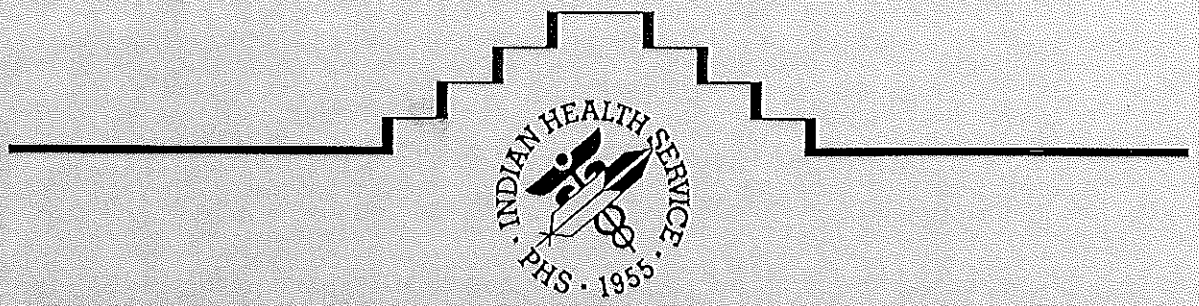

INDIAN HEALTH SERVICE HOSPITAL
PINE RIDGE, SOUTH DAKOTA

POST OCCUPANCY EVALUATION

February 1997

ENVIRONMENTAL HEALTH AND ENGINEERING
INDIAN HEALTH SERVICE

INDIAN HEALTH SERVICE HOSPITAL
Pine Ridge, South Dakota
POST OCCUPANCY EVALUATION
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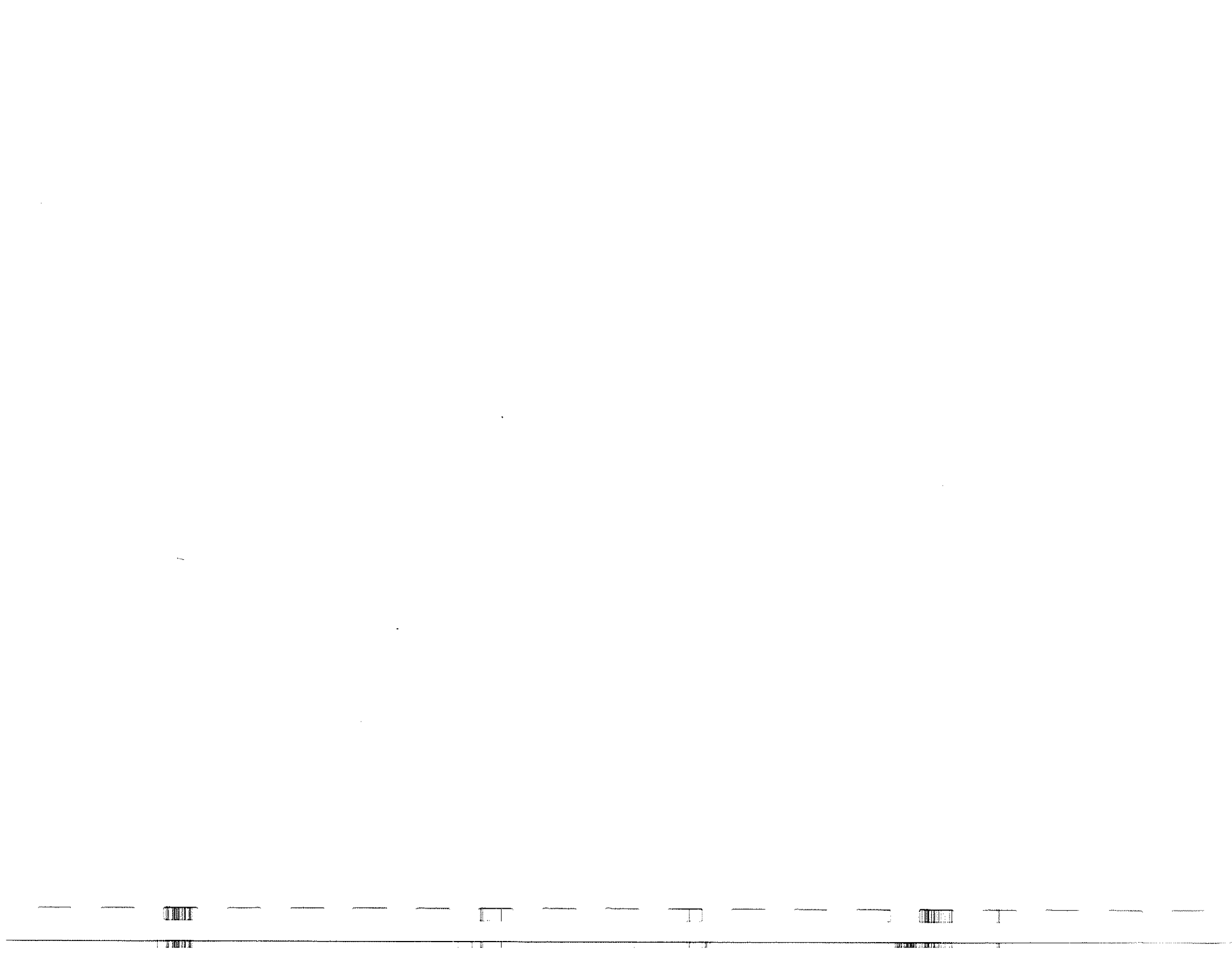

INDIAN HEALTH SERVICE HOSPITAL
Pine Ridge, South Dakota
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February 1997

INTRODUCTION

The Indian Health Service (IHS) conducts Post Occupancy Evaluations (POEs) of recently completed health care facilities to gain knowledge for planning, designing, constructing, and operating new and replacement facilities. Generally, a POE is conducted during the second year of a facility's operation. This allows the staff an opportunity to become familiar with the facility and to implement procedures for utilizing the new departmental space.

The IHS Hospital at Pine Ridge was planned, designed, and constructed with English measurements. However, the POE report includes metric measurements in compliance with the Indian Health Service Technical Handbook for Health Facilities, Volume I, Part 16.

The IHS 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, 15 hospitals and 19 health centers, 2 youth regional treatment centers, and 2 joint venture projects have been constructed. At the present time, 6 hospitals, 8 health centers, and 3 youth regional treatment centers are in the planning, design, or construction phase.

PINE RIDGE SERVICE AREA OVERVIEW AND HISTORY

The Pine Ridge Reservation is in southwest South Dakota, approximately 440 kilometers southwest of the Area Office in Aberdeen, South Dakota. It is comprised of Jackson and Shannon Counties, and encompasses approximately 7 350 square kilometers. The Pine Ridge Service Area includes the Reservation and Bennett, Custer, and Fall River Counties in South Dakota, and Dawes and Sheridan Counties in Nebraska. Service area health centers at Kyle and Wanblee, South Dakota, and health stations at Manderson, Allen, and Porcupine, South Dakota, are supported by the IHS Hospital at Pine Ridge. According to the 1990 Census, there are 11,006 Indians living on the Pine Ridge Reservation. Fiscal year 1994 IHS patient data shows that the IHS is the primary source of health care for 20,521 eligible beneficiaries within the Pine Ridge Service Area.

The replaced Indian Hospital at Pine Ridge was constructed in 1912. A wing was added to it in 1961. Obstetrical and optometry clinics, mental health, social services, and health education programs were housed in separate structures. The 58-bed hospital contained 4 830 square meters. The replacement hospital has 45 beds, with 25 general medical/surgical, 10 pediatric and 10 obstetrical beds. Services provided include general medical, surgery, pediatrics, obstetrics, as well as a full range of ambulatory care with specialty clinics and a comprehensive community health services program.

Climate

The climate of the Pine Ridge Service Unit is typical of the Northern Great Plains. The mean temperature for January is -15 degrees Centigrade (°C) and for July it is 23 °C. There is considerable daily and annual variation in temperature. The first frost comes towards the latter part of September, and temperatures below -15 °C are experienced from November through April. The months of July, August, September, and early October are very pleasant and mild with daytime temperatures in the 20's °C. The winters are cold and temperatures of -30 °C are not uncommon. Normal precipitation averages 405 mm a year. Snowfall is heavy at times, and it is usually accompanied by high winds, which cause it to drift. The prevailing wind directions are northwest-southwest (40 percent) and north-south (33 percent). During warmer months, winds from the southeast and southwest are fairly common, and periodically they are from the northeast. While average wind velocity ranges between 15 to 25 km/hr, winds of 80-100 km/hr are common during the winter months and 55-70 km/hr during the summer months. The effect of wind is an important factor to consider when determining the most appropriate building orientation.

Transportation and Communications

The Reservation contains political and geographical subdivisions. The towns of Oglala, Wanblee, Kyle, Martin, Allen, Porcupine, and Manderson, which are larger communities on the Reservation, are within 160 km of the IHS Hospital at Pine Ridge. They are linked by primary roads. Few paved secondary roads exist to serve clusters of outlying housing. There is no public transportation on the Reservation, but it is available in Rapid City, South Dakota, 180 kilometers northwest of Pine Ridge. The Tribe operates a full-time ambulance service.

Communications include KOTA-TV, KEVN-TV, KINI-FM, KCSR-AM & FM. All these stations are off-Reservation. Several AM radio stations are received regularly including KCSR - Chadron, Nebraska, and KOBH - Hot Springs, South Dakota. Daily newspaper

service is available from the Rapid City Journal. The Bennett County Booster, Sheridan County Star, and the Lakota Times all provide weekly newspaper service to the area.

PURPOSE OF POST OCCUPANCY EVALUATION

The process of surveying and analyzing recently constructed and occupied facilities is termed, "Post Occupancy Evaluation". The purposes for conducting a POE include:

- Avoiding design or construction deficiencies in future facilities.
- Documenting noteworthy construction features or practices for inclusion on future projects.
- Verifying that functional requirements of the program are met at reasonable costs.
- Evaluating staffing patterns and determining the adequacy of space provided compared to the approved Program of Requirements.
- During the POE survey, the team evaluates the planning, design, construction, and operating processes. The subsequent report provides feedback to those offices responsible for each process. The goal is to reduce costs by incorporating efficient features and practices into future facilities.

SURVEY TEAM

The POE of the IHS Hospital at Pine Ridge was conducted on September 12-14, 1995. The following were members of the POE team:

Joseph J. Corliss	Division of Facilities Planning and Construction (DFPC) Civil/Structural Engineer
Kent B. Morgan	DFPC Architect
John Yourshaw	DFPC Engineer/Project Officer
Paul Ninomura	Office of Engineering Services (ES)-Seattle Mechanical Engineer

Edwin Danks	ES-Seattle Electrical Engineer
Sylvia Rhodes	Health Programs Consultant
John DeVitt	Aberdeen Area Facilities Construction Coordinator

This report was prepared by team members. The team greatly appreciates the assistance and cooperation Leonard Little Finger, Pine Ridge Service Unit Director; Walter Thomas, Pine Ridge Hospital Facilities Manager, who served as the Service Unit coordinator for this review; and many other members of the hospital staff who participated in the POE.

GENERAL COMMENTS AND PROJECT DEVELOPMENT

1. Chronology

Program Justification Document Approved	June 20, 1986
Program of Requirements Approved	October 27, 1986
Program of Requirements Amendment Approved	November 14, 1988
Design Completed	October 19, 1990
Construction Contract Awarded	June 13, 1991
Beneficial Occupancy by IHS	August 23, 1993
Hospital Operational	March 28, 1994

2. Design Contractor . . . . . Wyatt/Rhodes Architects
4524 North 12th Street
Phoenix, Arizona 85014

3. General Construction Contractor . . . . . Hackett-Kurtz
P.O. Box 1917
Rapid City, SD 57709

4. Project Costs

Archaeological Survey	$11,000
Water Storage Tank and Wells	500,000
Subtotal	**$511,000**
Hospital Design Contract	1,086,375
Hospital Design Contract Change Orders	74,346
Printing	22,631
As-Builts	3,045
Subtotal	**$1,186,397**
A/E Construction Contract Administration	705,135
Subtotal	**$705,135**

Hospital Construction Contract	20,484,000
Hospital Construction Contract Change Orders	1,047,216
Subtotal	**$21,531,216**
Equipment	3,169,640
Artwork	100,100
Telephones	480,260
Subtotal	**$3,750,000**
Total	**$27,683,748**
Building Gross Square Meters	10 219
Actual Cost per Square Meter	$ 2,709

PATIENT SATISFACTION SURVEY

Shortly before the POE team visit, the hospital administration was asked to distribute a survey form to all patients using the facility during a one-week period. A total of 23 responses were received, rating various aspects of the building, from its geographic location to the temperature of the exam rooms. While this sample is not large enough to represent accurately the total number of users (over 40,000 outpatient visits and 3,000 inpatient admissions yearly), there appears to be a consensus among the respondents that the Pine Ridge Hospital is perceived as a generally good to excellent facility of high overall quality.

Survey items receiving a high degree of approval include location in community, interior and exterior appearance, interior finishes, artwork, interior finishes, departmental locations, and overall quality of construction. Areas receiving less favorable reaction include adequacy of parking, interior noise levels, paging system, waiting area furnishings, public telephones, stairs, size of exam rooms, and interior signage. (See Table 1 for summary of survey responses).

TABLE 1 SUMMARY OF 23 SURVEYS COMPLETED

PATIENT SATISFACTION SURVEY

(DESIGN/CONSTRUCTION)

FOR

PINE RIDGE COMPREHENSIVE HEALTHCARE FACILITY

(Name of Facility)

PINE RIDGE, SOUTH DAKOTA

(Location)

Your help is requested in determining if this Indian Health Service (IHS) health care facility meets your needs as a patient. Please take a few minutes to give us your opinion of the design and construction of this building. Your comments will assist us in the design and construction of future IHS health care facilities.

Please rate the following items in this building: (leave blank if you have no comment).

	Excellent	Good	Fair	Poor	Bad
Location (Is facility convenient to community?)	5	12	5	0	1
Exterior Signs (Are road and entrance signs adequate?)	5	8	7	2	1
Parking - (Are there enough parking spaces?)	4	7	7	2	3
- (Are parking lots convenient to the entrance?)	4	8	8	0	1
Sidewalks - (Are there enough?)	5	13	2	1	0
- (Are they wide enough?)	5	12	3	0	0
- (Are they where needed?)	5	13	3	0	0
Exterior Building Appearance	10	8	4	0	0
Interior Building Appearance	9	8	5	0	0
Handicapped Accessibility	8	10	4	0	1
Interior Finishes - Walls (Type/Color/paint/wallpaper, etc.)	8	10	3	0	0
- Floors (Type/Color/carpet/floor tile, etc.)	7	10	3	0	0
Artwork - Location	9	10	3	0	0
- Preference (Like or not?)	8	7	3	1	1
Location of patient check-ins	6	13	4	0	0
Bathrooms - Location Convenient?	3	15	5	0	0
- Size	5	13	3	1	0
Heating/Cooling (Temperature inside building) - Comfort	6	12	4	0	0
- Drafts	6	7	5	0	0
Level of noise in the building	4	11	3	2	3
Patient paging system (Can you hear it ok?)	3	11	4	4	0
Waiting areas - Location	5	12	4	1	0
- Furniture	5	9	3	2	2
Public telephones (Are they available and easy to find?)	3	8	4	4	3
Stairs (Are they easy to find and convenient?)	2	9	6	3	1
Elevators (Are they easy to find and convenient?)	4	11	3	3	0
Examining Rooms - Size	4	10	5	1	2
- Temperature	5	12	5	0	1
Drinking fountains (Are they convenient?)	4	12	3	1	2
Lighting - Entrance	8	12	1	1	0
- Public Areas	8	11	2	1	0
- Exam Rooms	6	12	3	0	0
Location - Information assistance	6	10	3	0	1
- Business office	5	9	5	1	1
- Emergency Room	6	12	2	1	1
- Outpatient clinic	6	11	4	0	1
- Dental	6	11	2	1	1
- Radiology	5	12	2	0	1
Signs in building (Can you easily find your way in the building?)	6	9	4	3	1
Overall quality of the construction - (Your opinion!)	5	11	4	1	0

ARCHITECTURAL

1. Building Orientation

a. The new hospital is located on high ground east of the town of Pine Ridge. Forty-five new units of quarters, completed at the same time as the hospital, are located directly behind it.

b. **Building Entrances:**

(1) The main entrance, on the northeast side of the hospital, is identified by a prominent covered entrance structure decorated with cultural symbols. This creates an inviting appearance. There is an outdoor seating area in the entrance courtyard, but no play equipment or play area is provided here or elsewhere (photos A-3 and A-4).

(2) The emergency entrance on the west side of the building is clearly identified. Ambulance traffic is routed through a covered "vestibule" with overhead rolling doors at each end (see photo A-5).

(3) The service entrance, power plant, and maintenance area are on the east side of the building on the lower level.

c. **Parking:** During the POE visit, parking areas appeared to be adequately sized. However, staff reported shortages of patient and staff parking during peak periods. There is a particular lack of parking for patients, visitors, and staff near the emergency entrance. Although the Government vehicle parking area is unfenced, security has not been a problem (see *4. Building Security*).

d. **Helicopter Access:** A helicopter landing area in front of the emergency entrance was designated on the drawings, but not built. (See *CIVIL/STRUCTURAL* comment A.2 for additional discussion.)

2. Exterior Features

a. General Observations/Design Criteria

(1) **General Appearance:** The hospital is a two-story building, with red brick exterior walls. The walls are punctuated by protruding window bays clad with insulated metal siding which is painted green (photo A-6). The green metal siding is repeated in other elements such as sun screens and penthouses. The design features extensive

and well maintained landscaping on all sides of the building (see photos A-1, A-2, and A-6).

(2) **Building Signage/Identification**: There is a sign located at the driveway entrance from the main road which reads, "Pine Ridge Comprehensive Health Care Facility." An identical sign is located in front of the main entrance (photo A-1). Directional signage is provided to the main and emergency entrances.

b. <u>Specific Features/Findings</u>

(1) **Main Entrance**: The main entrance is sheltered by a prominent glass-covered canopy structure which extends 18 m from the front door to the entrance drive. The canopy is supported by a heavy concrete structure, which at the front is 8 m high and is decorated with graphic symbols (see photo A-3).

(2) **Entrance Vestibules**: All personnel entrances (with the exception of the ambulance entrance) are provided with vestibules to reduce heat loss and wind penetration. See *Section 7,31.0, b(6)* for a discussion of the emergency entrance vestibule.

(3) **Exterior Walls**: The brick masonry used for the exterior walls (with an oversized unit face dimension of 200 x 200 mm) has proved to be a durable finish material.

(4) **Windows**: Windows are generally operable sash with no screens provided. This creates problems with insect infiltration and air balancing because patients and staff often open windows.

(5) **Roof**: Most of the roof has a single-ply membrane fully adhered to an insulated deck. The roof is completely surrounded by parapet walls, with an internal drainage system. The roof structure and insulation provides positive slope to drains. Staff reported that several leaks have been detected. The roofing contractor has been working to correct the problems.

- The clerestory and penthouse portions of the roof are covered with preformed metal roof panels.

- Roof access is by means of one of the two building stair towers, which extends into one of the penthouses. This is a functional arrangement.

(6) **Handicapped Accessibility:** The site and structure are generally accessible to the physically disabled.

(7) **Landscaping:** The area surrounding the building and parking lots is planted with grass and trees, which are watered by an in-ground irrigation system. This has been well maintained and looks attractive (photos A-1, A-6, and CS-3). The entrance courtyard is paved with concrete and furnished with fixed benches (photo A-4).

(8) **Loading Dock:** The dock is recessed under the floor above, which gives it good protection from weather (photo A-7). It is equipped with a leveler for handling a variety of truck sizes. The incinerator is located on an extension of the dock. This area is partially enclosed by a low concrete wall, which stops about 0.8 m short of the building. Children use this gap to ride bicycles in a loop across the dock, down the access ramp at the other end, and around the service drive. There has been some tampering with the incinerator control panel, which is easily accessible.

c. Comments/Recommendations

(1) In POE surveys conducted by PHS in recent years, single-ply roofing systems have been relatively problem-free when compared to built-up roofs. Single-ply systems should be considered in future facility designs. However, the team believes that the most critical factor in the successful performance of any type of roof is contractor quality control and careful construction inspection by Government representatives, the A/E or other independent entity.

(2) Service areas should be fenced to prevent easy access and tampering with equipment and to discourage unwanted traffic around loading dock areas.

3. Building Security

a. General Observations/Design Criteria

(1) A staff of two persons per shift is employed to provide 24-hour building security. Surveillance is accomplished by patrols and an array of cameras.

(2) No serious security problems were cited, although the building configuration, with many exits and low-visibility areas, would suggest surveillance problems.

(3) After-hours securability of the building (inpatient and outpatient areas) is good.

b. Specific Features/Findings

(1) **Monitoring System**: Sixteen remote cameras have been installed at critical points to cover entrances, parking lots, and key interior locations. These are monitored and taped in the security office adjacent to the emergency entrance. The cameras and monitoring equipment were added after occupancy.

(2) **Office Space**: The single small security office, located adjacent to the emergency entrance, is overcrowded due to the addition of the monitoring and recording equipment. Additional space for communications and monitoring functions would be desirable.

(3) **Staff Access to Building**: Locking of the back entrances on the lower level for security reasons inhibits access by community health staff coming from their cars in the nearby parking lot. Staff complained about this problem.

(4) **Cabinet Keying**: The cabinet keying system provides the same key for several locks (in an apparently random distribution). This is a potential security issue, as employees discover which cabinets their keys will open.

c. Comments/Recommendations

(1) This is a model facility in terms of security, both for building layout and management.

(2) Provision should be made in plans for future facilities for the installation of remotely monitored security cameras.

4. Functional Relationships and Traffic Patterns

a. General Observations/Design Criteria

(1) In general, this is a very successful design in terms of interdepartmental relationships and patient and staff flow patterns. However, the outpatient waiting areas adjacent to the main entrance appear to be relatively small and congested.

(2) Although departments are carefully and logically interrelated, the layout of the building is complex and

not immediately comprehended. The circulation system can confuse patients and visitors. This is mitigated by good directional signage (see photo A-8, showing a typical building directory).

(3) Inpatient care areas are well isolated from outpatient areas.

b. Specific Features/Findings

(1) **Compartmentalization**: There is provision for locking off major sections of the building during off-hours for security purposes. This is a useful feature.

(2) **Two-story arrangement**: This helps keep the plan relatively compact. Elevators (in two locations) are well placed for traffic flow. Having to use an elevator to access another floor does not appear to be a drawback.

(3) **Crawl Space**: On the lower level about one-half of the building "footprint" (the area enclosed by perimeter walls) is unexcavated crawl space. This area is accessible by access hatches on the lower level and on the building exterior.

c. Comments/Recommendations

(1) This is a good example of a two-story scheme. The interrelation of the floors and the resulting circulation patterns work very well.

(2) Provide lockable doors or gates to separate major segments of the hospital for security purposes during off-duty hours.

5. Interior Features (General)

a. General Observations/Design Criteria

(1) Interior public spaces, although limited in size, are attractive and well-maintained. There is an obvious "pride of ownership" among the staff and users of the facility. A coordinated color scheme establishes a tranquil and comfortable atmosphere (however, some called it too somber). The use of native art and traditional symbols and themes in graphic design enhances the appearance of public spaces (see photos A-9 and A-10).

(2) The main outpatient waiting area receives natural light from clerestory windows in three roof monitors which rise approximately 2 m above the roof level. This produces airy and attractive spaces (see photo A-11).

b. **Specific Features/Findings**

(1) **Handicapped Accessibility**: Spaces intended for public and staff use are generally accessible to the physically disabled. However, one deficiency noted was the 100 mm curb at the shower in the typical patient room (see photo A-13 and Section 9, *11.0 ACUTE CARE NURSING*). Patient toilet doors have raised marble thresholds, which are a tripping hazard for both able-bodied and handicapped. Also, the audiology testing booth in Ambulatory Care is not wheelchair accessible.

(2) **Corridor Guardrails**: The combination guardrails/handrails installed in most public corridors help to protect wall surfaces from damage (see photo A-10). This is a good feature. Rails are fabricated of molded plastic over a steel backing plate. The plastic occasionally fractures under the impact of carts, but it is easily replaced.

(3) **Floor Finishes**:

- Most public areas are carpeted, and the carpeting is generally in excellent condition. However, it presents continual housekeeping problems. Vending machines were relocated from the concession area to the lower level to reduce spillage of beverages by patients and visitors.

- Carpeting in areas such as bedrooms, exam rooms, and labor/birthing rooms is difficult to clean. Staff expressed concern about infection control, even though carpets are cleaned regularly and thoroughly.

- Exposed concrete floor surfaces in stair towers (which are dyed red) are uneven in color and impossible to keep looking clean.

(4) **Wall finishes**: The semi-gloss paint used on most interior walls generally has been durable. The dark green color of many corridor walls shows dust readily.

(5) **Storage Space**: Staff in almost all departments commented that storage space is insufficient. The team noted that this complaint arises in virtually all facility reviews. This is a result both of inadequate programming for

storage space in the 1986 Program of Requirements (POR), as well as inefficient use of the space provided. The design assumed that a cart exchange system would be used. Under this system, departmental storage can be minimized because Property and Supply replenishes supplies on a daily or weekly basis. This system has not yet been implemented at Pine Ridge.

(6) **Furniture**: Modular systems furniture is used in open office areas. It appears to be appropriate for its intended function. These units are of better design and higher quality materials than the standard furniture used in the enclosed offices.

(7) **Dust Infiltration**: Dust and insects brought into the hospital by air infiltration (including open doors and windows) present a maintenance problem.

(8) See also comments under Section 9, *45.0 PUBLIC FACILITIES*.

c. **Comments/Recommendations**

(1) Implement the cart exchange supply distribution and management system to utilize storage space more efficiently.

(2) Install curbless showers in 10% of patient rooms to comply with accessibility standards. (Because these showers often spill water into the adjacent space, their general use throughout a facility is not recommended.)

(3) Install guardrails/handrails in corridors to protect wall surfaces from damage. This hospital is a good example of their use.

(4) Use keyed locks to limit opening of operable windows and, therefore, reduce dust and insect penetration.

6. Comparison of Building Areas as Programmed and as Designed

NOTE: For the Summary of Building Areas (Table 2) on the following page, the construction document architectural floor plans as produced on AutoCAD were calculated electronically to find the building gross area as well as the areas of the hospital departments. This method may result in minor variances when compared with actual field conditions.

a. Overall, the building design follows quite closely the area prescribed by the POR. The POR, approved in October 1986, called for a total area of 10 207 gross square meters (110,302 gsf). The actual area as built is about 10 774 gm^2, or 5.6% over the POR. Distortions in reading drawings could account for some of this difference.

b. The total of all department gross areas is about 1% less than the POR totals. However, individual departments vary significantly above and below the corresponding POR amounts.

c. The ratio of building gross to department gross area was set at 1.2 in the original POR. The actual ratio of building gross to floor gross is 1.26.

d. When the planning criteria contained in the 1989 IHS Health Facilities Planning Manual (HFPM) are applied to the staffing and workloads as projected by the 1986 POR, the result is a facility about 43% larger than the POR size and 35% larger than the hospital as designed. Most departments would be larger than presently configured. Those which would be significantly larger under the 1989 criteria (10% or more) are Acute Care Nursing, Radiology, Emergency, Ambulatory Care, Community Health, Dental, Pharmacy, Physical Therapy, Administration (including Business Office), Health Records, Employee Facilities, Public Facilities, and Property and Supply. The only departments which would be reduced in size are Nursery, Laboratory, and Respiratory Therapy. (see Table 2 for details).

e. Space for major mechanical equipment was limited by the POR to 8% of total floor gross area. As built, major mechanical space occupies 8.9% of the total floor gross area. This allowance has since been increased to 12%.

NOTE: This hospital was programmed, designed and constructed using English units of measurement. Areas shown in Table 2 have been converted to metric units.

TABLE 2

PINE RIDGE HOSPITAL - SUMMARY OF BUILDING AREAS

Dept. No.	Department/Area	Planned DGM^2 per POR	Designed DGM^2 per Plans	Area ±	Pct ±	Current HFPM DGM^2
11.0	Acute Care Nursing	1 438	1 609	171	+12%	1 845
12.0	Nursery	54	40	-14	-26%	30
14.0	Surgery	845	746	-99	-12%	825
15.0	Labor/Delivery*					
21.0	Laboratory	168	170	+2	+01%	125
22.0	Radiology	255	249	-6	-02%	560
31.0	Emergency Care	223	190	-33	-15%	315
32.0	Ambulatory Care	670	794	+124	+19%	944
33.0	Community Health	575	577	+2	+00%	693
34.0	Dental Clinic	408	460	+52	+13%	723
35.0	Pharmacy	194	201	+7	+04%	258
36.0	Physical Therapy	166	159	-7	-04%	242
37.0	Respiratory Therapy	111	103	-8	-07%	81
41.0	Administration	215	244	+29	+13%	358
42.0	Health Records	340	336	-4	-01%	523
43.0	Employee Facilities	171	174	+3	+02%	229
44.0	Education and Consult.	194	61	-133	-69%	194
45.0	Public Facilities	412	288	-124	-30%	478
46.0	Business Office	0	0			179
51.0	Medical Supply	78	127	+49	+63%	136
52.0	Property and Supply	523	506	-17	-03%	773
53.0	Dietetics	289	316	+27	+09%	320
54.0	Housekeeping/Linen	136	99	-37	-27%	125
55.0	Facilities Management	327	247	-80	-24%	298
56.0	Building Services	17	46	+29	+171%	42
57.0	Clin. Eng.**(see 55.0)	0	0			75
	TOTAL AREA	7 809	7 742	-67	-01%	10 371
	FLOOR GROSS AREA	9 371	9 764	+393	+04%	12 964
	Major Mechanical Space	766	961	+195	+25%	1 556
	Ambulance Garage	70	49	-21	-30%	70
	BLDG GROSS AREA	10 207	10 774	+567	+06%	14 590

NOTES: * Combined with Surgery area.
** Clinical Engineering included in 55.0 Facil. Mgt. in POR.

7. Comments by Hospital Department

NOTE: Department numbers and names correspond to the standard system used in the 1989 edition of the IHS Health Facilities Planning Manual.

11.0 ACUTE CARE NURSING (GENERAL MEDICAL, PEDIATRIC AND OBSTETRICAL)

a. General Observations/Design Criteria

POR area:	1 438 gm^2
Area as built:	1 609 gm^2
Current HFPM allowable area:	1 845 gm^2

(1) **Comparative Data:**

- **POR Beds:** The POR called for a 45 bed hospital:

  25 med/surg (incl 2 isolation & 2 security)
  10 pediatric (incl 2 isolation)
  10 obstetrical (incl 1 isolation)

  These beds were to be located in 21 single bed rooms and 12 double rooms.

- **Beds As Built:**

  20 med/surg (1 isol/1 security) (8 single/6 double)
  5 intensive care (1 isolation) (5 single)
  10 pediatric (2 isolation) (6 single/2 double)
  10 obstetrical (1 isolation) (6 single/2 double)

  At present, one M/S isolation room is used for storage.

- **Revised HFPM:** Application of current criteria to this department would result in an area about 407 m^2 (28%) larger than the POR allowance, and about 236 m^2 (15%) larger than the department as built. The increase would not be in additional rooms, but in the size of individual rooms, particularly patient bed rooms (20 m^2 for a one-bed room vs. 17 m^2 in the POR; 28 m^2 two-bed room vs. 26 m^2). Also, the current department gross conversion factor for Acute Care Nursing is 1.5, as opposed to 1.25 in the POR.

(2) **General Arrangement:** Patient rooms are arranged in a typical double corridor layout with support functions

located in the center core. A single, expanded nurses station serves both medical/surgical and pediatric units. The intensive care unit is located in a separate area immediately to the east of the regular acute care unit. The ten bed obstetrical unit, with a separate nurses station, is located on the other end of the hospital beyond the Delivery/Surgery department.

(3) A survey of staff physicians completed prior to the POE visit stressed the need for more office space (for private consultations with other physicians), a physicians lounge, and additional on-call sleeping facilities.

b. **Specific Features/Findings**

(1) **Nurses Station:**

- **Control:** The location of the nurses station permits direct sight lines into only four patient rooms. The staff expressed the need for better visual connection and control of more patient rooms. Isolation rooms are located at the end of the acute care wing, farther from the nurses station than any other rooms.

- **Medication Alcove:** Although this space is sized according to the POR, the built-in counter across the back wall and the in-swinging door make it impossible to move the medication cart in and then secure the door.

- **Privacy:** Nursing staff complained that patient confidentiality is compromised because there is no private place designated for nurses to give or receive reports. The head nurse office is used for this purpose.

(2) **Patient Rooms:** The internal layout and equipment of the typical patient room is excellent (see photo A-12).

- All patient rooms are equipped with a built-in window seat for use by patients and visitors, a desirable feature. This seat is large enough to be used for visitor sleeping (photo A-12).

- All patient rooms are carpeted. This helps to downplay the institutional character of the nursing unit, but it also makes cleaning difficult. (See also *5. Interior Features (General.)*

- All patient room toilets include shower stalls with standard 100 mm tiled curbs (see photo A-13). This makes access by mobility impaired persons difficult and wheelchair access impossible. Toilet entrances have raised marble thresholds at doors, which may meet codes, but are tripping hazards for both able-bodied and handicapped.

(3) **Storage**: There was initially a lack of storage space for supplies and equipment. The consultation room has been converted to storage, and an isolation/security room in the medical/surgical unit is also being used as a storage room.

(4) **Tub Room**: This room is equipped with a fiberglass side entry tub, which is very convenient for staff to operate. There is no pediatric tub.

(5) **Office Space**: The visitor waiting area has been converted into a nurse supervisor's office. This office originally was located adjacent to the ICU, but that space was converted to office space for ICU and Emergency Care. The pediatric playroom also has been converted into office space.

(6) **Emergency Exit**: The emergency exit door from the acute care wing is located at the end of the pediatric unit. This has created security problems. The medical/surgical unit would be a preferable location for an emergency exit door. A security camera has been added at this door.

(7) **Obstetrical Unit**: The officer-of-the-day room, near the Nursery, is the only space provided for sleeping for physicians and other primary care providers. A midwife sleep room was not provided; normally, if staff lived in adjacent quarters, this would not be needed. However, many providers live over an hour away. Therefore, one of the labor rooms is being used as a sleep room.

(8) **Intensive Care Unit**: This was not included as a separate unit in the POR. Five beds were derived from medical/surgical space, along with the nurses station which was programmed for the pediatric nursing unit. One ICU bed is designed as an isolation room. One of the four regular bedrooms is presently used for storage of supplies. All ICU beds have good visual contact with the nurses station.

c. Comments/Recommendations

(1) Most patient rooms in the medical/surgical/pediatric wing are too distant from the nurses station. Acute care departments should be designed with as many patient rooms as possible (rather than offices and utility rooms) within direct sight of the nurses station.

(2) Patient toilets, including showers, should conform with applicable accessibility standards. In general purpose hospitals such as Pine Ridge, at least 10% of patient toilets and rooms must be wheelchair accessible.

(3) Carpeting should not be installed in patient rooms.

(4) More space should be programmed within the department for storage of patient care equipment.

(5) The ICU is state-of-the-art and should be used as a model for future facilities of its type.

12.0 NURSERY

a. General Observations/Design Criteria

POR area:	54 gm^2
Area as built:	40 gm^2
Current HFPM allowable area:	30 gm^2

A nursery, workroom/exam room, and janitor closet were programmed and built. The current criteria would provide only an observation/stabilization area and a storage space.

b. Specific Features/Findings

(1) The Nursery was designed to have separate nursing staffing, but to share a nurses station with the obstetrical nursing unit, a good feature. However, the nursery staff was not authorized. Even with windows between the nurses station and the intensive care nursery, it is considered too remote for good nursing care.

(2) The intensive care nursery is used as the observation nursery and procedure room for the nursery. Due to the remoteness of the nursery, babies often are kept at the nurses station for closer observation.

c. Comments/Recommendations

Provide a direct line of sight from the nurses station to the nursery.

14.0 DELIVERY/SURGERY

a. General Observations/Design Criteria

POR area:	845 gm^2
Area as built:	746 gm^2
Current HFPM allowable area:	825 gm^2

(1) **Delivery Suite:** The POR called for two delivery rooms and four labor rooms. However, only one delivery room and four labor/delivery rooms were built, which accounts for much of the 99 m^2 reduction in department area from the POR amount. Using current criteria, this suite would include one delivery room, two large labor/delivery/recovery rooms at 28 m^2 each (including toilets), plus a 22 m^2 recovery room and an admitting exam room which were not included in the POR. This would result in a 10% larger suite than built. One labor room is now used as a midwife sleep room.

(2) **Surgical Suite:** This area includes two operating rooms, a two-bay general recovery room and a one-bay isolation recovery. The design was changed to include a back door from the surgery clean corridor into the delivery room in the labor/delivery suite. This has contributed to the security problems in the surgical suite. The surgery suite did not appear to be heavily utilized at the time of the POE survey.

b. Specific Features/Findings

(1) **Labor/delivery room Layout:**

- There is insufficient space at the foot of the bed. During a delivery, the midwife must stand in the narrow space between the foot of the bed and the wall, and must position a movable instrument cart at her side (see photo A-14). This blocks movement across the room by staff or family members located in the window seat area at the far end of the room. (Note: This space problem is corrected by the current criteria, which provide a larger room.)

- The labor/delivery room features a newborn alcove on the opposite side from the headwall where utilities are located. No oxygen was provided on the alcove side of the room; therefore, it is not usable for newborn stabilization and the alcove space is wasted.

- The monitor displaying vital signs is mounted too high above the floor for staff to read.

- The large ceiling-mounted operating room light fixture provided in each birthing room far exceeds what is needed for the function of these rooms. A standard exam room lamp would be sufficient. In practice, a portable gooseneck halogen "pipe light" or similar spotlight would be more desirable.

- Electronic scales were provided in each delivery room. These scales are difficult to calibrate and do not produce uniform results from room to room. Therefore, only one set of scales is used for weighing newborns.

- Labor/birthing room floors are carpeted. This material is difficult to keep clean (especially blood spills), and is inappropriate for the function.

- The nurse call signal is connected to the medical/ surgical nurses station instead of the obstetrical nurses station.

(2) **Surgical Suite:**

- There are six access points to the suite (main entrance, obstetrical/delivery unit, Central Sterile Supply, male staff lockers, female staff lockers, and exit corridor). This makes the suite very difficult to secure and prevent unauthorized entry.

- The isolation recovery room has been converted to a storage room. Additional storage was needed because the exchange cart system was not implemented.

- The pre-op patient holding area is unnecessarily large for the volume of surgical cases.

- No operating room supervisors office was provided. The private pre-op room has been converted to a supervisors office.

- Humidity cannot be controlled adequately (see MECHANICAL comment A.4).

- No telephones were provided in the surgery suite (see ELECTRICAL comment 2.c).

- Power outages are a major problem. Even though Surgery is on emergency power, a seven-second blackout can be critical during a surgical procedure.

c. Comments/Recommendations

(1) Carpeting should not be installed in labor/delivery/ birthing rooms.

(2) Ceiling-mounted operating room lights should not be specified for labor/delivery rooms. Use standard exam room lamps.

(3) Surgical suites should be designed to limit access points and control entry by unauthorized persons.

21.0 LABORATORY

a. General Observations/Design Criteria

POR area:	168 gm^2
Area as built:	170 gm^2
Current HFPM allowable area:	125 gm^2

(1) **Design vs POR**: The laboratory space is crowded (although it exceeds the POR area by 2 gm^2). Additional space is needed for supply and records storage, state-of-the-art equipment, and the new Laboratory Information System. Current criteria, using the original PJD workload, would produce a laboratory 45 m^2 (26%) smaller than the existing facility.

(2) **Interdepartmental Relationships**: Laboratory is convenient to Radiology and Ambulatory Care, but quite distant from Acute Care. The waiting area is well separated from the laboratory area proper.

(3) **Additional Space**: To gain extra storage space, a door was added into a 3 x 4 m section of the adjacent Respiratory Therapy space; the remainder of Respiratory Therapy is now occupied by the surgery clinic.

(4) **Office Space:** The space designated as an office has been converted to a staff lounge, thus creating some of the overcrowding problems identified above.

b. <u>Specific Features/Findings</u>

(1) **Furniture**: The laboratory casework generally works well. However, there is much lab equipment in the limited amount of space, reducing bench top area and storage space (photo A-15). The height of some of the equipment placed on the benchtops requires staff to stand on a chair or stool to operate it.

(2) **Sinks**: The only hand washing sink provided for the entire laboratory area is the urine specimen sink.

(3) **Specimen Pass-thru**: The pass-thru windows between the specimen toilets and the lab are not used. It is standard procedure here for patients to hand carry samples to the lab.

(4) **Emergency shower/eyewash station**: The lab is provided with a floor drain, but the floor is not sloped to the drain. (Note: It is standard practice in laboratory design not to provide either drains or sloped floors under emergency showers.)

(5) **Microbiology**: This room is small and very narrow. It is not configured for efficient workflow (see photo A-16). Microbiology functions have expanded into adjacent Respiratory Therapy space.

(6) **Computer Space**: The department lacks space for computer terminals, which will be needed when the Laboratory Information System is installed.

(7) **Acoustics**: Numerous pieces of equipment produce a relatively high ambient noise level, which is amplified by the reflective wall and ceiling surfaces.

(8) **Morgue**: The morgue is located adjacent to the loading dock. It features a pass-thru refrigerator design (loaded from the building end, unloaded from the dock end), which is a very desirable arrangement.

c. <u>Comments/Recommendations</u>

(1) Specimen pass-thru windows could be omitted in future laboratory designs.

(2) Provide an adequate number of hand washing sinks at appropriate locations in the laboratory.

(3) Program adequate space for computer systems.

(4) Provide more absorptive acoustical materials (e.g., on ceilings) to reduce ambient noise levels.

(5) The morgue is an excellent design and should be used as a model for similar facilities.

22.0 RADIOLOGY - DIAGNOSTIC IMAGING

a. General Observations/Design Criteria

POR area:	255 gm^2
Area as built:	249 gm^2
Current HFPM allowable area:	560 gm^2

(1) **Location:** This department is well-located, directly across a corridor from Emergency. The walk-in entrance and waiting area is adjacent to both Laboratory and Ambulatory Care.

(2) **Design vs POR:** The original POR called for two x-ray rooms at 28 m^2 each. The 1989 criteria, using the PJD workload, would provide a 55% larger department, including two x-ray rooms at 28 and 30 m^2, plus separate ultrasound and mammography rooms.

(3) **Internal Layout:** The internal layout generally works well. The x-ray rooms are easily accessible.

b. Specific Features/Findings

(1) **Patient Dressing/Toilets:** Each x-ray room has a patient toilet which is accessible from both the room and the dressing area outside. This is a desirable feature. Four dressing booths were provided (two per x-ray room), but two would be sufficient for the current workload.

(2) **X-ray Control Areas:** Arrangement of the control booths (viewing angles and equipment location) is excellent.

(3) **Door Swings:** The large doors into the x-ray rooms open toward the room rather than toward the wall, presumably to shield patients from view, and also to avoid blocking control booth access when the doors are open. However,

staff finds them awkward to manage and would prefer to have them swing against the wall.

(4) **Conversion of Storage Space to Mammography**: The designated supply room was converted to a mammography room. (Mammography was programmed to share the same space with ultrasound, but staff wanted them to be separate.) This layout left the department without adequate storage space. The inpatient holding area is now used for storage (see photo A-17). The storage space as designed would have been adequate.

(5) **Employee Lockers**: Four large employee lockers were provided, which is a nice feature. However, there are eight technicians working in the department.

(6) **Dust Infiltration**: This has been a problem in the darkroom. Some blame the suspended ceiling material, but a more likely source is the emergency (ambulance) entrance, which is located in a direct line with the darkroom. Two sets of double doors intervene, but there is no vestibule at the emergency entrance (see *31.0 Emergency and Urgent Care*).

(7) **Security**: The double doors at the emergency/inpatient entrance to Radiology are not provided with locks. This interferes with security and limits patient control.

c. Comments/Recommendations

(1) Application of the current criteria would alleviate present space shortages claimed by the staff.

(2) Criteria for determining the number of patient dressing rooms should be reviewed. This facility, as well as others recently visited, appears to be over-designed in this respect.

31.0 EMERGENCY AND URGENT CARE

a. General Observations/Design Criteria

POR area:	223 gm^2
Area as built:	190 gm^2
Current HFPM allowable area:	315 gm^2

(1) **Size**: Emergency Care is undersized for its current workload. It was not programmed, sized, or well arranged for use as an after-hours walk-in clinic. It was noted

that 75% of the cases seen in this department are non-urgent.

(2) **Design vs POR:** The design provided 85% of the POR-prescribed space. Current criteria would provide 39% more space than the POR allotment. The unit lacks storage space (there is no cart exchange), office space for the nursing supervisor, and a medication alcove.

(3) **EMT Services:** Emergency medical transportation is a tribally operated program which is not housed within the hospital.

b. <u>Specific Features/Findings</u>

(1) **Circulation Problems:** The walk-in side of the emergency department is entered through a vestibule, which leads into a small corridor. Off this corridor is a 2 x 3 m enclosed waiting space and a 2 x 2 m triage alcove, which offers no privacy from the corridor. The security office also opens off this corridor. The treatment area is entered through double doors next to the triage alcove. Within the triage alcove there is a reception window.

(2) **Visitor Waiting:** This space is too small and too isolated from the reception desk. Often the entire corridor is filled with visitors.

(3) **Access to Ambulatory Care:** The design allows access during off-hours to three Ambulatory Care exam rooms directly from the emergency entrance corridor. The remainder of the Ambulatory Care department can remain locked. This is a workable arrangement, which is used regularly in overflow situations.

(4) **Cast Room:** This space is used primarily as an exam and storage room. Note: The current HFPM provides no cast room for a department of this size; treatment space is used for the casting function.

(6) **Ambulance Entrance:** Stretcher patients are transported directly into the treatment area from the ambulance enclosure through a single set of doors. The ambulance enclosure is a pass-through garage with overhead rolling doors to allow "indoor" loading/unloading of patients during inclement weather. In practice, these doors are seldom closed, which means that there usually is no vestibule at this entrance to Emergency Care. Drafts, dust, and insects penetrate the treatment area and also Radiology, which is directly across from the doors.

(7) **Security office**: See *4. Building Security.*

(8) **Office Space**: One small office was provided. Additional office space has been obtained for Emergency Care by dividing the Acute Care head nurse office which was placed in the intensive care unit. This office is remote from Emergency Care.

(9) **Janitor Closet/Medication Room**: The janitor closet provided for this department Care has been converted to a medication room (no separate medication room was provided).

(10) **Wheelchair Alcove**: An alcove was provided at the ambulance entrance. It also houses a fire extinguisher cabinet, which must be accessible at all times. This diminishes the usefulness of the alcove. The alcove is also used for cart storage.

(11) **Staff Lounge:** No staff lounge was provided in the Emergency Care or Ambulatory Care area. The current HFPM programs lounge space for this department at *43.0 EMPLOYEE FACILITIES*, and states that "staff lounge, toilets, and lockers must be conveniently accessible from the Emergency and Urgent Care Unit."

c. <u>Comments/Recommendations</u>

(1) Close attention should be paid to patient and visitor flow. Given staffing limitations, triage for walk-in patients should be contained within the treatment area so that it can be managed efficiently.

(2) Provide direct visual contact between the Emergency Care reception desk to visitor waiting.

(3) Provide a vestibule at the ambulance entry, large enough for maneuvering stretchers but not so large as to become a waiting room.

(4) The current criteria would eliminate the cast room in a facility of this size. This program change is supported by experience at Pine Ridge.

(5) It would be desirable to locate a staff lounge with lockers in the immediate area of Emergency Care, so that staff is not required to travel to a remote location.

32.0 AMBULATORY CARE, including OPTOMETRY, AUDIOLOGY/ENT and OBSTETRICS/GYNECOLOGY

a. General Observations/Design Criteria

POR area:	670 gm^2
Area as built:	794 gm^2
Current HFPM allowable area:	944 gm^2

(1) **Design vs POR:** The design as built is about 18% larger than programmed in the POR. Applying current criteria to the original PJD workload would yield a department about 39% larger than the POR and about 19% larger than built.

(2) **Room Utilization:** Twenty-five exam rooms were provided; three have been converted to offices, one to a supply room, and one to a non-stress test room. Two other exam rooms are used for other purposes, including sonograms.

(3) **Overcrowding:** Overcrowding has been relieved to some extent by the relocation of the outpatient surgery clinic, which was planned to be combined with the OB clinic. The surgery clinic is now located in part of the space originally designed for Respiratory Therapy, which is remote from other outpatient services.

(4) **Interdepartmental Relationships:** Relationships with Laboratory, Radiology, Pharmacy, and Emergency Care are very good. Staff noted that Health Records should be closer to Ambulatory Care (see *42.0 HEALTH RECORDS UNIT*).

(5) **Security:** The department can be secured from the rest of the hospital during off-hours. Three exam rooms can be used by Emergency Care during off-hours without opening up the whole department. This is an excellent feature.

(6) **Future Expansion:** Location at the northwest corner of the building will permit expansion without disruption of other hospital functions.

b. Specific Features/Findings

(1) **Patient Flow:** The small windows at the reception desks (both general Ambulatory Care and OB/Optometry clinics) create bottlenecks at the department intakes (see photo A-18). The sharing of a single reception window by OB and Optometry clinics interferes with patient privacy; the window is not wide enough for two clinics to use simultaneously.

(2) **Subwaiting Areas**: No subwaiting areas were provided in the general outpatient clinic; patients are returned to the main waiting area outside the reception desk. It would be useful to have subwaiting space, so that patients could be retained in the clinic for short periods. The OB clinic has a small internal subwaiting area.

(3) **Triage Space**: The supply/medications room near the nurses station has been converted to triage. This, plus the lack of a cart exchange system, has caused a severe shortage of storage space in the department.

(4) **Patient Toilets:** No toilet was provided in the OB clinic, where it is most needed. The OB patients use the toilet in the ENT clinic.

(5) **Typical Exam Room**: The exam rooms are generally well arranged and equipped.

- The overhead exam light provided is oversized and not well positioned for pelvic exams. Portable gooseneck "pipe lights" have been added at the foot of each exam table in the OB clinic.
- Windows (clear glass, with a sill height of approximately 1.2 m) compromise patient privacy, especially in OB exam rooms facing the main entrance courtyard. Opaque film has been applied to some windows by nursing staff.
- Building columns which protrude into some exam rooms interfere with required table space. These rooms have been converted to other uses (e.g., non-stress testing).
- A wall-mounted x-ray view box was provided in each exam room and office. Although this provides great flexibility, far fewer boxes are needed.
- The wall-mounted blood pressure cuffs provided in each exam room are rarely used and not needed.
- Acoustical privacy in exam rooms is good.

(6) **Treatment rooms**: Two were provided, but only one is needed for present clinic operation.

(7) **Optometry**: Except as noted in the first item below, the space provided is excellent and very well equipped.

- Patient flow is poor, due to entry through the OB clinic entrance.

- The vision screening room is fitted with a carousel at which the patient sits while various instruments are rotated into place. The operator sits in the center.

- The eyeglass fitting room is especially well furnished and lighted.

(8) **ENT**: This unit is co-located with optometry. It has a large audio testing booth (3 x 3 m inside) which also functions as office space. The booth is not wheelchair accessible. The x-ray view box provided is not needed. Additional office space, outside of the testing booth, is needed.

(9) **Floor Finishes**: All floors are carpeted. This provides a good appearance, but creates a maintenance problem in exam rooms, especially in the OB clinic.

(10) **Signage**: Exam and treatment rooms are provided with signs that have a built-in sliding panel which can be pulled out to reveal the message: "IN USE." This panel is somewhat difficult to manipulate. Therefore, the room status indication feature is seldom used.

(11) **Waiting Areas**: (See *45.0 Public Facilities)*

c. <u>Comments/Recommendations</u>

(1) Obstetrical clinics should have separate reception, control and subwaiting from other outpatient clinics where possible, to increase patient privacy and provide isolation from contagious patients.

(2) The use of sub-waiting areas should be considered in the layout of this department to facilitate patient flow.

(3) Additional triage and vital signs rooms should be provided.

(4) This facility should have a minimum of 16 exam rooms (two per primary care provider), and it could effectively use 24 rooms (three per provider).

(5) Carpeting should not be installed in exam rooms.

33.0 COMMUNITY HEALTH SERVICES

a. General Observations/Design Criteria

POR area:	575 gm^2
Area as built:	577 gm^2
Current HFPM allowable area:	693 gm^2

(1) **Location**: Community Health is located on the lower level adjacent to Administration and the conference rooms. It is remote from medical records and other patient-related departments, all of which are upstairs. Some patients have difficulty finding the department. It has a separate outside entrance and is well situated in relation to staff parking.

(2) **Design vs POR**: The department as built is about the same size as outlined in the POR. However, application of current criteria to the original PJD staffing would produce a department about 20% larger than the POR size. Several private consultation rooms would be added for use by professional staff.

(3) **SSA Office**: A small conference room (8 m^2) near the Community Health waiting area is occupied by the local Social Security Administration office under a lease agreement. SSA's presence in the building is viewed as a positive feature, enabling patients to obtain "one stop" health and social security services.

(4) **Contract Health**: The contract health unit has been added at the front of the Community Health/Environmental Health area (see *41.0 Administration*).

b. Specific Features/Findings

(1) **Open-plan Offices**: Much of the professional staff is located in an open-plan area, which is furnished with modular systems furniture. The large open office area shared by several Community Health functions is enhanced by a high ceiling (approximately 3 m) and high-quality, neutral-color systems furniture (see photo A-19). However, many of the staff commented about the lack of acoustical privacy in the open-plan offices.

(2) **Public Health Nursing**: Open office areas have created a privacy/confidentiality problem for professional staff. Staff in closed private offices also experiences difficulty with acoustical privacy. Storage space and utility space are insufficient for durable equipment used

by the home nursing program. The lack of a cart exchange system aggravates the situation. The sink in the utility room is too small for cleaning equipment such as car seats. Audio-visual media supply storage could be located elsewhere, outside of the department. The secretary/receptionist work station is not visible or accessible to the public (i.e., clients). The windows in both the private offices and the open office areas are much appreciated by staff.

(3) **Environmental Health:** Only the sanitation portion of the program was moved into the building. The engineering section remained at its offices in Martin, South Dakota, some 70 km away. This gave the sanitation and other community health programs additional office and storage space.

(4) **Mental Health/Social Services:** These two departments were originally co-located in a separate area between Administration and main Community Health area. Social Services has been relocated into the unused Physical Therapy department on the upper level, where it is near the inpatient services it serves. Mental Health has expanded into the vacated Social Services space.

(5) **Health Education:** This department was not staffed at the time of the POE site visit.

(6) **Public Health Nutrition:** This department was not staffed at the time of the POE visit, a loss of 4.5 programmed positions. Its space is used by the Information Systems Coordinator.

c. <u>Comments/Recommendations</u>

(1) The use of open-plan offices raises serious privacy issues. Staff expressed a need for more private offices or consultation rooms for patient counseling. Existing consultation rooms have been converted to office space (e.g., safety officer).

(2) Adequate soundproofing is required for offices and consultation/therapy rooms which demand patient privacy.

(3) Reception/secretary work stations in open office areas should be provided with half-height partitions to allow public visibility and easy identification.

34.0 DENTAL CLINIC

a. General Observations/Design Criteria

POR area:	408 gm^2
Area as built:	460 gm^2
Current HFPM allowable area:	723 gm^2

(1) **Location**: The dental clinic space is well arranged and functional. It has a separate sub-waiting area which is well supervised and controlled from the reception desk.

(2) **Design vs POR**: This clinic as built is about 13% larger than the POR amount. Current criteria would allow a suite about 57% larger than built, with increases in darkroom, laboratory and reception space.

b. Specific Features/Findings

(1) **Operatories**: The 15 open-plan operatories generally work well. In most cases, one x-ray head is shared by two operatories, which makes it difficult to maneuver to the far side of the patient.

One of the three enclosed operatories provided has been converted to a staff lounge. The two remaining enclosed operatories are sufficient for the workload.

(2) **Offices**: There is a 31.5 m^2 shared office, plus one private office for the supervisor.

(3) **Casework**: It was noted that the cabinetwork is not the item originally specified, but an "or equal" substitution under the contract.

(4) **Laboratory**: This is a very small space, with inadequate countertop area for the equipment and procedures conducted.

(5) **Clean-up Area**: The clean-up area is conveniently located in the center of the department, serving operatories on both sides equally well.

(6) **Staff Lockers**: Employee storage lockers were provided in the storage room within the dental suite.

(7) **Storage**: There is an inadequate amount of storage space for dental supplies.

c. Comments/Recommendations

(1) This is an excellent layout that could be used as a model for other dental departments of similar size.

(2) The provision of staff lockers within the department (and also a staff lounge, created from office space) is appreciated by the dental staff.

35.0 PHARMACY

a. General Observations/Design Criteria

POR area:	194 gm^2
Area as built:	201 gm^2
Current HFPM allowable area:	258 gm^2

(1) **Location**: The Pharmacy is well located in relation to Health Records, but its relationship to the outpatient clinics is only mediocre. Pharmacy staff noted that the main Ambulatory Care department, at the opposite end of the long waiting area, is too far removed. Pharmacy has a small sub-waiting area of its own, which is very useful.

(2) **Design vs POR**: Use of current planning criteria would produce a pharmacy 33% larger than the POR size, and 28% larger than built. The outpatient pharmacy would be about 7% larger than the present 152 m^2. The inpatient pharmacy would be 92% larger than the 49 m^2 space built.

b. Specific Features/Findings

(1) **Work flow**: The layout of the outpatient pharmacy enables good work flow. A section of standard shelving was added for holding of filled-prescriptions. (This was not provided in the design).

(2) **Records Pass-through**: Direct access provided to Medical Records from Pharmacy via a window between the departments is excellent.

(3) **Consulting rooms**: Three consulting rooms were provided, one of which is separate and out of the patient flow pattern. It is used as a staff lounge; the two remaining rooms are sufficient for current needs.

(4) **Office Space:** One office was provided. (Note: The current HFPM would provide an additional 19 m^2 of office space for pharmacists.)

(5) **Cabinetwork:** Much gravity-feed shelving was provided (see photo A-20). Although some is desirable, it was overdone here and is inefficient. Staff would prefer more standard shelving. Locked cabinets are unnecessary when a safe is provided. Electrical power was not provided at the center island casework (see ELECTRICAL comment 6). Maintenance staff has added power receptacles, but conduit from floor to base of cabinet is exposed in aisle (see photo A-21).

(6) **Bulk Stores:** The track-mounted, manually operated movable storage units, designed for efficient utilization of space, function well.

(7) **Inpatient Pharmacy:** The inpatient pharmacy, which is amply sized, is located at the entrance to the acute care wing. However, it is much farther from the OB nursing unit than is the outpatient pharmacy.

c. Comments/Recommendations

(1) This department generally works very well, considering that it is relatively undersized by current standards. Application of current HFPM criteria would alleviate space shortages.

(2) Provide temporary storage shelving for filled prescriptions.

(3) It did not appear that any additional space is needed in the inpatient pharmacy (current criteria would provide an additional 45 m^2).

36.0 PHYSICAL THERAPY

a. General Observations/Design Criteria

POR area:	166 gm^2
Area as built:	159 gm^2
Current HFPM allowable area:	242 gm^2

This department is not staffed. The space is used in part by Social Services, and also for storage and, occasionally, specialty medical clinics.

(1) **Design vs POR:** Current criteria would allow a department about 30% larger than the POR allotment.

(2) **Location:** The department is well located in the hospital, equally accessible from inpatient and outpatient areas, and convenient to radiology. It has an exterior exposure, featuring an enclosed outdoor "exercise yard."

37.0 RESPIRATORY THERAPY

a. **General Observations/Design Criteria**

POR area:	111 gm^2
Area as built:	103 gm^2
Current HFPM allowable area:	81 gm^2

This department is not staffed. The space is used by Surgery ambulatory clinic and Laboratory.

Current criteria would provide a department about 30% smaller than the POR allotment.

41.0 ADMINISTRATION

a. **General Observations/Design Criteria**

POR area:	215 gm^2
Area as built:	244 gm^2
Current HFPM allowable area:	358 gm^2

(1) **Design vs POR:** Administrative functions have expanded significantly beyond those originally programmed for this hospital. The department is presently about 13% larger than the POR area.

(2) **Current HFPM vs Design:** Current planning criteria, using the original staffing and workloads, would yield a department about 47% larger than designed, and about 65% larger than the POR allotment. The added space would be primarily in computer room, personnel office, and business office (billing functions).

(3) **Additional Functions:** The business office, involving patient registration and billing, was not included in the POR or the design (nor was it included in the 1989 HFPM). It has been squeezed into library and concession space.

(4) **Location:** The main Administration suite is located on the lower level at the back of the building. It has direct access to staff parking. The conscious decision to remove Administration from the front door of the hospital has proven to be very workable.

b. **Specific Features/Findings**

(1) **Main administrative suite:** Except as noted below, this space functions reasonably well.

- Acoustics are poor in the central open office area.
- The open office area serves as trafficway from the corridor to the dining room on the opposite side.
- The computer room was relocated to the Building Services area. Computer space was converted to personnel office space.
- Space for Personnel was not provided in the POR. One private office within the suite has been taken from Quality Assurance for use by the personnel officer.
- At the front of the open office area is a work station with a half-height partition, suggesting that this is the departmental receptionist. In fact, the hospital switchboard function is located here.

(2) **Contract Health:** This department was not included in the original POR. It has been inserted at the front of the large Community Health open office area on the lower level. Contract Health is somewhat crowded here because several units share the space. The area lacks acoustical privacy for confidential patient conversations. Its location at the front, next to the waiting area and reception counter, results in much traffic through the department by outsiders on their way to other departments or to the copy machine. This office is remote from most patient-oriented activities, which are located on the upper floor.

(3) **Automated Data Processing (ADP):** The computer room was relocated from the main administrative suite to the telephone switchgear room in the central mechanical plant. This is a logical location; computer equipment is isolated from office functions, securable, with separate HVAC, uninterrupted power source, and flexibility for

future modifications to the system. A local area network is being installed. An office for the ADP administrator is located in Community Health Services adjacent to Environmental Health.

(4) **Business Office**: *See 46.0 Business Office.*

c. Comments/Recommendations

(1) Considering the additional functions and staff which are now part of administration, and the several adjustments which have occurred in space assignments, the department operates reasonably well.

(2) In view of the numerous changes over the past several years in the function of Administration, it would be advisable to design this space with enough flexibility to accommodate future change. Use of open office planning and a location within the hospital which allows for expansion are desirable strategies.

(3) Future designs should consider locating Administration away from patient-intensive functions to more remote, yet still accessible portions of the hospital. This is a good example of this arrangement.

42.0 HEALTH RECORDS UNIT

a. General Observations/Design Criteria

POR area:	340 gm^2
Area as built:	336 gm^2
Current HFPM allowable area:	523 gm^2

(1) **Size**: This unit has ample space for the records being housed. Additional storage space could be gained by replacing the fixed shelving with a movable system.

(2) **Design vs POR**: The area as built is very close to the POR area. Current criteria would provide about 53% more space than authorized by the POR. At the current level of operation at Pine Ridge, this additional space is not needed.

(3) **Added Functions**: No space was specified in the POR for the Business Office, which now shares some space in Health Records. This arrangement has created privacy and security problems regarding confidentiality of records.

(4) **Location**: Health Records is perceived as being too remote from Emergency Care and Ambulatory Care, which are located at the opposite end of the outpatient waiting area. There is a direct connection to Pharmacy via a pass-through window. This arrangement works very well. The relationship to the billing office (located across a corridor) is also good. Cross-traffic through the unit by outsiders has not been a problem.

b. <u>Specific Features/Findings</u>

(1) **Reception**: The original reception window, which is located opposite the main entrance doors of the hospital, is now used only as a pickup point for records under the Freedom of Information Act. Patient registration is now located at the former information desk across the main corridor and adjacent to the hospital entrance door.

(2) **Storage**: There is insufficient storage space for forms and supplies. Property and Supply does not store any forms, so they must be stored within the department.

(3) **Shelving**: Records shelving units are standard fixed metal shelving (warehouse type), bolted to the floor with external angles. Staff complained that file folders are easily snagged in the perforated vertical shelf supports.

(4) **Furniture**: The open office systems furniture generally works well. Managers would like to have additional work stations (i.e., desks) to accommodate all workers. A number of non-systems cabinets have been brought in from the old hospital.

(5) **Illumination levels**: In the records storage area, light levels are quite low, even though fixtures are located directly over the aisles. Staff finds the lighting level to be poor and colors of walls and shelving too dark.

(6) **HVAC**: Staff noted that often it is too hot or too cold, with poor air circulation in the large records area. Portable fans and humidifiers have been added.

c. <u>Comments/Recommendations</u>

(1) This is a good design in terms of internal work flow. It provides direct access from the entrance to the records work area and the active storage area.

(2) Use more efficient shelving designed for records storage.

(3) Provide adequate lighting levels in records storage area.

(4) Consider door lock system with keypads or card coded locks to improve security in this department.

43.0 EMPLOYEE FACILITIES

a. General Observations/Design Criteria

POR area:	171 gm^2
Area as built:	174 gm^2
Current HFPM allowable area:	229 gm^2

(1) **Design vs POR**: This unit, consisting of lockers, toilets and showers, is 2% larger than the POR allotment. Current criteria would add 55 m^2 to the unit as designed, including larger toilets and showers, and an employee exercise center. This would be a significant change in the nature of this department, which is now used primarily by housekeeping and maintenance personnel.

(2) **Location**: Employee facilities are provided on both upper and lower levels. The upper level includes toilets and a small lounge with an exterior window. The lower level provides employee lockers, showers and toilets (with separate handicapped toilet rooms), but no lounge space. For staff in many departments, employee locker facilities are still too remote from their work stations and do not provide adequate security, in their judgment.

b. Specific Features/Findings

(1) **Lockers**: The number of lockers provided appeared to be large in proportion to the number actually being used.

(2) **Showers**: The shower/dressing area offers little privacy, being open to the major part of the locker area.

(3) **Towel Dispensers**: Wall-mounted paper towel dispensers are located across the room from the lavatories, so that users drip water across the floor before they can dry their hands.

c. Comments/Recommendations

(1) Locating employee locker and lounge areas conveniently in departments such as Dental, Emergency Care, Ambulatory Care, and Community Health would promote use by more

staff. This has been done to some extent in this facility.

(2) Additional staff amenities, such as an employee fitness center, would be desirable at Pine Ridge. Application of the current criteria would help in this respect.

(3) A dedicated physician lounge would be desirable.

44.0 EDUCATION AND GROUP CONSULTATION

a. General Observations/Design Criteria

POR area:	194 gm^2
Area as built:	61 gm^2
Current HFPM allowable area:	194 gm^2

(1) **Space**: There is a shortage of conference space in the hospital. With the exception of the "library," whose function has become very specialized, there are no conference rooms on the upper level, where most patient care services are located. A larger conference/training room is needed, such as was provided by the library in the original design.

(2) **Location**: Located at the east end of the building near the dental clinic, the nursing education program/library is remote from most of the departments which use it. The nurse educator is located in the library space, which is used for nursing staff training.

b. Specific Features/Findings

(1) **Library Usage**: The library, which also is occupied by the nursing education program, is used for staff training and as a resource room. It is not large enough for programs such as CPR training. With the recent removal of all materials over five years old, there are very few library materials left. (It was said that this was done to meet JCAHO requirements.) Medical staff members are reluctant to leave personal books in the library because they are likely to disappear.

(2) **Added Functions**: Approximately 40% of the original library space has been converted to business office use. A larger conference/training room is needed. (In the original design, the library provided one such space.)

(3) **Dining Room:** This space is often used for conferences and group meetings. It would serve this function much better if the space could be isolated physically from the kitchen by means of a rolling door or window.

c. Comments/Recommendations

(1) There is no suitable space large enough for a general staff meeting. All-hands meetings have been held in the outpatient waiting area, which is not well configured to serve as a large meeting area.

(2) The library should be used as programmed, and not converted to other uses, such as office space.

45.0 PUBLIC FACILITIES

a. General Observations/Design Criteria

POR area:	412 gm^2
Area as built:	288 gm^2
Current HFPM allowable area:	478 gm^2

(1) **Design vs POR:** The combination of waiting and sub-waiting areas, public toilets, concession, and meditation room as built is about 30% smaller than the POR allowance. The current HFPM would increase the allotted public facilities space by 66 m^2 (17%) above the POR level.

(2) **Net vs Gross Area:** It is difficult in many instances to distinguish lobby/waiting (net) area from adjacent circulation (gross) area. However, since Public Facilities is well short of the POR allowance, while the total building floor gross area exceeds the POR by about 4%, it appears that some public facilities area has been sacrificed to circulation or other building area.

(3) **Social Center Function:** This hospital, like many in the IHS system, serves as a social as well as a healing center. It is a magnet for the community (the only air conditioned public place in the summer heat), and this increases the problem of keeping well people separated from the sick. The congested general and outpatient waiting areas make this more difficult.

(4) **Future Expansion:** The broader focus of the hospital as a community center is recognized by the hospital administration, who would like to see additions made (perhaps around the perimeter drive) to expand the

facility into a more all-encompassing "wellness center." This would tie in with Lakota cultural concepts, focusing on diet, fitness, healing, and well being. It was noted that there is no swimming pool in the community or on the reservation.

b. <u>Specific Features/Findings</u>

(1) **Waiting Areas**: Main outpatient waiting is attractive, but relatively small. There is no provision for television or video monitors in any of the waiting areas. This would be useful for keeping children and adults occupied and for presenting educational materials.

(2) **Circulation Areas**: Public lobbies and corridors are attractively designed, some with clerestory natural lighting, and native art on the walls, all with carefully coordinated colors (photos A-9, A-10, and A-11).

(3) **Concession space**: The designated space, located near the main entrance, was to contain vending machines. These machines were seen as a threat to the carpeted floors throughout the main lobby and waiting area. Therefore, the vending machines were relocated elsewhere in the building (principally in Administration--also a carpeted area). This has reduced spillage on carpeted floors in the public areas. The dietary department serves staff and visitors as well as patients, reducing the demand for concession services. Concession space has been reallocated to the Business Office.

(4) **Wall Protection**: Combination guardrails/handrails installed in most public corridors have done much to protect wall surfaces from damage (see photo A-10). They are made of molded plastic with a textured finish.

(5) **Window Walls at Main Lobby**: Where window walls come to floor level, fin tube radiators are installed in front of and higher than window frames, creating an awkward pocket (see MECHANICAL comment 10 and photo M-8).

(6) See also comments under *5. Interior Features (General).*

c. <u>Comments/Recommendations</u>

(1) This facility is a good example of the use of overhead natural lighting (clerestories/monitors). Its use in the upper level waiting areas is designed to minimize heat gain/loss and to avoid the harsh effects of direct sunlight on the interiors.

(2) Designers should not skimp on the size or design of main entrance and waiting spaces. Although IHS does not want to create extravagant lobbies and waiting rooms, these spaces should present a welcoming, comfortable, and reassuring image to the public.

46.0 BUSINESS OFFICE

a. **General Observations/Design Criteria**

POR area:	0 gm^2
Area as built:	0 gm^2
Current HFPM allowable area:	179 gm^2

(1) **Design vs POR:** This department was not included in the original PJD or POR.

(2) **Location:** The Business Office is located in a portion of the library, which is separated from the remaining library space by a folding partition.

b. **Specific Features/Findings**

(1) The space is densely packed with four workstations and related filing equipment. This is not adequate in terms of space, equipment, or location for patient registration and other functions of the department.

(2) The business office also occupies former concession space near the main entrance, which should be remodeled to replace the overhead rolling gate with a standard door.

c. **Comments/Recommendations**

Application of the updated HFPM criteria would provide space for this department and alleviate the present overcrowding.

51.0 MEDICAL SUPPLY SERVICES (CENTRAL STERILIZING)

a. **General Observations/Design Criteria**

POR area:	78 gm^2
Area as built:	127 gm^2
Current HFPM allowable area:	136 gm^2

(1) **Design vs POR:** The space as built is about 63% larger than the POR allotment. Current criteria would add about

9 m^2 (7%) to the department, providing larger receiving/decontamination, cart wash, unsterile storage, equipment storage, linen packing and office areas.

(2) **Location**: The proximity of the department to Delivery/ Surgery is excellent. Its relationship to Acute Care, Ambulatory Care, and Emergency Care is adequate.

(3) **Work Flow**: This department is well arranged, providing a good flow of materials from soiled receiving to sterile storage and issue. An issue window for outpatient supplies opens directly from sterile storage onto the public corridor.

b. **Specific Features/Findings**

(1) **Finishes**: Floor and wall finishes, including quarry tile, ceramic tile, and paint, have proved to be durable.

(2) **Cart Washing**: An alcove was provided for cart washing, including floor drain and ceramic tile walls (see photo A-22). This space is adequate, but is not used as designed because the portable steam gun provided does not operate as designed and is too heavy and unwieldy for staff to operate. Carts are washed by hand.

(3) **Gas sterilizer**: This equipment has never been used because of staff concerns about its toxicity. It is located in a separate room, which appears to be adequately ventilated.

(4) **Shelving**: None was provided in the sterile storage area. Closed-type metal shelving units were moved over from the old hospital.

(5) **Sinks**: The sinks provided are too small for the needs of the department.

c. **Comments/Recommendations**

(1) Application of the current criteria would provide a fully adequate amount of space for this department.

(2) Careful consideration needs to be given to the anticipated use of equipment, such as gas sterilizers. Also consider the expected skill level of staff prior to specifying major equipment of this type.

52.0 PROPERTY AND SUPPLY UNIT (CENTRAL STORES)

a. General Observations/Design Criteria

POR area:	523 gm^2
Area as built:	506 gm^2
Current HFPM allowable area:	773 gm^2

(1) **Design vs POR:** Storage space in the hospital as designed is generally quite limited. The area of this department is 3% less than the POR allotment. Current criteria would allow about 53% more space than built, mostly in forms, records, refrigerated and computer equipment storage.

(2) **Non-programmed Out-of-hospital Storage Areas:** Currently the basement and garage at the old hospital building are being used to meet storage space demands.

(3) **Location:** The department's location is good, even though it is located on the lower level and requires elevator access to most departments.

b. Specific Features/Findings

(1) **Exchange cart system:** The design called for a cart exchange system, in which departments would be supplied on a daily or weekly basis from Property and Supply. This system has not yet been implemented at Pine Ridge. The space designated for cart exchange is currently used for bulk storage.

(2) **Ceiling Height:** At approximately 3 m, the ceiling height in the central stores area allows barely adequate volume for efficient storage. Code requires clearance of 0.45 m between stored materials and ceiling, leaving an effective storage height of about 2.5 m. With a forklift handling system, additional ceiling height would be useful for increasing storage capacity.

(3) **Forms Storage Room:** Although only a small space was provided, it was not arranged to take advantage of its full potential.

(4) **Air Curtain:** To supplement the heating system, an air curtain was added above the overhead rolling door to the loading dock. This has been effective in reducing heat loss. (See MECHANICAL comment A.6.)

(5) **Loading Dock**: The dock is located directly adjacent to central stores receiving.

c. Comments/Recommendations

(1) For more efficient use of space, a relatively high ceiling height is recommended for the bulk stores (warehouse) area. Although this design is not the ideal solution, it meets this requirement better than some other similar installations where Property and Supply is located on the lower level of a multi-story structure, and, therefore, has limited headroom.

(2) The hospital needs assistance in determining a three-month supply level. A Prime Vendor system is being considered. This would require a two-month supply, which should be workable within the existing space.

(3) The utilization of a cart exchange system should continue to be evaluated in order to make the entire hospital more functional.

53.0 DIETETICS UNIT

a. General Observations/Design Criteria

POR area:	289 gm^2
Area as built:	316 gm^2
Current HFPM allowable area:	320 gm^2

(1) **Location**: Dietetics is located on the lower level, relatively close to the loading dock, and with a separate exterior entrance for potential outdoor dining in good weather.

(2) **Change in Workload**: The kitchen/serving area layout works well. It was designed for serving inpatient meals only. The workload has been expanded, and now includes serving staff and some visitors. The kitchen appears to be adequately sized for the added workload. However, the dining room, which is combined with conference space and located adjacent to Administration, appeared to be overcrowded during the lunch period at the time of the POE visit.

(3) **Design vs POR**: The design is about 9% larger than the POR area, and is about equal to the area allowed by current criteria.

b. Specific Features/Findings

(1) **Dining Room Separation:** There is no means for closing off the dining room from the kitchen. This makes the dining room less desirable for conferences and group meetings during off-hours than if a rolling overhead door had been provided. Kitchen noise interferes significantly with the conference room function. Also, due to its location, the dining area is used as a shortcut between the back door of Administration and the public corridor.

(2) **Exterior Exposure:** The dining room has a large window and door opening onto a paved terrace which is shielded from the parking area by a low wall. This is a pleasant and inviting feature in this room. Unfortunately, the terrace is not furnished or used for dining.

(3) **Dishwashing Operations:** The dishwashing/pot scrubbing/ cart washing area is separated from the kitchen and dining room by the primary circulation path leading from the kitchen to the corridor. This means that there is no good method of returning soiled dishes from the dining room to dishwashing. They either must be carried through the serving area, or out the dining room entrance, through the public corridor and into the back door next to the cart washing area. A layout with a different location of this kitchen entry door might have allowed a pass-through window from the dining room directly to dishwashing.

(4) **Equipment:** Kitchen and dishwashing equipment appears to be adequately sized for the increased workload. The cart washing area is not used. All wheeled equipment and most non-fixed equipment were transferred from the old hospital facility. The icemaking machine is not holding up to use: evidence of leakage is shown by mineral deposit streaks.

(5) **Inpatient Feeding:** Loaded tray carts leaving the kitchen/ serving area are taken to upper level inpatient care area in passenger elevators. One set of elevators to the west of Dietetics is used for the acute care nursing unit; the other elevator, to the north and east, is used for the obstetrical nursing unit. This separation of nursing units requires separation of cart traffic.

(5) **Supervisory Offices:** Offices are located at the rear of the kitchen area. This layout works well for employee supervision, but visitors (e.g., vendors) must travel through the kitchen to reach the offices. The

dieticians' offices are located off the public corridor outside the kitchen area.

(6) **Employee lockers** are located within the department in the sub-corridor near the receiving entrance. This is a good feature.

c. Comments/Recommendations

(1) Provide a means of physically separating the dining room from the kitchen during non-serving hours.

(2) Design the kitchen/dining room layout so that soiled dishes can be returned without crossing the serving area or requiring transport through public corridors.

(3) The dining room was designed with attention to visual surroundings and view to the outside. This is a good feature. Outside dining areas should be furnished with picnic type tables and benches for patient and staff use.

54.0 HOUSEKEEPING AND LINEN

a. General Observations/Design Criteria

POR area:	136 gm^2
Area as built:	99 gm^2
Current HFPM allowable area:	125 gm^2

(1) **Design vs POR:** This department was built 27% smaller than prescribed in the POR. It is well arranged, with offices at the front of the suite and storage at the rear. This facility utilizes contract laundry services.

(2) **Current HFPM vs Design:** Application of current criteria would provide a unit about 26% larger than now exists, with increases in clean linen storage and office space for the housekeeping foreman. Additional janitor closets (beyond those required for specific departments) would be programmed in this department, based on a formula using the total area of the building.

b. Specific Features/Findings

(1) **Linen Handling:** Separation of clean and soiled linen is well handled. An exchange cart system is used for linen. However, three linen carts are used for fixed storage.

(2) **Janitor Closets**: Janitor closets are well located throughout the building, and adequately sized for carts and other equipment being used. Closets are finished with sheet vinyl floors, painted walls, and floor-mounted sinks with ceramic tile surrounds (see photo A-23). Door stops and additional shelving would be desirable. The janitor closet in Emergency Care has been converted to a medication storage room (see *31.0 Emergency and Urgent Care*).

(3) **Morgue**: see *21.0 LABORATORY*.

c. Comments/Recommendations

(1) This facility is being very well maintained. Wall and floor surfaces generally look excellent, and have obviously been well cared for.

(2) This facility provides a good example of janitor closets which are adequately sized, located, and provided with appropriate finishes and fixtures for heavy-duty usage.

55.0 FACILITIES MANAGEMENT

a. General Observations/Design Criteria

POR area:	327 gm^2
Area as built:	247 gm^2
Current HFPM allowable area:	373 gm^2 (incl Clin Eng)

(1) **Location**: Facilities Management is located within the main building on the lower level at the south side. The power plant, three levels high, is located adjacent to maintenance. It shares a common wall with the hospital, but is well isolated from the main structure. All air handling units are located in penthouses on the roof.

(2) **Design vs POR**: Departmental space as designed is 24% less than the POR amount. Current criteria would provide 14% more space than the POR amount, and 51% more than what was built.

(3) **Clinical Engineering** was programmed within this department. The POR allotted 19 m^2 for this function, and 17 m^2 was provided. The current criteria would provide 75 m^2, including space for parts storage and equipment holding.

(4) **Mechanical Space**: The building area devoted to major mechanical equipment is 961 gm^2, or 8.9% of the total floor gross area of the building. This includes boiler and chiller rooms, electrical switchgear space, penthouse air handlers, etc., but does not include grated areas on the upper levels of the power plant which are used for access to equipment. The total mechanical space is consistent with the POR allotment of 8% of the gross building area. The current criteria allow up to 12% for this function.

b. <u>Specific Features/Findings</u>

(1) **Maintenance Shops**: In the open area intended for floor-mounted equipment, maintenance staff has moved benches from the storage area to the center of the main shop and added a countertop. A divider panel in the center is used for hanging tools (see photo A-24). This area is now used for working with hand and benchtop tools. The two large overhead electrical power buses are no longer needed. The table saw has been relocated to the outdoor equipment storage building because it creates too much dust for the clinical engineering operation, which is located in the shops area.

(2) **Clinical Engineering**: Located in a small room directly off the shops area, Clinical Engineering finds this environment too dirty, dusty, and noisy for its function. The space is overcrowded, with no room for storage of equipment. It was noted that the door to Clinical Engineering could have been located off the corridor outside the maintenance shop entrance doors.

(3) **Outdoor Equipment Storage**: This is located in a separate 56 m^2 building across the enclosed yard. This is a very useful building, but too small for the equipment needed to maintain the grounds of the hospital and quarters. The building also contains shop equipment for operations such as woodworking.

(4) **Central Plant**: The team felt that the central mechanical space generally was well laid out and efficiently utilized (see MECHANICAL comments, A.1.c).

(5) **Mechanical Systems Monitoring**: During construction, mechanical systems monitoring devices were relocated from the "building services" room near the power plant entry to the maintenance supervisor's office at the back of the shops. The former "building services" room is now used as the facility engineer's office.

c. Comments/Recommendations

(1) The location of maintenance functions in a separate building (or semi-detached building) is desirable in order to isolate noise, vibration, fumes, dirt, etc.

(2) Clinical Engineering, although administratively part of Facilities Engineering, should not be located within the shops area. A location convenient to patient care areas served (such as Dental) is desirable.

56.0 BUILDING SERVICES

a. Loading Dock - see *52.0 PROPERTY AND SUPPLY UNIT.*

b. Security - see *ARCHITECTURAL, Section 3.*

c. Mechanical Systems Monitoring - see *55.0 Facilities Management, b.5,* and *MECHANICAL.*

57.0 CLINICAL (BIOMEDICAL) ENGINEERING

(See *55.0 FACILITIES MANAGEMENT*)

FIRE SAFETY, SECURITY, MAINTENANCE AND MISCELLANEOUS SYSTEMS

A. FIRE SAFETY

1. Automatic Door Closers

a. General Observations/Design Criteria

The Life Safety Code requires that "doors in an exit passageway...or smoke barrier may be held open only by an automatic release device" which meets specific requirements, in particular that any interruption of the hold-open feature will cause the door to be released and self-closing (see 12.211.6, 12.6.2.11.5 and 12.6.3.7.6 [LSC-1981]).

b. Specific Features/Findings

Many heavily-used doors in the Hospital cannot be latched open without violating codes because they lack approved fire release devices. These self-closing doors cause significant congestion in busy thoroughfare areas, especially near the elevators and the main waiting room. Carrying armloads of supplies or moving gurneys is particularly frustrating.

c. Comments/Recommendations

Future designs should include appropriate automatic release devices, such as magnetic hold-backs, for fire and smoke control doors that are part of heavy traffic areas. It is much more difficult to add this capability at a later date because the release mechanisms must be connected to the central alarm system and located within specified distances from smoke/fire detectors.

B. SECURITY

1. 24-Hour Physical Security

a. General Observations/Design Criteria

Most, if not all, hospitals have certain functions that are operational 24 hours-a-day, 7 days-a-week, and other functions which are only carried out during "normal" working hours. Outside of normal working hours, patients and visitors should only have access to those parts of the hospital which have 24-hour activities.

b. **Specific Features/Findings**

The layout of the Pine Ridge Hospital provides the ability to lock off major sections of the building during off hours. This facility is generally a good example of this security feature.

c. **Comments/Recommendations**

The A/E should be required to submit a visitor control and security plan for the building. This plan should specify means of restricting patient and visitor access to the after-hours area, with particular attention being paid to assuring adequate means of egress from all parts of the building, in accordance with the Life Safety Code.

A preliminary draft of the plan should accompany the 35 percent drawings so that any changes needed can be readily incorporated into the design while it is still easy to modify.

C. MAINTENANCE

1. Equipment Access

a. **General Observations/Design Criteria**

Many pieces of building equipment or their components have finite life spans and must be replaced or refurbished at specified intervals. These items are removed from their working locations and carted to a loading point, and the replacement item brought from the loading point to the working location and installed. Suitable access to these equipment items, for maintenance as well as installation/removal, and a safe and convenient means to bring them to a loading point must be provided.

b. **Specific Features/Findings**

Although removal and replacement of major equipment located at the roof level would not be without problems, there are locations around the roof perimeter where hoists could be set up for this purpose.

c. **Comments/Recommendations**

The A/E should be required to submit an access and cartage plan for each equipment item (including parts of

equipment such as burners for a boiler), that has a life-expectancy of less than 30 years and weighs more than 100 kilograms, or has any single dimension greater than 2.5 meters or combined dimensions (maximum H+W+L) greater than 5 meters. This plan should identify the affected items, including removal and replacement, and transport to and from an appropriate loading station. Required hoists and/or transport carts should be specified and necessary capacities and clearances verified. A preliminary draft of the plan should accompany the 35 percent drawings so that any changes needed to accommodate equipment cartage can be readily incorporated into the design while it is still easy to modify.

2. **Maintenance Space**

a. **General Observations/Design Criteria**

Certain maintenance activities are unavoidably hazardous (e.g., welding), produce undesirable fumes and odors (e.g., painting), or are simply very "dirty" (e.g., sawing wood or filing metal). These activities should not be performed within the hospital building itself.

Other maintenance activities require use of lubricating oils and greases, fertilizers, weed killers, etc. These compounds should be stored separate from the hospital building. Maintenance crews also need to store bulky outdoor equipment such as lawn mowers and snow blowers.

b. **Specific Features/Findings**

A separate outdoor equipment storage building was located building across the enclosed yard. The intended function of this building has been expanded to include major shops operations such as woodworking, which were found to be too "dirty" for the main building.

c. **Comments/Recommendations**

Hospital design must recognize and accommodate essential maintenance activities and requirements, such as welding, painting, sawing, and storing chemicals and motorized equipment, which can adversely impact on the normal day-to-day operations of the facility. In many cases, these needs can best be met by a separate, free-standing structure, rather than being incorporated into the hospital itself.

3. **Preventive Maintenance**

a. **General Observations/Design Criteria**

Even in a new building, preventive maintenance activities must be initiated as soon as equipment is placed in operation in order to maximize reliability and life of the equipment, and minimize the cost of keeping the equipment functioning properly.

b. **Specific Features/Findings**

Essentially there was no preventive maintenance (PM)program for the first year of operation. During the fall of 1995 a comprehensive PM program was being put into practice.

c. **Comments/Recommendations**

A comprehensive preventive maintenance program should be in place when the facility starts up. This requires at least two specific actions: First, the A/E should provide a list of all items that require preventive maintenance, along with location, maintenance schedule, and detailed description of the required procedures. Ideally, this should be part of a computerized maintenance management system. Second, the facility manager should be on-board well before the facility begins operations. Six months to a year before start up is not unreasonable.

4. **Maintenance Plan and Training**

a. **General Observations/Design Criteria**

Many IHS facilities are located in remote areas. They frequently have relatively inexperienced maintenance personnel and no local commercial services options for mechanical equipment.

b. **Specific Features/Findings**

The maintenance staff at the Pine Ridge Hospital indicated that little or no training was provided in the first year on the operation and maintenance of the hospital mechanical systems.

c. Comments/Recommendations

A comprehensive operation and maintenance program must be in place at the time the health facility is put into operation. This should include a fully trained maintenance staff and an operational computer based maintenance management system. In order to achieve this, many of the maintenance staff must be hired well in advance of the opening date for the facility. One to three months before start up is not unreasonable.

D. MISCELLANEOUS FACILITY SYSTEMS

1. Interstitial Space

a. General Observations/Design Criteria

Hospital operations today, with their emphasis on outpatient care, day surgery, technology, and business practices, could not have been imagined 50 years ago. For health care facilities constructed today to be viable into the future, they must be specifically designed to accommodate changes readily, both in programs and technology.

b. Specific Features/Findings

At the "brand new" Pine Ridge Hospital, policy changes at the Congressional and headquarters levels have imposed major new requirements on the facility, specifically the need for a business office. Changes in computer and other technologies have already dramatically impacted the building. Most of the countertop space in the laboratory is covered with automated machinery. New cooling and wiring requirements, unforeseen at the time of design, must be accommodated.

c. Comments/Recommendations

All new hospitals, whether single or multiple-story, should be constructed with full interstitial space to assure the ability to meet changing program, technology, and operational requirements well into the next century. Interstitial spaces must be constructed and maintained in accordance with strict protocols to maximize the benefits of the space.

2. Air Conditioning for Computer Rooms

a. General Observations/Design Criteria

Computer rooms tend to be enclosed and have high concentrations of heat-producing but heat-sensitive equipment. As technological advances are made, more and more computer equipment is utilized by health care facilities.

b. Specific Features/Findings

The computer room was relocated from Administration to the telephone switchgear room in the central mechanical plant. This allowed separation of this equipment from office functions, better security, and a separate HVAC system for the new space.

c. Comments/Recommendations

Separately controlled cooling with expansion capacity, must be made available for central computer rooms. This need not be a completely independent system, but it must be able to provide excess cooling to the computer room. The design for cooling must also be able to accommodate relocation of the computer room.

CIVIL/STRUCTURAL

A. GENERAL

The hospital is located on a 65 ha (160 acre) site along with the staff quarters. The developed area for the hospital, including access roads and parking, encompasses approximately 10 ha (24 acres). The natural characteristics of the site are typical of the Northern Plains area with the vegetation dominated by the many varied indigenous grasses. There are clusters of trees and bushes established where natural wind breaks exist. Physically, there is an overall slope of the site that runs from northeast to the southwest, with the natural storm drainage exiting the northwest corner of the site.

The hospital building is basically a two story structure, with administrative and support space on the ground floor, and the remainder of the space, including inpatient and ambulatory care, on the second floor (photos A-1 and A-2). The building structure consists of reinforced concrete footings, foundation walls and piers supporting a structural steel framing system, and a composite steel deck and concrete floor and roof system. The structural design was based essentially on the 1981 Life Safety Code, NFPA 101, and the 1982 Uniform Building Code.

1. Sewage System

a. Criteria/General Observations

All the sanitary sewage at the Pine Ridge Hospital is gravity fed to the community system. Eventually all the community sewerage will be treated in a series of EPA approved lagoons.

b. Specific Features/Findings

There are problems with the community system, but the service for the Hospital has worked as designed and has experienced no major problems. The community lift station has experienced some clogging problems and the unit has by necessity been placed in an emergency bypass mode. Work is currently underway to correct this problem.

c. **Comments/Recommendations**

Utilize gravity-fed systems and connect to the community system wherever possible.

2. **Helicopter Landing Area**

a. **Criteria/General Observations**

A landing area was designed and included in the construction drawings, but was not installed due to a shortage of funds. As a result, there is a dedicated helicopter landing area located on the west side of the site adjacent to the Emergency Entrance (Photo CS-1). Patients are now transported by fixed wing aircraft from the local airport.

b. **Specific Features/Findings**

The proposed siting of the helicopter landing area is excellent and does not interfere with other hospital functions.

c. **Comments/Recommendations**

This helicopter landing area design and location is safe and functional, and should be constructed as soon as funds are available.

3. **Parking Areas**

a. **Criteria/General Observations**

The POR called for 224 parking spaces, which were provided at the site. During the week of the study, there was always ample parking, and there was no complaint from the staff relating to parking problems.

b. **Specific Features/Findings**

It was noticed that curbing and planters were kept to a minimum throughout the parking areas. The maintenance personnel stated that snow removal was satisfactory and snowplow damage to curbs was not a problem.

c. **Comments/Recommendations**

The parking areas are well designed for the climate of the area.

4. Solid Wastes

a. Criteria/General Observations

The routine solid waste (trash) generated at the hospital is handled through private contract, which subsequently is disposed of in the landfill on the reservation. The medical and biological wastes are burned in the incinerator, and the ashes are disposed of at the same landfill.

b. Specific Features/Findings

Efforts are now underway to develop a solid waste disposal plan that will meet EPA standards.

c. Comments/Recommendations

Continue with planning efforts to bring solid wastes disposal for the reservation within EPA standards.

5. Roof

a. Criteria/General Observations

The hospital roof consists of a single-ply unballasted system for the main flat areas and architectural metal roofing for the penthouses and clerestory areas (photo CS-2).

b. Specific Features/Findings

The roof systems have not had any major failures, and seem to be performing satisfactorily. Access to the main roof area is by a stair to a penthouse. Maintenance personnel with tools can gain access to the roof by using these stairs, which are a desirable feature.

c. Comments/Recommendations

Maintenance access to the roof areas is acceptable.

6. Landscaping Features

a. Criteria/General Observations

A mulched garden area was set up around the building perimeter and certain areas between the main entrance and primary parking areas (photo CS-3).

b. Specific Features/Findings

The maintenance of plants and grassed areas requires irrigation in the great plains. The landscaped and grassed areas within the perimeter loop road have been surviving well. The landscape design and the sprinklers have performed well (photo CS-4).

c. Comments/Recommendations

The plantings and sprinkler types have performed well for the Pine Ridge site. Maintenance has not had any major problems.

7. Potable Water Supply

a. Criteria/General Observations

There were two wells that were drilled on site to supply water for the hospital and a storage tower was installed to provide the fire fighting reserve. The wells and tower are located southwest of the hospital.

b. Specific Features/Findings

The system is tied in with the utility system and all maintenance is their responsibility. Reliability has been satisfactory, but some concern has been expressed that future water demand in the community may affect the fire fighting reserve in the elevated tank (photo CS-5).

c. Comments/Recommendations

The water supply is adequate for the present, but future plans will have to include additional sources as the number of hookups expand. One long term solution may rest with the development of the Oglala Sioux Rural Water Supply System.

8. Storm Water Drainage

a. General Observations/Design Criteria

The storm water is collected by piping, culverts drainage ditches and french drains (photos CS-6 & CS-7). Generally, the runoff flows away from the hospital within the loop road and collects along the west side of the loop road, and follows the access road, then exiting the site at the northwest corner.

b. **Specific Features/Findings**

The system works well in general, but there is one area where erosion is a problem. At the junction of "D" street with the loop road there is excessive erosion (photo CS-8). It is believed that regrading after the residential access road was built may have contributed to the problem.

c. **Comments/Recommendations**

The junction of two construction sites always needs greater attention and coordination to assure consistent results. A maintenance project is being planned to improve the drainage ditch and slow the erosion.

B. DETAILED OBSERVATIONS

1. There is a waterproofing problem at the north wall of the mechanical equipment room (photo CS-9). Evidently the paint is showing efflorescence from excess moisture in the wall.

2. Parapet flashing shows signs of separation (photo CS-10). It is speculated that some pieces of flashing are not anchored correctly, and that this causes the separation.

3. On the north side of the loop roadway there is a settlement failure. Evidently, environmental conditions have caused settlement around a drainage pipe under the road (photo CS-5). Correction of the problem would require major repairs to the drainage system and the roadway surface.

MECHANICAL

A. HEATING VENTILATION AND AIR-CONDITIONING

Overall, the design provides good flexibility as well as reliability. This design reflects good hospital engineering design. These general design features provide for an efficient, economical system with easy operation.

1. CENTRAL PLANT

a. General Observations/Design Criteria

Two 100 BHP heating hot water boilers are furnished for space heating requirements. The boilers are sized for 80% of the total load.

The central plant consists of two 300 ton centrifugal chillers each sized to handle 70% of the total cooling load. Chiller efficiencies are greater than 0.65 KW per ton.

The pumping system is a primary/secondary arrangement with 2-way valves at all cooling coils. The secondary pumps have variable speed motor controllers.

A water side economizer systems has been installed utilizing a plate and frame heat exchanger. The heat exchanger was installed in the chilled water return piping to allow for the temperature "assist" mode as outside temperatures and building load allows.

A separate water-cooled, 30 ton reciprocating chiller was installed for the surgery air handling unit.

Cooling towers are located adjacent to the building on ground level.

The central plant is evaporatively cooled and heated with hot water unit heaters.

b. Specific Features/Findings

(1) **Plate and Frame Water Side Economizer:** A plate and frame heat exchanger is utilized to allow "free cooling" or economizer cycle operation. The centrifugal chillers can be "secured" during certain times of the year, even though cooling is still required, by using condenser water from the cooling towers as the primary source of cooling. Due to the

low wet bulb temperatures experienced in this area, cold water can be generated by passing it through the cooling tower, where heat absorbed directly from the chilled water secondary loop is rejected and the resulting cold water leaving the cooling tower is pumped through the heat exchanger's "cold" side. The secondary loop return chilled water is passed through the exchanger's "hot" side where its heat is rejected to the condenser water.

(2) **Separate Surgery Chiller** (see photo M-1): The operating rooms and computer rooms are on separate air handling units which receive their chilled water from a separate chiller. Since these spaces are required to be kept at a colder space temperature than the other areas of a hospital, colder supply chilled water is usually required. Providing a separate chiller means that the main chilled water plant does not have to provide colder water than necessary just to serve these departments. The main chilled water supply temperature can be reset higher to satisfy the cooling demands of the majority of the hospital which operates at warmer space temperatures (72°F to 78°F as opposed to 65°F to 68°F space temperature required in surgery).

(3) **Primary/Secondary Chilled Water Pumping**: The chilled water pumping system is a primary/secondary pumping arrangement. This allows us to pump only the amount of chilled water required to satisfy the cooling demand, which in turn saves pumping horsepower energy. Secondary loop system pressure is controlled using variable speed motor controllers on the secondary pumps. The chilled water control valves are two-way type.

(4) Cooling towers are centrifugal, blow-through type. Towers discharge water to a remote sump. The tower is located adjacent to the building on ground level. A chemical injection type water treatment system has been furnished for the cooling towers.

c. <u>Comments/Recommendations</u>

Overall, the central plant appears well laid out with adequate space for operation and maintenance (See Photo M-2). The design provides good flexibility as well as reliability. The provision for a separate surgery chiller is a good example.

(1) **Plate and Frame Water Side Economizer:** By locating the heat exchanger in the secondary loop chiller water return piping, it can be used during certain times of the year to "assist", or lower, the return water temperature. This means that less mechanical cooling needs to be performed to bring the water entering the chiller down to the leaving chilled water set point temperature.

(2) **Separate Surgery Chiller:** Allows the heat exchanger to operate at its best efficiency.

2. VENTILATION SYSTEM

a. General Observations/Design Criteria

(1) Heating/Cooling System: The facility is served by 10 AHU with heating and cooling coils.

(2) The air distribution system utilizes variable volume air handling units and terminal boxes to the extent allowable by the 1987 Edition of *Guidelines for Construction and Equipment of Hospital and Medical Facilities* and IHS requirements. Generally, variable air volume is provided for all areas that are not required to have a specific air pressure relationship with adjacent spaces.

(3) For areas in the hospital where variable air volume cannot practically be used due to air pressure relationship requirements, a double duct/bypass air distribution system is provided. These areas include the laboratory and the operating rooms.

b. Specific Features/Findings

(1) **Variable Air Volume Air Distribution:** Should a space require maximum cooling, the variable volume box serving that space would be 100% open. As the space temperature is satisfied, the VAV box modulates closed. As the air quantity is reduced, the airhandling unit fan horsepower is reduced resulting in a savings in energy. Variable speed motor controllers are utilized to reduce fan speed and maintain control over duct static pressure.

(2) **Double Duct/Bypass Air Distribution:** This utilizes a two duct system that supplies air to double duct terminal boxes. One duct system is the cold deck

airstream which carries approximately 55°F air. The other is the bypass deck airstream which carries supply air that has been bypassed around the air handler cooling coil and is approximately room temperature (75°F±). Should a zone require full cooling, a damper in the terminal box opens the cold duct side 100% and closes the bypass duct side. As the space temperature is satisfied, the dampers on both ducts are modulated to maintain the space temperature. Should a demand for heating occur, the cold duct modulates to closed and the bypass duct damper opens to 100%. The only zones which have an added heating hot water coil are exterior exposures and areas that require quick response temperatures changes (Surgery, etc.).

(3) **Minimize Duct Runs:** In an effort to conserve air transport horsepower, the air handling units are located as close as possible to the area/departments they serve.

c. <u>Comments/Recommendations</u>

Overall, the design provides good performance with flexibility. There were only limited complaints regarding temperature and thermal/ indoor air quality comfort.

(1) **Variable Air Volume Air Distribution**: Variable volume air systems conserve energy by supplying only the amount of air to a given space necessary to maintain space temperature.

(2) **Double Duct/Bypass Air Distribution**: The double duct/bypass system is an energy efficient system that utilizes the building internal heat to provide any necessary heating in interior zones to maintain space temperatures. This system has been appropriately utilized for the Operating Rooms and Lab spaces.

(3) **Minimize Duct Runs**: This minimizes the amount of static pressure loss in the duct system resulting in a reduction of motor horsepower.

3. CONTROL SYSTEM

a. General Observations/Design Criteria

Control of the HVAC system is accomplished through a Direct Digital Control system (DDC) system actuating electric/pneumatic operators.

b. Specific Features/Findings

Control System: Control of the HVAC system is accomplished through a Johnson Controls Direct Digital Control system (DDC) system actuating electrical/pneumatic operators. This type of control system is more precise and accurate than the standard pneumatic system. Utilizing electronic controls eliminates the "drift" that has been associated with pneumatic controls and therefore maintains temperature set point with a greater degree of accuracy.

The exhaust fans on the roof are equipped with status switches (pressure switches) which have been a source of nuisance problems. The sensors send a false signal due to winds.

c. Comments/Recommendations

Control System: The control system appears to be appropriate for a facility of this size.

4. SURGERY

a. General Observations/Design Criteria

The ventilation supply system in the operating room consists of ceiling mounted four-way supply diffusers (See photos M-3 and M-4).

Humidity in was reported to be a problem.

b. Specific Features/Findings

It was reported that humidity was high, e.g., 75%-80% RH, in the surgical unit when ambient humidities are high.

c. Comments/Recommendations

Humidity control in surgery unit: This needs to be investigated further. The capacity to obtain additional

dehumidification should be available by lowering the chill water temperature.

5. **DENTAL**

a. **General Observations/Design Criteria**

Exhaust in dental lab area is a continuous slot placed in the wall along the counter (see photo M-5). It was reported that Glutaraldehyde is not utilized.

b. **Specific Features/Findings**

Exhaust in dental lab area is a continuous slot placed in the wall along the counter.

c. **Comments/Recommendations**

The continuous exhaust slot in the dental lab is a reasonably good design practice. It is believed to be more effective than general ventilation.

6. **SUPPLY**

a. **General Observations/Design Criteria**

The existing overhead ventilation supply was inadequate to maintain comfortable indoor space temperatures.

b. **Specific Features/Findings**

An air curtain was retrofitted at the main supply loading area.

c. **Comments/Recommendations**

The air curtain which was installed (see photo M-6) has resolved the problem with maintaining comfortable indoor space temperatures.

7. **ELEVATORS**

a. **General Observations/Design Criteria**

Elevator machine room: It was reported that the rooms were over-heating.

b. Specific Features/Findings

Elevator machine room ventilation: the supply and return grilles were both located at the ceiling and "short circuiting" occurred, resulting in over heating of the room.

c. Comments/Recommendations

Elevator machine room ventilation: the supply and return grilles were relocated; to provide improved ventilation effectiveness.

8. ROOFTOP EQUIPMENT

a. General Observations/Design Criteria

Swamp coolers located on roof: exhibit considerable mineral precipitate.

b. Specific Features/Findings

Swamp coolers located on roof: exhibit considerable mineral precipitate.

c. Comments/Recommendations

The precipitate accumulation is normal.

9. FAN ROOMS

a. General Observations/Design Criteria

(1) The Temptrol AHU's are equipped with windows and lights to allow easy viewing of the fans.

(2) Some of the pre heat coils have frozen and have been a source of leaks.

b. Specific Features/Findings

The pre-heat coils were designed for operation without utilization of glycol in system. This installation has been vulnerable to freezing.

c. Comments/Recommendations

(1) The windows and lights provided with the AHU's should be helpful in maintenance operations (See Photo M-7).

(2) Although, theoretically the pre-heat coils should not freeze as designed; freezing has been a problem. The design concept is predicted on the concept that if the water is maintained in motion that it will not freeze. The frequent power outages experienced in this locality have exacerbated this problem, i.e., when the pumps shut down the super-cooled fluid can quickly freeze. Although this design is, 1) energy efficient, i.e., the heat transfer coefficient for water is higher that for a water-glycol solution, and 2) low initial cost, i.e., the related equipment and piping sizes may be smaller; a glycol solution(inhibited propylene) may be a better choice for cold-climate, remote locations.

10. **LOBBY/PUBLIC SPACES**

a. General Observations/Design Criteria

Fin tube radiators were installed with a space between convector cover and window which allowed accumulation of debris (See Photo M-8).

Fin tube radiation (baseboard type) is provided below all windows that do not have cabinetry located directly underneath. Where cabinets make it difficult to provide baseboard radiation, ceiling registers are provided, close to the window, to discharge warm air along the glass.

b. Specific Features/Findings

Fin tube radiators were installed with a space between convector cover and window which allowed accumulation of debris.

Fin tube radiation is necessary due to the extremely cold temperatures experienced in this area.

c. Comments/Recommendations

Double pane glass is being provided; however, due to the cold ambient air temperatures outside and the humidity

requirements of certain spaces inside, the possibility exists of condensation occurring on the inside face of the glass. By providing fin tube radiation below the glass, or discharging air along the glass, we can minimize the potential for frost; and equally importantly increase the comfort level of persons in close proximity to the glass by reducing (induced) cold drafts.

B. PLUMBING

1. GENERAL

Plumbing fixtures and fittings appear to adequately serve the needs of the facility.

2. CENTRAL PLANT

a. General Observation/Design Criteria

MAIN SERVICE: The main water service to the building is a six-inch (150 mm) main to the building.

HOT WATER SYSTEM: Two hot water heaters provide domestic hot water for this facility. They are located in the mechanical room.

b. Specific Features/Findings

MAIN SERVICE: The main service includes a backflow preventor, which is required to prevent cross contamination of the local water supply.

HOT WATER SYSTEM: Propane-fired domestic hot water heaters.

c. Comments/Recommendations

The main service and hot water system are well suited for a hospital facility.

3. SURGERY

a. General Observation/Design Criteria

Scrub sink is equipped with "hands -free" operation.

b. Specific Features/Findings

(1) OPERATING ROOM: Scrub sink faucet has electric eye for "hands-free" operation. This was not performing in a satisfactory manner. The faucet tends to require the hands to be placed too close to spout, to turn the water on, which can result in touching the spout and resulting in having to rewash hands. Also, faucet was observed to turn on and off spontaneously.

(2) CLEAN STERILE SUPPLY: 14 x 14 Sink was too small.

c. **Comments/Recommendations**

(1) Scrub sink: Hands-free electric eyes should be the type that are located on the wall and scans the area in front of the sink.

(2) Clean/Sterile Supply: should be designed with larger, deeper sinks (14 x 14 Sink was too small).

4. **DENTAL**

a. **General Observation/Design Criteria**

Dental Vacuum: was replaced within one year of operation.

b. **Specific Features/Findings**

Dental vacuum suction was inadequate. Dental turbine was replaced with RamVac dental vacuum unit.

c. **Comments/Recommendations**

RamVac equipment provides more vacuum with less electrical power (see photo M-9).

5. **MEDICAL GAS**

a. **Specific Features/Findings**

(1) Medical Air: A carbon monoxide sensor, at the intake, was not provided and was needed to be added by facility staff.

(2) Oxygen tank: a second regulator was required to be added by the facility maintenance staff.

b. Comments/Recommendations

(1) Medical Air: should be equipped with a carbon monoxide sensor at the intake.

(2) Oxygen tank: Oxygen gas train design (including number of regulators) should be verified with local requirements.

C. FIRE PROTECTION

a. General Observation/Design Criteria

FIRE PROTECTION: A complete fire sprinkler system is installed in this facility. In addition, fire protection includes hand held extinguishers and outside fire hydrants.

FIRE DETECTION: A complete fire detection panel is located in the facility.

b. Specific Features/Findings

The combination of architectural wooden ceiling and clerestory windows made it difficult to fully sprinkler lobby areas.

The operating rooms were sprinklered.

c. Comments/Recommendations

This facility is fully sprinklered. Inspection and testing should be performed as required by the local fire department.

ELECTRICAL

1. Main Electrical Service

a. General Observations/Design Criteria

The main electrical service provided by Nebraska Public Power District is 12,470 volt primary and 480/277 volt secondary, three phase, 60 hertz system (photo E-1). Facility electrical metering and the main service disconnect (3000 Amp circuit breaker) are located in the main switchboard. The service is grounded per the requirements of the National Electrical Code (NEC). The electrical service ground was not measured as part of the project requirements, but site conditions indicate that the service ground is at least 25 ohms. The secondary voltage is reduced by dry type transformers (15) to 208/120 volts for branch circuit applications in the clinical and administrative areas. Two diesel generators rated 350 Kw, 480v, 3 phase, 4 wire are the source of alternate power when the normal utility power is not available. Three automatic transfer switches ATS-3 @ 400 Amps for Equipment Load, ATS-2 @ 600 Amps for Critical Load, and ATS-1 @ 100 Amps for Life Safety Load are as required by the NEC Article 517 for Health Care Facilities. One manual transfer switch MTS-1 @ 600 Amps is provided for the non critical HVAC load.

b. Specific Features/ Findings

The main electrical service power quality is good. Recent studies by Nebraska Public Power indicated that only minor transformer adjustments were required at their substation to provide for the growing electrical load as the hospital has become fully functional. System reliability is a concern. The hospital experiences 15-20 power outages per year. These outages generally are of short duration (4-5 minutes) and result in frequent operation of the hospital's two diesel generators. Electronic equipment have experienced operational errors during the generator operation, but no major equipment failures. Power conditioners have been added to the laboratory equipment and surge protection has been provided to the office computers. Start sequences for the HVAC equipment has been modified because of the frequent diesel generator operations. This change provides more time-delay before restarting the units. The system ground needs to be measured. Grounding for the computer room needs to be revised. Presently the computer ground is attached to the building lightning

protection system grounding conductor. The are no UPS units for the computer room equipment.

c. Comments/Recommendations

The remote nature of this site and the severe seasonal weather supports the finding that electrical utility reliability is only good at best. The large electrical load at the end of the utility distribution line makes the power quality good most of the time, but unsatisfactory on occasion. The installation of two diesel generators in the original construction project is fully justified and is an excellent source of alternate power for this hospital. Provide UPS units for the computer room equipment.

2. Telephone/Public Address System

a. General Observation/Design Criteria

The public address (PA) system and the telephone system raceways were part of the project design. These systems are satisfactory for this hospital project.

b. Specific Features/Findings

No telephones were provided in surgery and the ICU patient rooms. Central stores required an additional telephone. No PA paging was provided in the Administrative area and in the inpatient pharmacy. System electrical ground has not been measured.

c. Comments/Recommendations

Provide telephones in surgery and central stores (additional telephone). Extend the PA system to the administrative and inpatient pharmacy locations. Measure the electrical systems ground. Typical telephone system ground requirement is 5-10 ohms. Generally, including the telephone system installation into the project contract requirements would provide a superior product (photo E-2).

3. System Furniture

a. General Observation/Design Criteria

The system furniture was a separate contract from the hospital design project. Coordination of these two

contracts for lighting and electrical receptacle outlet locations was lacking.

b. **Specific Features/Findings**

Examples of the lack of coordination are in the central stores where shelves block the lighting to the walkways and the administrative areas where some work stations' overhead lighting does not align with the work station. Field measurements indicate that major power quality problems are generated in the administration area of the hospital where the systems furniture installation was not coordinated with the building electrical design. See item No.5 below on Power Quality.

c. **Comments/Recommendations**

Incorporate the system furniture procurement into the project design.

4. **Lighting**

a. **General Observation/Design Criteria**

Site lighting is generally very effective. Exterior lighting provided by high pressure sodium (HPS) is efficient and adds to the architectural presentation of the hospital. Interior fluorescent light fixtures (34 watt, T-12 type lamp) are low maintenance and cost effective. Task lighting is provided in dental, surgery, and outpatient exam rooms. No lighting is provided in the building crawl space for maintenance access lighting.

b. **Specific Features/Findings**

Lighting system was installed as designed and has performed well. Lack of access lighting in the crawl space is considered a major deficiency. Original design specified crawl space lighting, but was deleted.

c. **Comments/Recommendations**

Add permanent lighting to the building crawl space to provide safe access lighting for maintenance staff. Recent government manufacturing requirements for fluorescent lamps delete the vast majority of the T-12 type lamps. The new replacement lamp (T-8) which will fit in the existing fixtures requires a different ballast as part of retrofitting existing fixtures. Upgrade existing fluorescent light fixtures to provide a

maintainable lighting system. Current lamps will no longer be manufactured after 1995.

5. Power Quality

a. General Observation/Design Criteria

The hospital design incorporated power quality devices and loading criteria to minimize the effects of harmonics on systems with multiple electronic loads. System furniture installation was a separate contract which did not provide for harmonic load consideration.

b. Specific Features/Findings

Field testing (photo E-3)indicates that the areas where post hospital completion installation of equipment and system furniture (photos E-4, E-5 and E-6) are areas with excessive current on the branch circuit neutral conductors. The areas of concern are the administrative and outpatient areas of the hospital. There are indications of some equipment malfunction and possible fire hazard. The graphs from the field tests (APPENDIX II) indicates a problem since the form of the current wave is not smooth.

c. Comments/Recommendations

Specification/installation of specialty equipment and systems furniture shall be part of the main project design/construct. Proper design consideration for power quality issues can only be done when the responsibility is centralized with the principal project designer.

6. Receptacle Outlets

a. General Observation/Design Criteria

Outpatient pharmacy, the dental area and the building crawl space lack electrical receptacle outlets.

b. Specific Features/Findings

The outpatient pharmacy center/room island lacks electrical receptacles and the present use of extension cords is a tripping hazard. The dental area furniture/ equipment layout conflicts with the electrical receptacle locations. Safe maintenance work requires receptacles in the crawl space which are of the ground fault interrupter type (GFCI).

c. Comments/Recommendations

Add electrical outlets to the outpatient pharmacy center island. Include dental area furniture/equipment specification into main project design. Add/relocate

additional electrical receptacles to the dental area. Provide GFCI type receptacle circuits in the crawl space area.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

General

This section contains listings of major desirable and undesirable design features, and also the major recommendations for consideration by the Design Criteria Committee for revision to the Health Facilities Planning Manual (HFPM), which would result in the criteria being included in future Programs of Requirements (PORs).

Generally, this is a very well-planned facility, and it is a good model for a hospital of its size, especially in terms of general layout in a multi-story scheme. The overall gross area of the building as designed is close to the amount specified in the POR, although there are fairly wide variations among departments.

An IHS hospital with the same staffing and workload assumptions as the 1986 PDJ would contain about 2 500 additional gross square meters if designed in accordance with the latest HFPM. This suggests that many of the "lack of space" complaints and deficiencies cited in this report are valid and have already been addressed in the newer planning criteria. The addition of programs and staff not included in the original PJD would, of course, result in an even larger facility.

See also Comments/Recommendations in individual chapters of report.

1. **Desirable Design Features**

   a. The site layout, featuring the loop road and the location of the helicopter landing area, works well. The emergency traffic and associated helicopter activity occur in the area of least traffic on the loop road, since all of the main traffic and deliveries occur in the other direction.

   b. The parking has been functionally designed with efficiency of maintenance and operation as a priority. Minimizing curbing and planters in paved areas is important for northern sites with harsh winter climates.

   c. The landscaping and irrigation system has been very successful. Selection and distribution of the plantings is most suitable for the northern plains.

d. This is an excellent example of a multi-story hospital design. The interrelationship of the two floors and the general circulation pattern function very well.

e. Administration is located on the lower level, away from the front door of the hospital yet still accessible directly from outside the building.

f. Community Health has a separate building entrance on the lower level.

g. Roof monitors for daylighting of public spaces provide effective lighting, while minimizing heat gain and loss.

h. The hospital has been retrofitted with an excellent system of remotely monitored security cameras. Security problems at the facility have been minimal.

I. Use of Variable Air Volume (VAV) air supply system is economical where ventilation rates can vary. The installed systems utilize variable inlet vanes. Newer installations should consider the installation of variable speed drives to further reduce energy consumption.

j. Layout of the main mechanical room allows good access for equipment maintenance and repair. Access to the roof by a stairwell is also an excellent feature.

2. **Undesirable Design Features**

a. Lack of acoustical privacy in open-plan office areas compromises patient confidentiality.

b. Conference space is quite limited, especially on the upper floor, where most clinical services are located.

c. The incinerator is not used, resulting in expenditure of facility resources that could have been utilized elsewhere.

d. Several exterior entrances, central supply and snack bar, needed additional heat from air curtains in order to make the spaces occupiable in the winter.

e. There is a problem of humidity control in the operating suite. Under certain conditions the walls and ceiling will sweat and remain wet even though the A/C system is operating full blast.

f. The computer room grounding is connected with the building lightning protection grounding conductor. The computer room should have a dedicated grounding system to protect the equipment.

2. **mendations**

e IHS should consider more multi-story schemes such as
's one in order to reduce internal travel distances,
rove interdepartmental relationships, improve energy
ciency, and reduce operational costs.

quality, durable and easily cleanable finish
'.als, components and hardware should be mandated in
R and specified in the design documents. This
.u help avoid costly maintenance and repair, and numerous makeshift solutions required in the field.

c. Close attention should be paid during design to building security, both interior (including limiting after-hours access to certain areas) and exterior entrances and storage areas. Provide for installation of remotely monitored security cameras and related intrusion detection systems.

d. Flexibility of services is needed for hospital spaces with changing program needs and advances in technology. Many factors now favor interstitial space as the most effective method of achieving this flexibility and slowing obsolescence in hospitals. It is recommended that interstitial space be considered for all future designs for special purpose space.

e. Design open-plan office areas to maximize acoustical privacy. Coordinate systems furniture layout with overhead ceiling lighting. Incorporate systems furniture procurement into the project design to insure adequate lighting and power quality.

f. Distribution of conference room space, especially in larger multi-story facilities, should reflect needs of users. Consideration should be given to programming one larger conference room for large-group meetings.

g. Provide simplified, proven conventional controls for HVAC system for ease of maintenance and energy conservation.

h. Equipment access and removal is an important consideration for all IHS hospitals. To ensure that all future designs include these important considerations, a cartage plan should be required at the 35 percent design stage.

I. Require complete specification of the HVAC control system in the construction drawings and specifications. All sensors, controls and equipment operation should be detailed for complete sequence of operation. The controls contractor should not be determining the method of control based on his submittal.

j. Require a separate design analysis for cooling towers based on Chapter 37 of the ASHRAE Systems and Equipment Handbook.

k. Require flow criteria be specified in contract documents to include throw and noise criteria at designed flows, and effects of Variable Air Volume on diffuser performance.

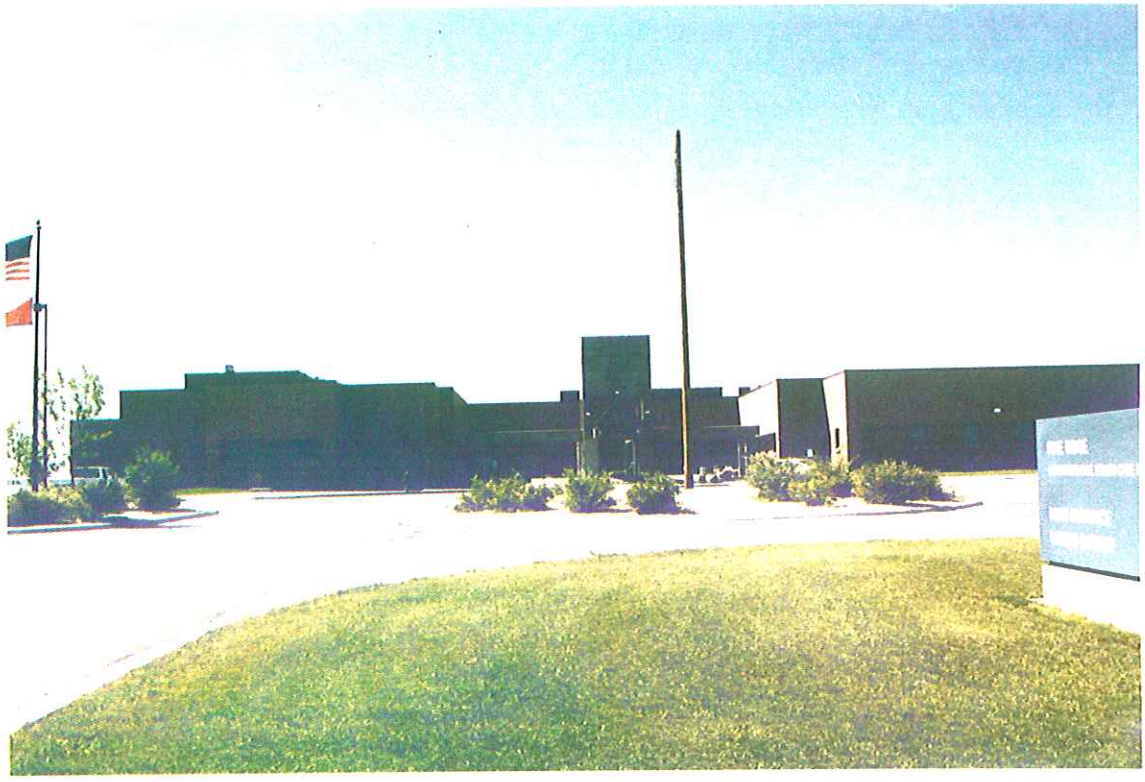
l. Require access panels for all shutoff valves not otherwise clearly and easily accessible.

m. Provide switching so that half of the lamps in general lighting may be turned off as an energy-saving method.

n. Task lighting should be provided for specialized departmental needs. Areas such as blood-drawing rooms and cast rooms, etc., should have design criteria to provide for specialized task lighting.

o. Install a 600 mm cable tray system above suspended ceiling system of each hallway. Present data/communication cabling lacks a logical means of routing as required by the National Electric Code requirements (Article 300-23).

APPENDIX I - PHOTOGRAPHS



(A-1) Main Entrance

(A-2) Northwest Portion of Site

(A-3) Main Entrance Canopy Structure

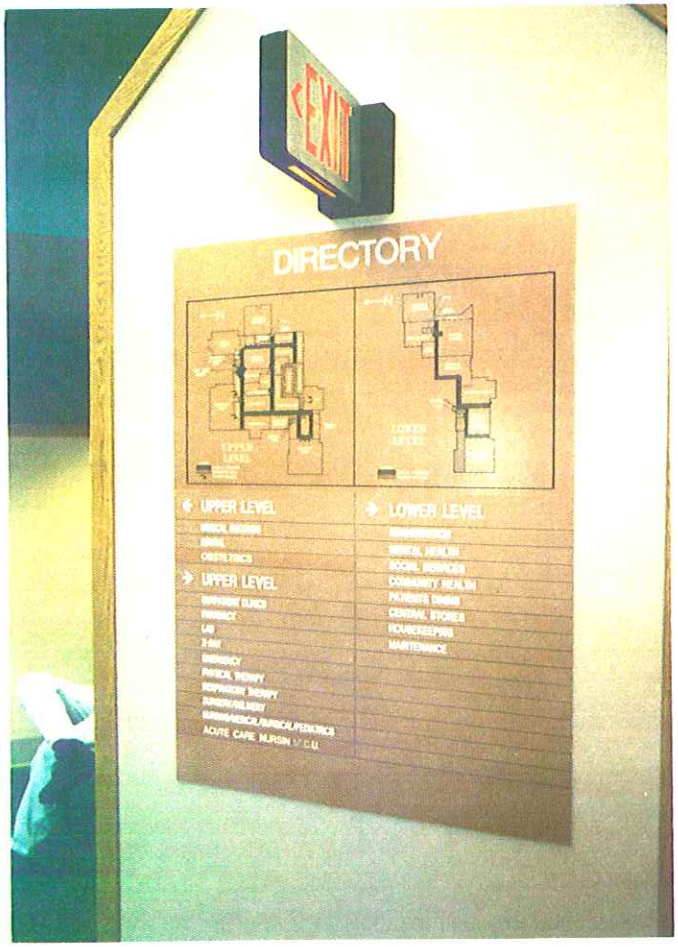
(A-4) Outdoor Seating at Main Entrance

(A-5) Vehicle Vestibule at Emergency Entrance

(A-6) South Side of Building

(A-7) Loading Dock

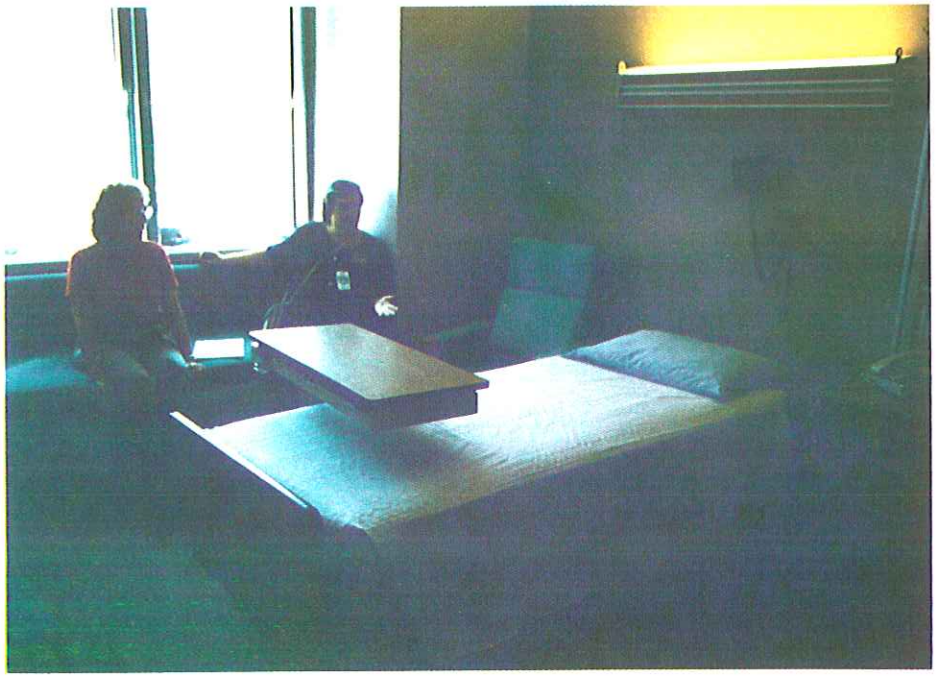
(A-8) Typical
Building Directory



(A-9) Main Ambulatory Care Waiting Area

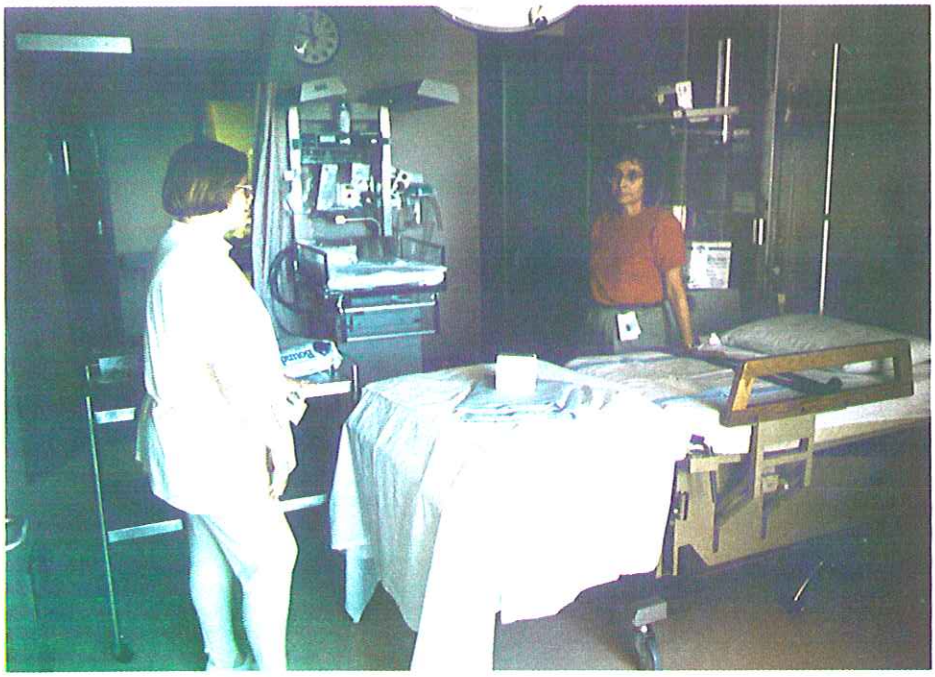
(A-10) Corridor With Graphic Design

(A-11) Waiting Area With Clerestory Lighting



(A-12) Typical Patient Bedroom

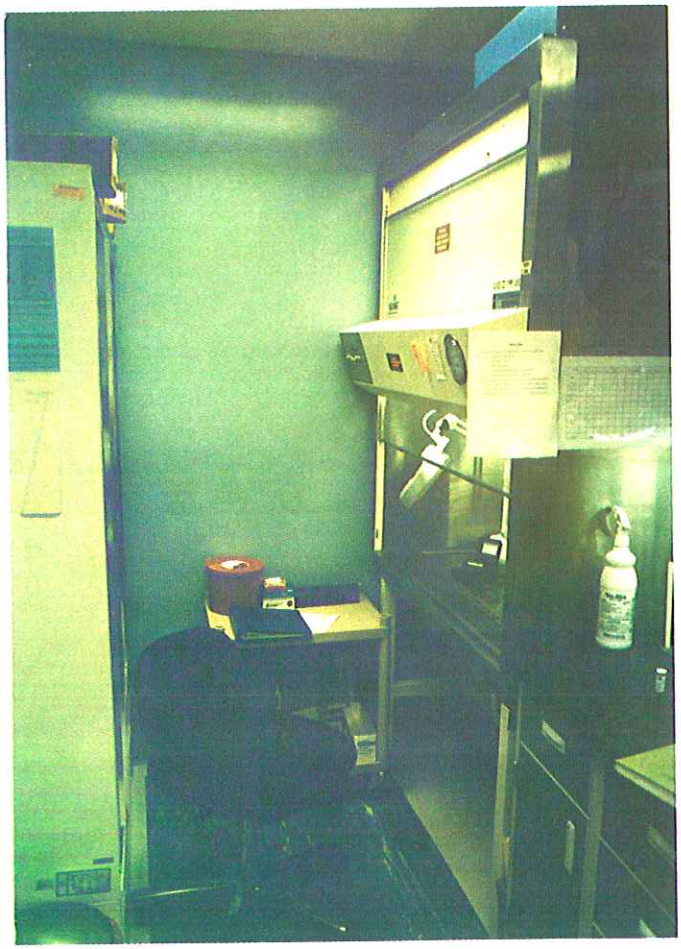
(A-13) Typical Patient Toilet With Shower Stall



(A-14) Labor/Delivery Room

(A-15) Laboratory-General View

(A-16) Microbiology Room



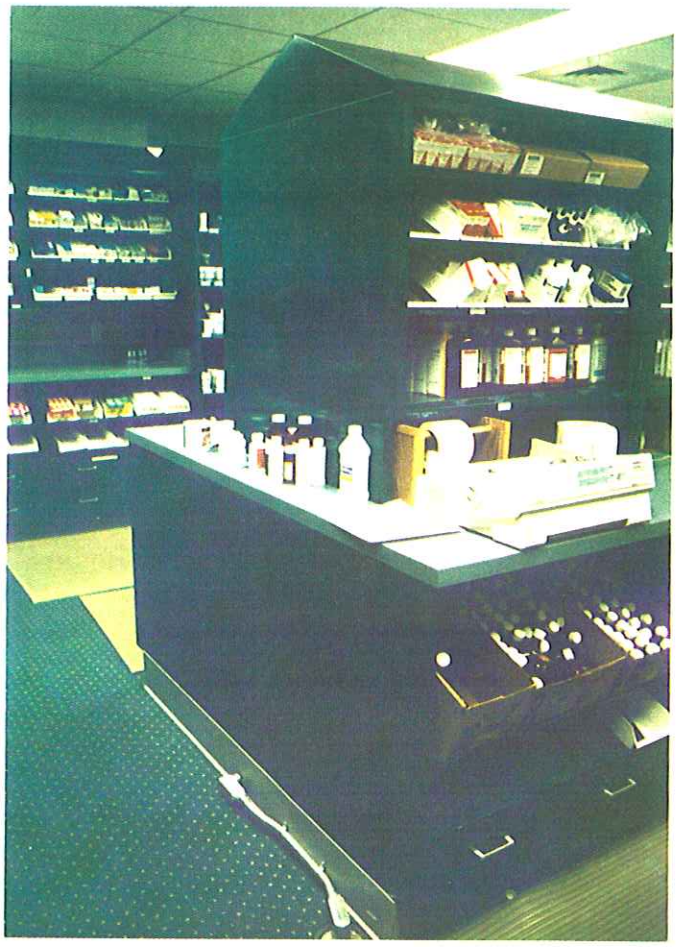
(A-17) Radiology Suite-Inpatient Holding (used for storage)

(A-18) Ambulatory Care Nurses Station and Recption

(A-19) Community Health-Open Office with Systems Furniture

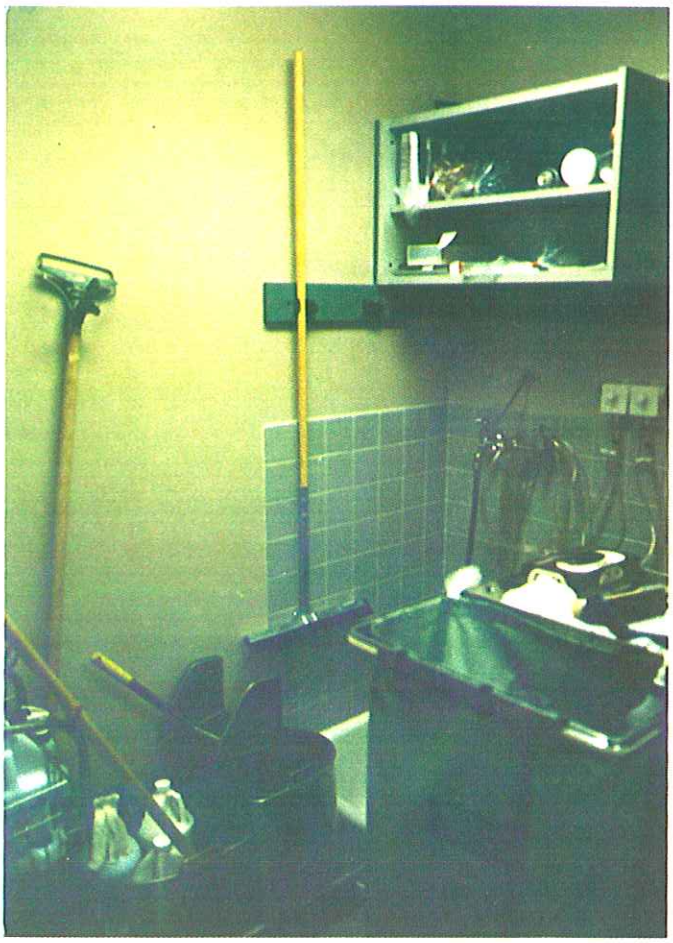
(A-20) Pharmacy Cabinetwork with Gravity Feed Shelving

(A-21) Pharmacy Center Island with Exposed Electrical Conduit



(A-22) Medical Supply-Cart Washing Area

(A-23) Typical
Janitor Closet



(A-24) Facilities Mnaagement-Main Shop Area

(CS-1) Emergency Entrance-Proposed Heliopad

(CS-2) Roof-Looking West

(CS-3) Landscaping Near Front Entrance

(CS-4) Tree Plantings and Turf Sprinklers

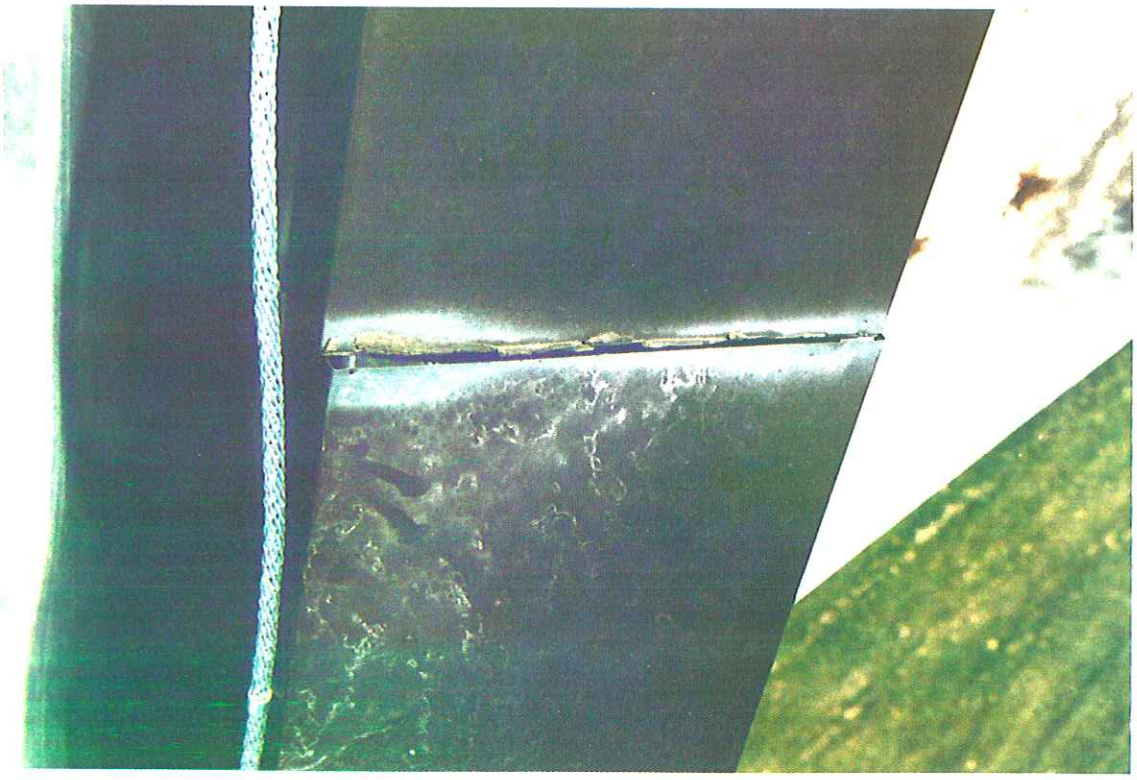
(CS-5) Loop Road Pavement Failure

(CS-6) Drainage to Northwest Corner of Site

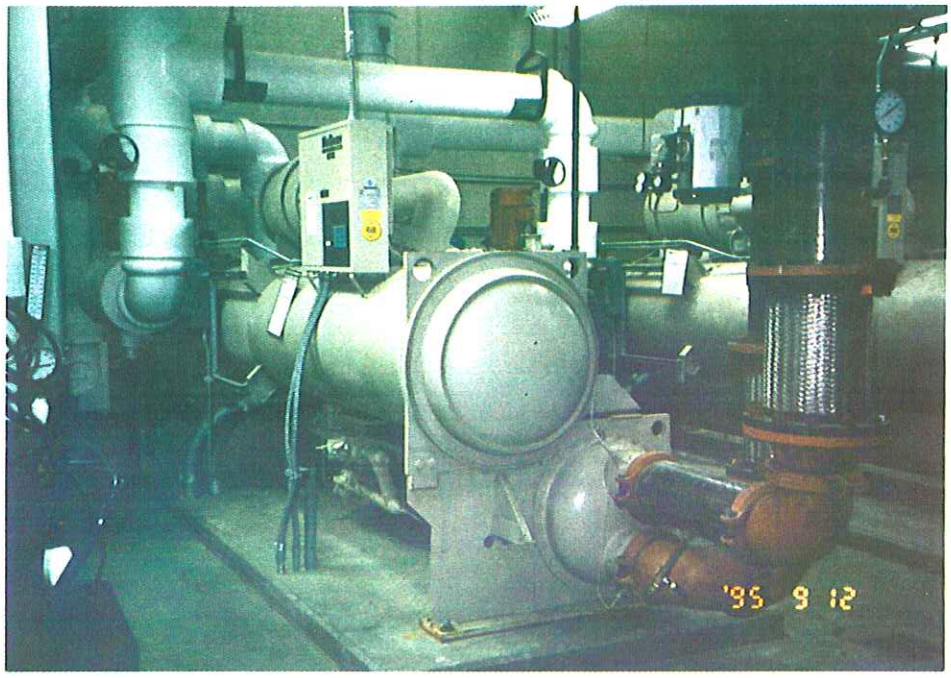
(CS-7) French Drain and Loop Road Drainage

(CS-8) Erosion at Intersection of the Loop and "D" Road

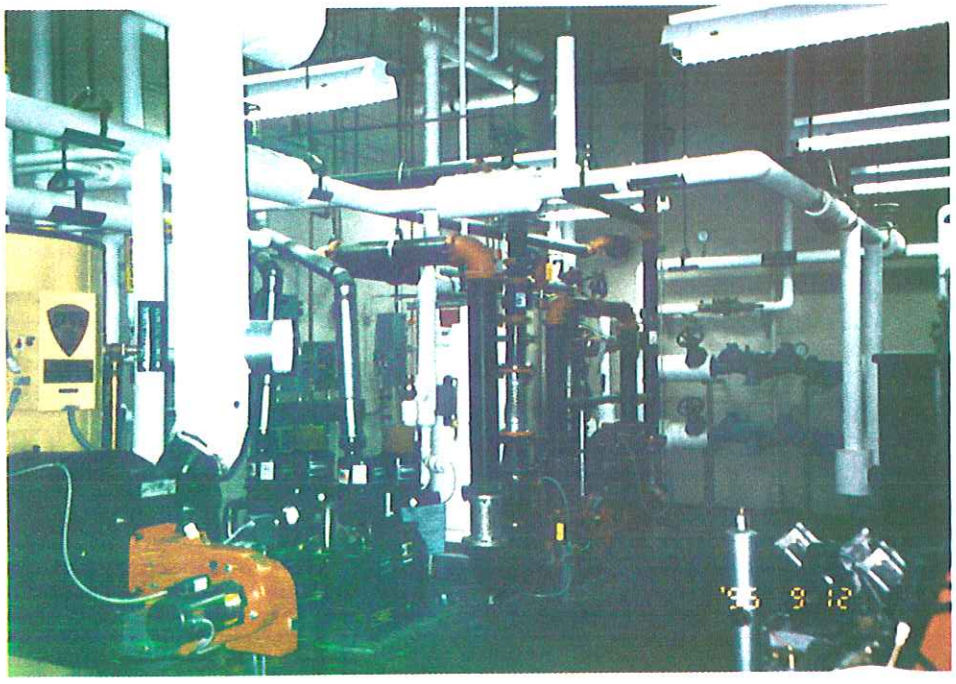
(CS-9) Mechanical Room-North Wall



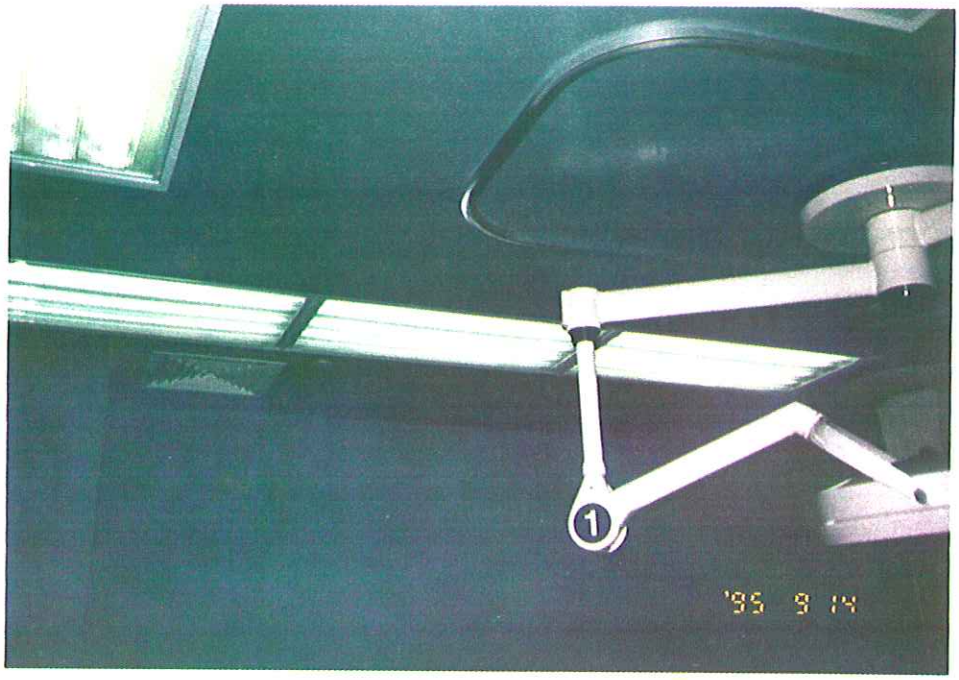
(CS-10) Parapet Flashing Separation



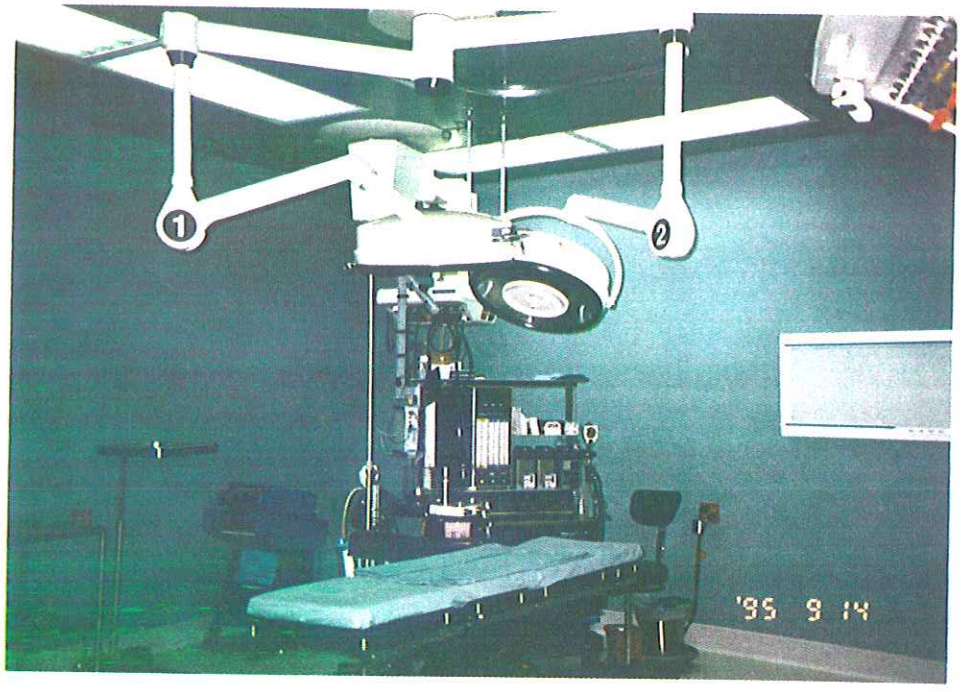
(M-1) Separate Surgery Chiller



(M-2) Central Mechanical Plant



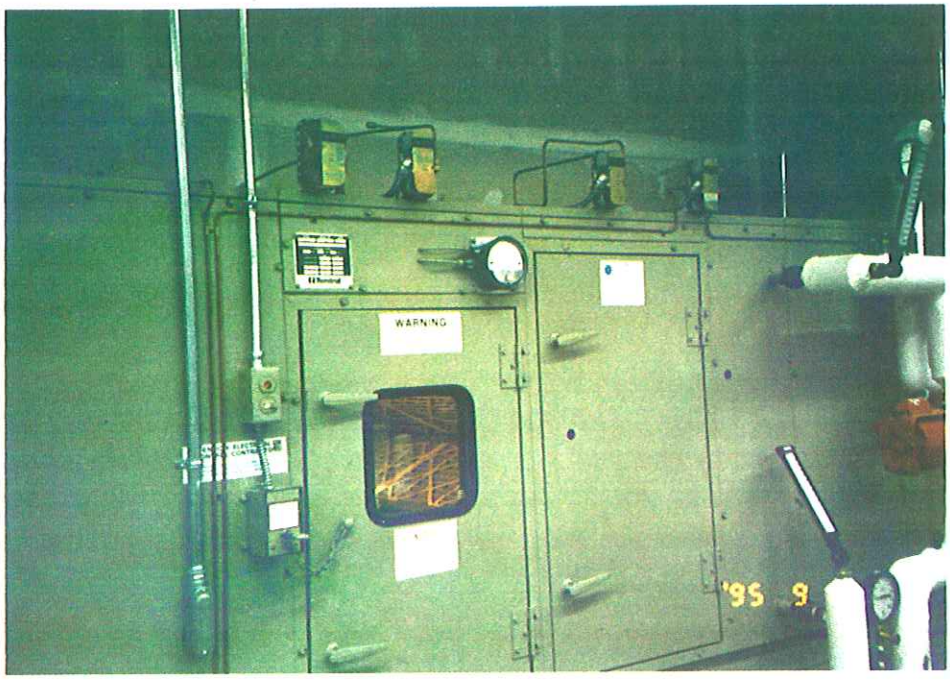
(M-3) Operating Room-Fourway Ceiling Diffuser



(M-4) Operating Room and Equipment

(M-5) Workbench with Strip Exhaust in Dental Lab

(M-6) Air Curtain Over Supply Room Door

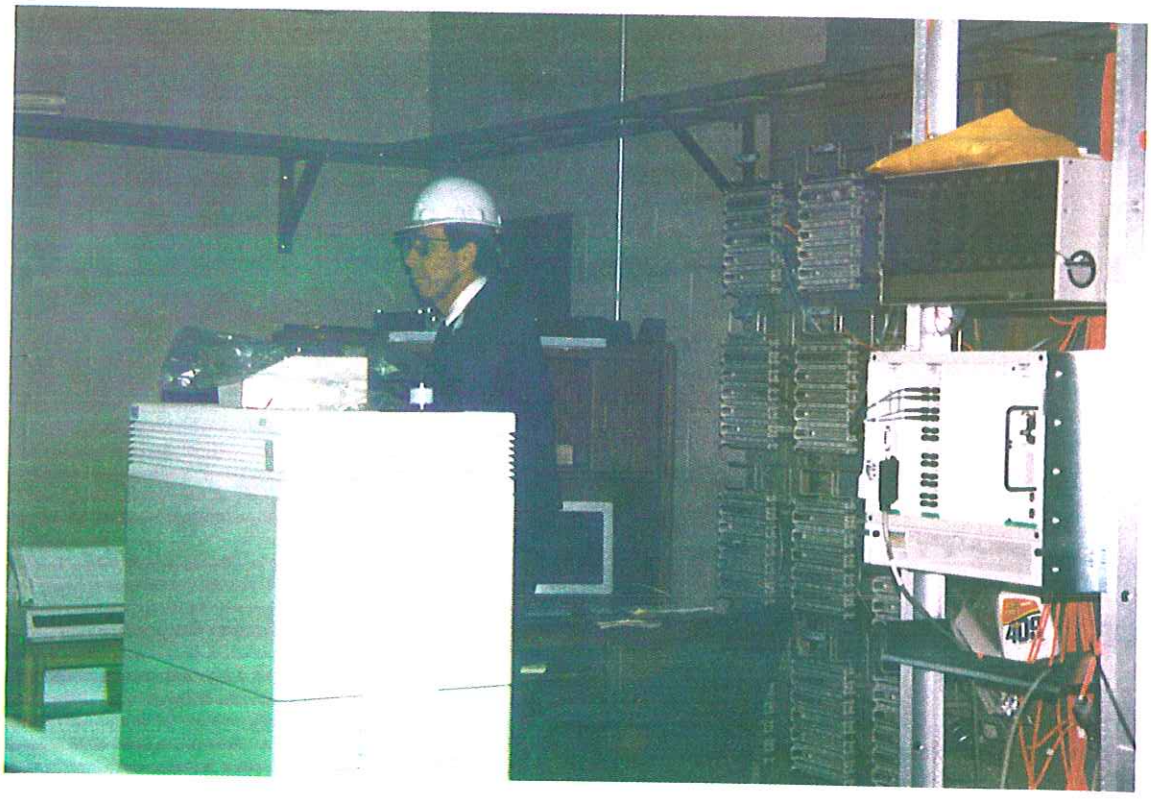


(M-7) Air-Handling Unit

(M-8) Radiators in Front Lobby

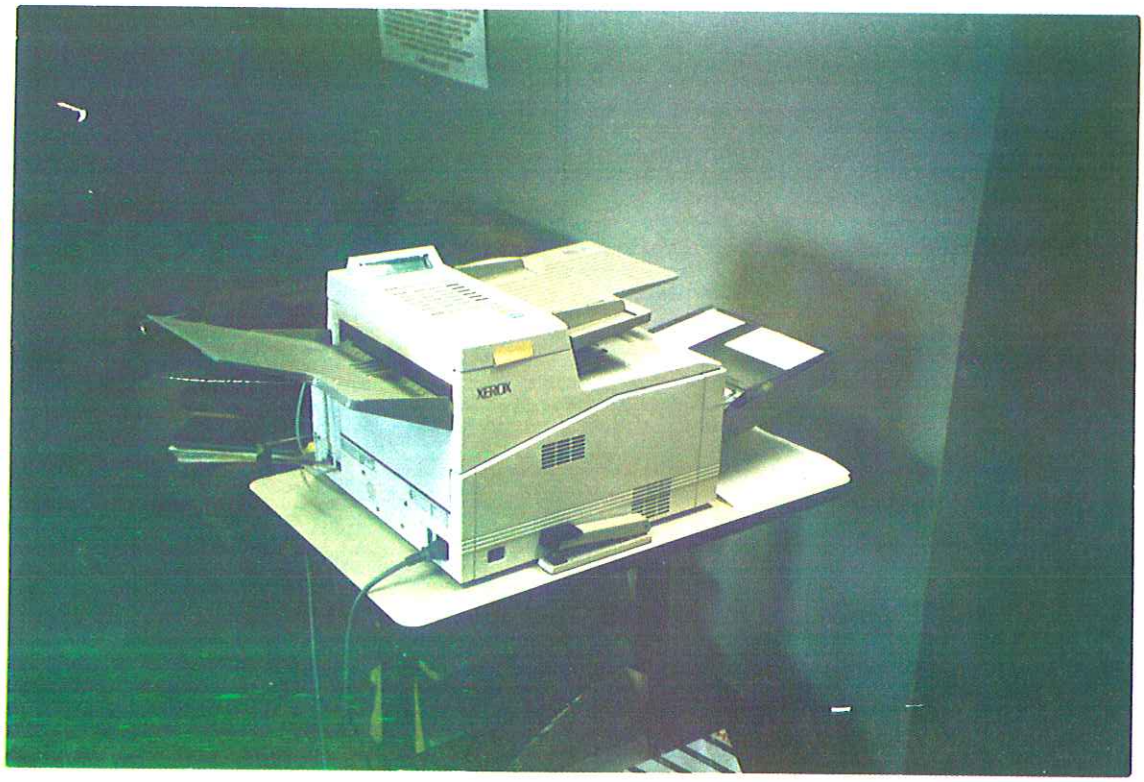
(M-9) New Dental Vacuum Equipment

(E-1) Main Electrical Switchgear



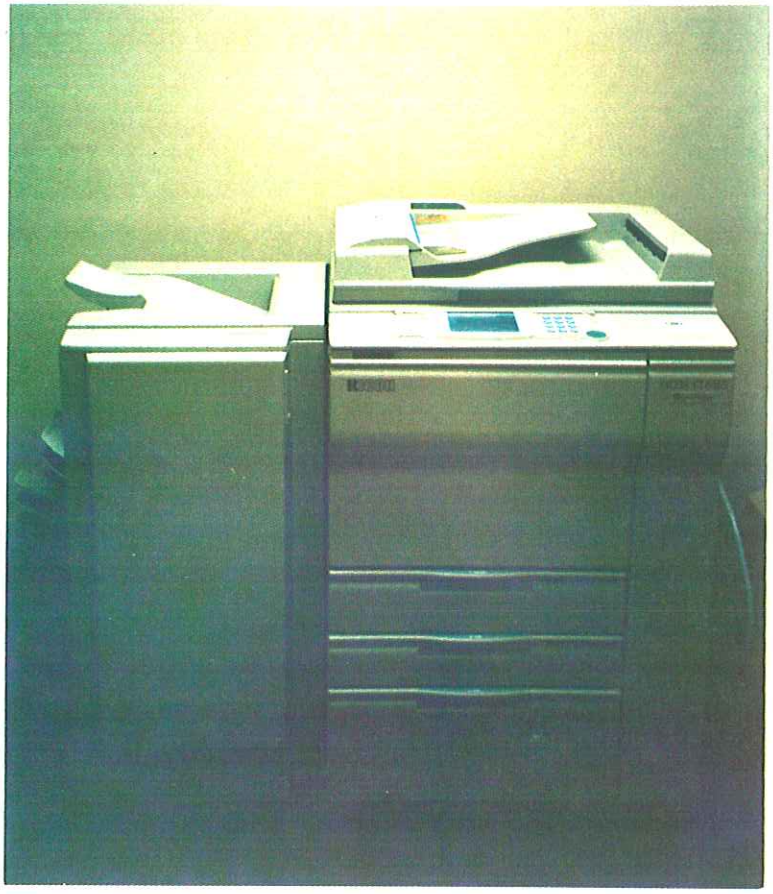
(E-2) Telephone and Systems Support Room

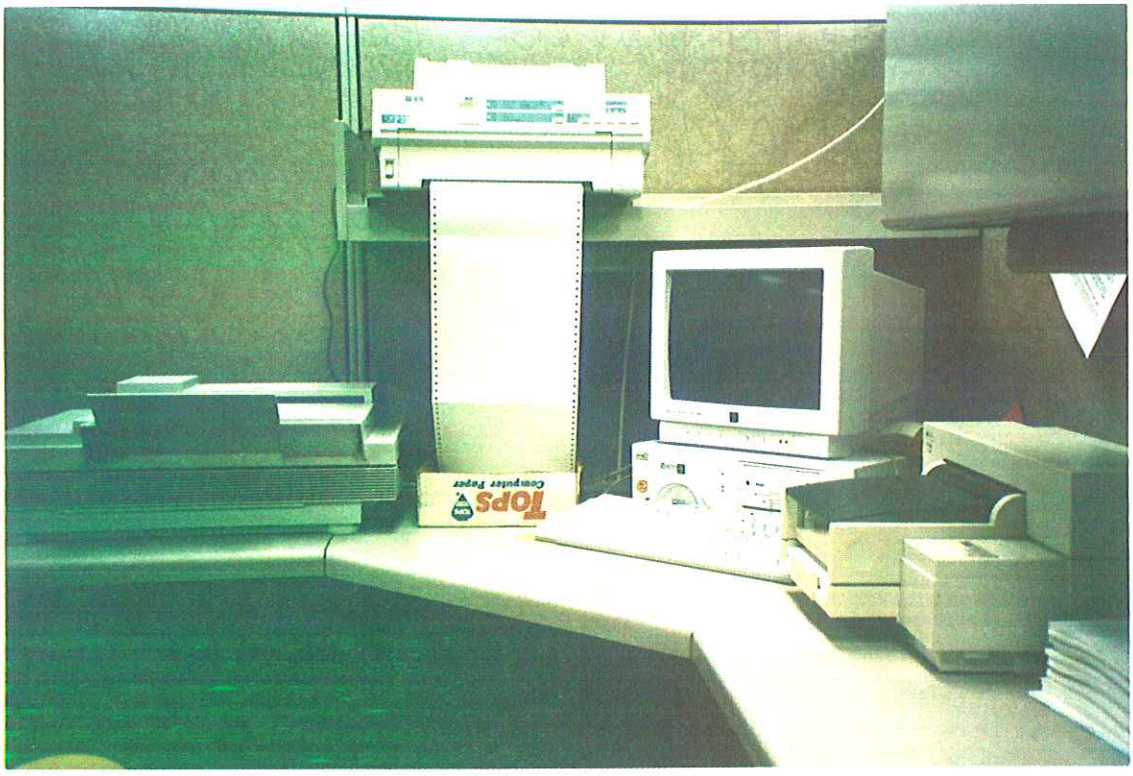
(E-3) Electric Power Field Test Points



(E-4) Fax Machine-Added Power Demand

(E-5) Reproduction Equipment-Added Power Demand





(E-6) Computer Work Station and Systems Furniture

APPENDIX II

ELECTRIC POWER FIELD TEST DATA

Readings - 09/20/95 15:17:07

MDB4NHA1
Outpatient Clinic
IN = 99.9% THD

Summary Information

			Voltage	Current
Frequency	60.0	RMS	496	4.20
Power		Peak	720	10.48
KW	0.0	DC Offset	-1	-0.02
KVA	2.1	Crest	1.45	2.5
KVAR	0.1	THD Rms	2.0	99.8
Peak KW	-5.1	THD Fund	2.0	**OL**
Phase	67° lead	HRMS	10	4.15
Total PF	0.02	KFactor		**OL**
DPF	0.39			

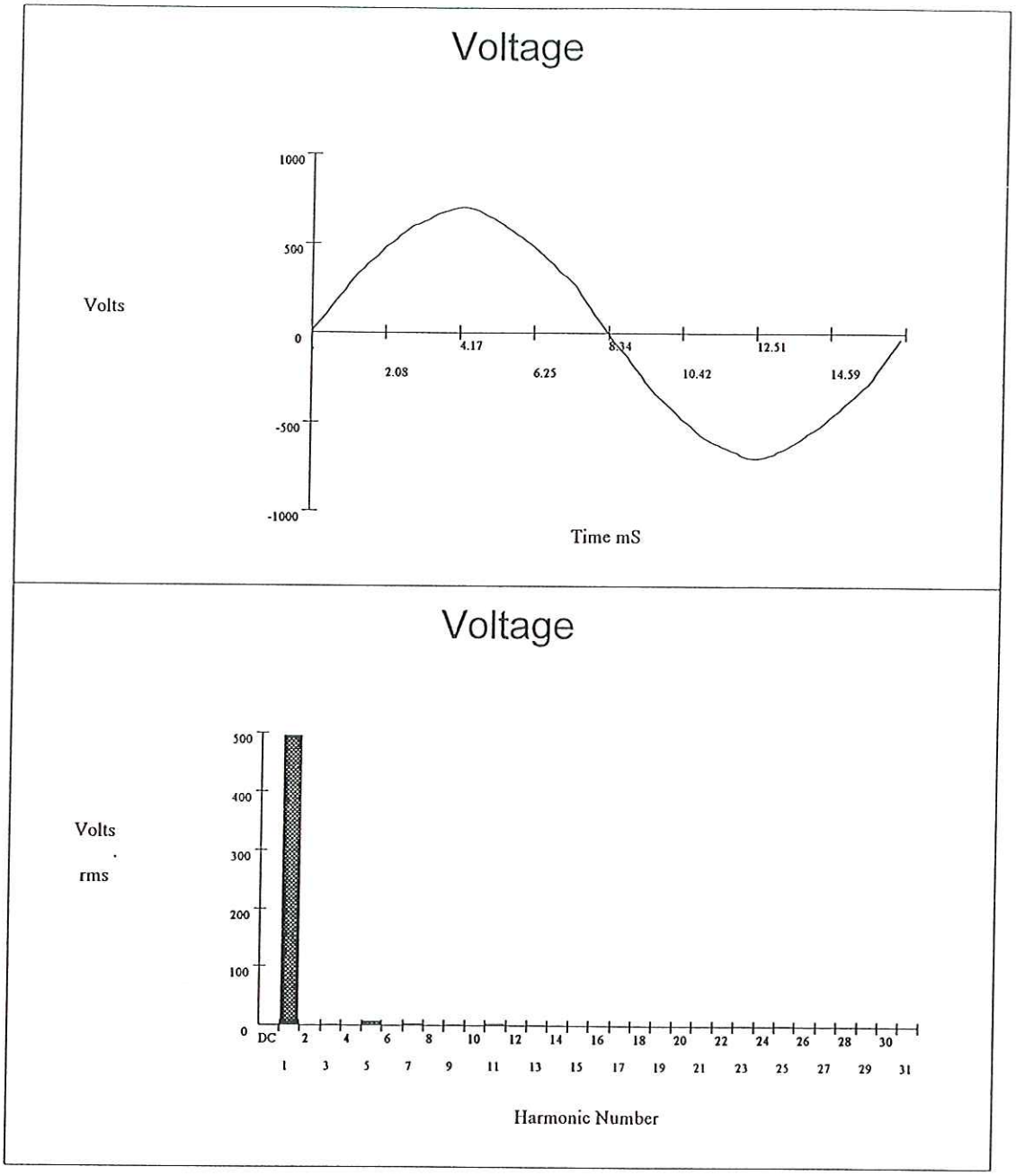
Record Information

	Max	Average	Min
V RMS			
A RMS			
V Peak			
A Peak			
V THD-R%			
A THD-R%			
KWatts			
KVA			
TPF			
DPF			
Frequency			

Harmonic Information

	Freq.	V Mag	%V RMS	V Ø°	I Mag	%I RMS	I Ø°	Power (KW)
DC	0.0	1	0.2	0	0.02	0.4	0	0.0
1	60.0	496	100.0	0	0.23	5.4	67	0.0
2	120.0	1	0.1	32	0.09	2.2	-94	0.0
3	179.9	2	0.3	-63	2.60	62.0	25	0.0
4	239.9	0	0.0	148	0.02	0.6	134	0.0
5	299.9	9	1.7	4	0.93	22.1	-22	0.0
6	359.9	0	0.0	170	0.06	1.4	54	0.0
7	419.8	3	0.6	117	0.93	22.0	-19	0.0
8	479.8	0	0.0	-167	0.04	0.8	-13	0.0
9	539.8	1	0.2	34	1.68	39.9	-83	0.0
10	599.8	0	0.0	-96	0.02	0.4	-28	0.0
11	659.7	3	0.7	142	1.52	36.2	45	0.0
12	719.7	0	0.0	-87	0.06	1.5	161	0.0
13	779.7	1	0.3	113	0.92	22.0	-56	0.0
14	839.7	0	0.0	-148	0.04	1.1	91	0.0
15	899.6	0	0.1	-159	0.88	20.9	-43	0.0
16	959.6	0	0.0	105	0.03	0.7	60	0.0
17	1019.6	1	0.2	-20	0.41	9.9	-107	0.0
18	1079.6	0	0.0	-73	0.06	1.4	-100	0.0
19	1139.5	1	0.1	-19	0.62	14.8	150	0.0
20	1199.5	0	0.0	29	0.02	0.5	169	0.0
21	1259.5	1	0.1	-61	0.42	9.9	-140	0.0
22	1319.5	0	0.0	-65	0.01	0.1	58	0.0
23	1379.4	1	0.2	72	0.44	10.5	-27	0.0
24	1439.4	0	0.0	118	0.03	0.7	-38	0.0
25	1499.4	1	0.2	70	0.84	19.9	-165	0.0
26	1559.4	0	0.0	158	0.02	0.4	-112	0.0
27	1619.4	0	0.1	69	0.37	8.8	-132	0.0
28	1679.3	0	0.0	119	0.03	0.8	-150	0.0
29	1739.3	0	0.0	146	0.24	5.7	121	0.0
30	1799.3	0	0.0	89	0.02	0.6	101	0.0
31	1859.3	0	0.1	158	0.39	9.3	-95	0.0

Readings - 09/20/95 15:17:07



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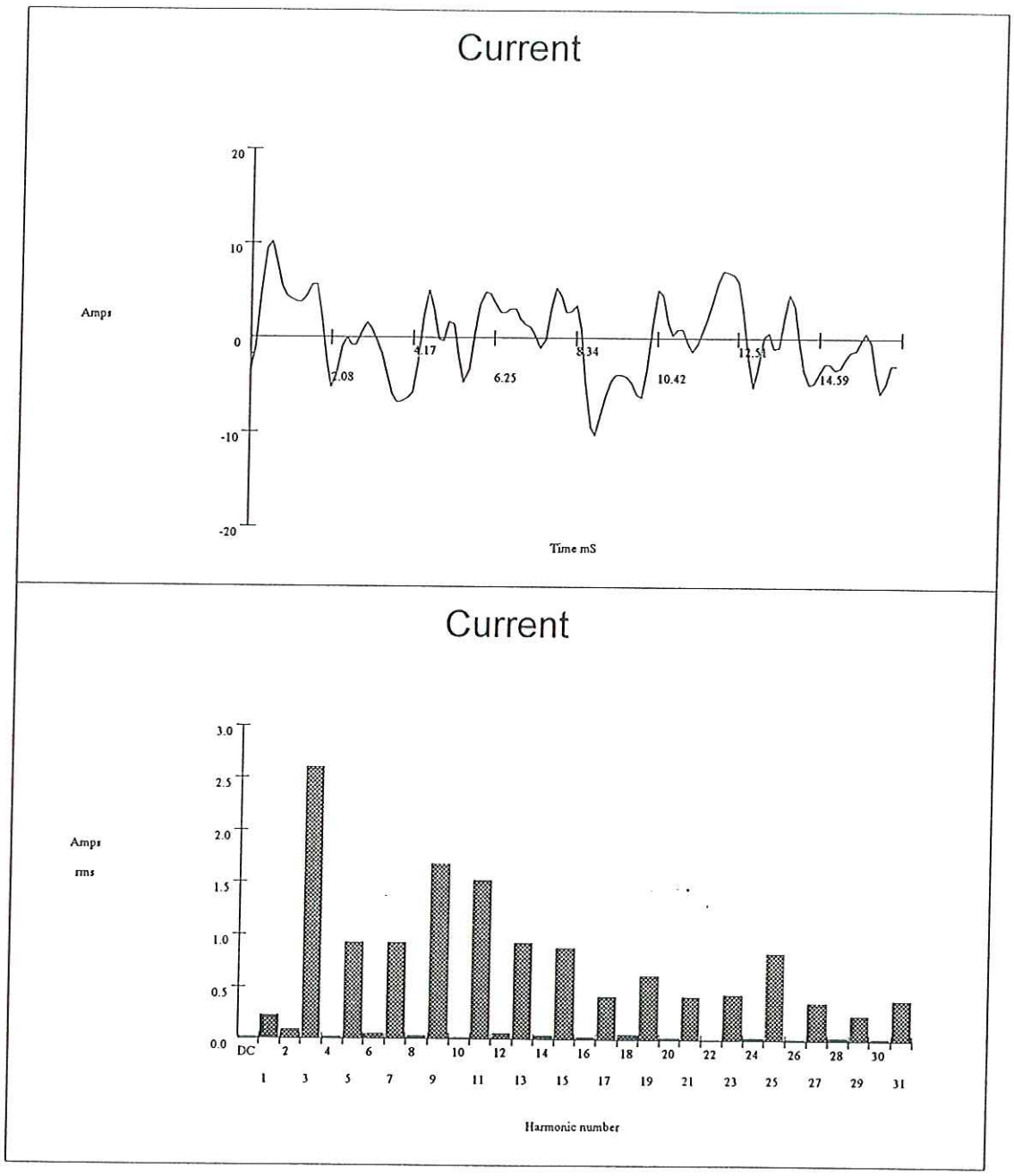

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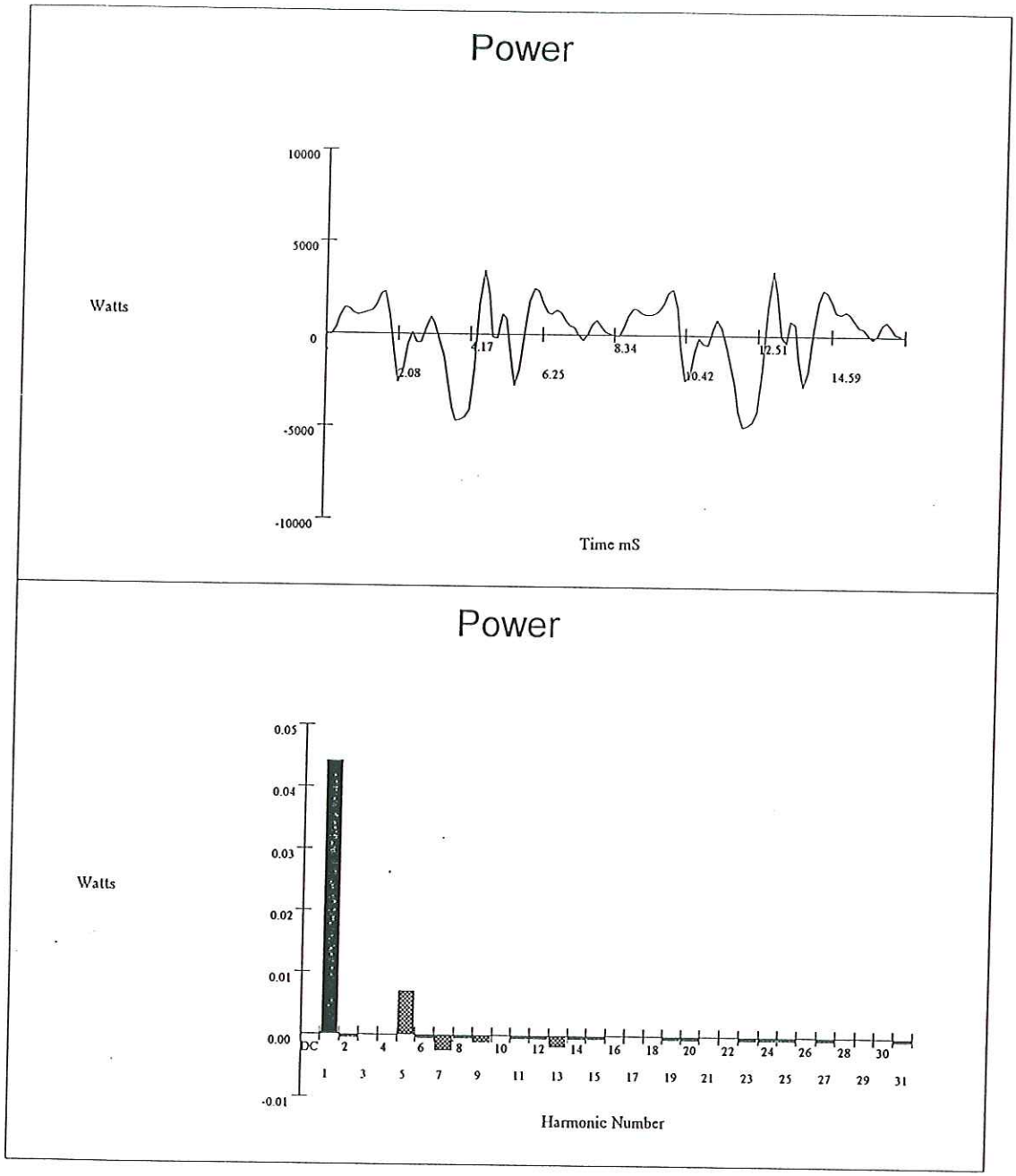


Readings - 09/20/95 14:42:20

MOB4 #H61
Rooftop
I_N = 46.7% THD

Summary Information

			Voltage	Current
Frequency	60.0	RMS	494	10 2
Power		Peak	718	19.6
KW	2.0	DC Offset	-1	-0.1
KVA	5.1	Crest	1.45	1.91
KVAR	4.0	THD Rms	2.1	46.4
Peak KW	10.7	THD Fund	2.1	52.4
Phase	64° lag	HRMS	11	4.7
Total PF	0.39	KFactor		6.2
DPF	0.44			

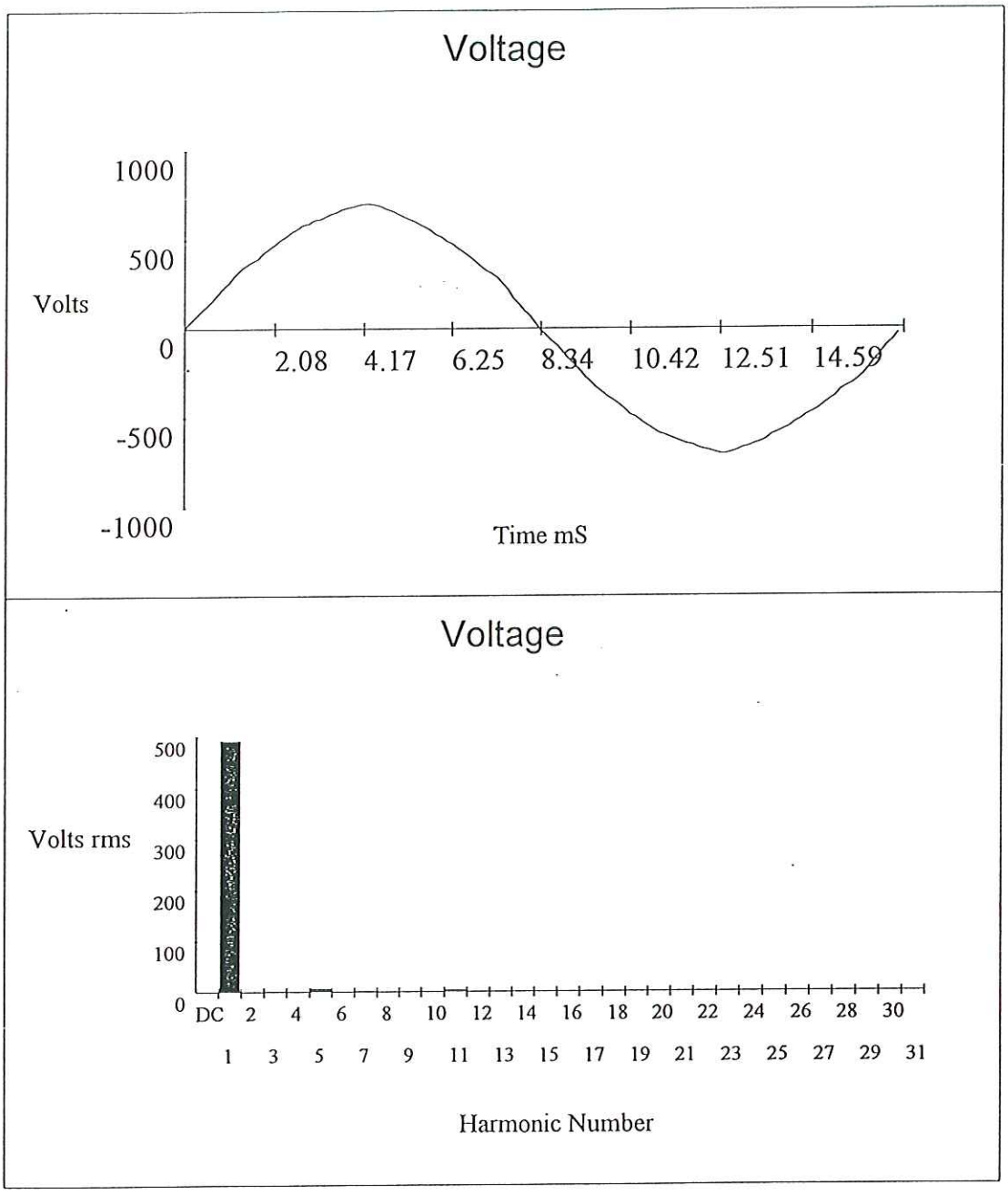
Record Information

	Max	Average	Min
V RMS			
A RMS			
V Peak			
A Peak			
V THD-R%			
A THD-R%			
KWatts			
KVA			
TPF			
DPF			
Frequency			

Harmonic Information

	Freq.	V Mag	%V RMS	V Ø°	I Mag	%I RMS	I Ø°	Power (KW)
DC	0.0	1	0.2	0	0.1	1.4	0	0.0
1	60.0	494	100.0	0	9.1	88.5	-64	2.0
2	120.0	0	0.0	169	0.1	0.8	-58	0.0
3	179.9	2	0.4	-60	4.2	41.1	41	0.0
4	239.9	0	0.0	174	0.0	0.2	-167	0.0
5	299.9	9	1.8	4	1.4	13.5	-136	0.0
6	359.9	0	0.0	153	0.1	0.5	178	0.0
7	419.8	3	0.7	117	0.3	3.4	98	0.0
8	479.8	0	0.0	39	0.1	0.5	75	0.0
9	539.8	1	0.2	34	1.5	14.6	-24	0.0
10	599.8	0	0.0	112	0.0	0.4	-58	0.0
11	659.7	4	0.7	150	0.1	0.9	-1	0.0
12	719.7	0	0.0	102	0.0	0.4	134	0.0
13	779.7	1	0.3	122	0.1	0.9	131	0.0
14	839.7	0	0.0	72	0.0	0.1	29	0.0
15	899.6	0	0.1	-153	0.5	5.2	14	0.0
16	959.6	0	0.0	-21	0.0	0.2	43	0.0
17	1019.6	1	0.2	-44	0.2	1.6	-139	0.0
18	1079.6	0	0.0	-96	0.0	0.4	-67	0.0
19	1139.5	1	0.2	-22	0.1	1.3	171	0.0
20	1199.5	0	0.0	112	0.1	0.5	162	0.0
21	1259.5	1	0.1	-49	0.3	2.5	27	0.0
22	1319.5	0	0.0	153	0.0	0.2	0	0.0
23	1379.4	1	0.2	82	0.2	2.1	-86	0.0
24	1439.4	0	0.0	143	0.0	0.1	15	0.0
25	1499.4	1	0.2	74	0.1	0.7	13	0.0
26	1559.4	0	0.0	-97	0.0	0.2	-106	0.0
27	1619.4	0	0.1	56	0.1	1.0	48	0.0
28	1679.3	0	0.0	163	0.0	0.4	129	0.0
29	1739.3	0	0.0	178	0.2	1.6	8	0.0
30	1799.3	0	0.0	167	0.0	0.2	-5	0.0
31	1859.3	0	0.1	-169	0.1	0.5	158	0.0

Readings - 09/20/95 14:42:20



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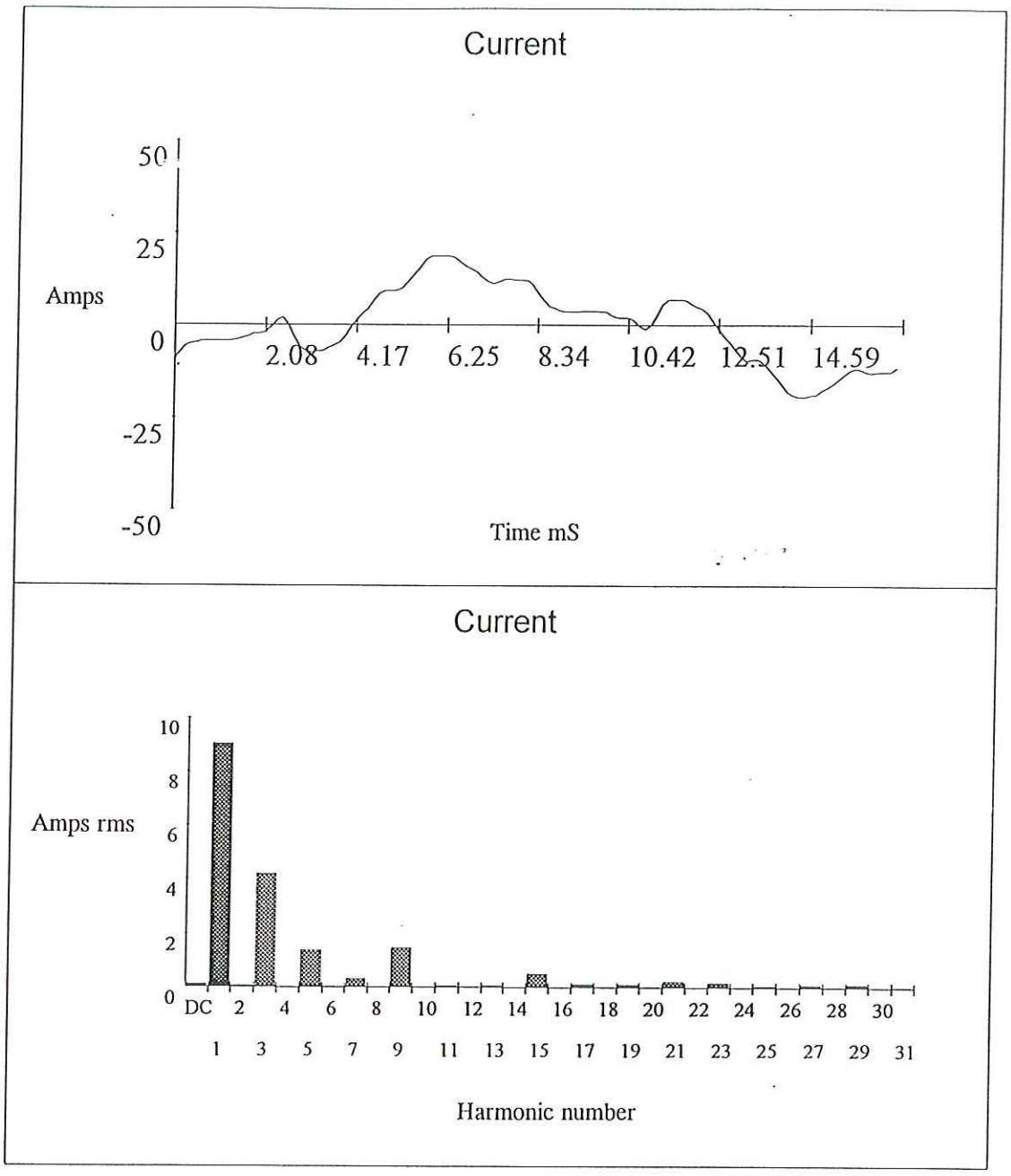

Readings - 09/20/95 14:42:20