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A. M. KINNEY, INC.

CONSULTING ENGINEERS

CINCINNATI, OHIO

ENERGY ENGINEERING ANALYSIS PROGRAM STUDY

Holston Army Ammunition Plant

Kingsport, Tennessee

EXECUTIV · SUMMARY

DEPARTMENT OF THE ARMY

Mobile District, Corps of Engineers

Mobile Alabama

Contract No DACA 01 81 C 0070

DEPARTMENT OF THE ARMY

CONSTRUCTION ENGINEERING RESEARCH LABORATORY

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ENERGY ENGINEERING ANALYSIS PROGRAM STUDY

HOLSTON ARMY AMMUNITION PLANT

KINGSPORT, TENNESSEE

CONTRACT NO. DACA 01-81-C-0070

EXECUTIVE SUMMARY

Prepared by

A. M. KINNEY, INC.
CONSULTING ENGINEERS
CINCINNATI, OHIO

For

MOBILE DISTRICT, CORPS OF ENGINEERS

MOBILE, ALABAMA

January 1983

ENERGY ENGINEERING ANALYSIS PROGRAM STUDY

HOLSTON ARMY AMMUNITION PLANT

KINGSPORT, TENNESSEE

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EXECUTIVE SUMMARY

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1.0 INTRODUCTION

This volume is a summary of the results of the Energy Engineering Analysis Program (EEAP) study for the Holston Army Ammunition Plant (HAAP).

This EEAP includes energy conservation project recommendations and analyses that will result in a reduction in energy usage. This study also develops data necessary for the Installation-Wide Energy Systems Plan.

The study effort is separated into the following increments:

Increment A - Buildings

Increment B - Utilities Distribution Systems and EMCS

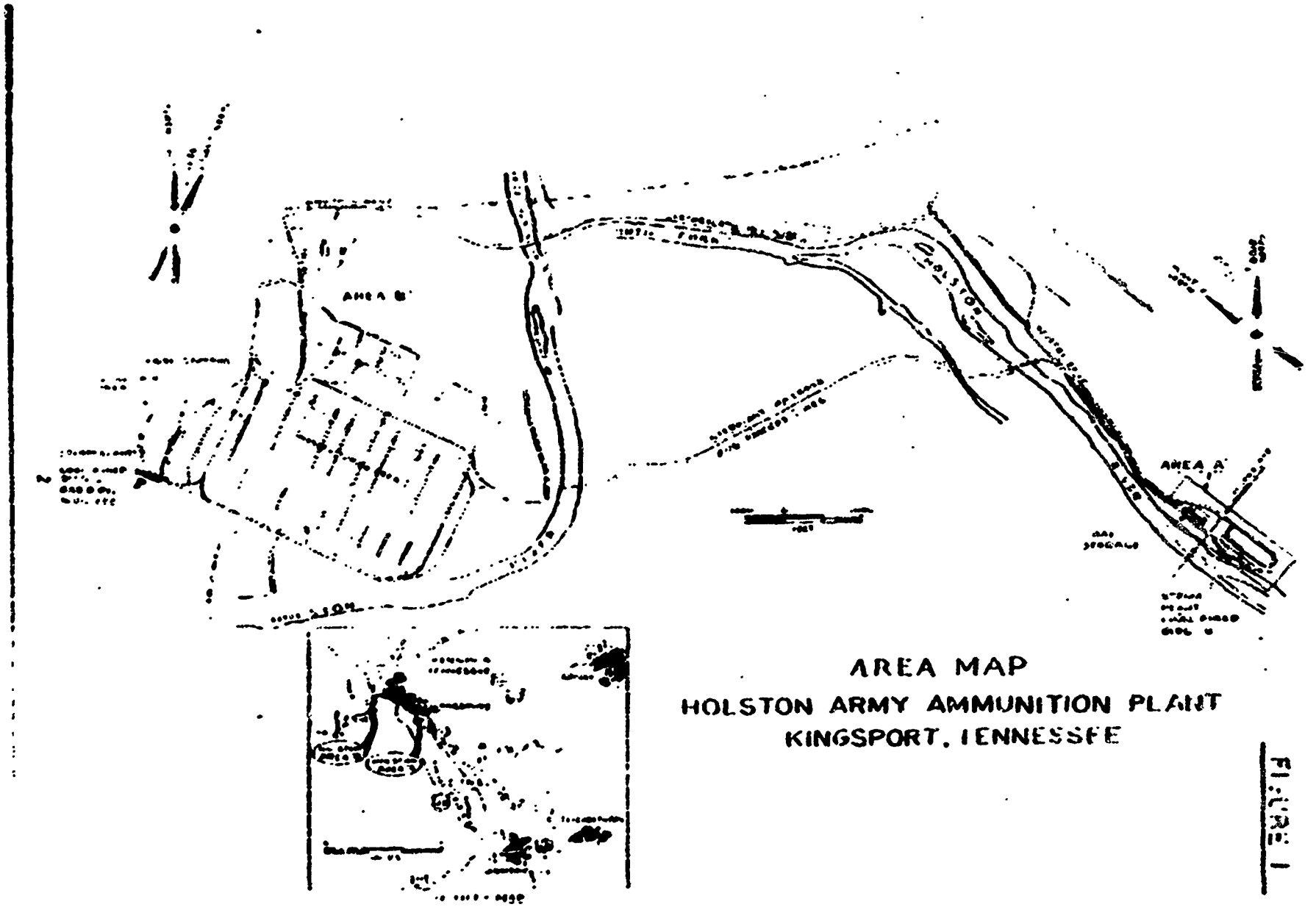
Increment E - (Mod) - Central Boiler Plants

Increment F - Facilities Engineer Energy Conservation Measures

Increment G - Maintenance, Repair and Minor Construction

The HAAP is a Government-owned, contractor-operated (GOCO) military industrial installation under the jurisdiction of the U. S. Army Armament Materiel Readiness Command (ARRCOM), Rock Island, Illinois, built in the early 1940's for the manufacture of explosives as required by the Department of Defense. HAAP is presently operated by Holston Defense Corporation (HDC) at a reduced rate, with the inactive process buildings disconnected from the plant utility systems, but ready to be reactivated quickly in the event full or increased mobilization is required.

Geographically, the plant is divided into two parts known as Area A and Area B, see Figure 1. The total area originally consisted of approximately 6,503 acres (288 acres at Area A and 6,215 acres at Area B). Subsequent disposition has reduced



AREA MAP
HOLSTON ARMY AMMUNITION PLANT
KINGSPORT, TENNESSEE

FIGURE 1

Area A to approximately 112 acres, and Area B to approximately 5,913 acres, or a total of 6,025 acres.

Area A is located within the city limits of Kingsport, Tennessee. Area B is located in Hawkins County, Tennessee, 5 miles west of downtown Kingsport, along U. S. route 11-W. The two areas are interconnected by a narrow corridor which contains two acid pipelines, a railroad and a liquid waste line.

Area A is used for the concentration of weak acetic acid into glacial acetic acid and for the production of acetic anhydride. The acetic anhydride is pumped into Area B where explosives are produced. Area B has ten separate explosives production lines with their required supporting facilities. Recovered explosivesfree acetic acid is pumped to Area A for reprocessing. Currently, the equivalent of approximately two explosives production lines with necessary support facilities are in operation. The present operating staff of the facility is made up of 1,107 people, including two military and 38 civilian army staff.

As originally constructed, HSAAP consisted of 553 buildings. However, since the time of completion, the total number of buildings or facilities has been reduced to 333 (not including 141 explosives magazines).

The 333 buildings currently at the plant include 207 buildings which are presently either closed, laid away or otherwise not included in this energy report but which are maintained in readiness for quick activation in the event that increased production rates are required, leaving 126 active buildings with a total floor area of 99,263 square feet. Table I presents the Building Data Sheets, see Pages 6 through 17.

The majority of the active process buildings operate on a 24 hour day, 7 days per week, during which time heat radiated from pipes and process equipment is more than adequate for building heating. The heating systems for these buildings are required only during shutdown periods as freeze protection for water lines and wet type fire protection systems. No significant energy can be saved in these buildings if we exclude process systems.

Original maintenance and office buildings are wood frame construction, no wall insulation, and 0 to 8 inches loose ceiling insulation, with gravity ventilated attic spaces. Some buildings have uninsulated wood floors over ventilated crawl spaces. These buildings are mainly heated by steam cast-iron radiators with manual control. Steam is supplied to most buildings from central steam plants, with the more remote buildings having oil-fired furnaces. Air-conditioning is provided primarily by window type air-conditioning units, except for a few central air-conditioning units using direct expansion coils and air-cooled condensers.

Newer office and service buildings are centrally air-conditioned. Boiler type insulated metal buildings or insulated curtain wall construction.

The general level of maintenance at the plant is good and leaves few areas for improvement.

Inspection of the steam distribution system revealed no gaps or breaks in the insulation, except that steam lines were uninsulated downstream of the isolation valves in the inactive production areas.

The central boiler plants in Area A and B are in very good condition even though they are almost 40 years old. The coal-fired boilers have been converted to gas

excellent operating condition except for a tube thinning problem at the stoker line of the Area A boilers. Because of their original conservative design, the boilers represent systems equal to or better than present new boiler installations. After a boiler is fired at or near its capacity for a period of a year or more, as would be the case in a full mobilization, the boiler should be inspected by a recognized boiler inspector to determine its capability to handle future full load demands.

HDC, the civilian operating contractor, has done extensive work to reduce energy usage from the base year 1975. Fiscal year 1981 shows a reduction on the order of 40 percent from the base year, as opposed to the federal target range of 20 percent reduction by FY 1985 and 30 percent by FY 2000.

The general level of enthusiasm for energy conservation appears to be quite high, and is maintained at this level by programs sponsored by the operating contractor and the civilian army staff.

A. M. KINNEY, INC.

BUILDING DATA [illegible] · [illegible], TENNESSEE · BUILDING DATA · AREA "A"

[illegible] · [illegible] · Date 8-25-82 · Date 8-16-82

BUILDING DATA SHEET

COLUMN NO'S

TABLE [illegible] - BUILDING DATA SHEETS - PART 1

(1) BLDG NO	(2) NAME	(3) NO FLOORS	(4) YEAR BUILT	(5) CONSTRUCTION ROOF	(6) CONSTRUCTION WALL	(7) CONSTRUCTION FLOOR	(C) CONSTRUCTION WINDOW	(8) CONSTRUCTION DOOR	(10) U VALUE ROOF	(11) U VALUE WALL	(12) U VALUE FLOOR	(13) U VALUE WINDOW	(14) U VALUE DOOR	(15) WINDOW AREA SQ. FEET	(16) DOOR AREA SQ. FEET	(17) FLOOR AREA SQ. FEET
1	[illegible] & ADMINISTRATION	1	1963	ASPHALT SHINGLE	MASONRY	CONCRETE	METAL D.H.	INSUL. METAL	.075	.070	--	1.10	.67	275	91	3520
[illegible]	[illegible]	2	1963	B.U. CONCRETE	MASONRY	CONCRETE	METAL AWNING	INSUL. METAL	.045	.070	--	1.10	.67	830	217	6572
3	[illegible]	1	1963	B.U. [illegible]	MASONRY	CONCRETE	METAL AWNING	INSUL. METAL	.085	.037	--	1.10	.63	2630	107	8052
[illegible]	[illegible] BUILDING	8	1963	B.U. CONCRETE	MASONRY	CONCRETE	METAL AWNING	METAL	.033	[illegible]	--	1.10	1.00	3729	310	64204
[illegible]	[illegible] BUILDING	3	1963	B.U. CONCRETE	MASONRY	CONCRETE	METAL AWNING	METAL	[illegible]	.487	--	1.10	1.00	12907	803	122960
[illegible]	[illegible] PLANT	2 & BSMT.	1969	B.U. [illegible]	MASONRY	CONCRETE	METAL AWNING	METAL	.025	.619	--	0.10	1.04	10040	100	59730
[illegible]	[illegible]	1 & 2	[illegible]	B.U. WOOD	MASONRY	CONCRETE	WOOD, AWNING	INSUL. METAL	.005	.017	--	1.10	[illegible]	0110	054	11200
[illegible]	[illegible]	[illegible]	1958	B.U. WOOD	WOOD FRAME	CONCRETE	METAL AWNING	INSUL. METAL	.005	.500	--	1.10	.67	001	130	3004
11	[illegible]	[illegible]	1961	B.U. CONCRETE	CONCRETE	CONCRETE	METAL AWNING	METAL	.035	.070	--	1.10	1.04	100	80	7906
12	[illegible]	2	1963	B.U. CONCRETE	MASONRY	CONCRETE	METAL AWNING	WOOD	.025	.078	--	1.10	.67	36	42	[illegible]
[illegible]	[illegible]	1	1963	METAL SHEET	MASONRY	CONCRETE	METAL AWNING	INSUL. METAL	.333	.025	--	1.10	.59	1100	294	8470
[illegible]	[illegible]	1	1963	B.U. WOOD	WOOD FRAME	CONCRETE	METAL AWNING	INSUL. METAL	.005	.500	--	1.10	.67	1501	303	10151
[illegible]	[illegible]	1	1963	ASPHALT SHINGLE	[illegible]	CONCRETE	METAL AWNING	INSUL. METAL	.075	.066	--	0.10	.67	1054	432	6022
[illegible]	[illegible]	2	1963	METAL SHEET	WOOD FRAME	SLAB	METAL AWNING	INSUL. METAL	.079	.300	--	1.10	.59	462	62	5630
[illegible]	[illegible]	1	1960	ASPHALT SHINGLE	WOOD FRAME	CONCRETE	METAL AWNING	WOOD	.312	.320	--	1.10	.39	237	84	1000
[illegible]	[illegible]	1	1960	METAL SHEET	CONCRETE BLOCK	CONCRETE	METAL AWNING	INSUL. METAL	.379	.017	--	1.10	.67	100	239	3700
[illegible]	[illegible]	1	1973	[illegible]	[illegible]	CONCRETE	--	METAL	--	--	--	--	--	--	--	--
[illegible]	[illegible]	1	1973	[illegible] STEEL DK.	[illegible]	[illegible]	METAL AWNING	[illegible]	.007	.017	--	1.19	1.04	436	400	6109
[illegible]	[illegible]	1	1965	METAL SHEET	WOOD [illegible]	[illegible]	METAL AWNING	INSUL. METAL	.178	.300	--	1.10	.67	206	396	2300

FOR CONTINUATION, SEE PART 2, PAGE 2 OF 12

A. M. KINNEY, INC.

[illegible] AFB
[illegible], TENN.
BUILDING DATA

CIRCLED NO'S

TABLE 1 - BUILDING DATA SHEETS - PART 2

(1) BLDG NO	(2) NAME	(18) COOLING SYSTEM	(19) COOLING CAPACITY	(20) HEATING SYSTEM	(21) HEATING FUEL	(22) PEAK HEATING LOAD GAIN	(23) PEAK HEATING LOAD LOSS	(24) DOMESTIC HOT WATER CAPACITY	(25) DOMESTIC HOT WATER FUEL	(26) CONNECT LOAD KW	(27) LIGHTING LOAD KW	(28) DEMAND KW	(29) ANNUAL USAGE KWH	(30) REMARKS
1	[illegible]	[illegible] A.C.	--	[illegible]	STEAM	--	104,000	40 GAL.	STEAM	10.7	48.9	35.4	16,235	
[illegible]	[illegible]	--	--	U.H. AND CONVECT.	STEAM	--	CONT.	--	--	10.9	10.0	53.0	15,500	
3	[illegible]	--	--	U.H.	STEAM	--	CONT.	--	-	676.2	54.0	[illegible]	331,621	
6	[illegible]	--	--	U.H.	STEAM	--	CONT.	--	--	700.0	97.4	[illegible]	361,070	SPOT HEATING
7	[illegible]	--	--	U.H.	STEAM	-	CONT.	--	-	1525.0	104.4	[illegible]	[illegible]	SPOT HEATING
8	STEAM PLANT	--	--	U.H.	STEAM	--	CONT.	--	--	650.0	30.0	[illegible]	[illegible]	SPOT HEATING
9	FILTER PLANT	--	--	U.H. & CONVECT.	STEAM	--	171,350	30 GAL.	ELECT.	400.5	19.6	210.5	[illegible]	
10	[illegible]	-	--	U.H.	STEAM	--	CONT.	--	--	203.1	18.0	173.0	[illegible]	
11	[illegible]	-	--	U.H.	STEAM	--	227,000	--	--	1532.7	84.7	765.9	[illegible]	
12	[illegible]		--	CONVECT.	OIL	--	[illegible]	--	--	14.7	14.7	12.2	[illegible]	
14	[illegible]	--	--	U.H.	STEAM	--	[illegible]	60 GAL.	ELECT.	17.0	17.6	15.3	[illegible]	
15	[illegible]	WINDOW A.C.	--	U.H. & CONVECT.	STEAM	--	[illegible]	--	--	23.6	23.6	28.2	[illegible]	
[illegible]	[illegible]	WINDOW A.C.	--	U.H. & CONVECT.	STEAM	--	[illegible]	30 GAL.	ELECT.	20.0	20.0	20.8	[illegible]	
[illegible]	[illegible]	--	--	U.H. & CONVECT.	STEAM	-	[illegible]	30 GAL.	ELECT.	16.0	16.9	10.4	[illegible]	
[illegible]	[illegible]	WINDOW A.C.	--	U.H. & CONVECT.	STEAM	--	[illegible]	[illegible] GAL.	ELECT.	11.5	11.5	19.4	[illegible]	
[illegible]	[illegible]	--	--	U.H. & CONVECT.	STEAM	--	[illegible]	100 GAL.	STEAM	30.0	13.6	10.9	[illegible]	
[illegible]	[illegible]	--	--	--		-	--	--	--	30.0	0	23.0	32,500	
[illegible]	[illegible]	--	--	U.H. & CONVECT.	STEAM	--	[illegible]	50 GAL.	ELECT.	76.3	27.3	46.7	[illegible]	
[illegible]	[illegible] SHOP	--	--	U.H.	STEAM	--	[illegible]	30 GAL.	ELECT.	25.6	9.5	22.9	[illegible]	

A. M. KINNEY, INC.

AREA "B"

Date 8-25-82
Date 8-16-83

COLUMN NO'S

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 1

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
				CONSTRUCTION					"U" VALUE					WINDOW AREA	DOOR AREA	FLOOR AREA
BLDG NO	NAME	NO. FLOORS	YEAR BUILT	ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOW	DOOR	SQ FEET	SQ FEET	SQ FEET
2	[illegible]	1	1941	ASPHALT SHINGLE	WOOD FRAME	WOOD	METAL D.H.	HOLL. METAL	.332	.310	.369	1.10	.50	651	175	12,990
3	[illegible]	1	1940	ASPHALT SHINGLE	WOOD FRAME	WOOD	METAL AWNING	HOLL. METAL	.079	.310	.309	1.10	.50	1664	220	9,984
4	[illegible] HEADQUARTERS	1	1939	ASPHALT SHINGLE	WOOD FRAME	WOOD	METAL D.H.	HOLL. METAL	.332	.310	.309	1.10	.59	1130	261	14,300
[illegible]	[illegible] HALL	1	1943	METAL ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	METAL O'HEAD	.079	.318	—	1.10	.59 1.04	954	84 420	2,075
[illegible]	[illegible]	1	1943	METAL ON WOOD	MASONRY	CONCRETE	METAL AWNING	HOLL. METAL	.079	.078	--	1.10	.59	1676	85	12,702
[illegible]	[illegible]	1	1943	B.U. ON WOOD	CONCRETE BLOCK	CONCRETE	METAL AWNING	HOLL. METAL	.605	.201	--	1.10	.59	272	130	3,087
[illegible]	[illegible] STORAGE	1	1944	B.U. ON WOOD	MASONRY	CONCRETE	--	HOLL. METAL	.405	.478	--	1.10	.59	--	72	323
[illegible]	[illegible]	1	1933	B.U. ON CONCRETE	MASONRY	CONCRETE	METAL AWNING	METAL O'HEAD	.070	.072	--	1.10	.59 1.04	56	28 170	3,347
[illegible]	TRAINING	1	1943	METAL ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	HOLL. METAL	.079	.360	--	1.04	.50	658	420	9,112
[illegible]	[illegible] BUILDING	1	1943	--	--	--	--	--	-	--	--	--	--	--	--	--
[illegible]	ADMINISTRATION	1	1900	B.U. ON METAL	PORCELAIN PANEL	CONCRETE	FIXED GLASS	GLASS	.050	.031	--	0.56	0.05	3778	627	60,023
[illegible]	[illegible] & METAL [illegible]	1	1933	B.U. ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	METAL O'HEAD	.005	.360	--	1.10	.59 1.04	2618	176 550	25,135
[illegible]	GENERAL STORES	1	1943	B.U. ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	HOLL. METAL	.005	.563	--	1.10	.50	1324	531	16,095
[illegible]	[illegible] & [illegible]	[illegible]	1943	B.U. ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	HOLL. METAL	.005	.500	--	1.10	.50	1906	382	26,935
[illegible]	[illegible]	1	1943	B.U. ON WOOD	STEEL FRAME	CONCRETE	METAL AWNING	HOLL. METAL	.035	.500	--	1.10	.33	1091	500	13,120
[illegible]	[illegible] SHOP	1	1943	METAL ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	HOLL. METAL	.370	.310	--	1.10	.50	594	660	6,200
[illegible]	SERVICE STATION	1	1943	METAL ON WOOD	WOOD FRAME	CONCRETE	METAL AWNING	METAL O'HEAD	.079	.310	—	1.10	.55 1.04	754	35 615	5,050
[illegible]	[illegible]	1	1943	B.U. ON [illegible]	WOOD FRAME	CONCRETE	METAL AWNING	HOLL. METAL	.305	.318	—	1.10	.59	1200	213	9,059
[illegible]	[illegible]	1	1943	B.U. ON WOOD	MASONRY	CONCRETE	METAL AWNING	HOLL. METAL	.332	.470	--	1.10	.59	654	162	6,317

FOR CONTINUATION, SEE PART 2 PAGE 4 OF 12

[illegible]
[illegible], TENNESSEE
BUILDING DATA

A. M. Kinney, Inc.
AREA "B"

[illegible] 87591
[illegible] 8-?-82
[illegible] 8-10-82

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 2

COLUMN NO'S

(1)	(2)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
BLDG NO	NAME	COOLING SYSTEM	COOLING CAPACITY	HEATING SYSTEM	HEATING FUEL	PEAK TRANS LOAD GAIN	PEAK TRANS LOAD LOSS	DOMESTIC HOT WATER CAPACITY	DOMESTIC HOT WATER FUEL	CONNECT LOAD KW	LIGHTING LOAD KW	DEMAND KW	ANNUAL USAGE KWH	REMARKS
1	[illegible]	WINDOW A.C.	--	CONVECT	STEAM	--	401,369	50 GAL	STEAM	61.6	60.5	40.[illegible]	12,69[illegible]	
2	[illegible]	WINDOW A.C.	--	CONVECT	STEAM	--	334,473	30 GAL	ELECT	13.2	44.8	32.[illegible]	37,89[illegible]	
4	[illegible]	WINDOW A.C.	--	CONVECT	STEAM	--	400,531	30 GAL	ELECT	35.3	17.3	26.[illegible]	30,40[illegible]	
5	[illegible]	WINDOW A.C.	--	FORCED AIR	OIL	--	520,050	80 GAL	ELECT	33.0	16.5	23.3	20,91[illegible]	
8	LABORATORY	WINDOW A.C.	-	CONVECT	STEAM	--	610,049	100 GAL	STEAM	166.6	73.0	126.0	56,3[illegible]	
8A	LABORATORY ANNEX	-	--	U.H. CONVECT	STEAM	--	123,893	--	-	50.6	33.9	60.[illegible]	20,39[illegible]	
8B	[illegible] STORAGE	-	--	U.H.	STEAM	-	19,070	--	--	6.0	5.2	6.5	73[illegible]	
9	[illegible]	-	--	FORCED AIR	OIL	--	112,999	--	-	9.9	8.8	8.5	36[illegible]	
12	[illegible]	CENTRAL W.H.	173,[illegible]	FORCED AIR	STEAM	180,620	122,[illegible]	30 GAL	ELECT	55.4	17.7	31.[illegible]	40,20[illegible]	
30	[illegible] BUILDING	-	--	--	-	--	--	-	--	--	--	--	--	
40	ADMINISTRATION	CHILLED WATER	1350	FORCED AIR	HOT WATER	806,512	1500,[illegible]	50 GAL	ELECT	[illegible]13.4	310.0	561.[illegible]	778,00[illegible]	
100	[illegible]	WINDOW A.C.	--	U.H. & CONVECT	STEAM	--	1194,317	26 GAL	ELECT	[illegible]99.2	49.7	120.[illegible]	203,90[illegible]	
101	[illegible]	WINDOW A.C.	--	U.H.	STEAM	--	1999,40[illegible]	--	--	58.1	70.7	50.[illegible]	12,00[illegible]	
102	[illegible]	-	--	U.H.	ELECT	-	2119,06[illegible]	26 GAL	ELECT	76.0	30.0	60.[illegible]	39,53[illegible]	
121	[illegible]	WINDOW A.C.	--	U.H.	STEAM	--	2143,052	--	--	99.4	21.7	10.[illegible]	0,20[illegible]	
144	[illegible]	-	--	U.H. & CONVECT	STEAM	--	886,782	--	--	77.4	10.9	20.[illegible]	60,27[illegible]	
145	[illegible] STATION	-	--	U.H.	STEAM	--	196,465	52 GAL	ELECT	17.4	17.6	12.[illegible]	40,00[illegible]	
199	[illegible]	--	--	U.H. & CONVECT	STEAM	--	975,610	1000 GAL	STEAM	[illegible]16.4	40.6	87.[illegible]	60,21[illegible]	
140	[illegible]	-	--	U.H.	STEAM	--	341,19[illegible]	30 GPH	STEAM	11.9	11.2	28.[illegible]	24,22[illegible]	

A. M. Kinney, Inc.

BUILDING DATA SHEET
PAGE 5 OF 12

PART I - (CONTINUED) BUILDING DATA SHEET - PART I

COLUMN NO'S

(1) BLDG. NO.	(2) NAME	(3) NO. FLOORS	(4) YEAR BUILT	(5) CONSTRUCTION: ROOF	(6) CONSTRUCTION: WALL	(7) CONSTRUCTION: FLOOR	(8) CONSTRUCTION: WINDOW	(9) CONSTRUCTION: DOOR	(10) "U" VALUE: ROOF	(11) "U" VALUE: WALL	(12) "U" VALUE: FLOOR	(13) "U" VALUE: WINDOW	(14) "U" VALUE: DOOR	(15) WINDOW AREA SQ. FEET	(16) DOOR AREA SQ. FEET	(17) FLOOR AREA SQ. FEET
[illegible]	[illegible]	1	1941	[illegible] WOOD	WOOD FRAME	CONC.	METAL [illegible]	GLASS	.079	.180	--	1.10	.67	319	360	6768
[illegible]	[illegible]	1	1942	B.U. ON WOOD	CONC. BLOCK	CONC.	METAL AWNING	WOOD	.035	.310	--	[illegible]	.67 1.04	427	42 304	2562
[illegible]	PAINT & [illegible]	1	1950	STEEL W/[illegible]	STEEL W/[illegible]	CONC.	--	[illegible] METAL	.240	.67	--	--	0.67 1.04	--	42 112	2152
[illegible]	[illegible] STATION	1	1962	[illegible]	[illegible] W/TILE	CONC.	[illegible] GLASS	WOOD	.515	.417	--	1.10	1.10	228	193	227
[illegible]	[illegible]	1	1966	CORR. METAL	[illegible] METAL	CONC.	METAL D.H.	[illegible] METAL	.060	.060	--	1.06	.67	200	105	8700
[illegible]	[illegible]	1	1967	STEEL	STEEL	CONC.	METAL AWNING	[illegible] METAL	.100	.192	--	1.10	.50	129	290	9840
[illegible]	DATA [illegible]	1	1900	STEEL	STEEL	CONC.	METAL AWNING	[illegible] METAL	.079	.192	--	1.06	.50	56	336	8555
[illegible]	[illegible]	2	1970	B.U. ON [illegible]	CONC. BLOCK	CONC.	METAL AWNING	GLASS	.100	.170	--	1.10	.67	330	215	6735
[illegible]	[illegible]	[illegible]	1971	B.U. ON [illegible]	CONC. BLOCK	CONC.	METAL AWNING	[illegible] METAL	.100	.069	--	1.10	.50	627	179	9960
[illegible]	[illegible]	1	1975	[illegible] METAL [illegible]	CONC. BLOCK	CONC.	METAL AWNING	[illegible] METAL	.050	.13	--	1.06	.50	570	125	16386
[illegible]	[illegible]	1	1975	[illegible] METAL [illegible]	CONC. BLOCK	CONC.	METAL AWNING	GLASS	.050	.15 .192	--	1.06	.67	466	706	22517?
[illegible]	[illegible]	1	1970	[illegible] METAL [illegible]	BLOCK	CONC.	METAL AWNING	METAL	.050	.510?	--	1.06	.67 1.04	26	321	666
200?	[illegible]	[illegible]	1961	[illegible]	MASONRY	CONC.	METAL AWNING	METAL	.025	.417	--	1.10	.67 1.04	1200	780	80,000?
201?	[illegible]	2	1963	[illegible] WOOD	CONC. BLOCK	CONC.	METAL AWNING	METAL	.515	.069	--	1.10	.67 1.04	2006	203	12,040?
[illegible]	[illegible]	2	1959	[illegible]	MASONRY	CONC.	METAL AWNING	[illegible] METAL	.035	.037	--	1.10	.50	93	103	1,600
[illegible]	[illegible]	1	1962	CONC. STEEL	MASONRY	CONC.	METAL AWNING	GLASS	.052	.070	--	1.10	.67	661	212	3,029?
220?	[illegible]	1	--	[illegible]	CONC. STEEL	WOOD	--	[illegible]	--	--	--	--	--	--	--	303
[illegible]	[illegible]	1	1962	[illegible]	MASONRY	CONC.	METAL AWNING	[illegible] METAL	.025	.037	--	1.10	.50	100	57	[illegible]
[illegible]	[illegible]	1		STEEL	CONC. STEEL	WOOD	--	[illegible]	--	--	--	--	--	--	--	301
[illegible]	[illegible]	1	--	STEEL	CORR. STEEL	WOOD	--	WOOD	--	--	--	--	--	--	--	192
[illegible]	[illegible]	1	1972	STEEL	CONC. STEEL	CONC.	--	WOOD	--	--	--	--	--	--	--	400
[illegible]	[illegible]	2	1974	B.U. ON CONC.	[illegible]	CONC.	97	[illegible] METAL	.100	.070	--	1.10	.67 1.04	69	65 255	3,200
[illegible]	[illegible]	1	1972	B.U. [illegible]	MASONRY	CONC.	METAL AWNING	[illegible] METAL	.067?	.017	--	1.10	.56	64	207	2,276

FOR CONTINUATION, SEE PART 2, PAGE 6 OF 12

A. M. Kinney, Inc.

BUILDING DATA

BUILDING DATA SHEET
PAGE .8. OF .12.

COLUMN NO'S

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 2

(1) BLDG. NO	(2) NAME	(18) COOLING SYSTEM	(19) COOLING CAPACITY	(20) HEATING SYSTEM	(21) HEATING FUEL	(22) PEAK TRANS LOAD GAIN	(23) PEAK TRANS LOAD LOSS	(24) DOMESTIC HOT WATER CAPACITY	(25) DOMESTIC HOT WATER FUEL	(26) CONNECT LOAD KW	(27) LIGHTING LOAD KW	(28) DEMAND KW	(29) ANNUAL USAGE KWH	(30) REMARKS
110	[illegible]	CENTRAL W.S.	130,000	U.B. & CONV.	STEAM	-	102,190	27 GAL	STEAM	42.3	36.3	30.0	41,090	
[illegible]	[illegible]	--	--	U.H. & CONV.	STEAM	--	175,173	6 GAL	ELEC	15.6	19.4	20.8	36,500	
[illegible]	[illegible]	-		U.H.	STEAM	-	120,008	--	-	5.1	5.1	--	--	STORAGE
[illegible]	[illegible]	--		CONV.	ELEC.	--	50,235	33 GAL	ELEC.	7.8	2.8	2.8	38,185	
[illegible]	[illegible]	CENTRAL W.S.	120,000	FORCED AIR	STEAM	90,796	196,111	47 GAL	ELEC	42.7	22.3	19.4	58,010	
[illegible]	[illegible]	WINDOW A.C.	--	FAN COIL	STEAM	-	123,953	52 GAL	ELEC	33.4	11.6	19.4	17,329	
[illegible]	DATA PROCESSING	CENTRAL W.S.	802,000	FORCED AIR	GAS STEAM	196,017	133,038	14 GAL	ELEC.	91.9	40.1	73.5	90,188	
[illegible]	[illegible]	WINDOW A.C.		U.H.	ELEC. STEAM	-	200,907	-	--	20.7	23.8	25.8	3,189	
[illegible]	[illegible]		--	U.H. CONV.	STEAM	--	139,909	--	-	47.9	25.4	11.2	1,282	
[illegible]	[illegible]	CENTRAL W.S.	600,003	FORCED AIR	ELEC.	325,891	300,814	20 GAL	ELEC.	149.9	85.1	119.8	353,515	
[illegible]	[illegible]	CENTRAL W.S.	170,000	UNIT VENT	STEAM	433,081	103,570	50 GAL	ELEC.	173.5	90.5	130.0	170,910	
[illegible]	[illegible]	--	--	U.H. FLOOR	STEAM		64,620	20 GAL	ELEC.	27.3	9.3	7.0	3,700	
[illegible]	STEAM PLANT	--	--	U.H.	STEAM	-	[illegible]	--	--	670.0	36.0	330.	870,200	
[illegible]	[illegible]	WINDOW A.C.	--	U.H. FLOOR	OIL	-	653,038	42 GAL	ELEC.	65.9	11.6	99.	164,120	
[illegible]	[illegible]	--	--	U.H.	ELEC		35,000	--	-	113.8	74.3	102.	365,910	
[illegible]	[illegible]	--	--	U.H.	STEAM	-	136,561	87 GAL	ELEC	26.3	17.0	23.	12,672	
[illegible]	[illegible]	--	-	-	-	--	--	--	-	20.3	5.5	23.	5,582	
[illegible]	[illegible]	--	--	U.H.	ELEC.	-	99,026	--	-	64.2	9.2	30.	2,285	
[illegible]	[illegible]	--	--	-		-	--	--	-	20.3	5.5	25.5	5,585	
[illegible]	[illegible]	--	--	-	-	-	--	--	--	20.3	5.5	25.	5,585	
[illegible]	[illegible]	--	--	-	-	-	--	--	--	20.1	5.5	25.7	5,585	
[illegible]	[illegible]		--	U.H.	GAS	--	100,007	6 GAL	ELEC	36.0	16.0	33.	3,355	
[illegible]	[illegible]	-	--	U.H.	STEAM		85,020	--	--	181.3	27.5	195.	101,810	

A. M. Kinney, Inc.

BUILDING DATA SHEET

PAGE [illegible] OF 12

TABLE I - (CONTINUED) BUILDING DATA SHEETS - PART 1

(1) BLDG. NO.	(2) NAME	(3) NO. FLOORS	(4) YEAR BUILT	(5) CONSTRUCTION ROOF	(6) CONSTRUCTION WALL	(7) CONSTRUCTION FLOOR	(8) CONSTRUCTION WINDOW	(9) CONSTRUCTION DOOR	(10) "U" VALUE ROOF	(11) "U" VALUE WALL	(12) "U" VALUE FLOOR	(13) "U" VALUE WINDOW	(14) "U" VALUE DOOR	(15) WINDOW AREA SQ. FEET	(16) DOOR AREA SQ. FEET	(17) FLOOR AREA SQ. FEET
[illegible]	[illegible] ST.	4	1902	[illegible]	[illegible]	[illegible]	--	METAL	0.10	[illegible]	--	--	0.70	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible] CORR.	[illegible]	[illegible]	--	METAL	0.30	[illegible]	--	--	0.70	[illegible]	126	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] GLASS	WOOD	[illegible]	.270	[illegible]	[illegible]	.67	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] PLANT	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	METAL	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	--	METAL	[illegible]	[illegible]	--	--	[illegible]	--	80	[illegible]
[illegible]	[illegible]	1	[illegible]	METAL [illegible]	[illegible]	[illegible]	METAL [illegible]	[illegible] METAL	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	48	[illegible]
[illegible]	[illegible]	1	[illegible]	METAL [illegible]	[illegible]	[illegible]	METAL [illegible]	[illegible] METAL	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	METAL [illegible]	[illegible]	[illegible]	METAL [illegible]	[illegible] METAL	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	METAL [illegible]	[illegible]	[illegible]	METAL [illegible]	[illegible]	[illegible]	[illegible]	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	STEEL	[illegible]	[illegible]	METAL [illegible]	[illegible] METAL	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	METAL [illegible]	[illegible] METAL	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	METAL [illegible]	METAL [illegible]	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	METAL [illegible]	[illegible]	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	METAL [illegible]	[illegible] METAL	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	METAL [illegible]	[illegible]	[illegible]	[illegible]	[illegible] METAL	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	METAL [illegible]	[illegible]	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	METAL [illegible]	[illegible] METAL	[illegible]	[illegible]	--	1.10	[illegible]	4,024	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	METAL [illegible]	[illegible] METAL	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	WOOD	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	WOOD	[illegible]	[illegible]	--	1.10	[illegible]	[illegible]	[illegible]	[illegible]

FOR CONTINUATION, SEE PART 2, PAGE 8 OF 12

[illegible] A. M. KINNEY, INC. [illegible] BUILDING DATA SHEET PAGE 8 OF 12

AREA "B"

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 2

COLUMN NOTS

(1) BLDG NO.	(2) NAME	(18) COOLING SYSTEM	(19) COOLING CAPACITY	(20) HEATING SYSTEM	(21) HEATING FUEL	(22) PEAK TRANS LOAD GAIN	(23) PEAK TRANS LOAD LOSS	(24) DOMESTIC HOT WATER CAPACITY	(25) DOMESTIC HOT WATER FUEL	(26) CONNECT LOAD KW	(27) LIGHTING LOAD KW	(28) DEMAND KW	(29) ANNUAL USAGE KWH	(30) REMARKS
[illegible]	[illegible] WASTE PUMP [illegible]	--	--	U.H.	ELECT.	--	90,005	--	--	179.9	9.0	170.5	[illegible]	
210	[illegible] WASTE PUMP [illegible]	--	--	U.H.	ELECT.	--	46,300	--	--	200.0	2.0	190.2	80,900	
233	WASTE TREATMENT	CENTRAL A.C.	420,200	U.H. & FCU AIR	ELECT.	439,774	736,360	120 GAL	ELECT.	3,209.3	20.1	3,100.4	7,834,000	
[illegible]	[illegible]	-	--	U.H.	STEAM	--	206,031	--	--	42.3	6.3	36.1	206,634	
[illegible]	[illegible]	--	--	U.H.	STEAM	--	60,003	--	--	12.0	6.0	0.9	9,624	
313	OFFICE & LAB [illegible]	WINDOW A.C.	--	U.H. & FCU AIR	STEAM	--	600,372	30 GAL	ELEC	16.0	7.1	15.1	9,775	
321	REPAIR SHOP & [illegible]	--	--	UH & CONV.	ELEC STEAM	--	172,235	--	--	12.0	6.5	10.9	6,200	
[illegible]	[illegible]	WINDOW A.C.	--	U.H.	STEAM	--	118,093	60 GPH	STEAM	39.7	29.2	26.1	11,185	
328	[illegible] AREA OFFICE	CENTRAL A.C.	190,000	CONV & FCU AIR	STEAM	117,400	90,300	32 GAL	ELECT.	25.2	11.7	22.7	13,105	
390	[illegible]	--	-	CONV.	STEAM	--	291,030	--	--	770.3	32.9	120.9	403,625	
[illegible]	[illegible]	--	--	U.H.	ELEC.	-	65,000	--	--	170	CHANGED TO [illegible] 1981			
399	MAINTENANCE SHOP	--	--	U.H. & CONV.	STEAM	-	205,903	50 GAL	ELECT.	101.0	10.7	91.6	52,915	
[illegible]	HEAVY EQUIP. SHOP	--	--	U.H. & CONV.	STEAM	-	507,600	--	--	130.0	80.3	111.0	201,700	
[illegible]	[illegible] BUILDING	WINDOW A.C.	--	U.H. & CONV.	STEAM	--	259,130	--	--	10.1	9.2	9.0	3,000	
[illegible]	[illegible]	WINDOW A.C.	--	U.H. & CONV.	ELEC.	--	59,670	52 GAL	ELEC	30.2	11.7	26.9	136,300	
A	[illegible]	--	--		STEAM	--	52,030	--	--	61.0	2.3	33.6	12,135	
[illegible]	[illegible]	--	--	CONV.	STEAM	-	103,603	--	--	61.0	12.0	33.0	22,135	
[illegible]	[illegible]	--	--	STEAM [illegible]	STEAM	--	[illegible]	--	--	774.3	82.2	610.6	602,300	
[illegible]	[illegible]	-	--	U.H. & CONV.	STEAM	--	172,600	--	--	150.7	11.5	103.0	169,525	
[illegible]	[illegible]	--	--	U.H. & CONV.	STEAM	--	172,600	--	--	150.7	11.5	107.0	169,525	

A. M. KINNEY, INC.

8/23/82

8/10/82

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 1

(1) BLDG NO	(2) NAME	(3) NO FLOORS	(4) YEAR BUILT	(5) CONSTRUCTION ROOF	(6) CONSTRUCTION WALL	(7) CONSTRUCTION FLOOR	(8) CONSTRUCTION WINDOW	(9) CONSTRUCTION DOOR	(10) "U" VALUE ROOF	(11) "U" VALUE WALL	(12) "U" VALUE FLOOR	(13) "U" VALUE WINDOW	(14) "U" VALUE DOOR	(15) WINDOW AREA SQ FEET	(16) DOOR AREA SQ FEET	(17) FLOOR AREA SQ FEET
[illegible]	[illegible]	2	1963	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	1,290	201	4,025
[illegible]	[illegible]	1 & PART	1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	4,016	151	10,290
[illegible]	[illegible]	1 & PART	1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	4,016	151	10,000
[illegible]	[illegible]	1 & PART	1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	4,016	151	10,000
[illegible]	[illegible]	1	1963	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	1,250	156	4,210
[illegible]	[illegible]	2	1963	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	1,250	156	4,210
[illegible]	[illegible]	2	1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	1,250	156	4,210
[illegible]	[illegible]	1	1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	1,250	156	5,570
[illegible]	[illegible]	1	1972	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.111	.417	--	1.10	.50	907	252	9,110
[illegible]	[illegible]	1	1980	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.333	.417	--	1.10	.50	907	252	9,110
[illegible]	[illegible]	4	1964	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	3,100	186	10,112
[illegible]	[illegible]	3	1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	3,100	186	10,112
[illegible]	[illegible]	3	1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	3,100	186	10,112
[illegible]	[illegible]	3	1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	3,100	186	10,112
[illegible]	[illegible]	3	1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.417	--	1.10	.50	3,100	186	10,112
[illegible]	[illegible]	1-1/2	1960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.310	--	1.10	.50	290	202	2,313
[illegible]	[illegible]	1-1/2	1960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.310	--	1.10	.50	290	240	2,313
[illegible]	[illegible]	1-1/2	1960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.310	--	1.10	.50	290	240	2,313
[illegible]	[illegible]	1-1/2	1960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.310	--	1.10	.50	290	240	2,313
[illegible]	[illegible]	1-1/2	1960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.310	--	1.10	.50	290	240	2,313
[illegible]	[illegible]	2	1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.500	--	1.10	.50	591	326	5,100
[illegible]	[illegible]	2	1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.500	--	1.10	.50	591	326	5,100
[illegible]	[illegible]	2	1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.500	--	1.10	.50	591	326	5,100
[illegible]	[illegible]	2	1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.500	--	1.10	.50	591	326	5,100
[illegible]	[illegible]	2	1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.500	--	1.10	.50	591	326	5,100

FOR CONTINUATION, SEE PART 2, PAGE 10 OF 12

[illegible] A. M. Kinney, Inc. [illegible]

[illegible] 8/23/62 [illegible] 8/30/62

[illegible] BUILDING DATA – AREA "B"

TABLE 1 – (CONTINUED) BUILDING DATA SHEETS – PART 2

COLUMN NO'S

(1)	(2)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
BLDG NO	NAME	COOLING		HEATING		PEAK TRANS LOAD		DOMESTIC HOT WATER		CONNECT LOAD KW	LIGHTING LOAD KW	DEMAND KW	ANNUAL USAGE KWH	REMARKS
		SYSTEM	CAPACITY	SYSTEM	FUEL	GAIN	LOSS	CAPACITY	FUEL					
[illegible]	PUMP PLANT	--	--	CONVECT	STEAM	--	207,955	--	--	267.6	13.5	220.1	181,010	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	PERF.	--	--	316.3	19.3	249.9	187,075	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	PERF.	--	--	316.3	19.3	249.9	187,075	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	PERF.	--	--	316.3	19.3	249.9	187,075	
[illegible]	[illegible]	[illegible] A.C.	--	CONVECT	STEAM	--	PERF.	--	--	307.6	13.6	229.9	159,200	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	PERF.	--	--	307.6	13.6	229.9	159,200	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	PERF.	--	--	307.6	13.6	229.9	159,200	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	PERF.	--	--	307.6	13.6	229.9	159,200	
[illegible]	[illegible]	[illegible] A.C.	--	U.H.	STEAM	--	612,995	60 GPH	STEAM	67.9	67.2	61.1	129,910	
[illegible]	[illegible]	--	--	U.H.	STEAM	--	612,995	60 GPH	STEAM	63.0	49.0	50.7	236,650	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	PERF.	--	--	209.	25.0	192.0	133,311	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	PERF.	--	--	138.8	24.6	111.9	401,300	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	PERF.	--	--	151.3	30.6	122.0	200,500	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	PERF.	--	--	130.3	40.0	115.9	181,700	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	PERF.	--	--	107.5	26.0	130.9	220,150	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	199,050	--	--	120.3	8.3	90.6	93,770	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	199,050	--	--	120.2	7.3	90.6	93,770	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	199,050	--	--	120.2	7.3	92.6	93,770	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	199,050	--	--	120.2	7.3	90.6	93,770	
[illegible]	[illegible]	--	--	U.H. & CONVECT	STEAM	--	199,050	--	--	120.2	7.3	92.9	93,770	
[illegible]	[illegible]	--	--	CONVECT FAN CL.	STEAM	--	301,005	--	--	31.1	19.5	30.5	182,000	
[illegible]	[illegible]	--	--	CONVECT FAN CL.	STEAM	--	301,005	--	--	32.0	13.0	30.2	181,000	
[illegible]	[illegible]	--	--	CONVECT FAN CL.	STEAM	--	301,005	--	--	30.5	10.2	25.1	170,300	
[illegible]	[illegible]	--	--	CONVECT FAN CL.	STEAM	--	301,005	--	--	30.7	07.6	31.0	184,000	
[illegible]	[illegible]	--	--	CONVECT FAN CL.	STEAM	--	301,005	--	--	60.4	15.0	23.	182,300	

COLUMN NO'S

TABLE 1 – (CONTINUED) BUILDING DATA SHEETS – PART 1

(1) BLDG. NO.	(2) NAME	(3) NO. FLOORS	(4) YEAR BUILT	(5) CONSTRUCTION ROOF	(6) CONSTRUCTION WALL	(7) CONSTRUCTION FLOOR	(8) CONSTRUCTION WINDOW	(9) CONSTRUCTION DOOR	(10) "U" VALUE ROOF	(11) "U" VALUE WALL	(12) "U" VALUE FLOOR	(13) "U" VALUE WINDOW	(14) "U" VALUE DOOR	(15) WINDOW AREA SQ FEET	(16) DOOR AREA SQ FEET	(17) FLOOR AREA SQ FEET
[illegible]	[illegible]	2	1943	[illegible]	[illegible] FRAME	CONC.	[illegible]	[illegible]	.035	.310	--	1.10	0.54	591	320	3,100
[illegible]	[illegible]	1	1943	[illegible]	[illegible] FRAME	CONC.	[illegible]	[illegible]	.035	.318	--	1.10	.54	110	292	1,116
[illegible]	[illegible]	1	1943	[illegible]	[illegible]	CONC.	[illegible]	[illegible]	.035	.310	--	1.10	.54	116	420	925
[illegible]	[illegible]	2	1943	[illegible]	[illegible]	CONC.	[illegible]	[illegible]	.035	.310	--	1.10	.54	591	326	3,100
[illegible]	[illegible]	2	1943	[illegible]	[illegible] FRAME	CONC.	[illegible]	[illegible]	.035	.310	--	1.10	0.54	506	326	3,100
[illegible]	[illegible]	2	1943	[illegible]	[illegible] FRAME	CONC.	[illegible]	[illegible]	.035	.310	--	1.10	0.54	593	326	3,100
[illegible]	[illegible]	2	1943	[illegible]	[illegible] FRAME	CONC.	[illegible]	[illegible]	.035	.310	--	1.10	0.54	593	326	3,100
[illegible]	[illegible]	2	1943	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.035	.316	--	1.10	0.54	581	326	3,100
[illegible]	[illegible]	2	1943	[illegible]	[illegible]	CONC.	[illegible]	[illegible]	.035	.310	--	1.10	0.54	591	326	3,100
[illegible]	[illegible]	2	1943	[illegible]	[illegible]	CONC.	[illegible]	[illegible]	.035	.300	--	1.10	0.54	594	326	3,100
[illegible]	[illegible]	2	1942	[illegible]	[illegible]	CONC.	METAL [illegible]	[illegible] METAL	.035	.300	--	1.10	0.59	70	111	2,101
[illegible]	[illegible]	1	1942	[illegible]	[illegible] FRAME	CONC.	METAL [illegible]	[illegible] METAL	.035	.300	--	1.10	0.59	112	229	2,709
[illegible]	[illegible]	1	1942	[illegible]	[illegible]	CONC.	METAL [illegible]	[illegible] METAL	.035	.300	--	[illegible]	0.59	70	212	2,100
[illegible]	[illegible]	1	1942	[illegible]	[illegible]	CONC.	METAL [illegible]	[illegible] METAL	.035	.300	--	1.10	0.59	112	129	2,769
[illegible]	[illegible]	1	1941	[illegible]	[illegible]	CONC.	METAL [illegible]	[illegible] METAL	.079	.310	--	1.10	0.59	263	196	1,131
[illegible]	[illegible]	1	1943	[illegible]	[illegible] FRAME	CONC.	METAL [illegible]	[illegible] METAL	.079	.360	--	1.10	0.59	262	196	1,110
[illegible]	[illegible]	1	1943	METAL [illegible]	[illegible]	CONC.	METAL [illegible]	[illegible] METAL	.316	.620	--	1.10	0.59	1190	252	2,099
[illegible]	[illegible]	1	1943	[illegible]	[illegible]	CONC.	METAL [illegible]	[illegible] METAL	.069	.075	--	1.10	0.13	171	90	330
[illegible]	[illegible]	1	1942	METAL [illegible]	[illegible] FRAME	CONC.	METAL [illegible]	[illegible] METAL	.079	.310	--	1.10	0.59	200	21	816
[illegible]	[illegible]	1	1942	[illegible]	[illegible]	CONC.	METAL [illegible]	[illegible] METAL	.035	.300	--	1.10	0.59	166	98	4,179

FOR CONTINUATION, SEE PART 2, PAGE 12 OF 12

A. M. KINNEY, INC.

[illegible] [illegible] 8/25/82
[illegible] [illegible] 8/16/82
AREA "B"

TABLE 1 - (CONTINUED) BUILDING DATA SHEETS - PART 2

COLUMN NO'S

(1)	(2)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
BLDG NO	NAME	COOLING SYSTEM	COOLING CAPACITY	HEATING SYSTEM	HEATING FUEL	PEAK TRANS LOAD GAIN	PEAK TRANS LOAD LOSS	DOMESTIC HOT WATER CAPACITY	DOMESTIC HOT WATER FUEL	CONNECT LOAD KW	LIGHTING LOAD KW	DEMAND KW	ANNUAL USAGE KWH	REMARKS
[illegible]	[illegible]	--	--	CONV'AT FAN [illegible]	STEAM	--	301,005	--	--	30.0	10.2	38.3	100,320	
[illegible]	[illegible]	--	--	[illegible]	STEAM	--	100,015	--	--	30.5	12.1	27.8	136,300	
[illegible]	[illegible]	--	--	[illegible]	STEAM	--	110,300	--	--	30.2	6.3	24.2	129,600	
[illegible]	[illegible]	--	--	CONV'AT FAN [illegible]	STEAM	--	101,605	--	--	33.2	18.2	23.3	131,200	
[illegible]	[illegible]	--	--	[illegible]	STEAM	--	101,605	--	--	33.2	10.2	35.3	104,200	
[illegible]	[illegible]	--	--	[illegible]	STEAM	--	101,005	--	--	30.3	10.2	35.3	122,200	
[illegible]	[illegible]	--	--	[illegible]	STEAM	--	101,605	--	--	66.3	17.6	51.9	432,960	
[illegible]	[illegible]	--	--	[illegible]	STEAM	--	121,005	--	--	66.3	15.0	62.0	234,600	
[illegible]	[illegible]	--	--	CONV'AT [illegible]	STEAM	--	301,992	--	--	66.6	10.2	62.1	236,300	
[illegible]	[illegible]	--	--	CONV'AT FAN [illegible]	STEAM	--	101,992	--	--	90.8	10.2	62.3	236,200	
[illegible]	[illegible]	--	--	H.B.	STEAM	--	184,304	--	--	32.9	2.3	22.4	125,000	
[illegible]	[illegible]	--	--	[illegible]	STEAM	--	237,200	--	--	42.7	12.6	30.1	190,900	
[illegible]	[illegible]	--	--	[illegible]	STEAM	--	187,791	--	--	31.2	10.2	30.3	190,200	
[illegible]	[illegible]	--	--	H.B.	STEAM	--	257,400	--	--	30.0	11.5	27.0	132,200	
[illegible]	[illegible]	CENTRAL [illegible]	60,000	FAN COIL	STEAM	--	56,005	40 GAL	STEAM	14.0	12.0	11.4	100,100	
[illegible]	[illegible]	--	--	FAN COIL	STEAM	--	76,005	40 GAL	STEAM	17.0	12.0	11.[illegible]	120,190	
[illegible]	[illegible]	--	--	H.B.	STEAM	--	201,540	60 GPH	STEAM	50.1	52.1	51.[illegible]	630,400	
[illegible]	[illegible]	WINDOW A.C.	--	U.H.	STEAM	--	29,600	--	--	5.0	2.2	4.4	30,190	
[illegible]	[illegible]	--	--	CONVECT	STEAM	--	67,000	30 GAL	ELEC	2.0	1.0	2.1	1,555	
[illegible]	[illegible]	--	--	--	--	--	--	--	--	0.2	0.2	3.[illegible]	6,265	

2.0 EXISTING ENERGY CONSUMPTION

Figure 2 shows that for FY 1981, coal and electricity account for 99.3 percent of all the energy consumed at HAAP.

Figure 3 plots the coal and electrical consumptions for the base year 1975 through 1981. Also plotted is equivalent RDX production and heating degree days which are used for the adjusted energy consumption plot.

Table 2 lists the fourth quarter 1981 utility costs that were used as the basis for all economic studies in this report.

Table 3 shows the present building energy use for building heating.

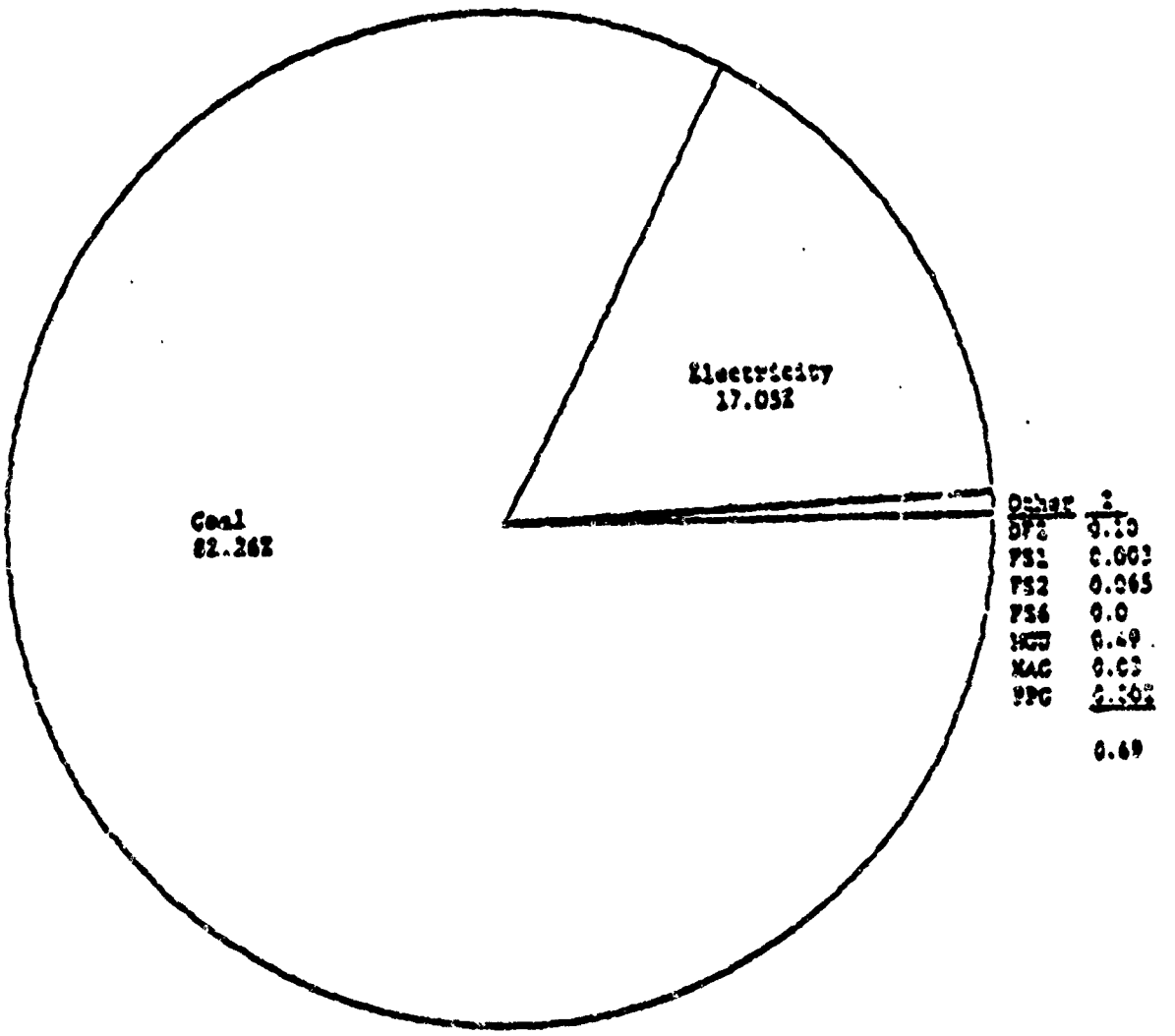
Table 4 shows the present energy use for building cooling.

Table 5 shows the present energy use for domestic water heating.

HOLSTON ARMY AMMUNITION PLANT FIGURE 2

Energy Consumption

FY-81 (Oct. 1980/Sept. 1981)



		MBtu	%	Total Dollar Cost
Diesel fuel	DF2	3,761	0.10	$ ----
Fuel oil	PS1	162	0.003	959
Fuel oil	PS2	2,347	0.065	6,361
Fuel oil	PS6	0	0.0	0
Coal, bituminous	COL	2,957,444	82.26	4,648,422
Leaded motor gasoline	MOG	17,662	0.49	----
Purchased electricity	ELE	613,991	17.05	1,786,968
Natural gas	NAG	1,190	.03	814
Propane	PPG	85	0.002	80[illegible]
Vehicular fuel				
TOTALS		3,595,386	100.0	$6,444,733

Job HOLSTON AAP

Location KINGSPORT, TENN.

Sub est

A. M. KINNEY, INC.
CONSULTING ENGINEERS
CINCINNATI, OHIO

File No. 2291 Sht. No. 3

Checked by: JWO Date 4-30-82

Computed by: RAB Date 5-25-82

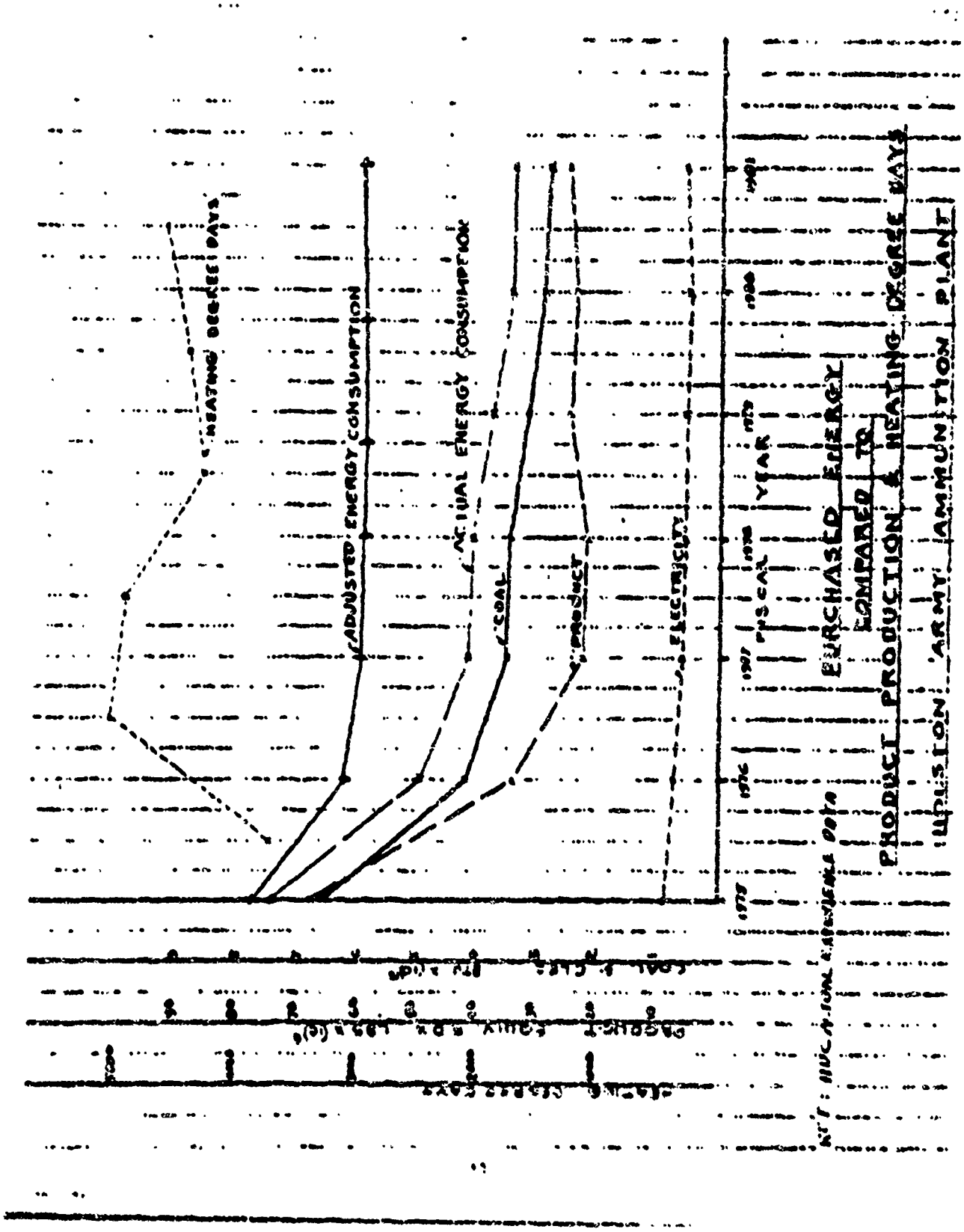


TABLE 2
HAAP UTILITY COSTS

4th Quarter FY 1983

Utility	Units	Area A	Area B
River Water	$/1,000 gal.	0.0234	0.0231
Filter Water	$/1,000 gal.	0.1315	0.1098
City Water	$/1,000 gal.	1.2935	0.5020
Compressed Air	$/1,000 cu.ft.	0.1960	0.036
Electricity	$/1,000 kWh	32.10	32.10
Steam	$/1,000 lb.	2.6740	2.6395

TABLE 3
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu) Steam	Elect.	Oil
Area A					
1	184,900	2,004	370.5	-	-
9	171,993	690	118.6	-	-
11	22 ,000	2,004	44.9	-	-
12	65,330	2,004	-	-	130.9
14	310,190	2,004	621.6	-	-
15	1,064,355	2,004	2,131.4	-	-
17	268,623	2,004	538.3	-	-
18	310,433	2,004	621.7	-	-
21	135,260	2,004	271.1	-	-
31	288,300	2,004	577.8	-	-
34	464,730	2,004	931.1	-	-
505	259,000	2,004	519.0	-	-
Area B					
2	401,369	1,420	569.9	-	-
3	550,425	2,354	1,294.5	-	-
6	403,332	2,004	808.7	-	-
7	524,654	2,004	-	-	1,05..3
8	618,649	2,004	1,239.8	-	-

TABLE 3 (CONT'D)
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu) Steam	Elect.	Oil
Area B					
8A	129,092	2,004	258.7	-	-
8D	19,474	690	13.4	-	-
9	132,600	690	-	-	91.5
12	140,300	1,420	279.9	-	-
26	1,546,414	1,420	2,195.9	-	-
100	4,194,515	2,004	8,405.8	-	-
101	1,089,409	2,004	2,183.2	-	-
102	2,119,662	2,004	4,247.8	-	-
103	2,329,432	690	1,604.6	-	-
104	446,700	2,004	895.2	-	-
105	336,445	2,004	674.2	-	-
106	823,644	2,004	1,650.6	-	-
108	321,330	2,004	643.9	-	-
110	282,370	2,004	565.9	-	-
116	375,172	2,004	751.5	-	-
118	128,648	690	88.6	-	-
119	54,225	2,004	108.7	-	-
127	132,111	2,004	257.3		
135	117,953	2,004	236.3	-	-

TABLE 3 (CONT'D)
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu) Steam	Elect.	Oil
Area B					
136	92,338	2,004	185.4	-	-
150	240,967	690	166.2	-	-
151	449,895	690	310.4	-	-
153 (See T-1b)	303,814	2,004	-	154.7	-
154	507,575	1,620	720.7	-	-
157	62,728	2,004	125.7	-	-
203	657,824	2,004	1,318.3	-	1,318.3
216	75,600	690	52.2	-	-
219	230,453	2,004	462.1	-	-
224	89,026	690	61.4	-	-
231	85,976	690	59.3	-	-
235	736,568	90% @ 2,220	-	322.9	-
315	489,573	2,004	981.1	-	-
321	372,215	1,620	-	-	-
322	331,095	2,004	663.5	-	-
323 (See T-1a)	97,300	2,004	194.9	-	-
324	1,291,930	690	891.4	-	-
335	41,048	2,004	82.4	-	-
339	202,961	1,620	328.8	-	-

TABLE 3 (CONT'D)
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu) Steam	Elect.	Oil
Area B					
556	597,636	1,420	848.7	-	-
530	359,150	2,004	719.7	-	-
634	59,624	1,420	-	84.7	-
A	32,535	695	22.6	-	-
B-1	383,603	695	264.7	-	-
B-3	353,603	695	264.7	-	-
C-3	372,680	2,004	746.9	-	-
C-5	372,680	2,004	746.9	-	-
C-6	297,955	2,004	597.1	-	-
F-3	412,945	2,004	827.5	-	-
F-5	412,945	2,004	827.5	-	-
H-1	199,458	2,004	399.7	-	-
H-3	199,458	2,004	399.7	-	-
H-4	199,458	2,004	399.7	-	-
H-5	199,458	2,004	399.7	-	-
H-6	199,458	2,004	399.7	-	-
J-3	301,485	2,004	604.2	-	-
J-4	301,485	2,004	604.2	-	-
J-6	301,485	2,004	604.2	-	-

TABLE 3 (CONT'D)
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu) Steam	Elect.	Oil
Area 3					
J-3	301,485	2,004	604.2	-	-
J-4	301,485	2,004	604.2	-	-
J-5	301,485	2,004	604.2	-	-
K-3	130,875	2,004	262.3	-	-
K-5	114,340	2,004	229.1	-	-
L-3	301,485	2,004	604.2	-	-
L-4	301,485	2,004	604.2	-	-
L-6	301,485	2,004	604.2	-	-
M-3	301,485	2,004	604.2	-	-
M-4	301,485	2,004	604.2	-	-
M-5	301,485	2,004	604.2	-	-
M-6	301,485	2,004	604.2	-	-
N-3	182,701	2,004	366.1	-	-
N-4	257,280	2,004	515.6	-	-
N-5	182,701	2,004	366.1	-	-
N-6	257,280	2,004	515.6	-	-
O-3	76,385	2,004	152.5	-	-
O-5	76,385	2,004	152.5	-	-
P-3	503,340	2,004	1,009.1	-	-

TABLE 3 (CONT'D)
PRESENT ENERGY USE FOR BUILDING HEATING

Bldg. No.	Design Day Heat Loss (Btu/Hour)	Equiv. Full Load Heating Hours	Annual Energy (Mega Btu.) Steam	Elect.	Oil
Area B					
R-3	29,690	2,004	59.5	-	-
R-1	47,846	2,004	95.9	-	-
Office (Sldg. Stor.)	13,619	2,004	-	27.3	-
Motor Control (Aerator)	16,080	690	-	11.1	-
Pump House (Sldg. Waste)	7,718	690	-	5.3	-
Motor Control (Digestor)	16,840	690	-	11.6	-
Motor Control (Filter)	11,363	690	-	7.8	-
Sldg. Trans. Pump Bldg.	22,584	690	-	15.6	-
Tank Drain Pump Bldg.	9,412	690	-	6.5	-
Land Fill Office	9,989	2,004	-	20.0	-
Elect. Bldg (Area A-1)	8,216	690	-	5.7	-
Compressor (Area A-1)	8,216	690	-	5.7	-
TOTALS			61,858.1	1,178.4	2,493.1
GRAND TOTAL			65,629.1 Mega Btu/year		

TABLE 4

PRESENT ENERGY USE FOR BUILDING COOLING

Bldg. No.	Design Day Heat Gain (Btu/Hour)	Annual Energy (Mega Btu) Fans	Condenser/ Chiller	Total
Area 3				
12	140,620	215.2	237.4	452.6
26	364,512	194.7	265.3	460.0
127	73,756	48.8	65.0	113.7
136 (Auto Din)	63,133	17.9	55.2	73.1
(Admin.)	76,064	39.0	81.9	120.9
(EAM Equip.)	39,840	33.4	81.4	114.8
155 (T-1b)	429,84.	307.9	461.9	769.8
156	127,681	91.3	137.0	228.3
235	369,776	58.9	244.3	302.8
328 (T-1a)	127,670	30.2	79.1	109.3
TOTAL				2,745.1

TABLE 3
PRESENT ENERGY USE FOR DOMESTIC WATER HEATING

Bldg. No.	Water Use (1,000 Gal/Year)	Annual Energy (Mega Btu) Steam	Elect.
Area A			
1	1.6	2.7	•
9	3.3	•	1.5
16	16.6	•	61.6
17	3.3	•	1.5
18	4.7	2.2	•
21	7.0	•	3.2
31	16.3	61.4	•
34	3.1	•	1.6
905	1.0	•	2.5
TOTALS AREA A	53.5	64.3	69.9
Area B			
2	5.9	•	2.7
4	11.5	•	5.3
7	27.3	•	12.5
8	25.7	11.7	•
12	15.6	•	7.1
26	66.3	•	30.4

TABLE 5 (CONTD)
PRESENT ENERGY USE FOR DOMESTIC WATER HEATING

Bldg. No.	Water Use (1,000 Gal/Year)	Annual Energy (Mega Btu) Steam	Elect.
Area B			
100	10.8	-	4.8
102	20.8	-	9.5
105	5.2	-	2.4
106	2,129.5	2,226.3	-
108	1,153.2	832.5	-
110	3.1	1.4	-
116	1.6	-	0.7
119	3.3	-	1.5
127	4.3	-	2.0
135	43.7	-	20.0
136	13.3	-	6.1
155	76.1	-	34.9
156	42.1	-	19.3
157	0.8	-	0.4
203	4.8	-	2.2
219	40.2	-	18.4
315	6.6	-	3.0
322	348.6	130.7	-

TABLE 5 (CONT'D)
PRESENT ENERGY USE FOR DOMESTIC WATER HEATING

Bldg. No.	Water Use (1,000 Gal/Year)	Annual Energy (Mega Btu) Steam	Elect.
Area B			
328	4.8	-	3.1
339	1.0	-	0.5
634	1.6	-	0.7
F-3	992.8	363.6	-
F-5	386.3	144.8	-
O-3	13.1	6.0	-
O-5	13.1	6.0	-
P-3	875.8	328.2	-
W-1	3.3	-	1.5
TOTALS AREA B	4,343.3	3,656.2	189.0
TOTALS			
Area A	53.5	66.3	68.0
Area B	4,343.3	3,656.2	189.0
TOTALS	4,396.8	3,722.5	257.0
GRAND TOTAL		3,977.5 Mega Btu	

3.0 ENERGY CONSERVATION MEASURES

The following areas were investigated for energy conservation:

a. Architectural. Air infiltration, insulation, storm windows, caulking, weather stripping, entry vestibules, surplusing buildings.

b. Heating, Ventilation and Air-conditioning. Outside air dampers, variable air volume, window air-conditioners, recirculation fans, new air-conditioning units, steam heat, heat recovery, burning waste engine oil, cooling tower, radiator valves, air curtain, ductwork, unit heater setback and interlock air-conditioning with lights.

c. Electrical. Power factor correction, transformer core loss, demand peak limiting, relamping, refixturing and reballasting.

d. Plumbing. Shower heads, water heaters, heat recovery, heat pump, solar hot water heater.

e. Boiler House. Steam venting, combustion airflow, hot water drains.

f. Utilities. Steam piping insulation, condensate return, coal handling, turbulators, river water pumping, air compressors, biomass fuel, cogeneration, high temperature hot water, soot blowers.

4.0 ENERGY AND COST SAVINGS

Table 6 lists the energy conservation investment program projects and Facilities Engineer Energy Conservation Measures. All projects are to be in operation in FY 1989 unless otherwise noted.

TABLE 6
RECOMMENDED PROJECTS AND RATIOS

Item	Description	Cost ($ K)	E/C Ratio	B/C Ratio	Years to Payback	Savings (Mega Btu)
T-1	Building Energy Conservation Projects	175.3	89.6	5.1	2.1	15,750
T-2	Small Boiler Feedwater Pump - Area A	142.3	382.5	27.0	0.5	56,608
T-3	Small Boiler Feedwater Pump - Area B	170.0	131.1	9.2	1.5	22,285
T-4	Additional Insulation H.P. Steam Pipe - Area B	1,331.0	20.0	1.2	11.0	25,379
FE-ECM-1	Water Flow Restrictors	2.8	505.0	33.7	0.3	1,344
FE-ECM-2	Programmable Clock Controller	3.7	327.6	23.4	0.5	1,151
FE-ECM-3	Refixturing, Reballasting and Relamping Lights					
a.	Replacing Standard Fluorescent Lamps with High Efficiency Fluorescent Lamps - 8,736 Hr/Yr Lamps FY-84	0.729	500	33.33	0.5	365
b.	Refixturing Six Change Houses in Area B, 1983 Project	41.237	127	11.66	1.25	4,982
c.	Replacing Standard Fluorescent Lamps with High Efficiency Fluorescent Lamps - 2,600 Hr/Yr Lamps FY-90	1.237	103	9.55	1.2	127

TABLE 6 (CONT'D)
RECOMMENDED PROJECTS AND RATIOS

Item	Description	Cost ($1,000)	E/C Ratio	B/C Ratio	Years to Payback	Savings (Mega Btu)
g.	Replacing Standard Ballasts with High Frequency, High Efficiency Ballasts - 8,736 Hr/Yr Operation FY-84	3.930	104	6.4	2.4	618
g.	Replacing Standard Ballasts with High Frequency, High Efficiency Ballasts - 8,736 Hr/Yr Operation FY-88	3.387	82.6	8.28	1.85	280
f.	Refixturing Six Office or Shop Buildings in Area B 1986 Project	42.609	70.4	7.67	1.89	2,838
g.	Replacing Standard Ballasts with High Frequency, High Efficiency Ballasts - 8,736 Hr/Yr Operation FY-91	6.233	69.4	10.9	1.5	436
h.	Refixturing Seven Buildings in Area A, 1984 Project	159.771	66.5	5.57	2.4	6,935
i.	Replacing Standard Ballasts with High Frequency, High Efficiency Ballasts - 2,600 Hr/Yr Operation FY-88	26.191	24.6	2.46	4.2	644

TABLE 6 (CONTD)
RECOMMENDED PROJECTS AND RATIOS

Item	Description	Cost ($1,000)	E/C Ratio	B/C Ratio	Years to Payback	Savings (Mega Btu)
j.	Replacing Standard Ballasts with High Frequency, High Efficiency Ballasts - 2,600 Hr/Yr Operation FY-91	53.061	20.6	2.98	5	1,095
k.	Replacing Existing Street Lighting Fixtures with High Pressure Sodium Fixtures Over a 10 Year Period (1983-1992)	14.319 to 24.529	8.6 to 5.1	2.3 to 2.76	4.8 to 4.3	126 to 126
FE-ECM-4	Feed Pump Recirc. Area A, FY-83	19.9	620	8.29	9.6	11,700
FE-ECM-5	Feed Pump Recirc. Area B, FY-83	19.9	331	4.4	1.1	6,243
FE-ECM-6	Feed Pump Recirc. Area B, Dec. - March FY-89	26.43	69.1	4.9	2.9	1,327
FE-ECM-7	Elect. Driven Deaerator Pump - Area A, FY-83	0	-	-	-	14,663
FE-ECM-8	Elect. Driven Deaerator Pump - Area B, FY-83	0	-	-	-	16,318
FE-ECM-9	Increase Deaerator Pressure - Area B, FY-83	0	-	-	-	2,768

5.0 INCREMENT A - ENERGY CONSERVATION INVESTIGATIONS FOR BUILDINGS

A survey of all buildings was made at the site to determine the condition of the buildings and to locate areas where building energy use could be improved.

This survey resulted in a number of Energy Conservation Measures which were developed into one overall ECIP for Building Energy Conservation Projects (ECIP T-1) consisting of:

a. Install a 12,000 Btu window air-conditioning unit in the shift foremen's office in Building No. 325 and reconnect existing steam heating radiator to existing low pressure steam line. The addition of the small air-conditioning unit to serve the shift foremen will allow the main building air-conditioning system to be shut down during nights and weekends.

b. Install a small air-conditioning unit and air-cooled condensing unit in Building No. 155 and modify existing ductwork, install temperature controls and electrical interlock with existing main air-conditioning unit. The addition of the small air-conditioning unit to serve the reduced number of building occupants during the night and weekend shifts will allow the main unit to be shut down during these periods.

c. Install electronic temperature programmers to automatically set back the thermostat setting of the unit heaters at four buildings in Area A and 15 buildings in Area B. For a list of buildings involved, see ECIP T-1 in Volume IV. The addition of these programmers will allow the unit heaters to operate at a lower temperature during night and weekend unoccupied hours.

f. Install variable frequency motor speed controllers on the supply and return fan motors on the variable air volume air-conditioning system in Building No. 26. The addition of the speed controllers will replace the use of constant speed fan motors with inlet dampers to control the volume of air handled by the system. The inlet vane dampers reduce the required power input to the motor somewhat; however, adding variable frequency controllers substantially reduces the required power input to the motor.

g. Install 3-1/2 inches of insulation to the underside of uninsulated floors that are over unheated crawl spaces in Buildings No. 2, 4 and 6. The addition of this insulation will reduce the building heat loss during the winter heating season.

h. Install an entrance vestibule at an exterior door and limit the use of all other exterior doors as emergency exits only, in the orange houses, Buildings No. 14, 21, 31, 103, 135, 176, 219, 323, F-3, F-5 and P-3. The addition of vestibules and restricting the use of the other doors will reduce the amount of air infiltration in the winter, thus reducing the amount of building heat required.

i. Install automatic temperature control valves on steam heating radiators in Building No. 1 in Area A and Building No. 4 in Area B to thermostatically control the steam supply. The automatic control valves will replace existing manual shutoff valves. The addition of the automatic temperature control valves will allow for accurate space temperature control, preventing overheating, thus saving on the use of steam.

6.0 INCREMENT B - ENERGY CONSERVATION INVESTIGATIONS OF UTILITIES DISTRIBUTION SYSTEMS, EMCS

Increment B is the study of all on-Base utility systems and the consideration of Energy Monitoring Control Systems (EMCS).

The on-Base utility systems are generally in good repair. The systems have been reviewed and improved in the past for energy conservation. The following are the energy conservation recommendations and conclusions resulting from this study:

a. Install additional insulation to the high pressure steam distribution piping in Area B.

b. It is not economical to add additional insulation to the high pressure steam distribution piping in Area A or the low pressure steam distribution piping in Area B.

c. It is not economical to install a condensate return system in Area B.

d. Continue the steam trap maintenance program.

e. Install smaller turbine-driven boiler feedwater pumps in both Area A and Area B boiler houses.

f. Install a boiler blowdown heat exchanger in the flash tank drain after the excess steam venting from the 5 psig steam system is eliminated.

g. Installation of turbulators in Area A waste heat boilers is not justified at the present low steam load.

h. Continue to monitor the recently implemented program to not operate the one road river water pump.

j. Incorporate, in future replacement of air compressors, an air dryer that utilizes the heat of compression.

j. A Base-wide Energy Monitoring and Controls System (EMCS) was investigated, but was found to be not feasible at this plant due to the limited energy savings which would be accomplished, and to the higher than average cost of transmitting the control and reporting signals over the long distances involved.

Local time clock controls are recommended for individual buildings.

7.0 INCREMENT E (MOD) - CENTRAL BOILER PLANTS

Increment E (Mod) is a program of modernization for existing central boiler plants. HAAP is served by similar central boiler plants in Area A and Area B, which are each about 40 years old and located about 6.3 miles apart. See Map, Figure 1, Page 2.

The coal-fired boilers are generally in excellent operating condition. The boilers have been derated due to a lack of fan capacity to handle the added particulate removal equipment. Each steam plant is capable of meeting the approved mobilization plan (Sierra VII), assuming the electrostatic precipitators with the pulverized coal-fired boilers are repaired or replaced as previously planned.

7.1 Existing Plans

It is recommended that the following existing plans be implemented:

a. Modernize the coal handling systems.

b. Continue the program of adding boiler overfire air systems to the stoker-fired boilers.

c. Add an oxygen analyzer to one boiler to help control excess combustion air on a test basis.

d. Replace the above mentioned electrostatic precipitators.

7.2 Results

The following is recommended or concluded as a result of the Increment E (Mod) investigations:

a. Biomass, in the form of wood, could be burned in the Area B stoker-fired boilers. This requires the addition of wood handling equipment to the proposed coal handling system.

e. Install a cogenerating turbine generator in Building B-6, Area B. Convert the existing high pressure steam header north of the C buildings to a low pressure steam header connecting the turbine generator to new distribution piping to the production buildings presently in operation.

f. The soot blower controls should be automated.

g. All boilers not required to be operated should be placed in a true layaway condition.

g. The boiler combustion air to the forced draft fan should be ducted from outside in the winter and from the upper areas of the boiler house in the summer.

f. No attempt should be made to burn any fuel other than natural gas or oil in the presently laid-away boilers in Building No. 222.

g. The existing ash handling systems are adequate even though they do not reflect the latest removal methods normally found in plants of this size.

h. Installation of a high temperature hot water heating system for modernization purposes is not feasible.

8.0 INCREMENT F - FACILITIES ENGINEER ENERGY CONSERVATION MEASURES (FE-ECM)

Increment F develops recommendations that can be used to update the Installation Base-wide Energy Systems Plan. These recommendations include changes, alterations or modifications to systems operations that are under the control and funding authority of the Facilities Engineer.

The following are the recommendations resulting from this study:

a. Reduce the excess low pressure steam venting to atmosphere from each boiler house by incorporating the following operational modifications:

(1) Operate the motor driven deaerator feedwater pump with the turbine-driven pump on warm standby in both Area A and Area B boiler houses.

(2) Reduce the boiler blowdown flows to the minimum acceptable level.

(3) Increase the Area B deaerator and low pressure steam system pressure.

b. Programmable time clocks with temperature setback are recommended for individual buildings.

c. Water flow restricters are recommended for the shower heads at all change houses and other areas where shower facilities are provided.

d. Reballasting, relamping and refixturing are recommended for all buildings as replacements are required.

e. Additional training of personnel is not required.

9.0 INCREMENT G - NON-ECIP MAINTENANCE, REPAIR AND MINOR CONSTRUCTION PROJECTS

Increment G is the identification of non-ECIP maintenance, repair and minor construction projects.

The level of maintenance presently performed at HAAP is typical of a well-run chemical plant.

One major maintenance item was found. The multiport relief valve in each boiler house low pressure steam system should be inspected for leakage after it has been determined that high pressure steam is required for makeup to the low pressure system.

It is recommended that an automatic recirculation control system be installed in each boiler feedwater pump recirculation line as a minor construction project in order to reduce the excess low pressure steam venting. Automatic shutoff of the recirculation flow at feedwater flows above the pump minimum flow will reduce the pump horsepower requirements, which will reduce the turbine exhaust low pressure steam flow.