW ANY ACCIDENTS OR UNUSUAL OCCURRENCES

LUTHERAN MEDICAL CENTER

ENGINEERING & MAINTENANCE DEPT.

DAILY MAINTENANCE REPORT - SISTER ELIZABETH

PM 114-70

Date _____

	YES	NO	COMMENTS
1) Check Boiler Steam Pressure and Record here _____psi			
2) Check & Clean Oil Strainer at Boiler	—	—	_____
3) Check Automatic Water Feed Valve	—	—	_____
4) Check Burner Nozzle at Boiler	—	—	_____
5) Check Water Feed Pump	—	—	_____
6) Check Water Level on Emergency Batteries in Delivery Rooms and Test Units ONCE each week.	—	—	_____
7) Check Temperatures & Humidities in Delivery Rooms and Filters	—	—	_____
8) Check all Electrical Outlets in Delivery Rooms and Recovery Room	—	—	_____
9) Check Air Cond. in Delivery & Labor Rooms	—	—	_____
10) Check Faucets & Controls in Scrub Area	—	—	_____
11) Check all Lights throughout building and replace lamps as required	—	—	_____
12) Changed Air Conditioning Filters in following areas _____ _____ _____	—	—	_____
13) Check air conditioning & Heating in Nurseries	—	—	_____
14) Check Operation of all Exhaust Fans in Toilets, Utility Rooms, etc.	—	—	_____
15) Check Ice Cube Makers & Clean Condensers & Grilles	—	—	_____
16) Check Refrigerator in Kitchen and Clean Condenser	—	—	_____
17) Check all Refrigerators and see that inside temperatures are between 40 45° F	—	—	_____

The above checked items of work have been performed by:

_____ _____

(NAME) (DATE)

M 106-69
ev. 2/70

LUTHERAN MEDICAL CENTER
ENGINEERING & MAINTENANCE DEPARTMENT

EMERGENCY GENERATOR - WEEKLY CHECKLIST

HECKED BY _____ DATE _____

TEM		SATISFACTORY	REPAIR OR ADJUSTMENT	COMMENTS
1.	Clean & Check Brushes on Starting Motor for Chipping, Cracks, Loose Connections, Length, etc.			
2.	Movement & Tension on Motor Brush			
3.	Commutator Clean			
4.	Clean & Blow Out Windings			
5.	Motor Mounting and Belt			
6.	Motor Temperature			
7.	Electrical Connections			
8.	If Unusual Noises - Explain			
9.	Battery Levels & Connections			
0.	Cooling Water Temperature (°F)			
1.	Fuel Oil Pressure (psi)			
2.	Lubrication Oil Level & Press. (psi)			
3.	A. C. Voltage Reading			
4.	D. C. Voltage Reading			
5.	A. C. Amperage Reading			
6.	D. C. Amperage Reading			
7.	Frequency - HZ			
8.	Fuel Oil - Gallons			
9.	Operation of Unit			
0.	General Ventilation			

OTE: Emergency Generator is to be operated under actual load conditions at least once each month. Indicate here if readings are made under load.
YES_____NO_____ Duration of all tests to be half-hour.

DDED COMMENTS: _____

PM 111-69

LUTHERAN MEDICAL CENTER
Engineering & Maintenance Department

WEEKLY DRAIN MAINTENANCE

CHECKED BY _____ DATE _____

ITEM	LOCATION	CLEANED STRAINER	CHECKED TRAP	CHECKED LEADERS	COMMENTS
1.	Roof Drains - North Building				
2.	Roof Drains - 1903 Building				
3.	Roof Drains - 1916 Building				
4.	Roof Drains - Above 2 E Ward				
5.	Roof Drains - Above Kitchen Storeroom				
6.	Roof Drain - Receiving Canopy				
7.	Roof Drain - Outside Admitting				
8.	Area Drain - Receiving				
9.	Area Drain - Carp Shop Entrance				
10.	Floor Drain - 360 45th Street Basement				
11.	Area Drain - Between 358 & 360 45th St				
12.	Floor Drain - 358 45th Street				
13.	Roof Drains - 358 45th Street				
14.	Roof Drains - 360 45th Street				
15.	Floor Drain - Can Wash Room				
16.	Floor Drains - New Boiler Room				
17.	Floor Drains - Kitchen & Serving				
18.	Area Drains - Outside E. R.				
19.	Floor Drains - Dark Room Radiology				
20.	Area Drain - Outside Personnel				
21.	Area Drain - Outside Lab Annex				
22.	Area Drain - Outside Mail Room				
23.	Roof Drains - Sisters' Home				
24.	Roof Drains - Nurses' Residences				
25.	Roof Drains - Lab Annex				

LUTHERAN MEDICAL CENTER
ENGINEERING & MAINTENANCE DEPT.

PM 125-70-A

SEMI-ANNUAL FIRE EXTINGUISHER CHECKLIST

INSPECTED AND TAGGED BY Sister Elizabeth DATE

ITEM NO.	LOCATION	DESCRIPTION	CHECKED & TAGGED	RECHARGED	DATE	COMMENTS
1.	Fourth Floor by Elevator	Soda & Acid				
2.	Third Floor by Nursery					
3.	Third Floor by Elevator	Pressurized Water				
4.	Third Floor back hallway	"				
5.	Second Floor back staircase	"				
6.	Second Floor Nursery	"				
7.	Second Floor Prem. Nursery	CO^2				
8.	Second Floor Elevator	Soda & Acid				
9.	First Floor by Elevator	"				
10.	Back of Recovery Room	CO^2				
11.	Side of Scrub Room	"				
12.						
13.	Boiler Room by Back Door	CO^2				
14.	Boiler Room by Front Door	"				
15.	Basement by Elevator	Soda & Acid				

PM 102-68
Rev. 1-70

LUTHERAN MEDICAL CENTER
ENGINEERING & MAINTENANCE DEPT.
WORK SHEET FOR MOTORS - SEMI-ANNUAL

LOCATION OF UNIT _____ DESCRIPTION _____

MFR. _____ INVENTORY TAG NO. _____

DATE OF INSPECTION _____ NAME OF INSPECTOR _____

ITEM No.	CHECKLIST DESCRIPTION	SATIS	ADJUST MADE	REPAIR MADE	COMMENTS
	BEARINGS & LUBRICATION				
1.	Vibration & Temperature				
2.	Grease Retention				
3.	Belts, Chain, Gear Pressure				
4.	Alignment				
5.	Lubrication				
	PROTECTIVE DEVICES, CONTROLS				
6.	Fuses (Size and Condition)				
7.	Starter				
8.	Controls				
	MISCELLANEOUS CHECKS				
9.	Check Motor Under Load				
10.	Motor Temperature				
11.	Ventilation for Motor				
12.	Unusual Noises				
13.	Electrical Connections				
14.	Moisture Protection				
15.	Motor Mounting				
16.	Ground Connections				
17.	Clean & Blow Out Windings				

LUTHERAN MEDICAL CENTER

December, 1971

JOB TITLE: CHIEF ENGINEER

JOB REQUIREMENTS:

A) EDUCATIONAL - Specific formal educational requirements should include minimum High School education. Prefer a college graduate with a B. S. degree in Engineering. Applicant may have, in lieu of formal education, Stationary Engineers License and Refrigeration License valid for N. Y. City.

B) EXPERIENCE - Minimum of five years experience as a High Pressure Boiler Watch Engineer with a minimum of five years in Supervisory capacity in an Engineering Dept. in a medical facility. Prefer experience as an Assistant Chief Engineer, Chief Engineer or Maintenance Supervisor. Prefer minimum of five years experience with large central air conditioning units. Prefer N. Y. City Certification for Central Oxygen Systems, Standpipe, Sprinklers, etc.

C) HOURS OF WORK - Generally 40 hours per week set at the convenience of the Chief Engineer. Days, no week-ends but occasionally available for emergenc call-ins.

JOB DESCRIPTION:

A) General total responsibility for daily operation of the physical plant. Must prepare all schedules of work for all trades and see that supervisors and/or Foremen carry out assigned responsibilities.

B) Plan, set up and carry out a Preventive Maintenance program. Modify existing PM forms and develop new ones as required.

C) Set up periodic Job Meetings with Engineering & Maintenance Dept. Supervisors and Foremen to plan and review work.

D) Prepare budget estimates of Dept. needs annually and estimates of various Engineeri projects as required.

E) See that material inventory is maintained and material ordered as required.

F) Assign work requests from various departments to different Foremen or Supervisors.

G) Trouble-shoot where necessary to help Foremen or Mechanics in occasional difficult situations.

H) Initiate design modifications of existing systems when necessary & review with Administration

I) Maintain and improve knowledge of Engineering and Maintenance requirements by study of current literature, attending meetings, seminars, etc.

J) Work closely with all other department heads to minimize breakdowns and work reques Attend and participate at staff meetings as required.

K) Maintain laiason with utility and/or fuel companies to review costs, efficiendy and operations.

LUTHERAN MEDICAL CENTER

December, 1971

JOB TITLE: ASSISTANT CHIEF ENGINEER

JOB REQUIREMENTS:

A) EDUCATIONAL - No specific formal educational requirements but prefer High School graduate with some higher education. Applicant may have, in lieu of formal education, Stationary Engineers License and/or Refrigeration License valid for N. Y. City.

B) EXPERIENCE - Minimum of five years experience as a Boiler Watch Engineer with some supervisory experience in an Engineering Dept. of a Medical Facil: Prefer experience as a Chief Engineer, Assistant Chief Engineer or Maintenance Supervisor. Prefer some experience in Maintenance of large central air conditioning units. Prefer N. Y. City certification for Central Oxygen Systems, Standpipe, Sprinklers, etc.

C) HOURS OF WORK - Generally 40 hours per week set by the Chief Engineer. Usually days with no week-ends but must be occasionally available for emergency call-ins on nights or week-ends.

JOB DESCRIPTION:

Work directly under the guidance and leadership of the Chief Engineer and assume his responsibilities in his absence. Assist the Chief Engineer in the performance of the following:

A) Prepare schedules of work for all trades and see that supervisors and/or Foremen carry out assigned responsibilities.

B) Plan, set up and carry out a Preventive Maintenance program.

C) Prepare budget estimates of annual Dept. needs and specific projects as required.

D) See that material inventory is maintained and materials for projects ordered as required.

E) Assign work requests from various depts. to Foremen.

F) Trouble-shoot in boilers, air conditioners and/or mechanical equipment to help Foremen or Mechanics in difficult situations.

G) Work closely with Foremen in Job Meetings to plan and review work

H) Maintain and improve knowledge of Engineering and Maintenance requirements by study of current literature, attending meetings, seminars, etc.

manner through welding, pipe replacements, etc.

I) Clean out boilers each year and maintain clean heat transfer surfaces & coils. Make all repairs on boilers and heating systems including control adjustments and replacements. Clean traps, strainers, filters, etc. periodically and make necessary repairs or replacements.

J) Periodically order materials as required for work.

K) Perform miscellaneous items of work including general clean-ups, moving, minor painting as required by the Engineering Office.

L) Check to see that plumbers and helpers conform to hospital rules during working hours.

LUTHERAN MEDICAL CENTER
Brooklyn, New York

January, 1974

JOB TITLE: ELECTRICIAN FOREMAN

JOB REQUIREMENTS:

A) Educational - No specific educational requirements but prefer individual with High School Diploma, capable of reading and writing English. Prefer some ability to speak Spanish.

B) Experience - Minimum of five years experience in the electrical field with substantial experience in maintaining or installing services. Must have some supervisory experience and/or heavy construction experience. Must be capable of performing independent work with a minimum of supervision and must have own hand tools.

C) Hours of Work - Generally 8:00 a.m. to 4:00 p.m. Monday through Friday with ½ hr. for lunch. May be required to work overtime or week-ends on occasion. All hours worked over 37½ hrs. per week are paid for at time-and-one-half rates.

JOB DESCRIPTION:

A) Have fairly good knowledge of N.Y.C. Electrical Code requirements and keep necessary records of tests performed as per code requirements.

B) Assign work orders, preventive maintenance work sheets, or other duties to electricians and helpers and periodically supervise their work to insure good standards of quality and safety.

C) Install and maintain, electric services, branch conduit and flexible cable including wire, rigid pipe, boxes, BX and greenfield.

D) Install and maintain panelboards and fuse boxes including up-to-date directories, circuit breaker and fuse replacement, etc.

E) Test or "ring out" both standard and low voltage wiring systems.

F) Read, understand, interpret and work from wiring diagrams on equipment, control systems and blueprints.

G) Install and maintain lighting fixtures, including ballasts, lamps, switches, etc.

H) Install and maintain signal systems such as low voltage nurses call systems, paging systems, etc. by following wiring diagrams and manuals.

I) Performs regular tests of equipment such as emergency generators, ground detectors, biomedical apparatus, etc.

J) Repair and maintain electrical equipment including solenoid valves, motors, electric beds, suction machines, pumps, etc.

K) Use required meters, tools to prepare occasional reports as required by the Engineering office.

L) Perform miscellaneous items of associated work including general clean-ups, painting of equipment and areas, moving equipment, etc.

M) Check to see that electricians, etc conform to hospital rules during working hours.

N) Periodically order materials as required for work.

LUTHERAN MEDICAL CENTER
Brooklyn, New York

January, 1974

JOB TITLE: CARPENTER FOREMAN

JOB REQUIREMENTS:

A) Educational - No specific educational requirements but prefer individual with High School Diploma capable of reading and writing English. Knowledge of some Spanish is desirable.

B) Experience - Minimum of five years in the Carpentry field with substantial experience in finish Carpentry, Masonry and tile work. Some supervisory work responsibilities preferred. Must have own hand tools and be capable of performing independent work with a minimum of supervision.

C) Hours of Work - Generally 8:00 a.m. to 4:00 p.m. Monday through Friday with ½ hr. for lunch. May be required to work overtime or week-ends on occasion. All hours worked over 37½ hrs. per week are paid for at time-and-one-half rate.

JOB DESCRIPTION:

A) Assign work orders or other duties to Cabinet-Maker, Carpenters and Helpers and periodically supervise their work to insure good quality standards and safety.

B) Use all standard carpenter, mason, tile setter tools and equipment including saws, grinders, levels, etc.

C) Read simple blueprints and lay out work by chalk-lines or other methods for partitions, doors, windows, cabinets, etc.

D) Install and repair door bucks, doors, windows and hardware.

E) Construct wood and plastic-laminate faced furniture.

F) Erect and/or repair brick or block walls.

G) Mix cement and install walkways, driveways, slabs, etc.

H) Construct suspended acoustical and/or sheetrock ceilings.

I) Install and repair sheetrock walls, including taping, spackling and sanding preparatory to painting.

J) Install floor and wall tiles, ceramic and vinyl asbestos, by adhesive or mud method.

K) Install and repair windows, sash and glazing, lintels and waterproofing.

L) Perform miscellaneous jobs as required or assigned, including general clean-ups, minor painting, etc.

M) Check to see that Carpenters, etc. conform to hospital rules during working hours.

N) Periodically order materials as required for work.

LUTHERAN MEDICAL CENTER
Brooklyn, New York

January, 1974

JOB TITLE: MAINTENANCE FOREMAN

JOB REQUIREMENTS:

A) Educational - No specific educational requirements but prefer individual with High School Diploma capable of reading and writing English.

B) Experience - Minimum of five years in the maintenance field with substantial experience on boilers and air conditioning equipment. Prefer some specific experience as a fireman or refrigeration mechanic with at least two years of some supervisory experience. Must have own hand tools and be capable of performing independent work with a minimum of supervision. Prefer certificates of fitness for Sprinkler, Standpipe and Oxygen system.

C) Hours of Work - Generally 8:00 a.m. to 4:00 p.m. Monday through Friday with ½ hr. for lunch. May be required to work overtime or week-ends on occasion and may be called in at any time of night or week-end in an emergency. All hours worked over 37½ hrs. per week to be paid for at time-and-one-half rate.

JOB DESCRIPTION:

A) Assign work orders, preventive maintenance work sheets or other duties to maintenance mechanics, helpers, refrigeration mechanic and periodically supervise their work to insure good quality standards and safety.

B) Use all standard maintenance tools such as drills, taps, welding and/or burning equipment, soldering iron, etc.

C) Read simple blueprints and schematic diagrams and understand principles of operation of boilers and air conditioners.

D) Repair and maintain low and high-pressure boilers, including control circuits, piping arrangements, water feed pumps, etc.

E) Repair and maintain pumps, compressors, bearings, motors, fans, etc.

F) Check water treatment systems and readings and maintain lubrication schedule.

G) Maintain repair and adjust control systems, pneumatic, electrical and others for boilers and air conditioners.

H) Maintain and repair various portable items of equipment such as suction machines, beds, ventilators, stretchers, wheelchairs, etc.

Have some knowledge of electrical wiring including ability to read and interpret simple wiring diagrams.

J) Repair leaks, replace small sections of defective piping, replace fuses, insulate areas, etc.

K) Install and repair simple hardware such as door closers, window locks, pulls, etc.

L) Repair and maintain air conditioning systems including cooling towers, condensors, filters, refrigerant piping, insulation and controls.

M) Perform minor jobs of moving equipment, patching, construction or demolition. Keep equipment and shop clean and freshly painted.

N) Check to see that mechanics, etc. conform to hospital rules during working hours.

LUTHERAN MEDICAL CENTER

APRIL, 1971

JOB TITLE: ELECTRICIAN

JOB REQUIREMENTS:

A) EDUCATIONAL - No specific educational requirements, but prefer individual with High School Diploma capable of reading and writing English. Technical related school training preferred.

B) EXPERIENCE - Minimum of five years experience as an Electrician and/or Helper with general experience pertaining to requirements of this job. Must be capable of performing independent work with a minimum of supervision. Must have own hand tools.

C) HOURS OF WORK - Normally Monday through Friday from 8 A.M. to 4:30 P.M. Emergencies or special job requirements may dictate occasional overtime, night time or week-end work.

JOB: DESCRIPTION:

A) Have some knowledge of N.Y.C. Electrical Code Requirements.

B) Install and maintain electrical service and branch conduit and flexible cable including wire, rigid conduit, junction, splice or pull boxes, hangers, greenfield and BX.

C) Install and maintain panel boards and fuse boxes including circuit breaker replacement and addition.

D) Test or "ring out" both standard and low voltage systems.

E) Install and maintain lighting fixtures including ballasts, lamps and reflectors and switches and receptacles.

F) Install and maintain nurses call systems by following wiring diagrams of manufacturer.

G) Install and maintain low voltage simple paging systems, alarms, etc.

H) Perform conductivity tests in O.R. and Delivery Room areas in accordance with Code Requirements. Perform other tests of emergency generators, and ground detection as directed.

I) Repair and maintain electrical equipment such as solenoid valves, motors, electric beds, suction machines and other pumps, hot plates, etc.

J) Use required hand and power tools and perform miscellandous associated jobs as required, including clean-ups, painting, etc.

LUTHERAN MEDICAL CENTER

APRIL, 1971

JOB TITLE: PLUMBER

JOB REQUIREMENTS:

A) EDUCATIONAL - No specific educational requirements, but prefer individual with High School Diploma capable of reading and writing English. Technical related school training preferred.

B) EXPERIENCE - Minimum of five years experience as a Plumber and/or Helper with general experience pertaining to requirements of this job. Must be capable of performing independant work with a minimum of supervision. Must have own hand tools.

C) HOURS OF WORK - Normally Monday through Friday from 8 A.M. to 4:30 P.M. Emergencies or special job requirements may dictate occasional overtime, night time or week-end work.

JOB DESCRIPTION:

A) Install, maintain and repair waste and soil piping and accessories including caulking of cast iron joints.

B) Install, maintain and repair water piping and vent lines and drains.

C) Install and repair steam piping, except welded pipe, including traps, strainers and valve repacking, threading, tapping, etc.

D) Install and repair compressed air piping, distilled water piping, acid waste lines, vacuum and oxygen piping and accessories.

E) Install and repair plumbing fixtures, pumps, boiler accessories.

F) Test and repair sprinkler and standpipe systems.

G) Has some knowledge of N.Y.C. Administrative Code Requirements for Plumbing installations.

H) Installs and repairs insulation on piping and equipment.

I) Perform miscellaneous associated jobs as required. Able to read and interpret simple sketches and drawings. May be required to perform general clean-ups, painting, etc.

LUTHERAN MEDICAL CENTER

APRIL, 1971

JOB TITLE: MAINTENANCE MECHANIC

JOB REQUIREMENTS:

A) EDUCATIONAL - No specific educational requirements, but prefer individual with High School Diploma capable of reading and writing English.

B) EXPERIENCE - Minimum of five years in the Maintenance field with substantial experience on pumps and/or boilers. Prefer specific experience as fireman or refrigeration mechanic. Is capable of performing independent work with a minimum of supervision. Must have own hand tools.

C) HOURS OF WORK - May be required to work day, evening, night or swing shifts. Hours of work may be changed to meet special conditions or problems. All hours worked over 40 hours are paid for at time and one half with night differentials paid to employees who do not work the day shift.

JOB DESCRIPTION:

A) Have some knowledge of boiler operation and maintenance, including piping arrangements, controls, burners, water treatment, etc.

B) Install, maintain and repair boiler sections and pumps, compressors and motors, including bearings, belts, pulleys, etc.

C) Maintain, repair and adjust system controls including gauges, valves and relays and have some knowledge of, and ability to repair, various hospital systems including HVAC, Plumbing and Electrical.

D) Maintain and repair various portable items of equipment such as suction machines, beds, pumps, etc.

E) Have some knowledge of electrical wiring including ability to read and interpret simple wiring diagrams.

F) Repair leaks, defective piping, replace fuses and/or circuit breakers and other similar items of work.

G) Perform minor repairs to, and maintain, air conditioning systems including cooling towers, condensers, filter changing, refrigerant piping and controls.

H) Install and repair hardware such as door closers, window locks and specialty items.

I) Perform minor jobs of patching, construction or demolition. Cleaning and painting of equipment including pumps, piping, tanks, generators, compressors, etc.