INDIAN HEALTH SERVICE HOSPITAL

BROWNING, MONTANA

FACILITY POST OCCUPANCY EVALUATION

DIVISION OF HEALTH FACILITIES PLANNING

OFFICE OF RESOURCE MANAGEMENT

OFFICE OF MANAGEMENT

OFFICE OF THE ASSISTANT SECRETARY FOR HEALTH

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FOREWORD

This report is one of a series of surveys of recently completed Indian Health Service Hospitals and Health Centers, which have been conducted to aid in the planning, design, construction and operations of future IHS facilities.

The IHS program currently provides direct health services to Indians, Alaska Natives, Eskimos and Aleuts in 43 hospitals and over 300 health centers and health stations. Since 1980, eleven new hospitals and seven new health centers have been constructed, and at the present time six additional hospitals and thirteen additional health centers are in the planning or design process.

The Browning Hospital was surveyed on June 6-8 1989. The following individuals participated as members of the POE team:

Joseph J. Corliss (DHFP, Structural Engineer)
James L. Crawford (OES - Seattle, Electrical Engineer)
William E. Duncan (DHFP, Mechanical Engineer)
Chris McGuigan (IHS Headquarters, Architect)
Kent B. Morgan (DHFP, Architect)
Richard S. Snapp (OES - Seattle)

This report was prepared by the DHFP team members, with substantial input from Jim Crawford of OES, Seattle, and Chris McGuigan of the IHS Division of Facilities Construction and Management.

In conducting the survey the evaluation team greatly appreciated the help and cooperation of David Means, Acting Service Unit Director; Reis Fisher, Administrative Officer; Rob Smith, Chief of Facilities Management; and many other members of the hospital staff.

EXECUTIVE SUMMARY

The new 64,000 gsf hospital at Browning was completed in 1986 as an addition to the 1960 building, which itself was an addition to the original 1937 structure. Upon occupancy of the new building, the two-story 1960 wing containing 20,000 gsf was completely renovated for use by Environmental and Community Health, Central Stores and Maintenance. The 1937 building was converted for use by tribal programs.

The POE team found that the mix of new and remodeled space at Browning functions reasonably well, with only minor sacrifices in efficiency. With few exceptions, this facility is well-planned and functions very well.

Several errors uncovered by the POE team could have been corrected during the design process. During the design phase it is important that frequent and careful reviews be conducted by each design discipline.

1. Architectural/Civil Highlights

   a. The addition was located by necessity at the rear of the compound, but directional signage is poor. The loading dock is unfavorably located on the windward side of the building.

   b. The single-ply roof system has held up well under severe conditions. Better anchoring methods are recommended.

   c. Parking lot snow removal is hindered by excessive curbing. The plastic sheeting used under lava stone ground cover has been unsuccessful in controlling weeds.

   d. Poor drainage at the ambulance entrance makes cleaning difficult. Rubber fabric matting makes a poor flooring material in the entrance vestibule, which is used as a waiting area during mild weather.

   e. Some interior materials have proven inadequate, including vinyl-covered corridor walls not protected by bumper guards, plastic laminate doors which have chipped and delaminated, and particle-board shelving which sags under loads in Medical Records, Pharmacy and Radiology.

   f. For better after-hours security, the maintenance staff installed additional corridor doors near the Emergency Department.

   g. The layout of the acute care nursing unit does not afford direct sight lines between the nurses station and any patient room, forcing staff to rely on complex electronic monitoring equipment.

h. During design, the emergency trauma room was separated from the Emergency Department and paired with the delivery room in order to provide an unprogrammed surgery department. This has yielded an under-utilized surgical suite and an obviously undersized emergency department, which cannot make good use of the trauma room.

i. The glasswashing section of the laboratory was placed in the center bay of the main area, but this area is not used and need not have been programmed. It makes the lab appear to be oversized for its workload.

j. Radiology shares its reception area with Laboratory, but the receptionist is awkwardly remote from the radiology staff. A pass-through window could have improved this situation considerably.

k. The Ambulatory Care Department, while provided with good exam and treatment space, suffers from the conversion of reception, triage, control, charting and subwaiting areas to other uses, in a kind of domino effect.

l. The placement of Community and Environmental Health on the second floor of the 1960 wing has isolated them from other outpatient services. However, staff saw some benefit in this situation, and complained only of poor acoustics and lack of direct outside access.

m. The administrative suite has exceeded its programmed space by moving contract health offices to the Medical Records Unit and relocating the security office to the Emergency Department.

n. Medical Supply suffers from an awkward and fragmented layout. The gas sterilizer is remotely located, and therefore has never been used.

2. Mechanical Highlights

a. A separate cooling system should be installed in the pharmacy and in the laboratory, such as a hot gas refrigeration system.

b. Whenever electric controls are installed on any fixture (such as a lavatory) or device which is required for patient care, the device should be served by the emergency generator.

c. Coil and boiler-tube pulling space must be provided for all equipment, to allow for easy and economical maintenance.

d. Ceiling plenums should not be used for return air in hospitals; return air should be ducted.

e. The cooling air through the emergency generator room must be sufficient to maintain the room temperature at 100 degrees F if the exterior temperature is 95 degrees F.

f. Air supply to janitors closets and toilets should be 10 air changes per hour, to meet code and conserve energy.

g. Shock absorbers should be installed in all domestic water lines between the quick closing device and the system piping that is being protected from over-pressure and resultant knocking.

h. Dental vacuum systems should have cleanouts per the Compressed Gas Association Standard, P-2.1.

j. Pipe hangers should be installed with no pipe weight bearing on equipment connections, as required by code.

k. As-built drawings should be submitted to the contracting officer before the last payment is made, showing exactly how the equipment and materials were installed. These should include sprinklers, controls, and corrected dimensions and locations of all equipment.

l. Air vents should be installed in all heating and cooling pipes where the pipe turns down in the direction of flow.

m. Rainwater piping should be insulated within the building, to prevent condensation and energy loss.

n. Duct access doors should be installed in all situations where devices are located within ducts, for ease of maintenance and adjustment.

3. Electrical Highlights

a. Power quality is a problem at Browning, which experiences frequent brownouts and voltage dips. As a solution, power conditioners were installed at sensitive electronic devices. Future projects should incorporate power conditioners for each piece of electronic equipment that might require such conditioning.

b. At locations such as Browning, where utility power is subject to outages and brownouts, enough of the heating plant should be connected to the essential electrical system (EES) to maintain indoor temperatures at 55 degrees F. Exterior receptacles should also be provided for engine block heaters for staff vehicles.

c. In projects which include renovation of an existing facility and addition of new square footage, electrical services should be combined into one service system, minimizing service power disconnects to the facility and combining utility metering into a single meter. The EES for new additions should be combined similarly into one centrally located distribution system.

d. Some government-furnished equipment had initial warranty periods which expired before the equipment was installed, or soon thereafter. Equipment purchases should be made to insure that warranties extend well beyond the installation dates of the equipment.

e. Location of electrical panels in janitors closets has resulted in storage of custodial equipment in front of electrical panels, in violation of code. Separate dedicated electrical closets should be provided.

f. The use of cable trays within ceiling cavities would allow installation of communications wiring without threatening the fire and smoke integrity of the building.

g. The power-operated ambulance garage doors should be provided with a manual "chain-operated" override.

h. Multi-level light switching is inappropriate for small spaces, such as exam rooms, where all the lights are normally required for the task. The "U-tube" fluorescent fixtures used in corridors should be avoided and straight four foot fixtures used for economy and efficiency.

i. The facility does not have a lightning protection system. All future projects should include analysis of lightning risks.

Although this report focuses on a number of deficiencies and suggested corrections, it should be emphasized that the design of the hospital is generally very successful in terms of its impact on staff, patients and visitors. The organization of the components is readily understood, so that patients and visitors are not easily confused.

The building is very attractive in appearance. The main entrance is inviting, and interior lighting, finishes and furnishings create a pleasant atmosphere. The building and its equipment are well-maintained. There is an obvious "pride of ownership" among the staff and users of the facility.

INDIAN HEALTH SERVICE HOSPITAL
BROWNING, MONTANA

FACILITY POST OCCUPANCY EVALUATION

A. ARCHITECTURAL

1. Introduction

a. The Program Information Document (PID) for the new hospital at Browning was approved in May 1982, and design documents were completed in July 1983. During the planning and design process there was much argument about whether to build an entirely new facility at a site removed from the existing hospital, or to construct an addition and continue to use portions of the older building for certain hospital functions. The latter course was adopted at the insistence of the Public Health Service headquarters and the Office of Facilities Engineering in the Office of the Secretary.

b. The new construction portion of the project was completed and occupied in February 1986, at which time a complete renovation of the 1960 wing was begun. Renovation was completed in April 1987. The A/E for both the new construction and renovation projects was Meyer/Page of Great Falls, Montana.

c. The PID called for new construction of 64,000 gross square feet (gsf), plus 2,900 gsf for a vehicle storage building. The actual area as built is about 66,800 gsf, plus vehicle storage of about 3,000 gsf. This is about 4% higher than the PID amount, due primarily to additional major mechanical space and other gross area such as the roofed ambulance entrance (see Summary of Building Areas, p.34). In addition to the area of new construction, the renovated 1960 wing contains approximately 20,000 gsf of space.

d. The new building is a single story steel frame structure of protected non-combustible construction, which is fully sprinklered. The structure is supported on concrete foundations, which enclose a crawl space about four feet in height. (See photos 1, 5 and 6 for general views of the building exterior.) The 1960 building is a two-story reinforced concrete structure with prestressed double T beams and masonry exterior walls. This portion of the facility contains an elevator, and it is directly connected to the original 1937 structure, the main floor of which is on the upper level. At the time of the site visit, the 1937 section of the building was being renovated for use by tribal health programs.

2. Site and Orientation

a. The new hospital is reached by a somewhat circuitous route through a residential area on the north side of the city of Browning, then through the BIA compound, past the old IHS quarters, over a hill and around the old hospital buildings and fenced vehicle compound. The placement of the vehicle garage and fenced compound gives the approach to the main entrance the appearance of a service area. The emergency entrance lies beyond, at the far end of the building (see photo 2).

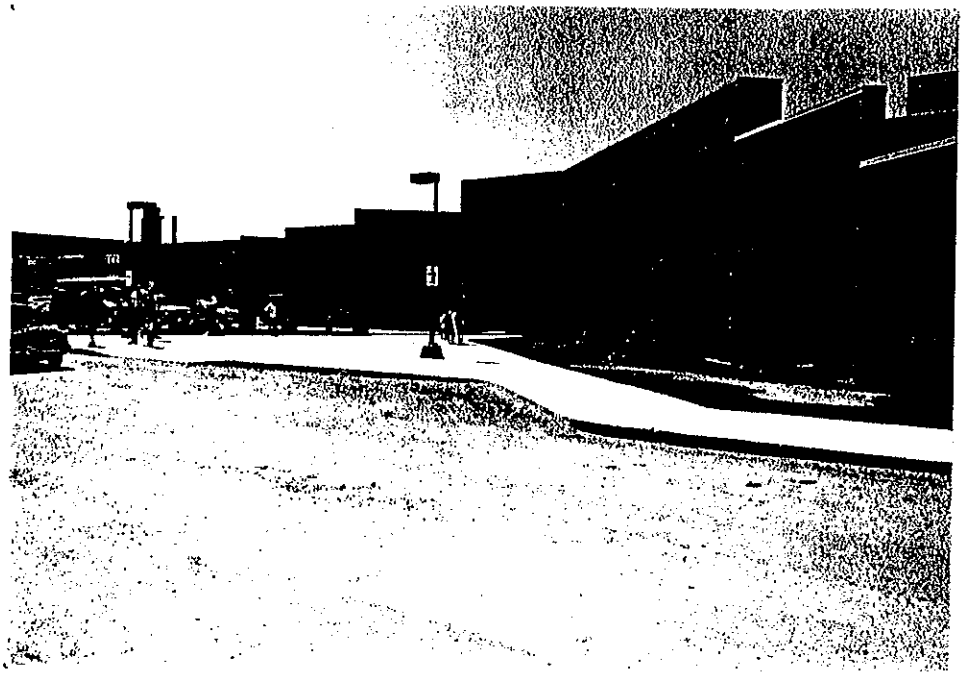
b. The main entrance, on the east side of the building, is well located in relation to prevailing winds. The emergency entrance, on the north side, is sheltered by baffle walls to the west and north of the entrance, a necessity during the winter. Even so, the staff complained about wind penetration through the emergency entrance vestibule.

c. The placement of the Acute Care wing on the west side affords it fine views of the imposing mountain range on the horizon. Since this is also the direction of the prevailing winds, the grade was bermed up to the window sill level (about 3' - 0") on the exterior walls in order to reduce the exposed area (see photos 4 and 40).

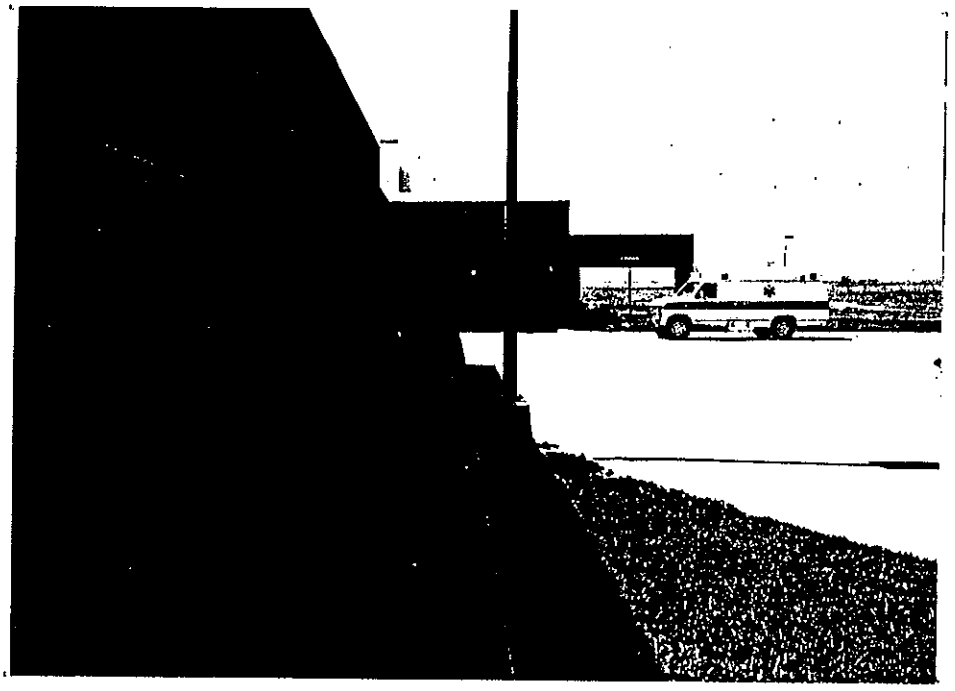
d. The loading dock and service entrance are unfavorably located on the windward side of the building (see photos 5 and 34). Browning is subject to strong winds during much of the year, and the configuration of the dock and service entrance in a pocket cause this area to collect windblown dust, snow and trash.

e. It should be noted that the placement of the new structure as an addition to the 1960 wing made the above arrangements almost inevitable. The construction of an entirely new hospital access road from the east would improve the approach to the main and emergency entrances.

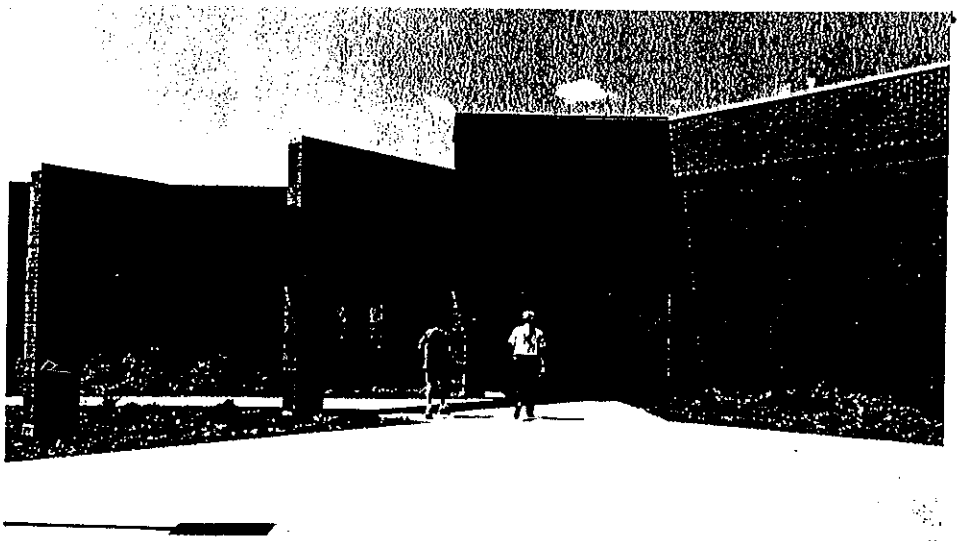
f. Signage/Identification: The new building is not well identified for the first-time visitor. At the entrance to the BIA/IHS compound, there is one directional sign, which reads "hospital". At the approach to the building there is no sign giving directions to the main entrance, which is actually near the rear of the complex. One could assume that the entrance to the original building, now used for tribal health programs, is the hospital entrance. Once around the east side of the complex and past the fenced vehicle storage area, the only sign, other than parking signage, is mounted on the wall at the front entrance. It reads "Blackfeet Community Hospital." There is no reference to the IHS or PHS (see photo 3).



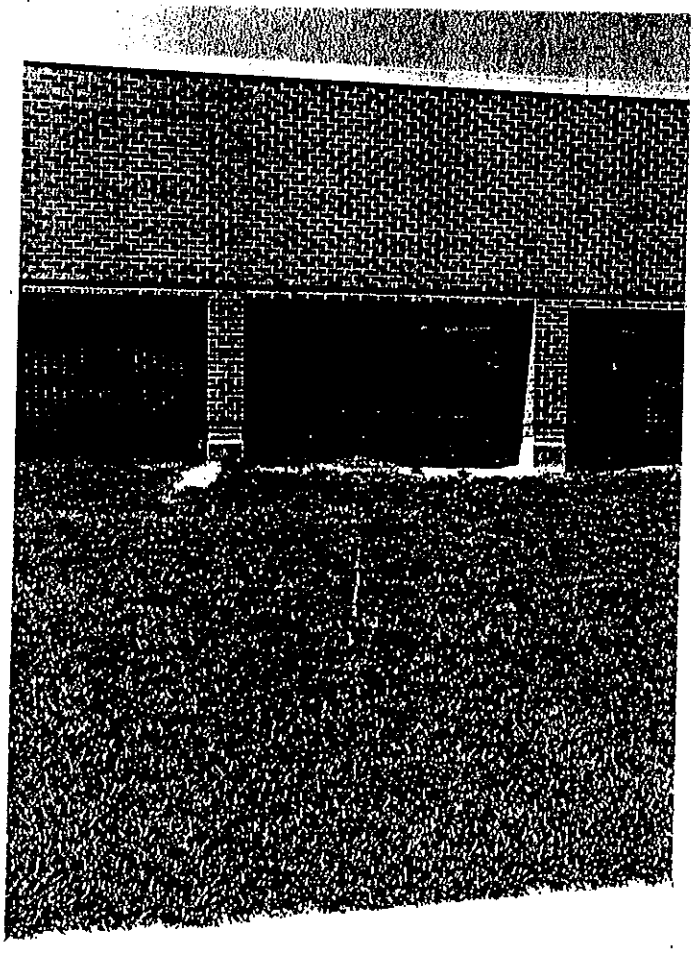
1. Approach to main entrance of hospital, looking southwest.



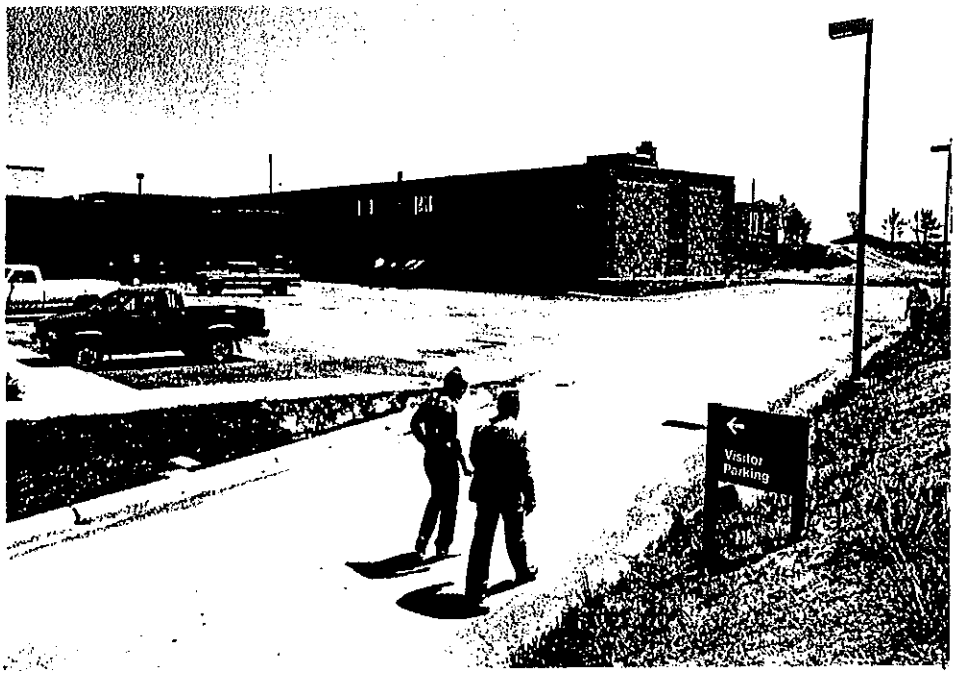
2. North side of building, showing partially enclosed emergency entrance.



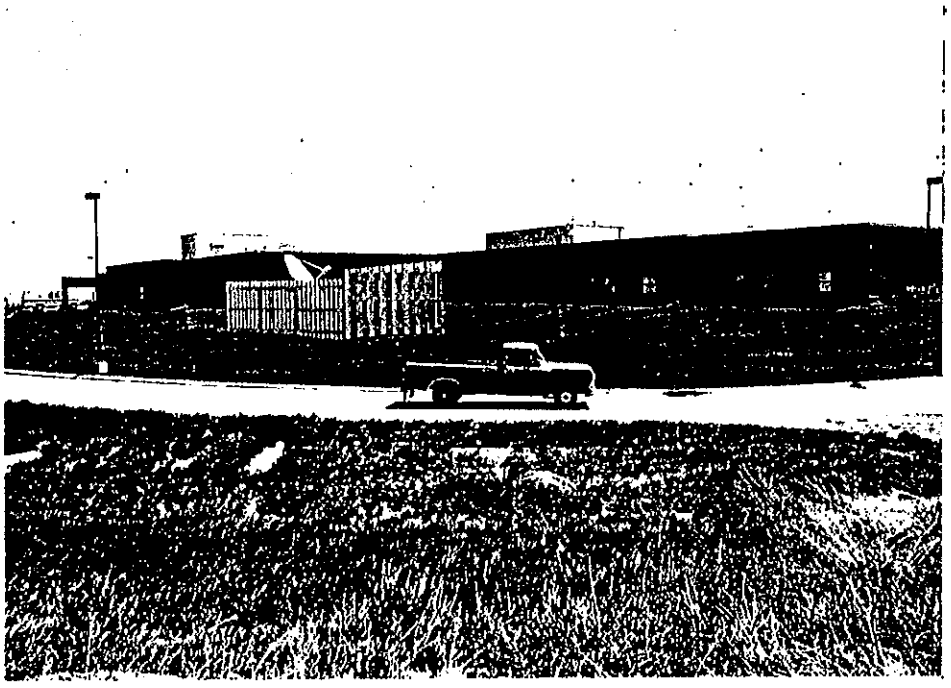
3. Main enterance, showing sole building identification sign at right of entrance doors.



4. South wall of acute care wing, showing ground bermed up to window sill height. Windows are located in recessed areas under "parapet" wall.



5. Acute care visitor parking, service entrance, loading dock and renovated 1960 wing.



6. North side of new building with acute care wing on right, showing windbreak constructed around satellite dish antenna.

3. General Appearance

The hospital (both new addition and renovated 1960 wing) is very attractive in appearance. The interior public areas are inviting, pleasant and well-maintained spaces. There is an obvious "pride of ownership" among the staff and users of the facility. The good acoustics produced by carpeting in the public areas, the natural light from skylights over the main waiting area, a muted color scheme and the display of numerous paintings, carvings and sculpture by local artists all reinforce the pleasant atmosphere of this facility (see photos 8 and 9).

4. Exterior Features

a. The roof of the new structure, as well as that of the renovated 1960 portion, is a single-ply membrane with gravel ballast. After some initial repairs during construction, no leaks have been observed. A severe storm on Jan. 31, 1989, with winds exceeding 100 mph, provided a good test of the roof. Although the ballast was partially blown off, and concrete blocks and salt bags had to be carried up to hold it down, the membrane remained intact. During this storm, a portion of roof of the 1937 structure was separated from the substrate and damaged. This older roof was being replaced at the time of the visit. In view of the many serious roof problems encountered at other IHS facilities, the POE team recommends serious consideration of the single-ply system used here in future facility designs.

b. The exterior walls of the new structure are primarily brick, a suitable material for this location. There has been a small amount of cracking due to settlement and thermal expansion. This is particularly noticeable at one corner of the building near the front entrance. A concrete walk adjacent to the building has cracked due to ground settlement (see photo 7).

c. The 1960 structure employs the Dryvit exterior insulation system applied to ground floor walls and piers. Brick veneer is used on the upper floor, and the original stone walls have been preserved on the ends of the wings (see photo 5).

d. The new structure is fully accessible to the handicapped.

e. Landscaping: Considering the harsh climate, the landscaping around the building was found to be in reasonably good condition. The few evergreens planted on the north end of the building showed considerable damage from severe weather. A windbreak of evergreens on the

north and west sides would be desirable if it could be established. (The only real windbreak at present is a massive wooden structure constructed for this purpose around the satellite dish antenna. See photo 6.)

f. The lava stone ground cover used around the main entrance has proven to be a maintenance problem: it is blown away by the high winds and is also picked up and thrown by children. The maintenance staff is considering paving more of the entrance area. Use of loose material such as lava stone should be limited in future designs (see photo 3).

g. The heliport is used frequently for transport of patients requiring specialized care, and also occasionally to receive patients from remote areas such as nearby Glacier National Park. It is well located in relation to the emergency entrance and away from parking areas, and appears to function adequately.

h. Drainage at the ambulance entrance, which is covered and partially enclosed, is a problem. This area must be hosed down regularly, but the concrete pad does not slope entirely to the drain, and in cold weather it becomes icy.

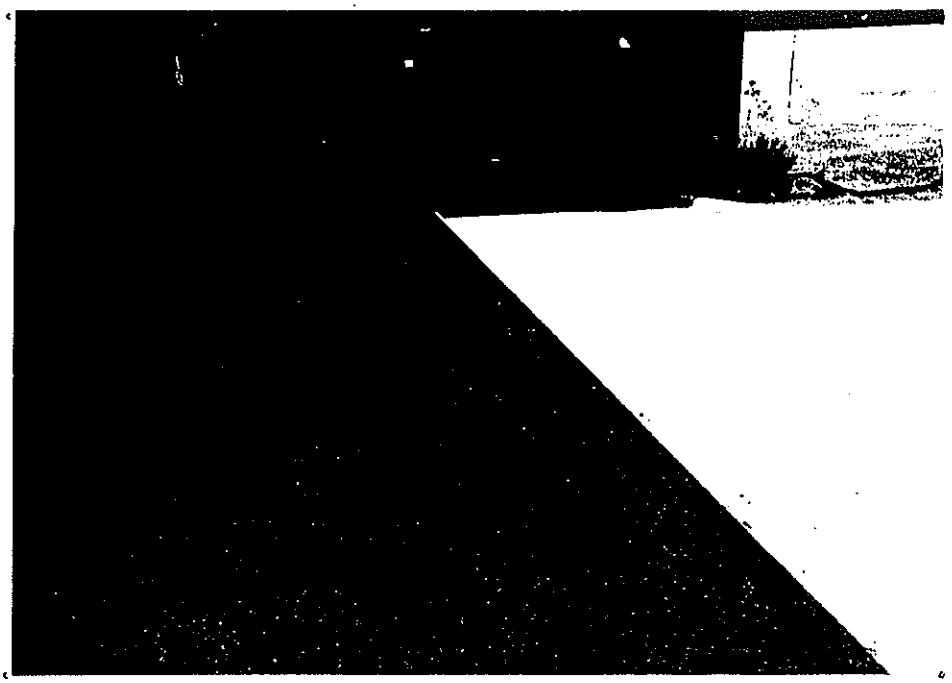
5. Building Security

a. The hospital security office has been relocated from the main entrance, which operates only during normal business hours, to a room adjacent to the Emergency Department front desk, which operates on a 24 hour basis.

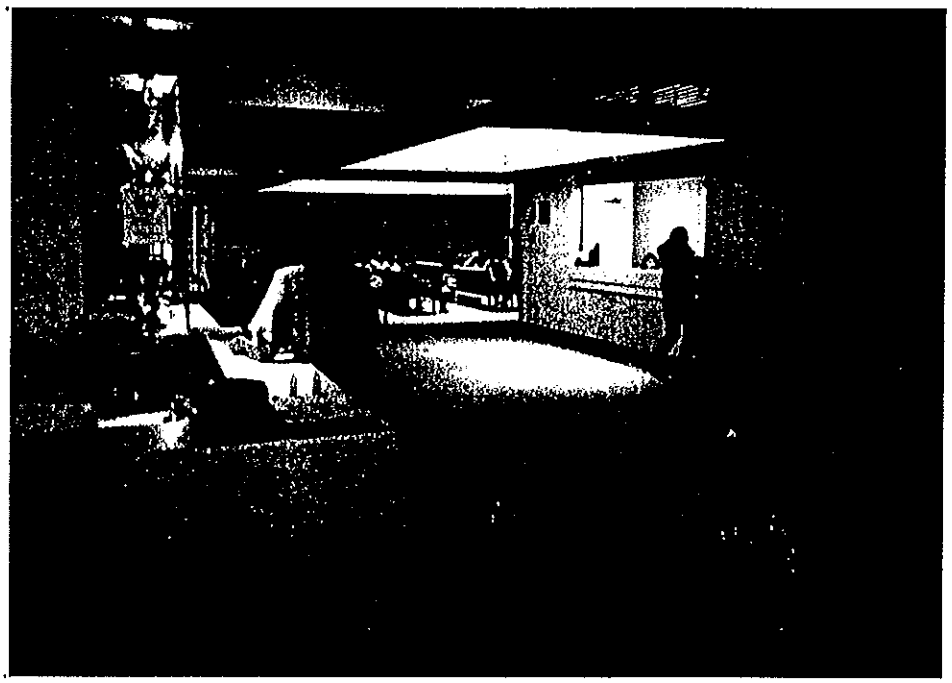
b. Additional corridor doors have been added between the emergency suite and the Laboratory/Radiology corridor to control access to the rest of the building after normal working hours. This barrier creates an access problem for emergency patients and visitors who wish to use the public toilet rooms, which are located near the main lobby.

6. Functional Relationships and Traffic Patterns

a. Due to its arrangement as an addition to an older building, the layout of this hospital should not be considered as a model for future facilities. Nevertheless, it is a generally successful design in terms of interdepartmental relationships and patient and staff flow patterns. Inpatient services are well isolated from outpatient functions. Connections to the renovated 1960 structure are logical and easy to use.



7. Sidewalk near emergency entrance, showing cracks in concrete due to settlement at building wall.



8. Main lobby and waiting area, taken from main entrance. Reception desk is in left foreground. Ambulatory care reception is at center in brightly lit area.

Patients and visitors do not easily become lost or confused, and elaborate directional signage and graphics are not needed.

b. Specific problems regarding traffic and inter-relationships are discussed in the detailed comments concerning certain departments. See 31.0 EMERGENCY CARE (relative to Surgery, Radiology and Public Facilities); 32.0 AMBULATORY CARE; 35.0 PHARMACY; 42.0 HEALTH RECORDS (relative to Pharmacy, Ambulatory Care, Emergency Care and Lab); and 51.0 MEDICAL SUPPLY (relative to Surgery & Obstetrics).

c. One result of using renovated space in this design is that Community Health Services and Environmental Health, located on the second floor of the 1960 wing, are relatively remote and separated from other outpatient services by hospital support functions. Generally this is a disadvantage. However, some advantage was seen in having mental health patients isolated and not exposed to the scrutiny of other patients.

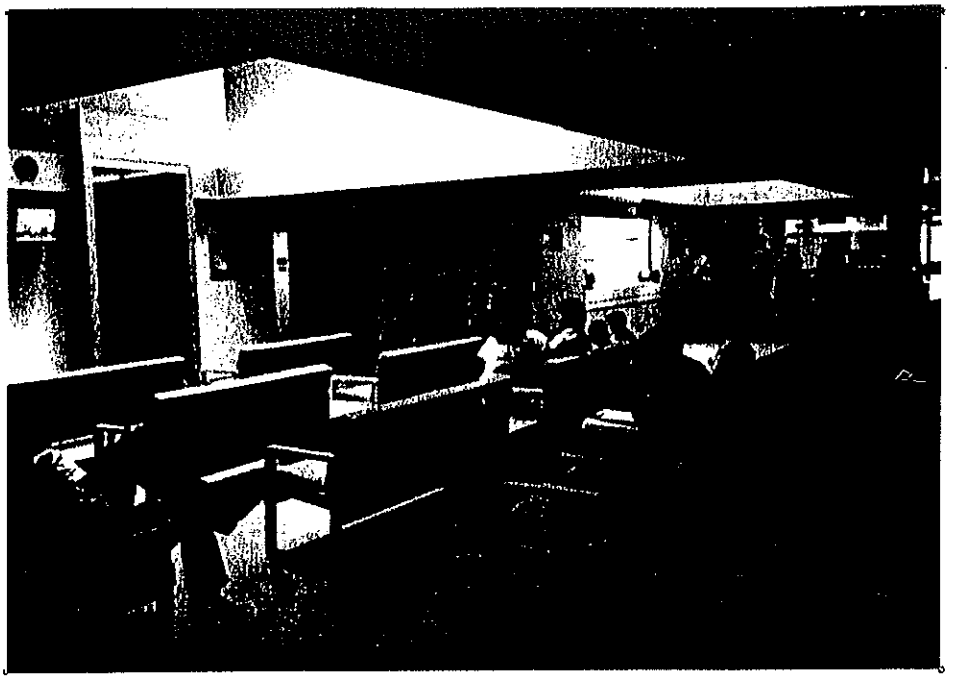
7. Interior Features (General)

a. The exposed concrete block wall finishes used in many corridors and other locations have proved difficult to clean: they collect dust and require brush vacuuming. The stippled finish of the vinyl wall covering also collects dirt. This is a problem especially in the Emergency Care Department, where blood often must be washed off the walls.

b. Many corridor walls, especially in the inpatient areas, have been badly scratched and gouged by carts and other equipment. Even with attentive maintenance, many walls are still being damaged. This indicates the need for using materials of greater durability, as well as bumper guards throughout the facility.

c. The plastic laminate doors throughout the building have presented problems since initial occupancy. Bumping by carts and other equipment has caused many doors to become chipped and delaminated. Maintenance staff reported that many doors were repaired under warranty, and many continue to be "patched" in the shop. More careful attention should be paid during design and construction to the quality of doors specified and installed.

d. Much of the built-in and movable shelving is sagging. This is due to the use of particle-board shelving in heavy loading situations (such as medical records, radiological films and pharmacy supplies). Such flexible



9. Main ambulatory care waiting area.

10. Acute care nurses station. Patient monitoring equipment located on counter at left of photograph.

shelving materials should not be specified in these situations.

e. Staff in almost all departments noted that departmental storage space is insufficient. The POE team noted that this observation recurs in almost all facility reviews. It was noted that this is usually the result of a combination of inadequate programming for storage space and also inefficient use of the space which is provided.

f. See also additional comments under 45.0 PUBLIC FACILITIES.

8. Comments by Department

NOTE: Number preceding department name corresponds to the standard system used in the IHS Health Facilities Planning Manual.

11.0 ACUTE CARE NURSING (GENERAL MEDICAL & PEDIATRIC), 13.0 ICU

a. The PID called for a 27 bed facility: 19 medical/surgical (including one isolation, one security and two equipped with intensive care monitoring devices), five pediatric and three obstetrical. This has since been reduced by two beds to accommodate the present delivery/birthing arrangement (see 11.0, OBSTETRICAL NURSING). In the medical/surgical category, the PID specified 15 single and two double bedrooms, but the facility was designed with 13 single and three double bedrooms. The POE team also noted that medical/surgical, obstetric and pediatric beds are used interchangeably.

b. The nurses station has no direct sight lines to any patient room (i.e., no visual control). This is the result of the department layout and the configuration of the nurses station (see photo 10). Program criteria and design review should produce a layout with better visual control. (However, cameras and other electronic monitoring devices are provided in several of the patient rooms. Some training is required of nursing staff to learn to operate the sophisticated devices.)

c. In the two-bed patient rooms, only one vacuum and one oxygen outlet were provided, whereas two of each outlet are often needed. This often means that only one patient can be assigned to a two-patient bedroom. Photo 10 shows a typical two-bed room.

d. The one-piece molded fiberglass shower stalls in the patient bathrooms were specified in order to meet

handicapped accessibility requirements (see photo 12). The curb does not adequately contain shower water, yet it does impede wheelchair access This type of fixture is required by code, but unfortunately does not function very well. Water on the bathroom floors is a common problem. Relocating the shower curtain somewhat "inboard" might help to contain the water in the shower.

e. Location of accessories within patient bathrooms is inconvenient or unworkable. Specifically, the toilet tissue holder and nurse call switch cannot be reached from a seated position. Greater attention should be paid to these details during design and design review.

f. The tub room is rarely used, and the staff felt that it could be eliminated, since each patient room has a shower. The Emergency Department is the main user of the pediatric tub.

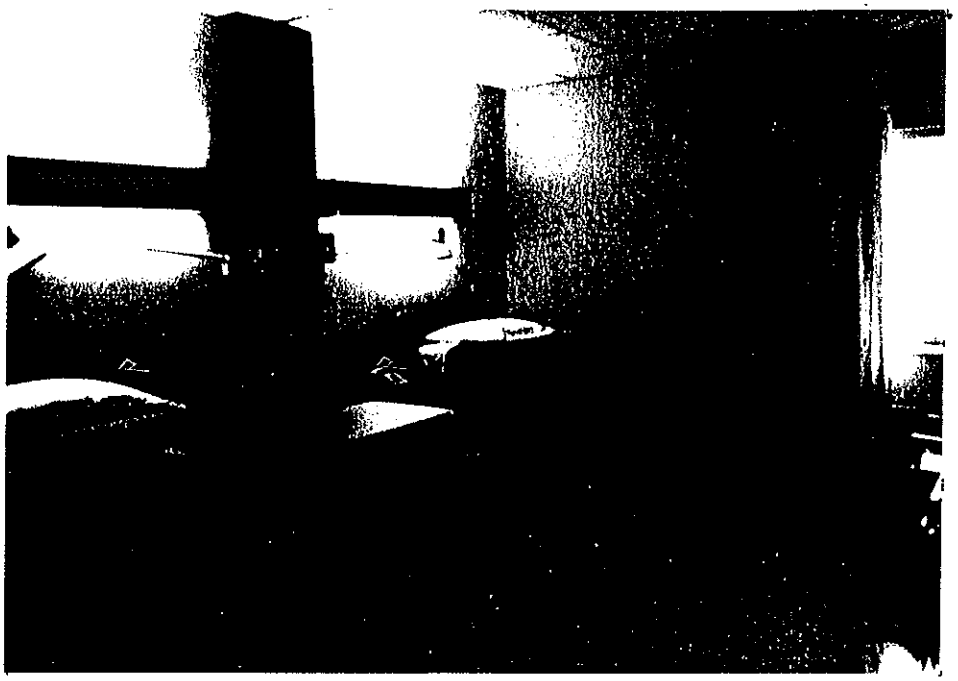
g. The door hardware in the patient toilet which serves the security room was incorrectly specified. It allows the door to be locked from the inside, a major inconvenience for the staff, a hazard to patients and an deterrent to using the room with high-risk patients. However, the location of the security room at the rear of the Acute Care Department works well and is liked by the staff.

h. The soiled utility room is inappropriately equipped, and provides no counter space on which to work. This room is currently used for storage, which underscores the lack of storage space provided for the unit.

11.0 OBSTETRICAL NURSING, 12.0 NURSERY, and 15.0 LABOR/DELIVERY

a. The PID specified a three-bed obstetrical suite with one isolation bedroom and one double bedroom. However, the obstetrics and labor/delivery departments have experienced considerable change in the way their space is utilized. The original delivery room, along with the adjacent trauma room provided in the plan, is now used as a surgical operating room, and is used only for surgical deliveries. Routine deliveries are accomplished in the larger obstetrical bedroom, which has been converted to a labor and birthing room. (The labor room within the Delivery Suite is used as a backup birthing room.)

b. The nurses station in the Obstetrical Nursing Department is not staffed on a 24 hour basis, due to staffing limitations. Obstetrical patients are often housed in the medical/surgical section and supervised from the medical/surgical/pediatric nurses station.



11. Typical two-bed patient bedroom.

12. Typical patient toilet, showing lip at shower access which does not contain water and impedes wheelchair entry.

c. The Exam Room located within the obstetrical unit is not used as planned for examining incoming patients, but only for circumcisions and storage of infant formula.

d. Labor and Delivery shares clean and soiled utility space with the Obstetrical Nursing unit. Therefore, for storage of clean and soiled goods, the staff must leave the delivery area (when they are using this area rather than the regular birthing room) and enter the Obstetrical Nursing unit.

e. The sink with electronic controls provided in the nursery work area is unsuitable for bathing babies: the temperature cannot be controlled, nor can the rate of flow. (The faucets do not work at all during power outages.) While these controls represent the latest technology, the staff feels that manually operated devices would be better. (This comment also applies to other departments, including ACUTE CARE and EMERGENCY CARE.)

14.0 SURGERY

a. The PID did not include a surgery department. The space identified as "Emergency Room" in the PID and as "Trauma" on the floor plans was paired with the delivery room by the A/E and located across a public corridor from the Emergency suite with a "back door" entrance from the public corridor (via an anteroom whose size and configuration (requiring a right angle turn in a small space) makes passing a gurney through it extremely difficult). Apparently, it was thought that in this way it could be used by Emergency Care and could be converted to regular operating room use when necessary.

   The PID instructed the A/E that "the emergency room may have to be converted to operating room use in emergency situations... The A/E should, therefore, consider special architectural-engineering considerations as well as essential equipment requirements with the above in mind."

b. The resulting design, with the large Emergency Trauma room located remotely from the Emergency suite, has not worked as intended. It leaves the Emergency Care Department without an adequate Trauma Room (see 31.0 EMERGENCY CARE), and, together with the delivery room, which is used only for surgical deliveries (see 11.0 OBSTETRICAL NURSING and 15.0 LABOR/ DELIVERY), yields an under-utilized surgical suite, a function which was not envisioned in the PID. This situation may be the result of a conflict of interests between various planning staffs and tribal authorities.

21.0 LABORATORY

a. The main laboratory space is spacious, well equipped and well maintained. One question raised by both administrative staff and the POE team was whether the lab is oversized for its workload. On initial inspection, it appeared that the Procedure area is clearly too large. On closer examination, it was found that this is due primarily to the presence of the central glasswashing bay in the center of the procedure area. The glasswashing facility is not used and need not have been programmed. Photo 13 shows the general laboratory layout.

b. No hood set-up was provided in the Microbiology Procedure Area, and as a result, excessive fumes accumulate in this area. A countertop hood was installed after occupancy, but it is not used, due to inadequate exhaust capacity.

c. The laboratory staff raised the following issues:

1) Noise levels in the laboratory are excessive (e.g., 95 db) when multiple pieces of equipment are operating (particularly refrigerators/freezers). This problem could have been avoided, at least to some extent, with proper sound dampening techniques.

2) The storage room is too small for necessary laboratory supplies.

3) Heavy laboratory doors are kept propped open to allow circulation of both personnel and air. Travel distance between lab and specimen collection is inconvenient.

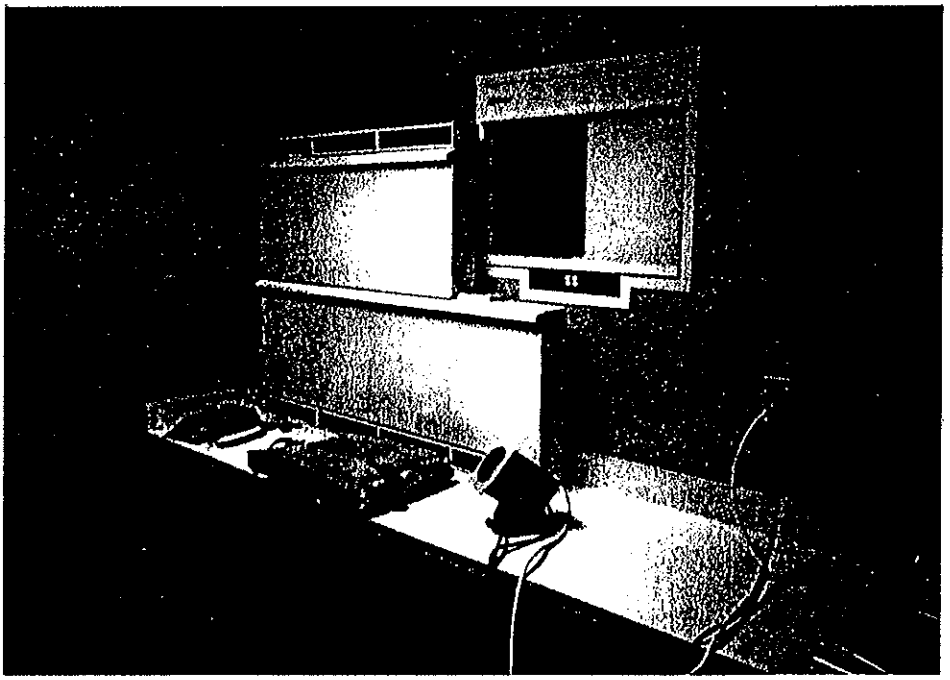
4) There is a need for computer equipment space. Currently the staff must work in the Procedure Area when using computer equipment. A separate computer area should have been planned, including proper power supply and telephone line for a modem.

5) One office has been converted to a small conference room, which is much used and appreciated.

22.0 RADIOLOGY - DIAGNOSTIC IMAGING

a. Although this department is sized 45% below the PID area, the staff did not complain of a shortage of space, other than the lack of transcription space. The greatest disparity between PID and actual design is in the film storage and work area: about 900 nsf in the PID versus 300 nsf as built.

13. Main laboratory area, with glasswashing bay at center.



14. Radiology film viewing room, with portable film illuminators added to supplement built-in unit.

b. The relationship between the radiology office and the reception area, which is required to be shared with the Laboratory, is too remote. It requires traveling through heavy doors and around a corner. A pass-through window between the receptionist and the radiology office would improve operations greatly (the two spaces share a common wall).

c. Staff expressed no dissatisfaction with the department's physical relationship to the Emergency Care Department. However, they noted that the portable x-ray unit is taken to the emergency suite frequently.

d. The room designated "EKG" on the plans (and included within the Laboratory Department in the PID) has been converted to an ultrasound room. According to planning criteria, the workload did not justify an ultrasound room. However, the staff felt that an ultrasound room was more useful than an EKG room.

e. Multiple recessed, wall mounted x-ray film illuminators were installed in the corridor, but only one unit was installed in the film viewing room. Five additional portable illuminators have been added in the film viewing room since building occupancy (see photo 14).

f. The Radiology suite is dark, with no access to natural light. Staff noted that it would be desirable to have an exterior window in the suite. There is ample exterior wall exposure, so that it could have been included in the design.

31.0 EMERGENCY AND URGENT CARE

a. Although on paper this department exceeds its PID allotment by about 21%, it is starved for space more than any other department in the hospital. There are several reasons for this situation:

1) The "official" trauma room is virtually unused and unusable by Emergency Care because of its location in the Labor/Delivery suite (see 14.0 SURGERY).

2) The 150 nsf office has been taken over as the Security Office (see # 5, Building Security).

3) The Emergency Care department plays a larger role at Browning than apparently was envisioned by the planners.

If the remotely located trauma room (now surgery) and security office are deleted from the department's space,

the effective area is about 6% below the PID area. In addition, the POE team found that the PID allotments were too low for functions such as waiting, triage, nurses work area and patient/visitor toilets.

b. The functions of various spaces have been modified in various ways to suit existing conditions:

1) The large vestibule between automatic entrance doors was also intended for stretcher storage (see photo # 13 of vestibule, waiting area and Emergency Care reception). It will accommodate stretchers, but during warm weather it is used as the emergency waiting room, and it is inadequate both in size and design for this purpose. The floor, which is covered with glued down 12" x 12" rubber fabric strip matting, often becomes soiled with food, blood and vomitus. It cannot be cleaned thoroughly and presents a continual housekeeping problem.

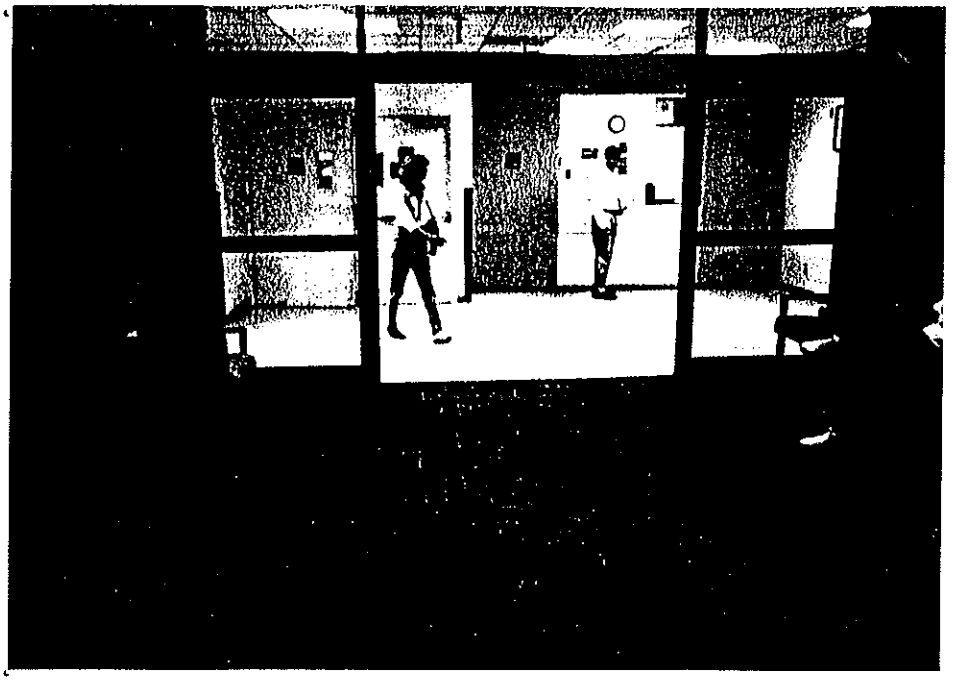
2) The area designated for emergency waiting is little more than a widened corridor in front of the reception window. It is used for waiting only in cold weather, when it is very inadequate in size (see photos 15 and 16).

3) A physician's office in the Ambulatory Care Department, located adjacent to the front of the Emergency suite, has been converted to a Triage Room, which was badly needed; this room has inadequate ventilation and storage space for its new function.

4) The first treatment bay or cubicle in the Emergency Room is used as a trauma treatment room. This space is too small and inadequately equipped for this purpose.

5) The suite includes five treatment cubicles, which are often insufficient. One has been converted to a trauma treatment area and the others must be paired at times for lack of vacuum outlets (one outlet was provided for every two beds). The one fully enclosed treatment room (labelled "holding room" on the plans), is used for OB/GYN exams, since it is the only area which offers privacy. Treatment Bay #2 lacks an overhead exam light.

6) The space provided for reception and nurses station has proved to be inadequate in size, and a "temporary" work area for the nurses has been set up in the treatment area corridor. This reduces circulation space in the treatment area. Also,



15. Emergency entrance with vestibule in foreground (dark area), waiting area and reception counter beyond.

16. Emergency care corridor with small waiting area and reception counter at left. Note marks on waiting area wall caused by chairs located here during cold weather.

there are inadequate electrical outlets here for the equipment, which includes radio communications apparatus for ambulances and helicopters.

7) As the department is presently configured, there is no patient toilet. A small toilet, apparently intended for patient use, but with dual access from the OB/GYN treatment room, is kept locked on the corridor side and reserved solely for the treatment room). Emergency patients and visitors must use the toilets near the main hospital waiting area. The HFPM calls for two patient toilets, and the idea of saving space by providing a shared toilet was not a functional one.

c. Other problems noted in the Emergency Care suite include:

1) The Orthopedic Cast Room should have been located with waiting space adjacent for use during orthopedic clinics; orthopedic patients must stand in the public corridor.

2) The orthopedic room needs a cabinet or space for crutch storage.

3) Problems have been experienced with the operation of the automatic doors (see ELECTRICAL).

4) There is a lack of drainage outside at the ambulance entrance (see #4, Exterior Features).

5) The walls in the reception/waiting area show marks and gouges from chair backs. A chair rail should have been provided.

6) The electronic handwashing sink valves sometimes malfunction; they also do not work during power failures. Staff thought that regular wrist blade controls would be better. (See also comments under 12.0 NURSERY.)

7) No ice machine was provided for this department, compelling staff to travel to Acute Care Nursing to obtain ice. An ice machine should be added to the equipment list for the medication alcove.

8) The Emergency and Urgent Care Department could use its own separate tub and shower. Patients requiring temperature stabilization or decontamination must be taken to Acute Care Nursing for this purpose.

9) To satisfy department needs, storage cabinets have been added by maintenance staff in both soiled utility and medication rooms.

10) There is no janitors closet within this department, which hampers maintenance. The HFPM requirement for a separate janitors closet should be enforced during design review.

11) The ceiling mounted IV tracks are seldom, if ever, used, since portable IV stands work more effectively and the stands can be moved with the patient. Equipment lists should be revised to delete this item.

32.0 AMBULATORY CARE, including ENT CLINIC AND EYE CLINIC

a. In general, this department has a functional, manageable layout, with good circulation. The flow of patients from main waiting to triage, sub-waiting, exam and treatment works well, with minor problems as noted below:

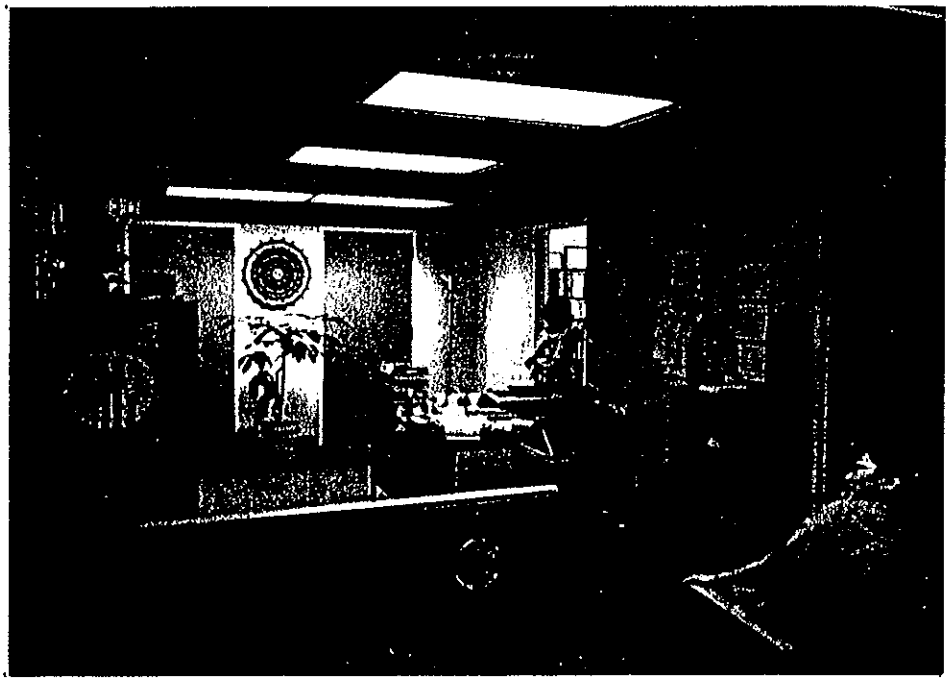
1) The original nurses station, control and charting area, which faces the main waiting room, was found to be too remote and too small, and is now used by the receptionist and clerks. Half of the sub-waiting area behind the department entrance doors has been converted to a nurses work and charting area. This shift has resulted in a less-than-ideal arrangement for the nurses work area, and also too little space available for patient sub-waiting (see photo 17).

2) Two triage rooms were provided in the plan, one for each of the exam room corridors. However, the one which is open to the departmental reception desk lacks privacy and has been converted to office use. The second triage room, therefore, is very heavily used. It is further crowded by an unused and unnecessary patient toilet. A second triage room (as was originally planned) would improve operations and patient flow in this department.

3) The exam rooms are well arranged and equipped. However, the large exam room located near the OPD entrance lacks privacy. The staff thought that the suction outlet provided in each exam room is an unnecessary feature.

4) A recovery room is needed for use in conjunction with outpatient surgery. No space was provided in the PID for this purpose. A section of the hospital

17. Ambulatory care sub-waiting area which has been converted to nurses work and charting area.



18. Mental health and social services reception area, located in renovated 1960 wing.

conference room is sometimes taken over as a recovery room.

b. The ENT and Audiology Clinics are awkwardly located. They have a separate sub-waiting area which can be entered only by passing through the entire Ambulatory Care clinic or through the Eye Clinic.

c. There appears to be an excessive amount of corridor space around the ENT entrance, which could be better utilized as program space. This problem is related to the ambiguous relationship between ENT, Audiology and Ambulatory Care.

d. According to the Audiologist, the audio testing booth is the best piece of equipment in the state of Montana. This is an needless luxury when viewed in the context of the facility's geographical location and the size of the population served. This excessive equipment should not have been specified by the Government.

33.0 COMMUNITY HEALTH SERVICES

a. Located on the second floor of the renovated 1960 addition, these departments fit well into the open office space scheme which this structure allows (see photo 18).

b. The staff in the Mental Health and Social Services section has experienced two interrelated problems with acoustical privacy: First, the relatively high fan noise level in the private offices makes it difficult to hear quiet conversation. Second, the sound transmission characteristics of the partitions and doors allow loud conversations (loud enough to overcome the background fan noise) to be heard easily outside the private offices. It appears that insufficient attention was paid to sound attenuating design in this part of the building.

c. An exit stair from the mental health and social services suite leads directly to the visitors parking lot. This was considered by staff to be a desirable feature, since many patients prefer to use this clinic with as little public notice as possible. However, the housekeeping staff had recently complained that this use required extra cleaning of the exit stair, and therefore this entrance was closed off as a public entrance.

34.0 DENTAL CLINIC

a. The entrance door to the dental suite should be located so as to lead the visitor to the reception desk, instead

of at the other side of the room where patients often bypass the receptionist and proceed directly to the operatory area. This also forces the receptionist to cross the waiting area to reach the treatment area. The position of either the entrance door or the receptionist should be relocated.

b. The staff toilet is located immediately adjacent to the patient waiting area. This is a poor location, since waiting patients are denied access to this toilet.

c. The dental laboratory, which is often unattractive in appearance, is visible from the waiting room. The door to lab should have been located elsewhere than directly at the end of the short corridor from the waiting room.

d. None of the dental operatories provides adequate acoustical privacy, which is particularly important for the treatment of young children. Although one operatory is located in a private room, more attention should have been paid during design to reducing sound transmission.

35.0 PHARMACY

a. The PID called for a separate inpatient pharmacy of 455 nsf. During design this was combined with the main outpatient pharmacy. Staff would prefer to have a satellite pharmacy in the inpatient department. As constructed, there is no space for a pharmacist to work in the inpatient area. This requires a great deal of travel by staff between departments.

b. The four consultation rooms provided (note that the PID specified six at 100 nsf each) are excessive for present operations. Currently, one is used as an office, one for storage, and two for consultation as designed. The HFPM criteria were unreasonable in this case.

c. The Drug Information Center is much larger than required by the PID. This area is never fully utilized, according to the pharmacy staff.

d. The relationship of Pharmacy to Health Records is awkward and labor intensive. Patient records are transported to and from Records on carts, which must be moved through the pharmacy waiting area and across the main outpatient lobby. There is no designated parking space within the Pharmacy for these carts. The relationship between Pharmacy and Emergency Care is even more remote, although staff did not raise this issue.

e. There is a large amount of space at the back of the Pharmacy unit, which appears to be wasted on unneeded circulation space and exit corridors. Much of the Active Storage area is not being used, the result of inefficient design and/or over-programming.

f. Problems with fixed equipment:

1) The reception counter as designed was too low and shallow, forcing patients to stoop over to fill out forms, and allowing them to easily reach over and take packages from the desk. This problem was solved by adding a new 2 foot deep countertop at a new height on top of the original counter.

2) The plastic laminate shelving appears to be sagging, even though many shelves are not fully loaded. This is due to the particle-board material used. Such flexible shelving materials should not be specified.

3) The sliding bulk storage units in the Active Storage area are slow and cumbersome to use. This inefficiency causes slowdowns in the entire department. Certainly, any space saved by this equipment has been wasted in this particular department layout by the excess circulation space described above. It is recommended that this type of equipment not be specified. (See photo 19 for a view of this equipment and other pharmacy furnishings.)

36.0 PHYSICAL THERAPY

a. Because there was no physical therapist on staff at the time of the site visit, the Physical Therapy Department was not currently being used by patients. It appeared to be well arranged and equipped, although it is about 25% smaller than the space delineated in the PID.

b. The Hubbard Tank, which is located in a separate room, has never been used. It was described as unnecessary by several (non-therapist) staff members, since burn patients are evacuated to major medical centers for treatment. It is recommended that future facilities programs be reviewed to determine if such equipment is actually required.

c. No separate janitors closet was provided for Physical Therapy, although one is specified in the PID.

19. Pharmacy dispensing area, showing bulk storage units at center of photograph.

20. Medical records active record storage area, with typical plastic laminate shelving which has been stiffened to correct excessive sagging.

41.0 ADMINISTRATION

a. The administrative suite is organized around a relatively large open office area designed to be occupied by secretarial staff, including contract health service clerks. After building occupancy, the contract health function was moved into Medical Records space (see 42.0 MEDICAL RECORDS).

b. The alcove labeled "Security" on the plans is now occupied by Administration's computer equipment. The security function was better located near the emergency entrance (see Item # 5, Building Security).

c. The resulting administrative suite, which was deficient about 100 nsf as designed, is now ample in size, exceeding its programmed space at the expense of other departments, i.e., Medical Records and Emergency Care.

42.0 MEDICAL RECORDS UNIT

a. This unit currently has adequate space for the records being housed. (Note that it also houses Contract Health with its associated records.)

b. The Transcribing and Records Study rooms along north side of the unit have been converted to house Contract Health offices. (Note that the PID included clerical space for the Contract Health function within the administrative suite.) This requires patients to travel through Medical Records space to reach Contract Health offices, which is a violation of the Privacy Act.

c. Excessive sagging of the plastic laminate shelving has required that all shelves be stiffened in a makeshift way, using 2 x 4's attached to the rear of each shelf, a project undertaken by the maintenance staff. See photo 20 for a view of this shelving.

d. There is no paging capability within the Records Area. Therefore, the staff cannot be paged when using this area.

e. Doctor's dictation is being moved into the medical records unit, which will further crowd the space.

44.0 EDUCATION AND GROUP CONSULTATION

The large conference room is utilized for many purposes (including recovery room for outpatient surgery; see 32.0 AMBULATORY CARE). However, the folding partitions which

divide the space into three rooms are so cumbersome to handle that they are seldom used.

45.0 PUBLIC FACILITIES

a. Public circulation and waiting areas are well designed, employing subdued lighting, vinyl wallcoverings and paint in pastel colors, natural skylighting, wood display cabinets, and Indian art on the walls (see photos 8 and 9). The carpeting and upholstered furniture in the entrance and waiting areas also contribute to pleasant acoustics.

b. Prior to building occupancy, the space near the main lobby designated on the plans as a canteen/vending machine room was converted to computer equipment space. Vending machines have been located in the main corridor on the lower level of the 1960 building. This may be less convenient for patients and visitors, but it has helped to keep the carpeted areas of the new building cleaner by moving much of the food and drink to the hard surfaced corridors.

51.0 MEDICAL SUPPLY SERVICES

a. The soiled holding room in the delivery/surgery suite is connected to Medical Supply only by a pass-through window. Staff noted that they would prefer a door here.

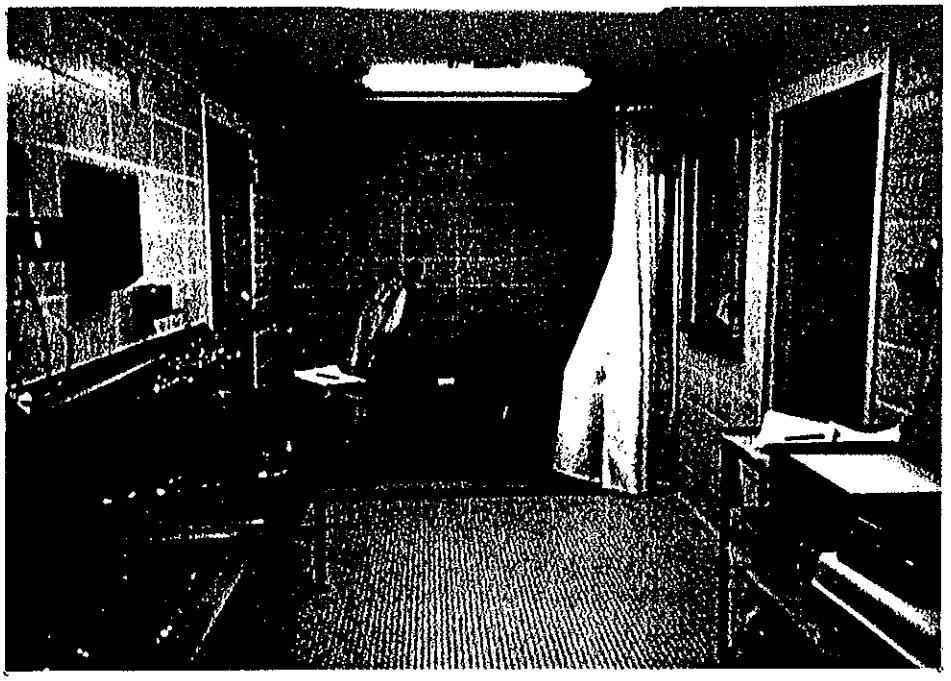
b. Sterile Storage and Issue is located directly off a major public corridor. This function shares a common wall with the delivery/surgery corridor, and it both could and should have had direct access from that corridor.

c. The cart washing area is not used as intended, but as a storage area (see photo 21), because the door to this area is not wide enough to allow passage of carts and gurneys. (Note also that the door swings toward the cart wash area.)

d. The ceiling over the cart wash area shows evidence of water leakage from the mechanical penthouse above. See also Mechanical comments.

e. The bottle washer is located within the Clean Room.

f. The gas sterilizer is located in a room near the main lobby labelled "office" on the plan, which is remote from the Medical Supply suite. As a result, the gas sterilizer has never been used and the space is utilized only for storage (see photo 22).



21. Medical supply unit receiving area, showing unused cart wash area at rear.

22. Gas sterilizer for medical supply unit was placed in remotely located office, which is now used as a storage room.

52.0 PROPERTY AND SUPPLY UNIT

a. The 8' - 6" ceiling height dictated by the existing 1960 structure makes this a relatively inefficient site for storage space. However, partly because of the low ceiling, the bulk stores room has excellent illumination.

b. The narcotics storage room is located outside the secure (alarmed) area.

c. The space designated on the plans as a gas storage room is not used for this purpose. Oxygen and medical gas cylinders must be transported from the loading dock across the main corridor to the medical gas storage room.

d. The loading dock accumulates snow, ice and windblown debris (see comments under #2, Site and Orientation).

e. The dock floor elevation is too low for most trucks which deliver to the hospital (semi-trailers); this requires a steep leveling ramp and sometimes results in difficult unloading situations.

f. The trash dumpsters are poorly located, upwind from the dock. Therefore, trash regularly blows into the dock and adjacent holding rooms. Trash is held temporarily in central stores service corridor located off the loading dock, which creates a bottleneck for other users of this service corridor.

53.0 DIETETICS UNIT

a. The kitchen layout appears to be poorly organized to facilitate food preparation. The stove/oven island acts as a barrier around which the food, which is prepared on the other side, must be carried for cooking. There seemed to be no logical order for food preparation and cooking in this kitchen.

b. A tray line for assembling trays for carts was not provided. Plans are now being made to install one.

c. Two cart systems are used: one for inpatient feeding, another for treatment programs housed upstairs in the 1960 wing. The doors into the kitchen area are too narrow to handle these carts easily. (Carts will pass through, but with only about 1" clearance.) To make things worse, the principal access door is located at the end of a narrow stub corridor.

d. The handwashing sink originally provided had been removed, and a coffee machine was being installed in its

place. This was to replace the coffee urn located in the dining room.

e. Dishwashing and cartwashing equipment and operations appear to be adequate and appropriately sized, and staff was satisfied with this function.

f. The 4" x 8" quarry tile flooring used in the food service areas is excellent. It has a non-slip finish and is easily cleaned and maintained.

g. The dining room would be a more pleasant space if it had an outside window. (Note that a small portion of the west wall of this room is an exterior wall.)

54.0 HOUSEKEEPING AND LINEN

a. Staff remarked about the lack of storage space in janitors closets throughout building. The location of electrical and telephone panels within janitors closets is inconvenient, as well as potentially hazardous.

b. Staff noted that the sinks located in janitors closets were too small. The POE team noted evidence of spillage and damage to gypsum board partitions around many sinks, and also evidence of attempts to patch these walls (see photo 33).

c. Doors to the laundry are too narrow for ready passage of laundry carts.

d. The sewing area is no longer located in the laundry room as designed; it is now located in the former soiled utility room. Therefore, the sink provided in this room is not needed. (Soiled Utility has been moved to the Trash Holding Room, and Trash Holding to the Central Stores service corridor--See also 52.0 PROPERTY AND SUPPLY UNIT.)

55.0 FACILITIES MANAGEMENT

a. The Maintenance Department benefits from its location on the lower floor of original building and 1960 addition. It occupies more space than it would be allotted by the HFPM, although it is more disconnected and oddly configured than if it were located in new space.

b. The building area devoted to major mechanical space is about 6,300 gsf, or about 10 percent of the total gross area of the new structure. (This includes the boiler room, emergency generator, electrical switchgear,

penthouses, etc.) The PID allotted 8 percent of the gross building area for major mechanical space. However, note that the 1989 revisions to the Health Facilities Planning Manual allow up to 12 percent for this function. The POE team felt that the mechanical space was justified and generally well utilized, although in several instances equipment was not arranged efficiently to allow pull space for removal and replacement of components (see MECHANICAL).

c. Access to the roof with its four mechanical penthouses is by way of a metal stair within the boiler room to a mezzanine, and then directly into Penthouse #3. This is an excellent means of access for workers carrying materials, tools, etc. The POE team recommends the use of this type of access in all facilities where equipment is located on the roof.

56.0 BUILDING SERVICES

a. Loading Dock - see Section A.2, Site and Orientation, and 52.0, PROPERTY AND SUPPLY UNIT.

b. Security - see, Section A.5, Building Security.

c. Mechanical Systems Monitoring - see Mechanical Section.

9. Architectural Summary and Recommendations

a. Generally, this is a well-planned facility, although a number of problems were discovered, as documented in this report. In most respects the building functions well, although sometimes not as it was designed, and sometimes in spite of its design.

b. One reason for choosing to evaluate the Browning facility was to learn how the mixture of new construction and renovated space has performed in actual use. The POE team concluded that, on balance, the combining of old and new space has worked reasonably well, with only small sacrifices in function and efficiency. It is recommended that this approach be studied at other IHS facilities in need of enlargement where there is a sound existing structure and an adequate site.

c. Specific major architectural findings described in this report are outlined in the accompanying Summary of Findings by Hospital Department (see page 36.) This table may be used as an index to the comments by specific department.

d. Several general conclusions reached in previous POE reports on other IHS facilities apply very well to the situation at Browning, and should be reiterated here:

1) Planners and designers need regular and timely feedback from the field, so that repetition of planning errors can be avoided. By the time the Browning facility was completed, the criteria upon which it was designed had already changed considerably. The 1989 revision of the HFPM is intended to allow the modification of planning criteria on an incremental basis, so that feedback from POE's and changing medical practice can be incorporated into design criteria for new facilities on a regular basis.

2) The IHS should attempt to employ highly competent A/E firms with proven experience in hospital design as well as familiarity with the geographic location. As is the case in many IHS projects, A/E selection at Browning was very competitive, with great political pressure to engage a Montana firm. This was also a 51% Indian set-aside design procurement. Given all these restraints, the IHS fared well in selecting Meyer/Page, a Montana firm with medical design experience.

3) During the design phase, more frequent and careful reviews should be conducted by each design discipline. Many design errors detected by the POE team could have been corrected during the design process. Apparently, design review teams were not adequately staffed for a project of this magnitude.

4) More careful construction inspection by Government personnel or contracted inspectors should be obtained in order to insure compliance with the design documents and with good construction practice.

5) High quality, durable and easily cleanable finish materials, components and hardware should be mandated in the POR and specified in the design documents. This will help avoid costly maintenance and repair, and numerous makeshift solutions required in the field.

BROWNING, MONTANA, IHS HOSPITAL
SUMMARY OF BUILDING AREAS

NEW CONSTRUCTION

Dept. No.	Department/Area	Area per PID	Area per Plans	Area ±	Percent ±
11.0	Acute Care Nursing	9,176	11,495 ✓	+2,319	+25%
12.0	Nursery	377	263	- 114	-30%
15.0	Labor/Delivery	2,728	2,553	- 175	-06%
		12,281	14,311		
21.0	Laboratory/Pathology	1,963	2,245 ✓	+ 282	+14%
22.0	Radiology/Diagnostic Imaging	3,255	1,781	-1,474	-45%
		5,218	4,026		
31.0	Emergency and Urgent Care	2,174	2,640 ✓	+ 466	+21%
32.0	Ambulatory Care	5,481	6,250 ✓	+ 769	+14%
33.0	Community Health	(located in renovated 1960 building)			
34.0	Dental Clinic	2,587	2,928 ✓	+ 341	+13%
35.0	Pharmacy	2,756	2,547	- 209	-08%
36.0	Physical Therapy	1,612	1,207	- 405	-25%
		14,610	15,572		
41.0	Administration	1,350	1,222	- 128	-09%
42.0	Health Records	3,384	3,140	- 244	-07%
43.0	Employee Facilities	1,416	1,072	- 344	-24%
44.0	Education and Consultation	1,656	1,615	- 41	-02%
45.0	Public Facilities				
	Info/Switchboard	80	75		
	Public Toilets	490	426		
	Meditation/Chapel	120	126 ✓		
	Concession	250	142		
	Lobby/Waiting	1,500	1,910 ✓		
	Dental Waiting	200	245 ✓		
	Lab/Rad. Waiting	200	288 ✓		
	Phys. Ther. Waiting	100	110 ✓		
	SUBTOTAL - Public Facilities	3,381	3,322	- 59	-02%
51.0	Medical Supply	794	848	+ 54	+07%
52.0	Property and Supply	60	150 ✓	(see also renov.)	
53.0	Dietetics Unit	2,676	2,573	- 103	-04%
54.0	Housekeeping and Linen	1,194	1,260 ✓	+ 66	+06%
55.0	Facilities Management	400	0	(see also renov.)	
56.0	Building Services	176	490 ✓	+ 314	+178%
57.0	Clinical Engineering	(located in renovated 1960 building)			
	TOTAL AREA	48,981	49,601	+ 620	+01%
	Floor gross factor (PID = .2)	9,796	10,391		
	FLOOR GROSS AREA	58,777	59,992	+1,215	+02%
	Major Mechanical Space	4,700	6,260	+1,560	+33%
	Ambulance Garage	500	528		
	BUILDING GROSS AREA	63,977	66,780	+2,803	+04% ✓

8% 10%

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BROWNING, MONTANA, IHS HOSPITAL
SUMMARY OF BUILDING AREAS

RENOVATED 1960 BUILDING

Dept. No.	Department/Area	Area per PID	Area per Plans	Area ±	Percent ±
33.0	Community Health	5,316	(not available)		
52.0	Property and Supply	5,302	(not available)		
45.0	Public Facilities (Community Health Waiting)	345	(not available)		
55.0	Facilities Management	2,533	(not available)		
57.0	Clinical Engineering	(included in PID in Facilities Mgt.)			
	TOTAL AREA	13,496			

INDIAN HEALTH SERVICE HOSPITAL, BROWNING, MONTANA

SUMMARY OF DEFICIENCIES BY DEPARTMENT

	DEFICIENCY TYPE	11.0 MS/OB	12.0 NURS	14.0 SURG	15.0 DELIV	21.0 LAB	22.0 RAD	31.0 ER	32.0 AMB	33.0 CHS	34.0 DENT	35.0 PHAR	36.0 PT	41.0 ADMIN	42.0 REC	44.0 CONF	45.0 PUBL	51.0 CSR	52.0 STOR	53.0 DIET	54.0 HSKPG	55.0 FACIL	56.0 BLDG
1	DEFICIENT INTERDEPARTMENTAL RELATIONSHIPS					X	X	X		X		X			X			X					X
2	INSUFFICIENT SPACE PROVIDED *				X			X	X														
3	INSUFFICIENT STORAGE SPACE *	X				X	X	X													X		
4	SEPARATE JAN CLOSET NEEDED *							X					X										
5	UNNECESSARY SPACE PROVIDED *	X				X			X			X											
6	MAJOR CHANGE IN SPACE USAGE *	X		X	X	X		X	X					X	X						X		
7	FRAGMENTED DEPARTMENT LAYOUT							X										X	X			X	X
8	AWKWARD DEPT CONFIGURATION	X					X	X	X		X	X						X	X	X		X	
9	STAFF CONTROL INHIBITED	X					X		X		X												
10	INSUFFICIENT SEPARATION OF CLEAN & DIRTY AREAS		X																				
11	INADEQUATE DOOR/ACCESS WIDTH *			X														X		X	X		
12	ACOUSTICAL PROBLEMS					X				X	X												
13	NEEDED EQUIPMENT NOT SPECIFIED					X		X												X			
14	UNNECESSARY EQUIPMENT PROVIDED *					X		X					?							X			
15	INAPPROPRIATE EQUIP SPECIFIED *	X	X					X	X			X			X						X		
16	EQUIPMENT POORLY LOCATED	X					X											X					X
17	INSUFFICIENT UTILITY CAPACITY	X						X															
18	INADEQUATE UTILITY CONTROLS		X																				

* LOOKED AT DURING THE UPDATING OF HFPM.

B. CIVIL/STRUCTURAL

1. General Comments

The Browning Hospital is a well constructed, well maintained health care facility. The new building is a single story steel framed structure with non-symmetrical spans and with mixed structural elements below grade, including reinforced concrete, masonry bearing walls and steel.

The marriage of the new addition with the existing facility appears to work well. The hospital is sited in an area with extensive fill. In some areas the ground adjacent to the building has settled about 6 inches. This should not be considered a major structural problem, and can be corrected is most cases by adding topsoil. (See photo 4 for evidence of ground settlement at acute care wing, and photo 7 showing concrete cracking due to settlement near emergency entrance.)

Drainage at the site has been adequately designed and constructed; however, there are some problems that have been identified at the junctions of project areas. At the south of the site, across an access street, there is a marshy are which fills with water when there is heavy precipitation.

A lack of exterior signage makes it difficult for a stranger to find the main and emergency entrances to the hospital (see Architectural, page 2, for additional comments on signage and identification). It appears that some directional signs were placed too close to the edge of the road and have been knocked down either by traffic or snow removal operations.

Maintenance of the facility is well organized and is working smoothly with the automated integrated system.

2. Specific Comments

a. Roof systems are a problem in the Northern Plains region. During February 1989 am arctic cold front was accompanied by winds up to 120 mph. The roof system was put to the test. The roof ballast of 2-3" diameter gravel was virtually blown from large areas of the roof. Since no roof are guaranteed or warranted to survive winds in excess of 100 mph, special design features and specifications should be provided for roof systems in the Northern Plains. As a minimum, structural anchors should be used on roof insulation, and ballast should not be less than the 3-4" range.

b. Parking Lots: As designed, the parking lots meet the POR requirements. A major fault lies in the extensive use of curbs, which inhibit or contribute to maintenance problems. Snow removal is next to impossible with the many curb returns. We recommend providing minimum curbing, with design aimed for ease of maintenance. Island or peninsular curbing especially should be minimized.

c. Sprinkler Systems: Sprinkler systems are a must in order to maintain plantings. Sprinkler heads should be protected from traffic and placed at least 4'- 0" from road edges where there is no curbing.

d. Weed Control: All weed control used in landscape plantings should be a specifically designated weed control mat, and not other plastic material. The weeds in the gardens around the hospital have grown through the plastic material, which appears to be 10 mil black plastic which is deteriorating.

C. MECHANICAL

1. GENERAL

a. The boiler and adjoining rooms within the main hospital building house the boilers, chiller, pumps, softeners, reverse osmosis (RO) unit, water heaters, and the medical vacuum pumps and air compressors. Penthouses protect the roof level mounted air handling units and the steam generators. The dental vacuum pumps are installed in the crawl space along with the condensate pumps and the domestic water circulation pumps.

b. The engineering and maintenance staff were very helpful in the post-occupancy examinations. Mr. Robert Smith, Mechanical Engineer, provided us with his first-hand information on the construction and operation and made members of his staff available as needed. The management and staff show pride in the facility by the cleanliness of the mechanical equipment and areas.

2. BASIC SCHEME

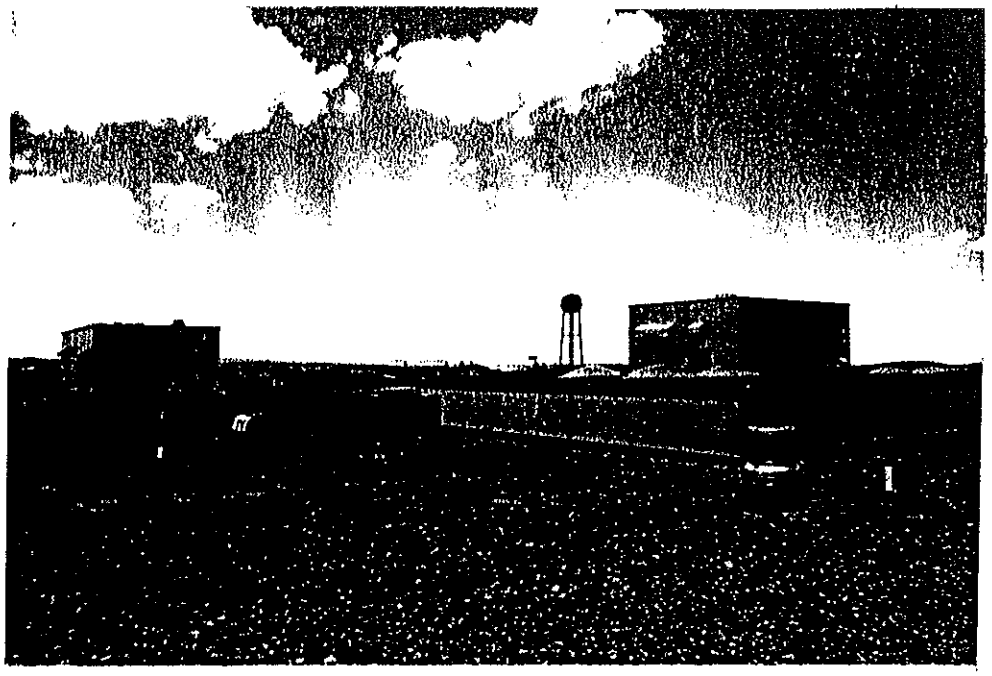
a. This facility is a single story, noncombustible, fully fire sprinklered building. The construction is a steel framed single story building over a crawl space with 4 mechanical penthouses on the roof, see photo 23, which shows the south side of penthouse No. 2 at the left and penthouse No. 1 along with the raised ceiling structure, with skylights, over the patient waiting area. Photo 24, looks to the southeast, shows penthouse No. 4 at the right and penthouse No. 3 in the center of photo.

b. The two heating water boilers are located in the boiler room (see figure no. 1 and photo 25). The boilers are dual fueled, natural gas and oil, and are 4 pass scotch marine fire tube type. Each boiler is sized to handle 100% of the heating load.

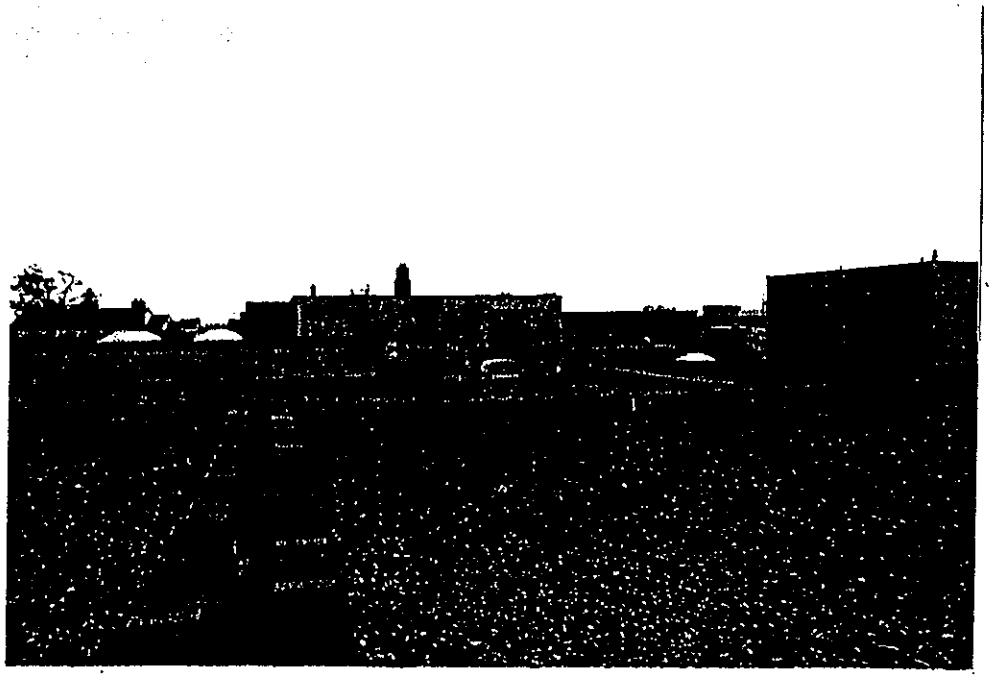
c. The water softening system and the Reverse Osmosis System are also located in the boiler room. See photo 26.

d. Other pieces of equipment installed on the boiler room floor include the fuel oil pump set, the expansion tanks and the temperature control air compressor with tank. See photos 28 and 27.

e. The mezzanine floor over the boiler room has installed on it the three water to water, heat exchangers for 110, 125, and 160 degrees F. domestic



23 Roof area, camera pointed North, with penthouse nos. 2 (left) and 1 plus raised roof for high ceiling waiting room area. Housing and water tank in background.

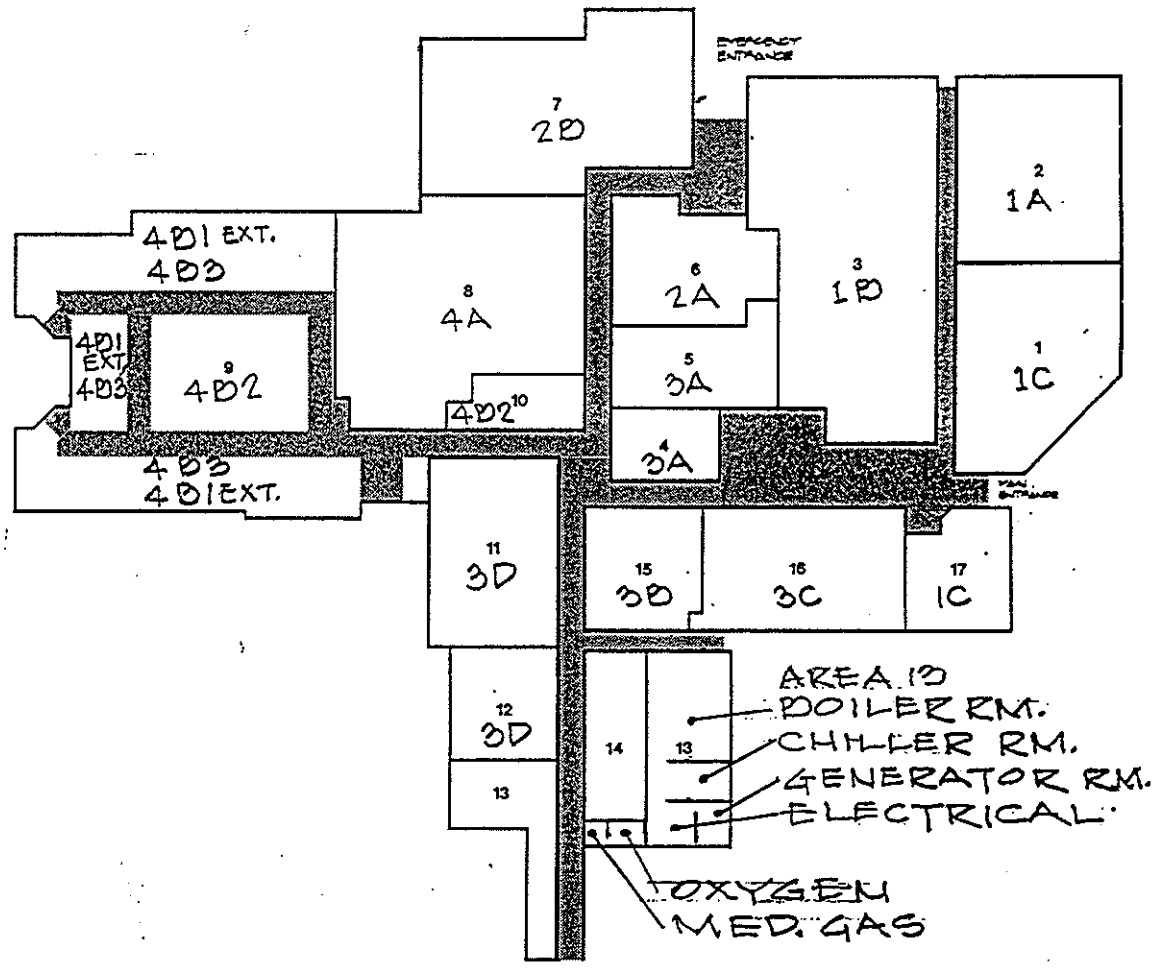


24 Roof area camera pointed South penthouse nos. 3 (left) and 4. Stone, 1937 and brick, 1960 construction in the rear.

Notes:

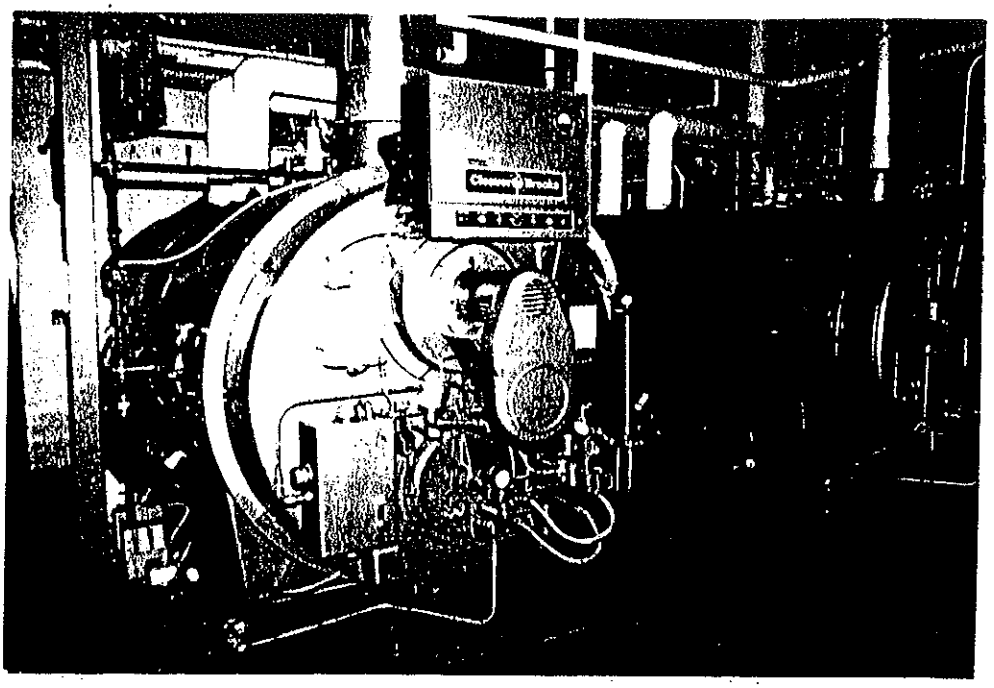
1. Numbers in addition to the reference numbers are the air handling units serving that area (example 4B3).
2. Shaded areas are hallways and public areas.
3. ☐ = Highlighted AHU numbers are on emergency power.

Areas & Reference numbers			
RECORDS	1	CENTRAL STERILE	10
DENTAL CLINIC	2	DIETARY	11
CLINIC	3	HOUSEKEEPING	12
PUBLIC FACILITIES	4	BLDG. SERVICES	13
TRAINING	5	EMPLOYEES	14
EMERGENCY	6	PHYS. THERAPY	15
LAB & X-RAY	7	PHARMACY	16
OBSTETRICS	8	ADMINISTRATION	17
PATIENT WING	9		

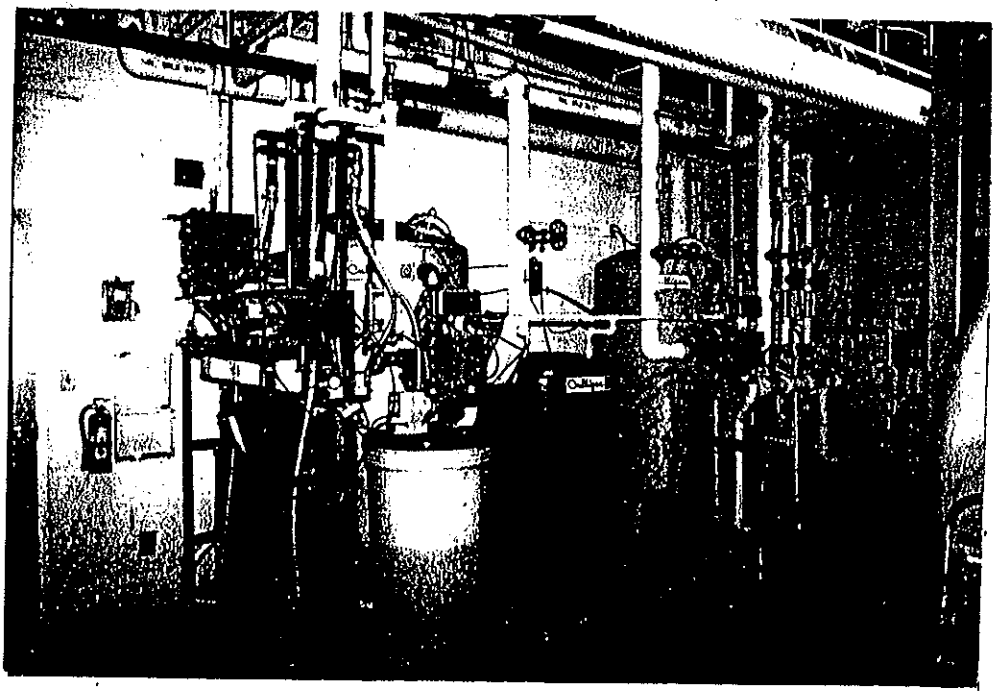


1986 ADDITION BROWNING IHS HOSPITAL

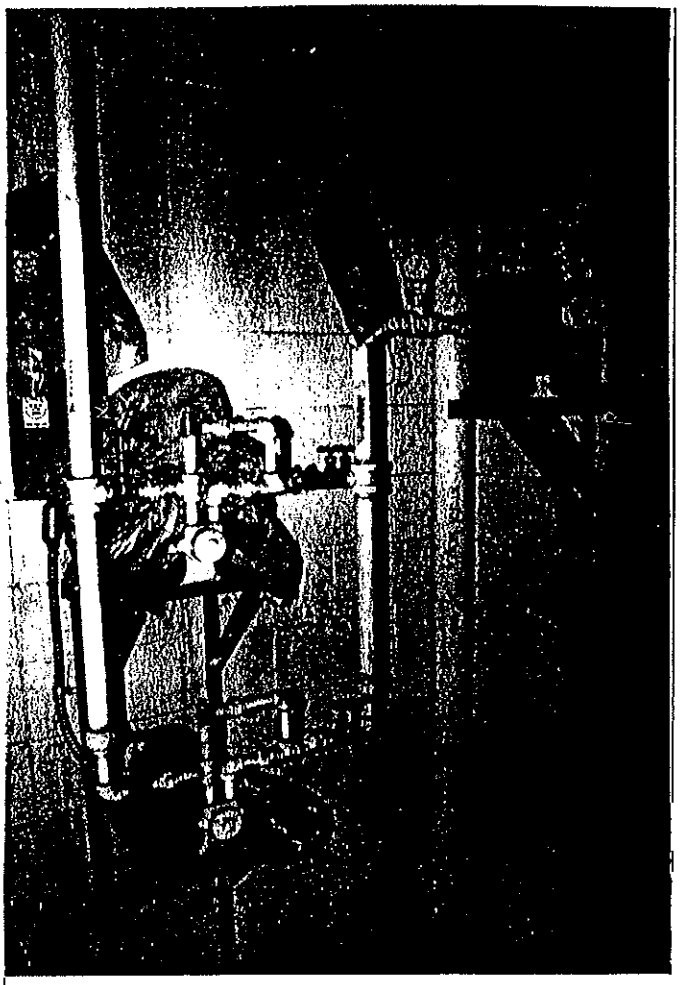
FIGURE I
Not to scale



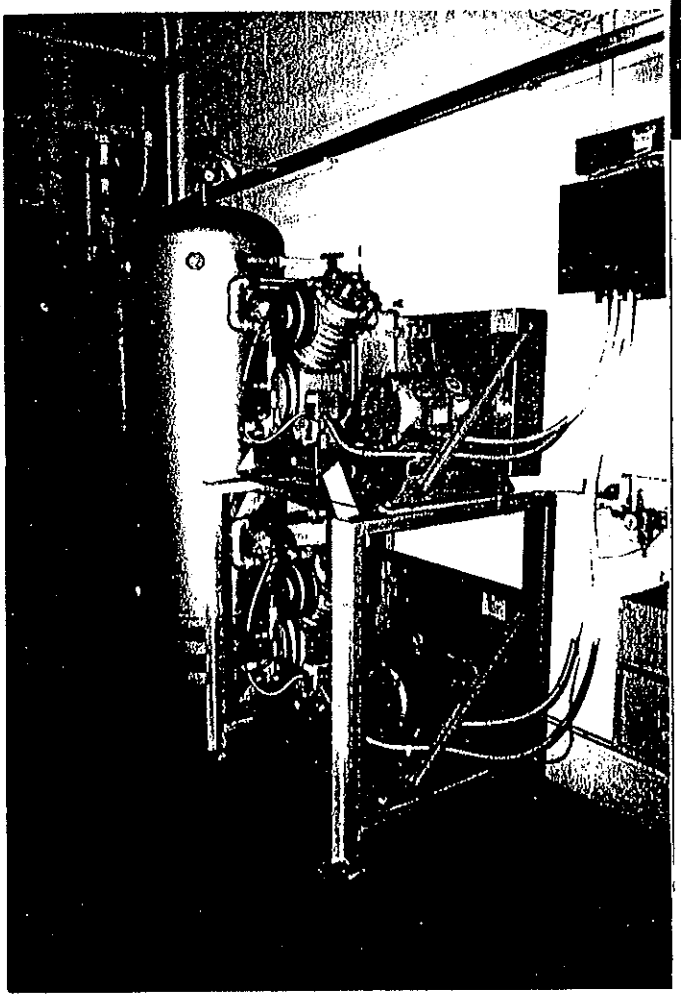
25 Hot water heating boiler, dual fueled natural gas and fuel oil. Note lack of pipe hangers over boilers.



26 Two water softener tanks (at left) with salt storage in between. Reverse Osmosis unit (blue) with storage tank.



27 Duplex fuel oil pumping station. Note plastic covers for dripping water from leaking valves in photo 32



28 Duplexed control air compressors compressors with air storage tank and expansion tanks for heating water system behind. Note lack of housekeeping pads.

water, Photo 29; the three base-mounted system heating water pumps, Photo 30; the medical air compressors and tank and the medical vacuum pumps and tank Photo 31; the two pipe mounted heating system primary pumps, Photo 32; and the boiler room fans.

f. Air Handling Units

There are 13 air handling and two make-up air handling units serving the hospital. In addition to these, there are 15 fan coil units providing heating to certain areas and nine unit heaters.

The 13 air handling units cover most of the patient areas for heating and cooling. The two make-up air units take outside air heat it and deliver it to the kitchen and the clinic/x-ray areas, respectively.

There are 15 fan coil units, seven of which are wall convector types heating the entrance to the building. The other eight above ceiling mounted units take air from the ceiling space, heat it, and recirculate it to the exterior main entrance, emergency entrance overhead, kitchen scullery sink and vegetable preparation area, sewing area, loading dock corridor, corridor to existing hospital, and mens and womens locker rooms.

3. DESIGN OBSERVATIONS

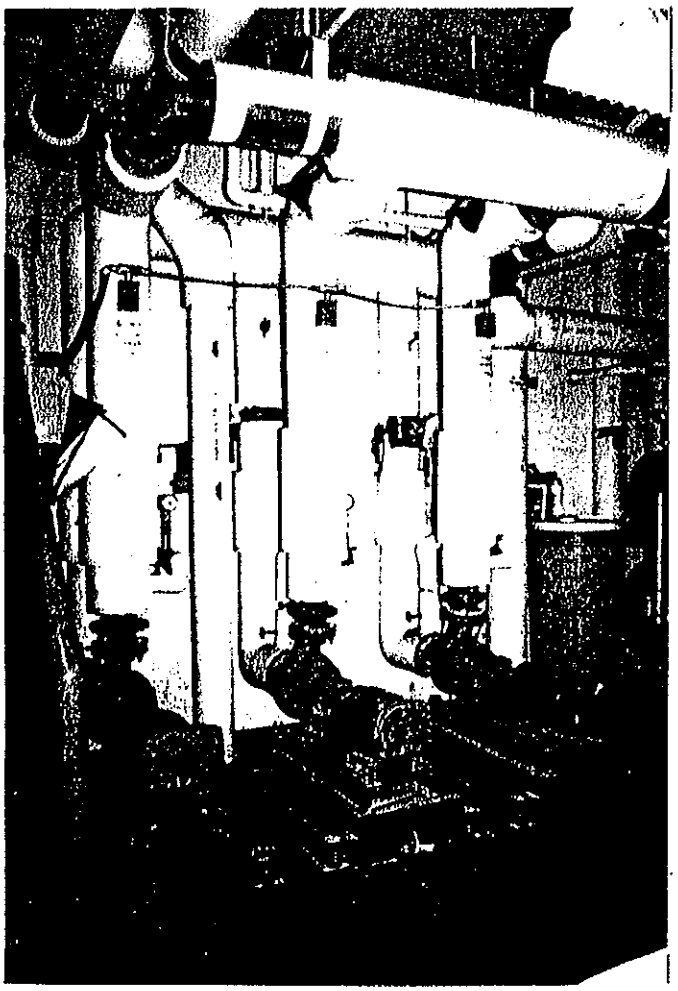
a. High temperatures in the laboratory and pharmacy: There are periods during the year when the sensible heat within these areas becomes extremely uncomfortable for human occupancy, and too hot for material storage. This condition has been observed in more than one hospital.

This problem has developed because of two conditions:

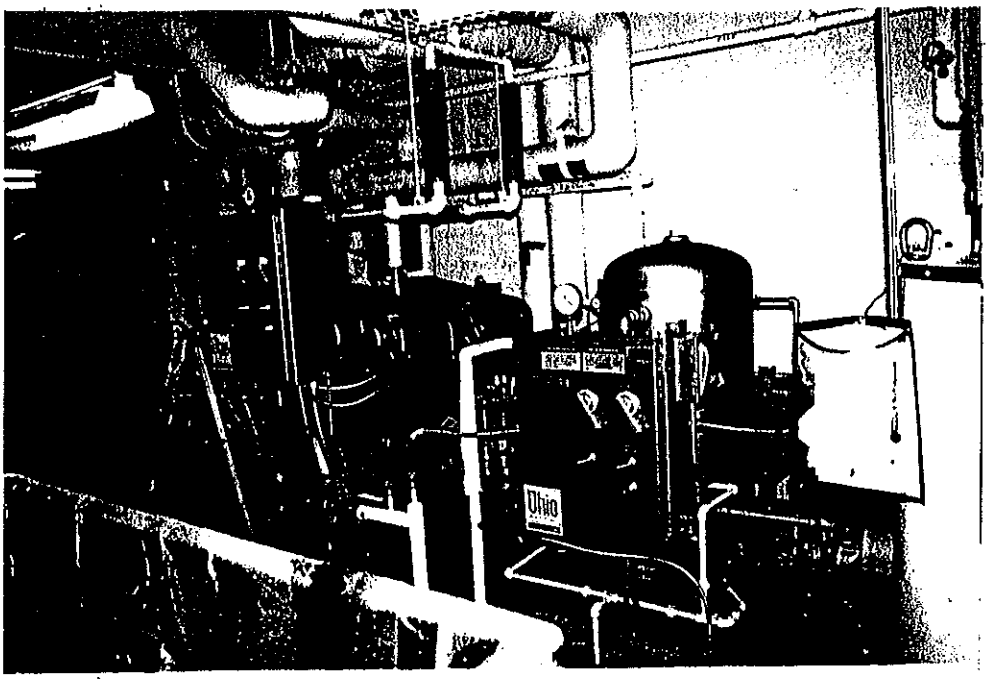
(1) The increasing number of electrical devices being used along with the high lighting intensity have increased the size of the sensible A/C room load.

(2) The chillers are usually turned off early in the fall one month before the heating season, causing these areas to be overheated. This situation is repeated in the spring, when the cooling is needed before the heating season is over.

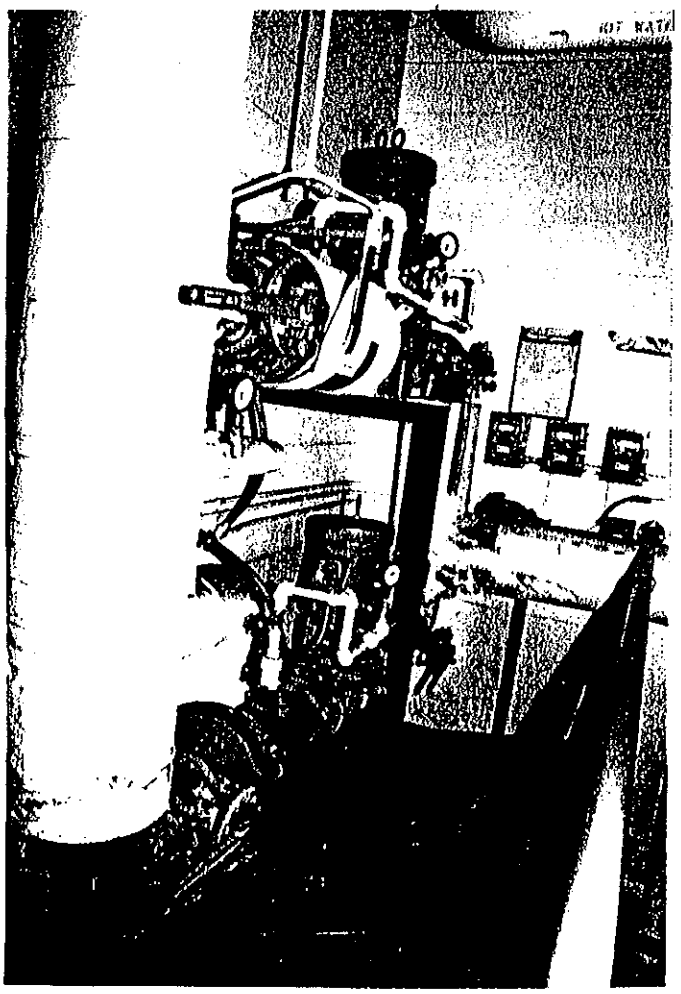
29 Domestic water tanks, hot water heated 160 deg. left, 125 deg. middle, 110 deg. right.



30 Hot water heating pumps. Note new butterfly valves ready for installation and lack of pipe supports



31 Medical duplex air compressors and vacuum pumps with storage tanks. Note plastic to catch drips from valves above.



32 Primary boiler hot water pumps recirculating water thru boiler.

b. Schedules

In reviewing the drawings, the POE team found that the schedule of symbols is not complete enough and omits many of abbreviations used on the drawings thus leading to a poor understanding of the drawing. Also, standard ASHRAE and plumbing symbols are not used.

c. Mop Sinks

The walls adjacent to the mop sinks are not tiled or covered with a permanent type waterproofing. The painted gypsum board is deteriorating. Photo 33 shows that the splash of the water onto the walls may have been diminished by the installation of a hose. This hose installation is against the plumbing code as it creates a cross connection where the products of any bucket or container in which the hose is placed could be sucked back into the water system.

d. Electric Controls, Sinks - The spigots on many of the sinks are electrically operated. This means that whenever there is an electrical outage these sinks are inoperative as they are not connected to the emergency generator. During the 1988-1989 winter there was a series of prolonged electrical outages. After the original outage, which lasted for nine hours, the area only had electrical power for two hours out of every six hours or eight total hours per day. These outages lasted for one week. These sinks only function when the utility power is on.

e. Roof Top Units Maintenance - Mechanical Equipment which is roof mounted is very difficult to maintain especially in the northern areas where extremely low temperatures prevail for long periods of time. At these temperatures when a breakdown occurs a person must work heavily bundled up with gloves on or his hands will freeze to metal. It is suggested that all mechanical equipment be installed in penthouses where adequate working conditions can be maintained for proper maintenance. Even exhaust fans can be installed in penthouses and exhausted externally.

f. Floor Area - The floor area dedicated to mechanical equipment is approximately 10% of the building gross area (see SUMMARY OF BUILDING AREAS, page 22). This is greater than the 8% normally provided at the time this facility was planned, but is within the allowance provided by the current planning criteria.

Even though about 10% was provided, more space is critically needed for maintenance of coils, boilers, and air compressors as noted herein.

g. Coil Pulling Space - All drawings of air handling units especially shop drawings should show clear coil pulling space adjacent to the unit. If this space is not dedicated then there is an inordinate amount of time required to dismantle the unit to replace the coil. Some units, according to the plans which have insufficient coil horizontal pulling space, are 1A, 1B, 1C, 3E and 4B(2).

h. Ventilation of Rest Rooms, Etc. - A quick check revealed that the air changes in the toilets and rest rooms were at least 10 and negative to the hallway, as required by the Plumbing Code. One exception is the Women's Toilet No. 1107, which appears to be neutral to the corridor. This causes odors to get into the hallway.

i. Incinerator - The incinerator is installed adjacent to and on the exterior of the hospital. There is a need for a storage area to house after-hours waste flow and leftover material at the day's end. The incinerator combined with only one eight hour workshift employee is insufficient to burn all of the waste in an eight hour day. Therefore, waste paper material removal is contracted out. The containers for this material are located outside of the loading dock and the supply storage areas. See photo 34. As the flow of material increases more will have to be contracted out or the hours of incinerator use will have to be increased along with the staff to operate it.

j. Flow measuring stations - The Taco water balancing devices are installed in the pipelines to restrict the water flow to the design quantities. To balance these circuit setters properly a readout meter is required which can be used with each of these units. Although the specifications do not require it, one of these meters should be provided at each hospital to be used for checking future flow adjustments.

k. Pump Specifications - there was no section in the specifications covering the pumps. The only information on the pumps is the pump schedule on drawing M-36. Any equipment as critical as pumps are should be specified.

l. Inconsistencies in the contract documents can be eliminated by thorough reviews during the design stages. As an example, sheet ME-1 gives the water

line as 6 inch diameter where it passes the helipad; while sheet ME-2 shows it at 4 inches and sheet ME-3 goes back to 6 inches.

m. Ceiling plenums should not be used for return air in the hospitals. This type of system cannot be balanced properly for the correct amounts of air within the various spaces, and allows recirculation of air which may not be part of the design but will occur.

n. The HVAC schedule for the kitchen requires that there be no recirculated air, but register no. 32 and fan coil no. 1268 cause recirculation of air.

p. There is no fan supplying outside air to the boiler room and in the summer the boiler room ceiling and Penthouse No. 3 temperature are around 100 degrees Fahrenheit.

q. The control air is being used 24 hours a day all year. Therefore, the controls cannot operate without acceptable control conditions. The compressor is duplexed for maintenance but the air dryer is not.

r. The cooling air though the emergency generator room is insufficient to cool the room if the generator were fully loaded and the outside temperature were 95 degrees Fahrenheit. The engine would be stopped by the controls because of overheat.

s. The air supply to the janitor's closets is not in all cases a minimum of 10 air changes per hour. This means they do not meet code requirements.

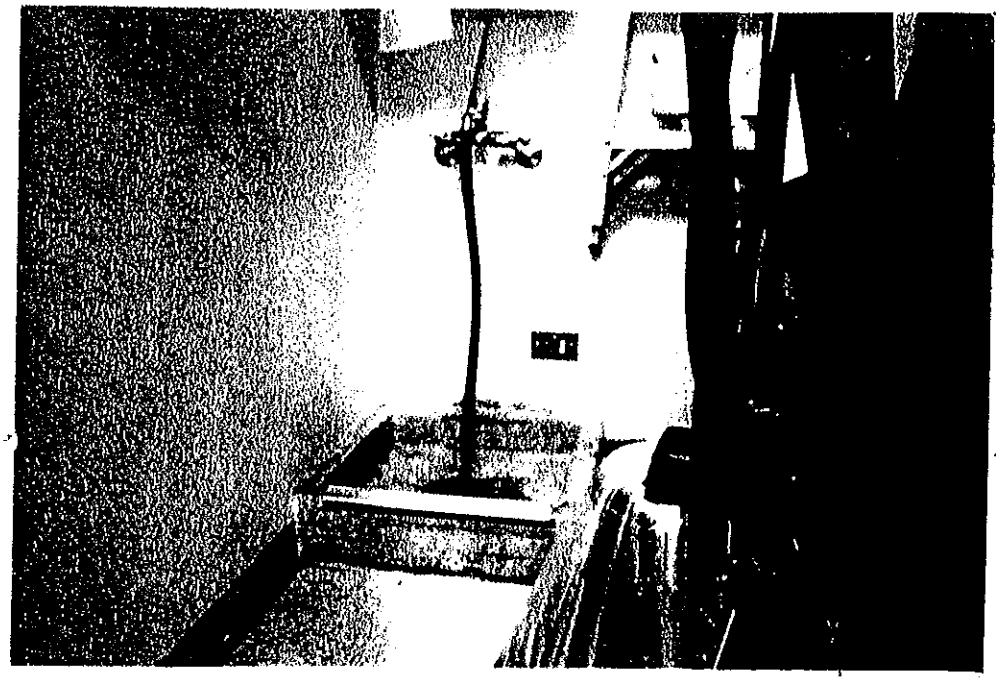
t. There are no shock absorbers on any of the water lines that have quick closing valves such as dishwashers and clothes washers. Solenoid valves shut quickly, stopping the water flow and causing water hammer. The use of an air compressed pipe behind the fixture is no longer advocated.

u. Room No. 1167, which on plan is a two patient bedroom, is now being used as a birthing room. The air supply to the room is insufficient for the present use of this space.

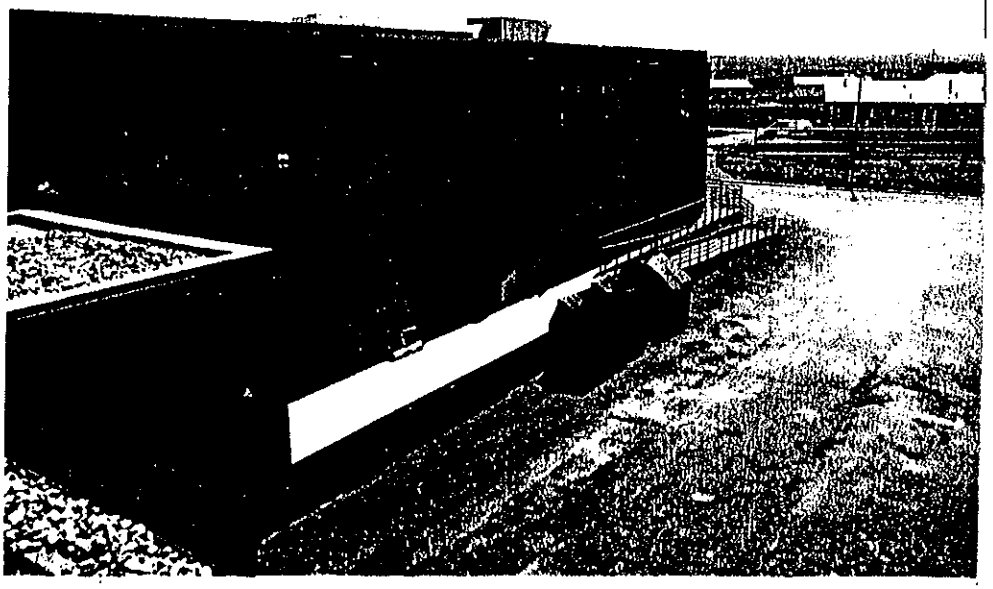
4. <u>CONSTRUCTION DEFICIENCIES</u>

a. Testing and Balancing

There are over 300 air supply outlets in the ceiling of this hospital, along with 13 air handling

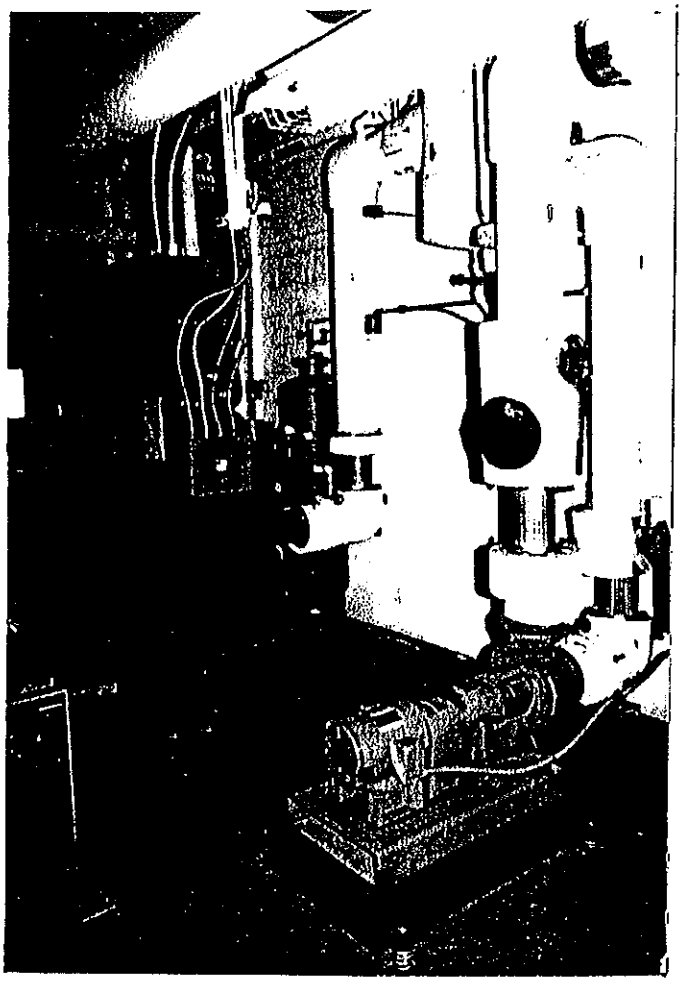


33 Janitors closet sink. Note hose on spigot and deteriorating wall behind.



34 Dumpsters for storing waste paper for collection, back of the loading dock near near handicapped ramp.

35 Chiller, pump, and air tank. Note lack of housekeeping pads on tank and pump.



36 Chiller and piping. Note lack of supports on smaller piping.

systems. The staff reported that one man and his wife balanced the systems in a few evenings, which would be impossible. Therefore, there is no assurance that the systems are:

1. balanced properly (as imbalance causes the improper temperatures mentioned repeatedly by the staff),

2. maintaining the proper pressure relationships, or

3. delivering the appropriate amount of air.

b. Valves

The butterfly valves in the hot water heating pipes were leaking due to deterioration of the seat and stem packing material. By the time this problem was discovered, the material temperature rating had been derated by the manufacturer, which meant these valves were unsuited for their current use. New valves are being installed in place of the leaking ones. Photo 32 shows the replacement valve below the leaking valve and photos 28 and 31 shows equipment that had to be covered with plastic because of the leaking water. These valves evidently did not meet the requirements of specification section 15100 paragraph 2.03. Also, there was no paragraph in the specs requiring these valves to be in satisfactory use for two years prior to use on this job.

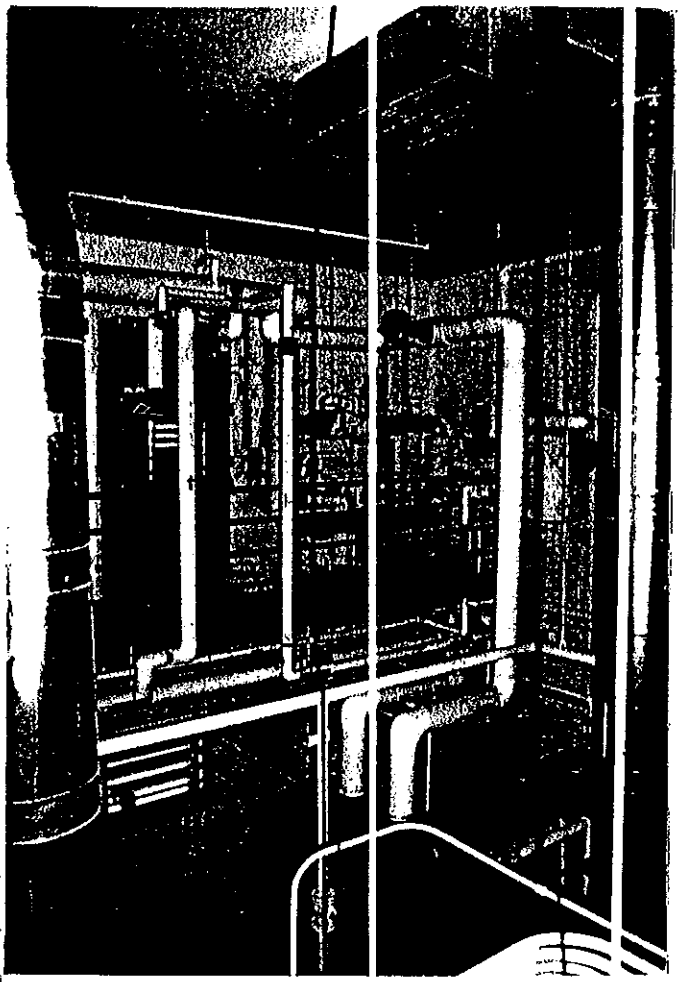
c. Pipe Markers

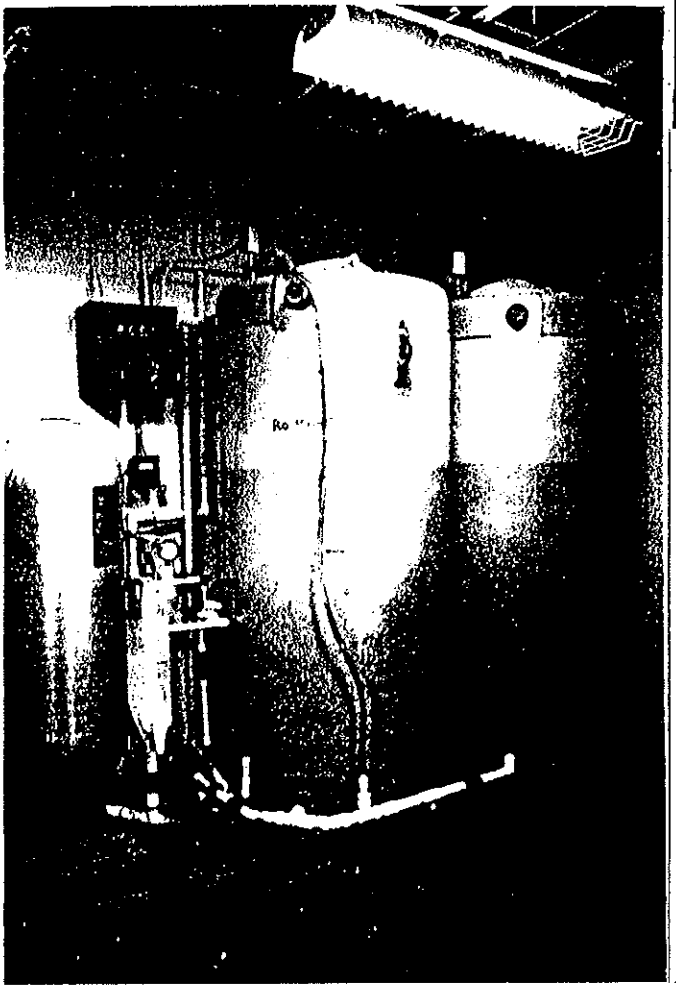
Spec Section 15055, page 15-24, paragraph 2.02 calls for SETON "Setmark" Semi-rigid plastic snap on markers, photos 25, 26, 35, 36, 30, 37, 29, show that the pipe identification was stenciled or pasted on contrary to specs and are not visible at a distance as they should be. The specified markers are also color coordinated. Figure No. 2 is an example of the material specified.

d. Housekeeping Concrete Pads

These pads are used to keep all mechanical equipment up and off of the floor which is wet at times due to drainage, hosing or wet mopping. The pad helps to prevent premature rusting of the equipment supports and helps to keep the area under the equipment clear. Photo: 27, shows the compressor and 3 tanks resting on the boiler room floor, 35 shows the tank and vibration isolation under the pump on the floor.

37 Boiler room ventilating system. Note louver thru roof and two thru wall,, also lack of pipe hangers.





38 Reverse osmosis (two) water storage tanks, 500 gals. each.

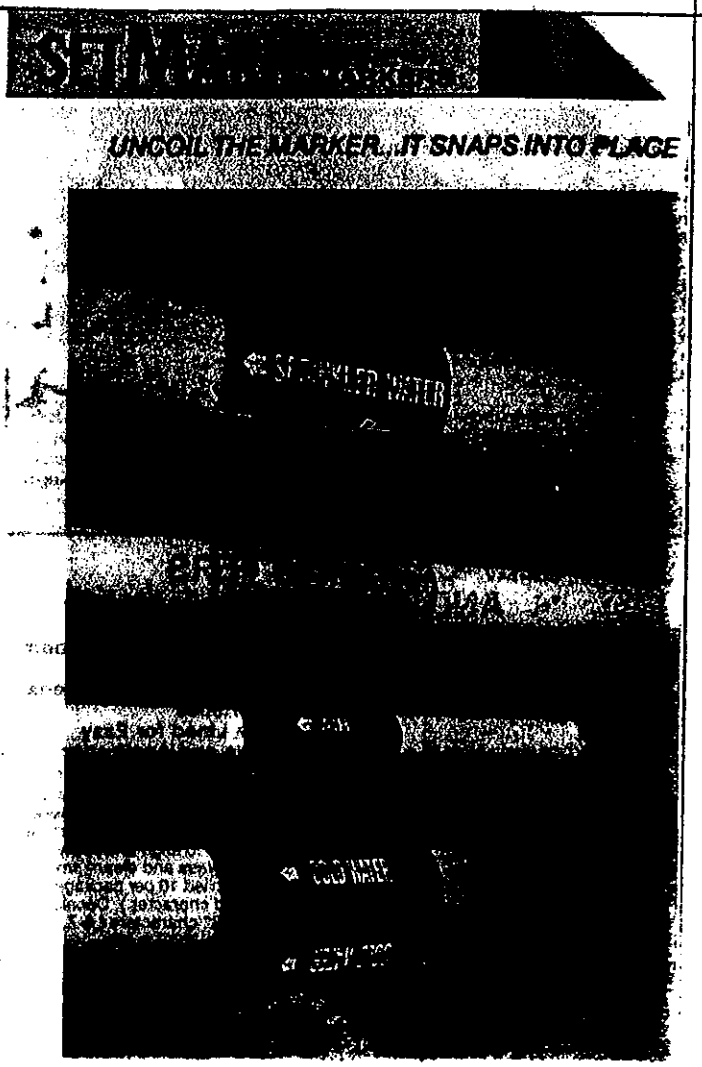


FIGURE 2

All mechanical equipment should be elevated above the floor for cleanliness and long life.

e. Reverse Osmosis System

The (RO) equipment, shown in photo 26 supported by the blue frame, takes water from the softening unit to the right of the RO unit. The water treated by the RO unit is stored in the tanks shown in photo 38. The problem is that the RO water frequently becomes contaminated with bacteria and the system has to be flushed out. During this periodic cleaning RO water is unavailable and all of the treated water goes to waste, thus raising energy costs.

f. Penthouse Boiler

The penthouse No. 4 high pressure boiler had overflow problems. This proved to be a makeup water problem in addition to boiler "internals" problems which have been solved by local forces, but not before several occasional floodings of the corridor between dietary and medical supply services under the boiler in Penthouse No. 4.

g. Temperature Control Compressors

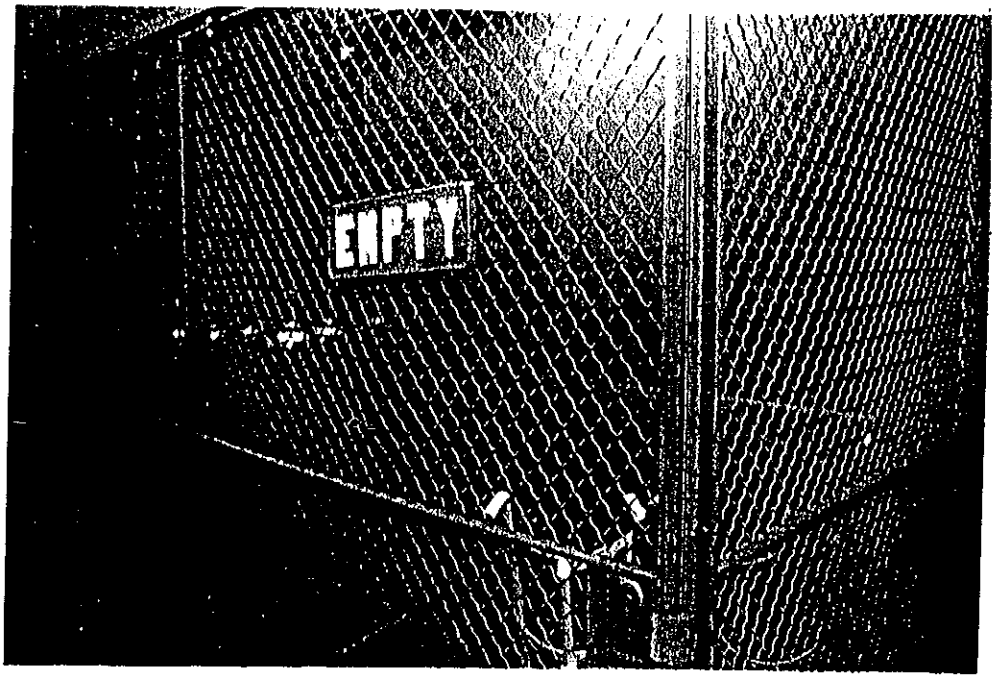
As shown in photo 27, the belts between the motors and compressors are covered by guards adjacent to the wall. These belts are occasionally replaced, but with much difficulty because of the equipment being installed close to the wall. If the stand had been rotated 90 degrees clockwise in plan the maintenance would be easier.

h. Gas Bottle Storage

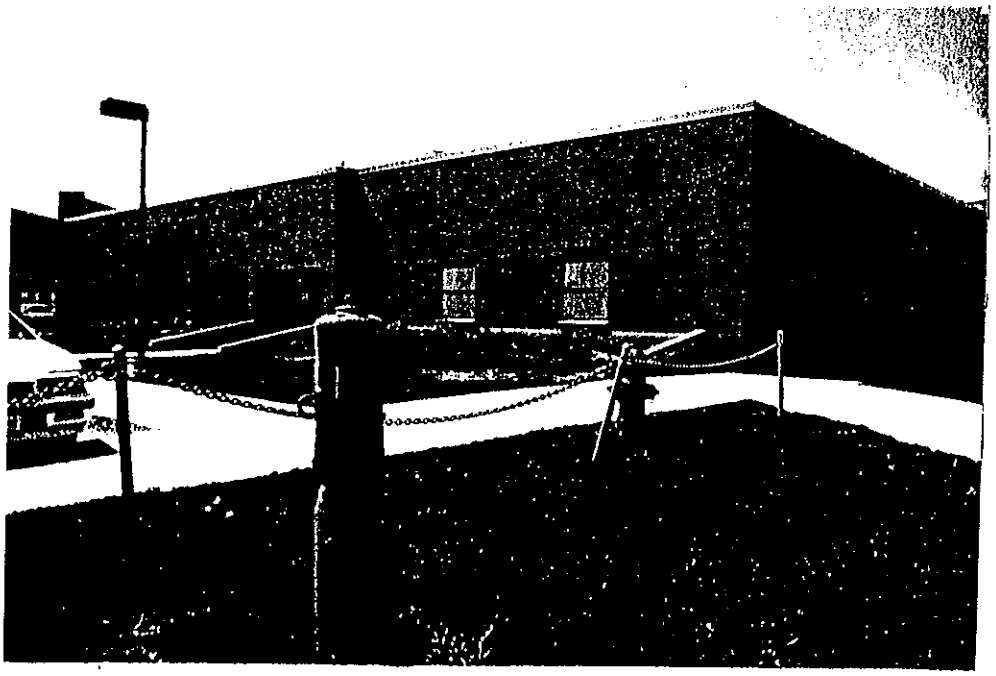
In general, gas bottles within the facility were not chained as they should be. Photo 39 shows empty cylinders enclosed by a fence but not chained. According to NFPA Standard No. 99-1987, paragraph 4-3.1.8.1 "cylinders in service and in storage should be adequately secured".

j. Post Indicator Valve

The post indicator valve is located adjacent to the heliport and appears to be installed on the new 6 inch diameter water pipe approximately 200 feet away, not within sight of the siamese connection location. Sheet No. M-10 indicates that there is to be a siamese connection installed on the building wall outside the north corner of the boiler room.

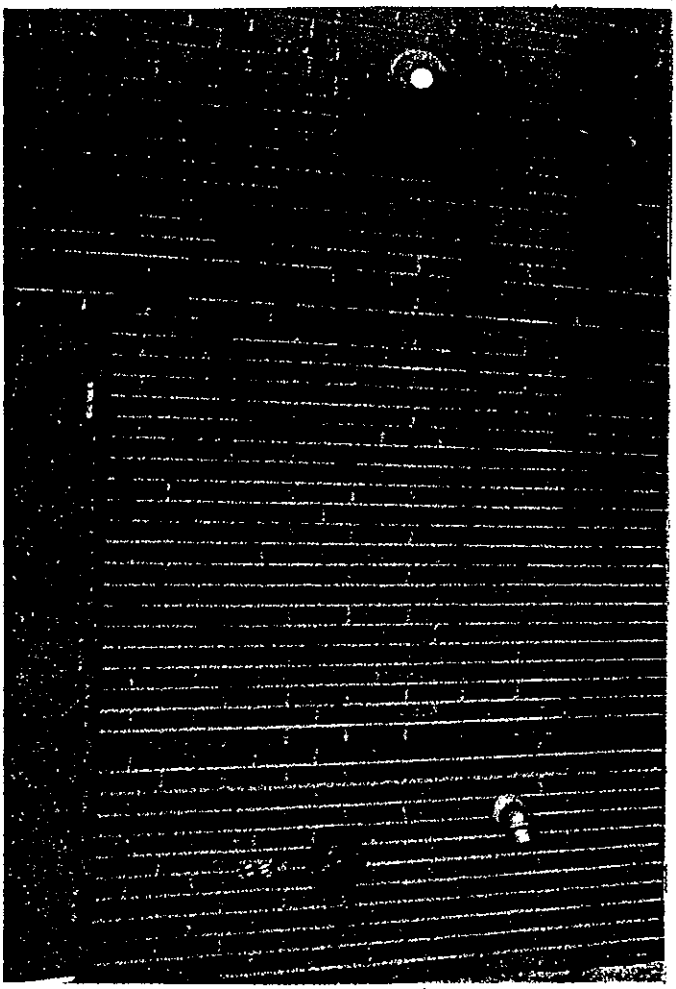


39 Caged empty gas cylinders not contained by chains.



40 Post indicator valve (PIV) note facing of adjacent hydrant and lack of wrench on PIV.

41 Hose inlet to sprinkler system, with brass cap, is not a siamese connection.



42 Hydrant at left halfway down picture is closest to the sprinkler system inlet on right wall. Also shown is part of the 1936 and 1960 hospital construction.

Notice that the handle to operate the post indicator valve is missing (see photo 40). Photo 41 shows the fire department connection is not a siamese. Photo 37 shows the closest fire hydrant (at left in middle of picture) to the hose connection location (right wall in corner of building). NFPA 13, Section 2.7.2, requires the fire department connection to be siamese if the supply pipe is 4 inch nominal diameter, which it is, according to the plans.

There is also a fire hydrant (see photo 43) that is not adjacent to the paved road. It does not have the pumper connection pointed towards the road and would not be very conducive to use by the fire department. See plan ME-6 and spec. section 15022, paragraph 3.01F. The hydrants should be adjacent to the road with the pumper connection pointed towards the road.

k. Dental Vacuum System

This system is not installed in accordance with CGA Standard, P-2.1, in that it does not have the required number of cleanouts installed according to this standard.

l. Pipe hangers

Specification section 15090. There is a lack of pipe hangers. Photo 25, 44, 30, and 35 show where there are:

1. Insufficient hangers

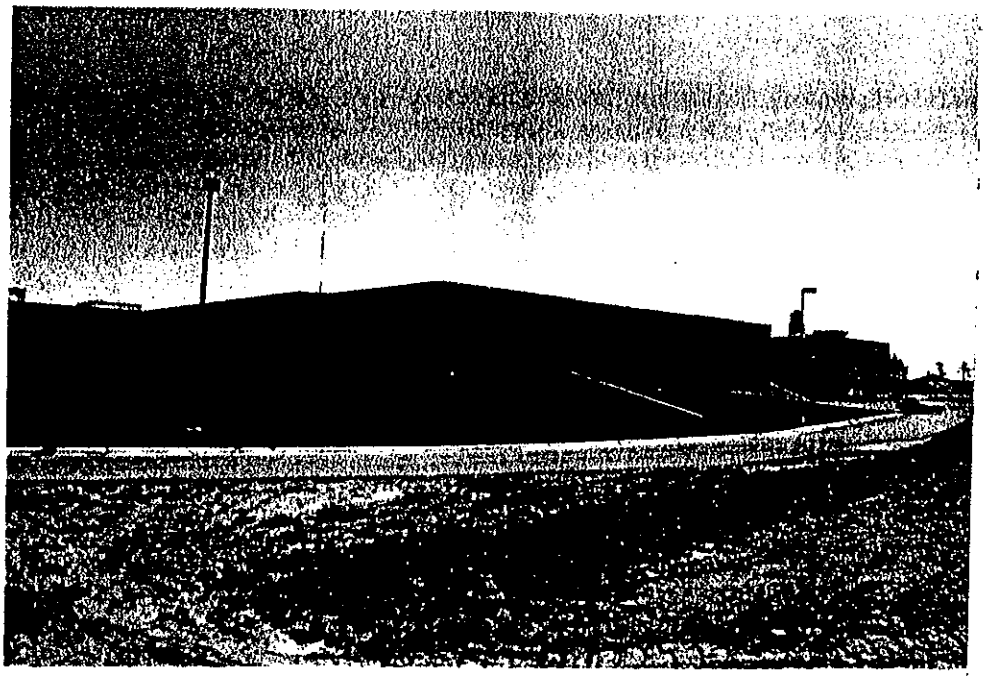
2. Pipes supported on equipment connections

3. No hanger supports within 1 ft. of each elbow

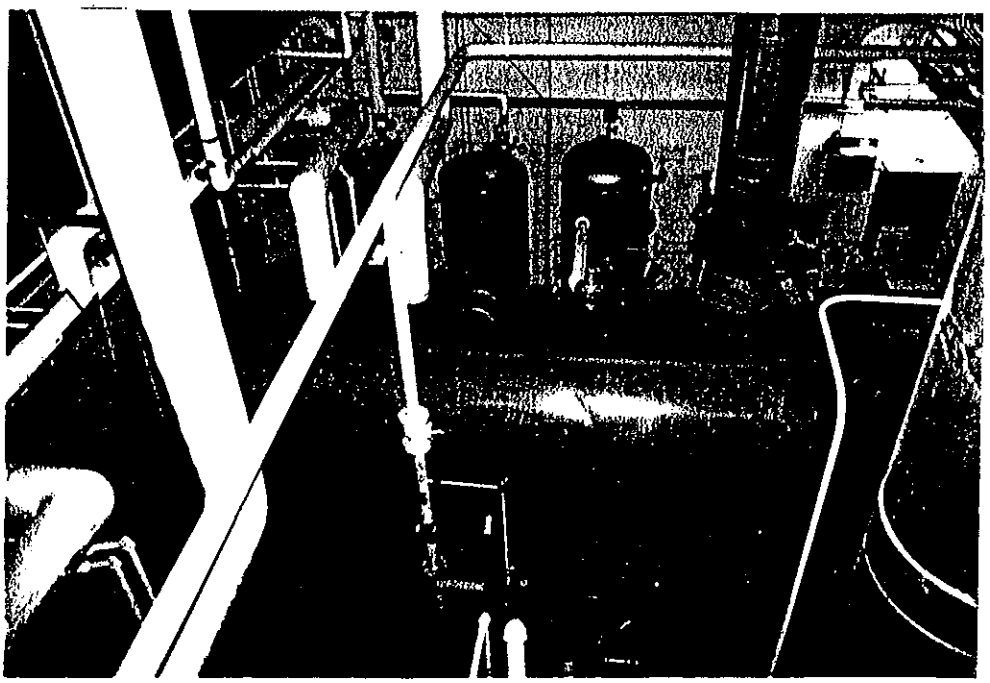
m. Refer to Page 11, paragraph 11.0 d., for comments on shower enclosures.

n. Shop Drawings - Shop drawings for the control system were submitted. The layout of the fire sprinkler system was submitted and is in the M&O documents. However, only one set of the original building drawings has been worked over very briefly and is not considered sufficient for future use. The tracings or mylars have not been revised for use in reproducing new as-built copies as they are required. The changes to the original reproducible drawings have yet to be accomplished.

p. Controls sequences are not current, according to the local forces. The documented control sequences



43 Fire hydrant in swale is not adjacent to roadway and nominal 4 inch opening does not face roadway.



44 Boiler room showing boiler air compressor and tanks, stack, and lack of pipe supports.

submitted are not up to date with the latest equipment control sequence. Control sequence documentation should be in accord with the latest operation sequence.

q. Air vents in hot water lines - All water lines should be vented where the pipe turns down from the horizontal to the vertical in order to release trapped air and keep the pumping head pressure steady at its design value. Lack of proper air venting promotes excessive pumping cost and is noisy. This excess pumping cost will continue for the life of the building.

r. Rain Header Insulation - Specification Section 15250, paragraph 3.02 G reads "Insulate all pipe roof drain headers, above finished ceilings of top floors." There is no insulation installed on the rain headers according to the facilities staff.

This represents quite a large heat loss to the building during the winter months as the piping transmits cold air within the heated envelope to lower the building temperature. The pipe also sweats, causing humidity loss within the hospital which is very difficult to maintain in this northern climate.

s. Drainage - The covered ambulance drive area has a drainage problem, as any liquid spilled from patients (blood, feces, urine, etc.) does not drain out of the area but must be washed up. It was mentioned that any blood spilled on the pavement presents a problem.

t. Tube Removal - There is insufficient space to remove the tubes from the southernmost boiler. The stairs will have to be cut or removed to facilitate retubing of this unit as each tube must go straight into the tube sheets with not much deviation.

u. Duct Access Doors - The specifications call for adequate access into the ducts such as spec section 15841; 2.01J1, 3.01I, and 15842; 2.02B, 3.01F. Evidently an insufficient number of access doors were installed during construction, as the hospital staff has already installed an additional 35 in order to gain entry for maintenance and adjustment of duct installations.

5. RECOMMENDATIONS

NOTE: The symbol (3a) means refer to paragraph 3.a. of this report.

a. (3a) This condition can be alleviated by designing the laboratory air conditioning system for normal loads and with sufficient outside air supply for hoods.

To complement the normal A/C system, a fan coil unit should be installed in the laboratory and the pharmacy ceiling with a dx compressor-condenser unit nearby. Each unit can be controlled with a separate thermostat, providing there is a sufficient deadband between it and the main room thermostat.

b. (3b) The drawings should be thoroughly reviewed and comments submitted during design to include all symbols and abbreviations used. These symbols and abbreviations should be those commonly used and/or published by a National Association.

c. (3c) All janitors closets should have waterproof walls around the mop sink, a hook to support buckets being filled, and have hooks to support drying mops, thus cutting down on bacterial growth. All janitor closet walls at Browning should be repaired. All hoses on the spigots should be removed.

d. (3d) If electrically controlled valves are installed on sinks, they should be on the emergency electric system. Such sinks at Browning should be rewired to be on the emergency electrical system.

e. (3e) For severe climates, standard design should require all mechanical equipment to be installed inside the building proper or in a penthouse. Some limit should be set up in the Design Manual, such as any area with more than 6000 degree days of heating. Any construction in areas with more degree days should have all rooftop equipment enclosed.

f. (3f) Maintenance and operation of a hospital is costly; therefore, all equipment layouts should be designed for operating and equipment renewal maintenance. Designs should be made to reduce cost of maintenance and operation after original construction.

g. (3g) All plans and elevations of equipment with coils should show the coil-pulling space dedicated in order to facilitate maintenance.

h. (3h) The return air (cfm) should be increased in order that the restroom no. 1107 pressure will be negative to the corridor. This will prevent odors in the hallway.

j. (3j) A flow measuring station should be purchased for use at this facility.

k. (3k) All equipment as large as pumps, especially considering their cost, should be specified. Drawings and specifications need to be checked during design for completeness.

l. (3l) All project designs should be checked by each discipline at each stage of design completion for accuracy and completeness of the design and documents.

m. (3m) It is extremely difficult or nearly impossible to control the flow of air when there are no control devices. The recirculating ceiling registers have no control elements and therefore all air will take the path of least resistance back to the fan. This leads to a very noisy air flow. Some control devices should be installed in problem areas for better air distribution.

n. (3n) The design should be altered in order that no air be recirculated within the kitchen area.

p. (3p) A two speed fan should be installed, thermostatically controlled in the summer on the high speed to keep the boiler room cooler and energized in the winter with the boiler, low speed, to supply combustion air.

q. (3q) The refrigerated air dryer is used continuously 365 days a year. In the event this unit should need to be replaced, it may be out of service for weeks and the control tubing could be slugged with water. We recommend that this high-use unit be duplexed.

r. (3r) There appears to be insufficient cooling air for an exterior temperature of 95 degrees Fahrenheit. It should be tested under these conditions to see if this is true. If the air capacity is low, then it should be increased.

s. (3s) The air supply in all janitor's closets should be increased to a minimum of 10 air changes per hour.

t. (3u) Properly sized shock absorbers should be installed in the hot and cold water supplies to any piece of equipment with quick closing valves such as solenoids.

u. (3v) If this room is to be a permanent birthing room then the air quantities, exchange rates, and pressure should be adjusted in accordance with code.

v. (4a) The systems should be checked to ascertain if the air and water are flowing properly. Air changes, water quantities, and pressure relationships should be correct or corrected. All equipment should be checked for operating efficiency and safety features.

u. (4b) Specifications should require that all equipment be tested by years of use before selection and use in IHS hospitals. The leaking valves are now in the process of being replaced.

x. (4c) The pipes are stenciled as to content and flow. If this method of identification is acceptable it should be completed as per specs. If, however, this method is unacceptable then the specified items should be purchased and installed.

y. (4d) Specifications and drawings should call for housekeeping pads under all mechanical and electrical equipment. At Browning, where possible, housekeeping pads should be installed.

z. (4e) One manufacturer of R.O. units reminds us that these units do not deliver 100% pure water, but, that a very low percentage of contamination passes through the unit. It was suggested that this small amount of contamination could be deactivated or killed by an ultra-violet light unit, with a filter downstream to remove the residue.

We suggest the installation of a filter on the storage tank vent. This prevents any contamination from entering the tanks when the water level is reduced and air is sucked in through the vents.

It is suggested that an ultra violet system and the proper filters be purchased and installed to decrease the downtime maintenance and cost of operating this system.

aa. (4f) All mechanical equipment should have been in use for two years prior to selection. This should be required by specification.

bb. (4g) The unit base should be rotated and at the same time it could be installed on a concrete pad as time and money allow.

cc. (4h) Chains and permanently fastened loops should be on the bottle racks so that chains can be used to support each of the bottles, both full and empty.

dd. (4g) First, someone should check to see if the missing handle for the post indicator valve is on site and lock it on the post. Second, someone should check to see if this valve does completely isolate the sprinkler system from the utility system. Third, the fire hydrant mentioned should be repiped to the curb and rotated to the proper position. Fourth, the single inlet to the sprinkler system should be repiped and replaced with a siamese connection.

ee. (4k) The cleanouts should be installed as per the standard.

ff. (4l) More pipe hangers should be installed to support the pipe and take these loads off of the equipment.

gg. (4m) (See Architectural comments, page 6.)

hh. (4n) The contractors should be appraised of the incomplete information and required to complete their work.

jj. (4p) Contractor or vendor should be contacted to complete all documentation for the control diagrams, equipment and sequences.

kk. (4q) All domestic and heating hot water and chilled water systems should be inspected to ensure that the piping systems are vented at all points where air is trapped and impedes the water flow. This would decrease pump operating costs.

ll. (4r) Heavily insulate this entire system from the underside of the roof to where it goes into the ground, not just to prevent condensation, but to prevent heat loss in the winter.

mm. (4s) The area should be kept swept clean at all times. Whenever blood or other liquids are spilled it can be wet vacuumed into a container and be disposed within the hospital as required for safety and sanitary reasons. Hosing the liquids out into the exterior area appears to violate safety and sanitary procedures.

nn. (4t) The space to retube boilers is usually provided by double doors to the exterior opposite the boilers. This reduces the dedicated floor area required for maintenance.

The stairs will have to be removed when the boilers are retubed and the connection to the mezzanine deck could then be revised for easier removal at the next retubing.

pp. (4u) Additional access door assemblies of all sizes should be kept on hand to install whenever a duct is opened for maintenance of inaccessible equipment. In future designs plan review should require these openings, and inspectors should insist that they be installed.

D. ELECTRICAL

1. General Design Features

a. Electrical service to the hospital is a multi-metered, multi-delivered 120/208 volt 3 phase 4 wire system with multiple disconnects, and multiple emergency generator (E/G) plants. The primary service line to the site is transformed from 34,500 volts. In the new portion of the hospital the main switch disconnect is sized for 2,000 amps, but a 1,200 amp emergency disconnect and a 600 amp chiller disconnect are tapped ahead of the main disconnect (service side). The new generator is a 400kw, 1800 rpm, 120/208 volt generator. The old portion of the hospital has four disconnects for main service, a main distribution panel "L" disconnect and three transfer switches tapped ahead of the main disconnect (service side); a 200 amp transfer switch #3 a 200 amp transfer switch #2 and a 200 amp transfer switch #1. The system is adequate, but conservatively sized for the new load. All electrical equipment is being well maintained and seems to be in good running order.

b. Lighting in the facility is primarily fluorescent interior lighting with "high-intensity-discharge" exterior lighting.

c. Interior power systems include the segregation of power into separate branches (life safety, critical, equipment), isolated power in trauma rooms and hospital grade receptacles in patient care areas.

d. Since the building is fully sprinklered, the fire alarm system is actuated principally by manual pull stations and by sprinkler flow switches. The fire alarm system as well as night light controls and the HVAC system is fully controlled from a computerized energy monitoring and control system (EMCS).

e. Designed communication and signal systems include an empty conduit system for telephone, a complete nurse call system and P.A. system, an intercom system, a satellite CCTV distribution system and a VHF antenna for ambulance communication. Wiring for communication systems is freely installed in plenum spaces without the use of conduit (conduit is used in walls only).

2. Specific Deficiencies, Features and Suggestions

a. The hallway lighting system was designed utilizing "two foot by two foot" fluorescent fixtures instead of straight "four foot" fixtures. This type of fixture uses "U-tubes" which resemble bent four foot fluorescent tubes. These tubes should be avoided and straight four foot fixtures used whenever possible. U-tubes are not as light efficient as their straight counterparts, they are not as commercially available, and are therefore harder to stock and more costly to purchase. They have the added problem of not lasting as long as straight tubes (despite what manufacturers' bulletins say), so they have to be changed more often.

b. Janitors closets have a double use as electrical closets. This has created a problem of having brooms and other custodial equipment stored in front of electrical panels in violation of the National Electrical Code. Separate dedicated electrical spaces should be provided in future designs in accordance with the recommendations of the "Guidelines for Construction and Equipment of Hospital and Medical Facilities."

c. Power quality is a problem at Browning, which experiences frequent brown-outs and voltage dips. This has proven to be a problem for electronic devices, such as EMCS controllers, electronic fluorescent ballasts and electronic boiler controls. Many of these devices initially required replacement due to burnout caused by the poor power. As a solution, appropriate power conditioners were installed at the equipment. Centralized power conditioning systems such as those installed in the lab area of the facility have been shown to be somewhat unreliable and very expensive to maintain, since most work must be done through technicians who come from a great distance and are very costly. Future designs should incorporate power conditioners for each piece of electronic equipment that might require such conditioning since the cost for power conditioning has dropped dramatically over the last several years. This proves to be a very economical alternative, especially since the smaller units are simple to install and can be replaced by shelf equipment kept in stock The defective units can easily be sent back to the manufacturer for repair or replacement rather than bringing a serviceman to the facility.

d. The facility does not have a lightning protection system. A calculation (attached) based on NFPA 78 "Lightning Protection Code," shows that the risk for lightning is "moderate-to-severe," so that perhaps the facility should be investigated for the possible installation of a lightning protection system. All future designs should incorporate similar analysis of lightning protection risks in accordance with NFPA 78.

e. A single transformer provides power to two x-ray units. The units are fed with a single feeder being tapped at the end by two subfeeders going to each of the x-ray units. This is a construction change from the original plans, which call for separate feeders. Furthermore, difficulties occurred during construction and testing of the x-ray units. When the units were operated simultaneously, one of the units was found to operate incorrectly, supposedly due to a voltage drop in the line. Later it was found that the tap connection required tightening. The connections were tightened. However, the units still require test by the supplier (VA). When multiple x-ray units are to be installed into a facility, future designs should consider upsizing single transformers, separate transformer for each extra unit, or possibly providing a separate power service to insure adequate power supply is available. Providing power conditioning equipment for each unit is also an option.

f. Since the service entrance to the old part of the hospital is separate and in another location from the service entrance to the new part of the hospital, a logistical problem is created in disconnecting the power within the building. This is further complicated by the use of multiple disconnects. No less than six operations of disconnects are required in order to remove service power from the building. Future designs which include renovation of an existing facility by the addition of new square footage should consider combining electrical services into one service system, minimize service power disconnects to the facility and combine utility metering into a single meter. Such a combination at Browning Hospital would have probably led to the selection of a service voltage of 277/480 volts instead of 120/208 volts, and greatly reduced the physical size and ampacity necessary for the service switchgear, as recommended by the Guidelines for Construction and Equipment of Hospital and Medical Facilities. This

would not only provide reliable and safe electrical distribution, but would also help reduce peak electrical utility costs.

g. The essential electrical system (EES) for the older portion of the hospital is separate (different generator and transfer switches) from the EES for the new portion of the hospital. The electrical system would be more reliable if it had a single EES, and a centrally located emergency plant for all EES loads as recommended by NFPA 99 and other codes. Also, since the EES was very conservatively designed, the capacity of the combined sources far exceeds the electrical loads connected. Therefore, the generators (E/G) are very lightly loaded and the diesel engines tend to build carbon in the piston chambers. Future design for additions to medical facilities should attempt to combine the EES into one distribution system centrally located. Secondly, designers should size their E/G plants for about 60-70% loading. THis would allow for higher reliability and decrease the cost of maintenance.

h. Since utility power at Browning, Montana, is subject to outages and brownouts, the temperature of the facility can drop rather dramatically in the winter. Only a minimal quantity of heating has been connected to the EES. In remote locations subject to brownouts hospital designers should consider connection of enough heating plant necessary to maintain minimum habitable temperatures inside the facility to 55 degrees Fahrenheit.

i. Lighting in the crawl space below the new building is sparse. Any outage of a single light will leave large areas of the crawl space unlit. It is recommended that in future designs more uniform coverage of the area with lighting be considered, since the space is used to access equipment and plumbing.

j. An empty raceway system was provided for telecommunications. This has proven to be an effective way to permit the installation of the telephone system at a later date than original construction, while minimizing damage to the building. In this facility, however, the raceway system is discontinuous with conduits emptying into the ceiling cavities where wiring is allowed to run openly. While "code permitted," this presents a potential problem during later installation of the telephone system where the installers who are unfamiliar with NFPA 101 and the fire protection

design of the building can easily penetrate fire rated and smoke rated partition walls without installing appropriate fireproofing. This problem can be minimized in future designs by providing a continuous raceway system between outlet boxes in walls and telephone backboards or terminal cabinets. Within void spaces the usage of raceway systems such as cable trays could limit the threat to fire and smoke integrity of the building during the installation of communications wiring, yet preserve system flexibility.

k. A satellite dish was installed to permit selection of network television stations for patient entertainment as well as educational stations for staff. While this system can be effective for bringing television into remote areas where cable television is not available and local broadcasting is limited, the facility has received complaints on the satellite dish because it does not receive local television news and programming. Further, the dish can only pick up several stations at a time and has to be adjusted to pick up additional stations. A master television antenna system has been added to the structure to receive local programming. Subsequently, the satellite dish is now being used infrequently. It is recommended that future designers carefully study local TV availability and television use patterns of the local population to determine the best method acquiring and distributing television within a hospital.

l. Exterior receptacles for engine block heaters were not installed in the facility. Future designs for remote areas in northern climates should consider provision of a minimal number of exterior receptacles for engine block heaters for use by staff. This will reduce the number of starting problems in staff automobiles that have been encountered in facilities such as Browning.

m. The garage doors for emergency and government vehicles are currently not on emergency power and have no capability for manual operation. It is suggested that in future designs ambulance garage doors be provided with a manual "chain-operated" override. In addition, serious consideration should be given to placing the garage doors on the equipment system of the EES.

n. The automatic sliding doors at the emergency entrance have not proven to be reliable for use as an emergency entrance device. The doors were supplied as an "as equal" to the doors specified, but were from a different manufacturer. They require frequent adjustment of their track and chain link mechanism and the ultrasonic door sensors are unable to be adjusted to detect people of all heights without at the same time creating nuisance openings of the doors. In the future designers should be careful to specify automatic doors that are well suited for the use to which they are intended. Automatic door specifications need to incorporate enough performance features to insure reliability and to determine "equivalence" of equal manufacturing.

o. Trauma room operatories have been provided with utility centers which include both medical gas and electric power. Power receptacles at the utility center are a "twist lock" type suitable for explosion-proof installation. This type of receptacle is not required in a room which uses only nonflammable anesthetics, which is the case at Browning. Since these receptacles require a special type of plug which is not normally available on operating room equipment, handmade extension cord converters are often use when power is required from these receptacles. For this reason these receptacles are avoided and most equipment is now being plugged into wall outlets which have normal hospital grade receptacles. It is suggested that future operating and trauma room of this type be outfitted solely with "straight blade" hospital grade 120 volt outlets. Existing "twist lock" receptacles normally can be replaced directly with "straight blade" receptacles.

p. The generator rooms, while having emergency lighting, have no lights during the startup period of a generator. It is suggested that future designs include a "battery pack" type light which will automatically operate during the start-up of the generator. This will allow for lighting of the space in the event the generator fails to start and maintenance staff is called to repair the generator. Such a light is recommended by the NEC/NFPA.

q. The hospital staff noted that some government-furnished equipment supplied for installation in the facility had initial warranty periods which expired before the equipment was installed, or soon thereafter. It is recommended that equipment

purchases be made in such a way as to insure that warranties extend well beyond the installation date of the equipment.

r. Small rooms such as exam rooms have been provided with multi-level switching. This type of switching is inappropriate for small spaces where all the lights are normally required for the task. The lights should be switched from one switch, saving wire and switches.

s. No smoke detectors were installed by "roll-down" partitions. Roll-down partitions, such as those to the records area, which separate hallways from interior rooms should usually be triggered to close from smoke detectors installed on either side of the partition.

The risk index (R) is:

$$R = \frac{A + B + C + D + E}{F}$$

Table I-2
Assessment of Risk, R

R Value	*Risk Value*
0-2	Light
2-3	Light to Moderate
3-4	Moderate
4-7	Moderate to Severe
Over 7	Severe

Table I-2(a)
Index "A" — Type of Structure

Structure	*Index Value*
Single family residence less than 5,000 sq ft (465 m²)	1
Single family residence over 5,000 sq ft (465 m²)	2
Residential, office, or factory building less than 50 ft (15 m) in height:	
Covering less than 25,000 sq ft (2323 m²) of ground area	3
Covering over 25,000 sq ft (2323 m²) of ground area	5
Residential, office, or factory building from 50 to 75 ft (15 to 23 m) high	4
Residential, office, or factory building from 75 to 150 ft (23 to 46 m) high	5
Residential, office, or factory building from 150 ft (46 m) or higher	8
Municipal services buildings, fire, police, water, sewer, etc.	7
Hangars	7
Power generating stations, central telephone exchanges	8
Water towers and cooling towers	8
Libraries, museums, historical structures	8
Farm buildings	9
Golf shelters and other recreational shelters	9
Places of public assembly such as schools, churches, theaters, stadiums	9
Slender structures such as smokestacks, church steeples and spires, control towers, lighthouses, etc.	10
Hospitals, nursing homes, housing for the elderly or handicapped	10
Buildings housing the manufacture, handling, or storage of hazardous materials	10

Table I-2(b)
Index "B" — Type of Construction

Structural Framework	*Roof Type*	*Index Value*
Nonmetallic (Other than wood)	Wood	5
	Composition	3
	Metal — not continuous	4
	Metal — electrically continuous	1
Wood	Wood	5
	Composition	3
	Metal — not continuous	4
	Metal — electrically continuous	2
Reinforced Concrete	Wood	5
	Composition	3
	Metal — not continuous	4
	Metal — electrically continuous	1
Structural Steel	Wood	4
	Composition	3
	Metal — not continuous	3
	Metal — electrically continuous	1

NOTE: Composition roofs include asphalt, tar, tile, slate, etc.

Table I-2(c)
Index "C" — Relative Location

Location	*Index Value*
Structures in areas of higher structures:	
Small structures — covering ground area of less than 10,000 sq ft (929 m²)	1
Large structures — covering ground area of more than 10,000 sq ft (929 m²)	2
Structures in areas of lower structures:	
Small structures — covering ground area of less than 10,000 sq ft (929 m²)	4
Large structures — covering ground area of more than 10,000 sq ft (929 m²)	5
Structures extending up to 50 ft (15.2 m) above adjacent structures or terrain	7
Structures extending more than 50 ft (15.2 m) above adjacent structures or terrain	10

Table I-2(d)
Index "D" — Topography

Location	*Index Value*
On flat land	1
On hillside	2
On hill top	4
On mountain top	5

Table I-2(e)
Index "E" — Occupancy and Contents

	Index Value
Noncombustible materials — unoccupied	1
Residential furnishings	2
Ordinary furnishings or equipment	2
Cattle and livestock	3
Small assembly of people — less than 50	4
Combustible materials	5
Large assembly of people — 50 or more	6
High value materials or equipment	7
Essential services — police, fire, etc.	8
Immobile or bedfast persons	8
Flammable liquids or gases — gasoline, hydrogen, etc.	8
Critical operating equipment	9
Historic contents	10
Explosives and explosive ingredients	10

Table I-2(f)
Index "F" — Lightning Frequency
Isoceraunic Level (See isoceraunic map.)

	Index Value
0-5	9
6-10	8
11-20	7
21-30	6
31-40	5
41-50	4
51-60	3
61-70	2
Over 70	1

The risk index (R) is:

$$R = \frac{A + B + C + D + E}{F}$$

$$= \frac{10 + 3 + 4 + 2 + 8}{6}$$

$$= 4.5 \quad \text{say } 5$$