TM-1436
Appendix IV

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
SYSTEMS ANALYSIS

12 NOVEMBER, 1986

ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
BUILDING SECTOR PHYSICAL PARAMETERS AND DESCRIPTION

12 NOVEMBER, 1986

ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

COMPLEX BUILDING INPUT SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86
Site : AURORA,IL FERMI, User Defined 60117862.0

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1. ROOM CONDITIONS AND FLOOR AREAS

Thermostat settings : Cooling = 78 F; Heating = 68 F; Setback = 5 F
Warm-up factor = 0 %; Room design relative humidity = 50 %
Floor Areas: Perimeter = 19,900 Sqft; Interior = 23,010 Sqft
Cooling provided during unoccupied period.

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2. WALLS, ROOF, GLASS, SKYLIGHTS:

Exposure	Area (Sqft)	U-Factor BTU/(hr-sqft-F)	Glass Area (Sqft)	Glass U-Factor BTU/(hr-sqft-F)
North Wall	0	0.060	3,360	0.550
Northeast Wall	0	0.060	5,640	0.550
East Wall	1,630	0.060	690	0.550
Southeast Wall	3,260	0.060	1,380	0.550
South Wall	3,260	0.060	1,380	0.550
Southwest Wall	5,540	0.060	2,340	0.550
West Wall	0	0.060	380	0.550
Northwest Wall	0	0.060	3,220	0.550
Perimeter Roof	12,740	0.050	0	0.001
Interior Roof	12,760	0.050	0	0.001

WALLS: Color = Light; Wt. = Medium; ROOF: Color = Medium; Wt. = Medium
BUILDING WT. = Medium; VERTICAL GLASS : Double Glazed
Shade Factors : Glass = 0.650 ; Skylights = 0.000
Internal shades are used. ; A ceiling plenum is used.

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3. LIGHTS:

Perimeter : 3.000 Watts/Sqft = 59,700 Watts Total
Interior : 3.000 Watts/Sqft = 69,030 Watts Total
Diversity Factors : Occupied = 95 %; Unoccupied = 20 %
Perimeter Lights : Ballast , recessed
Interior Lights : Ballast , recessed

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4. MISCELLANEOUS ELECTRICAL LOADS:

Perimeter : Occupied = 2.198 Watts/Sqft = 43,750 Watts Total
Unoccupied = 0.942 Watts/Sqft = 18,750 Watts Total
Interior : Occupied = 3.839 Watts/Sqft = 88,340 Watts Total
Unoccupied = 2.742 Watts/Sqft = 63,100 Watts Total

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5. PEOPLE LOADS

Total Occupancy = 550 sqft/person = 78 people total
Activity Level: 2. Office or retail
Sensible = 245.0 BTU/hr/person; Latent = 205.0 BTU/hr/person
Diversity Factors : Occupied = 70 %; Unoccupied = 20 %

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6. MISCELLANEOUS INTERNAL LOADS:

Sensible : Occupied = 0 BTU/hr; Unoccupied = 0 BTU/hr
Latent : Occupied = 0 BTU/hr; Unoccupied = 0 BTU/hr

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7. WALLS ADJACENT TO NON-CONDITIONED REGIONS:

Wall Areas : Perimeter = 2,640 Sqft; Interior = 5,900 Sqft
Wall U-Factor = 0.380 BTU/(hr-sqft-F)
Adjacent region heating temperature = 65 F
Adjacent region is not cooled

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8. INFILTRATION DATA:

Air Flow Rates: Occupied = 600 cfm; Unoccupied = 200 cfm

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
BUILDING LOAD CALCULATIONS

12 NOVEMBER, 1986

ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

LOAD PROFILE SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-10-86

Site Name : AURORA,IL FERMI, User Defined 60117862.0

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TABLE 1. OCCUPIED PERIOD (Load does not include vent. load, fan heat)

Bin Temp (F)	Bin Hours (hr/yr)	<-------Perimeter Zone------> Sensible (tons)	Latent (tons)	Plenum (tons)	Zone (F)	<--------Interior Zone-----> Sensible (tons)	Latent (tons)	Plenum (tons)	Zone (F)
93	0.0	85.96	1.82	7.50	78	46.45	0.71	8.49	78
90	25.8	69.45	0.94	6.85	78	44.63	0.50	7.80	78
85	59.4	62.67	0.71	6.66	78	43.61	0.50	7.60	78
80	145.3	55.89	0.50	6.46	78	42.59	0.50	7.41	78
75	237.7	49.11	0.33	6.26	78	41.57	0.50	7.21	78
70	270.6	42.32	0.17	6.07	78	40.56	0.50	7.01	78
65	264.5	35.54	0.05	5.87	78	39.54	0.50	6.81	78
60	255.0	29.18	-0.06	5.67	78	39.45	0.50	6.62	78
55	244.7	22.81	-0.15	5.47	78	39.37	0.50	6.42	78
50	232.1	16.45	-0.22	5.28	78	39.28	0.50	6.22	78
45	229.5	10.09	-0.53	5.08	78	39.20	0.50	6.02	78
40	237.6	3.72	-0.80	4.88	78	39.11	0.50	5.83	78
35	238.5	0.00	0.00	0.00	--	39.03	0.50	5.63	78
30	218.2	0.00	0.00	0.00	--	38.94	0.50	5.43	78
25	174.5	-4.71	-0.67	4.66	68	38.86	0.50	5.23	78
20	122.4	-11.07	-0.81	4.46	68	38.78	0.50	5.04	78
15	78.1	-17.44	-0.92	4.27	68	38.69	0.50	4.84	78
10	46.1	-23.80	-1.01	4.07	68	38.61	0.50	4.64	78
5	25.1	-30.17	-1.09	3.87	68	38.52	0.50	4.44	78
0	12.7	-36.53	-1.14	3.68	68	38.44	0.50	4.25	78
-5	6.2	-42.89	-1.19	3.48	68	38.35	0.50	4.05	78
-6	4.6	-44.17	-1.19	3.44	68	38.33	0.50	4.01	78

TABLE 2. UNOCCUPIED PERIOD (Load does not include vent. load, fan heat)

90	14.6	50.39	0.29	2.08	78	24.14	0.14	2.28	78
85	36.3	43.79	0.21	1.88	78	23.12	0.14	2.08	78
80	99.3	37.19	0.15	1.68	78	22.10	0.14	1.88	78
75	215.3	30.59	0.09	1.49	78	21.08	0.14	1.69	78
70	357.6	24.00	0.04	1.29	78	20.07	0.14	1.49	78
65	463.3	17.40	-0.01	1.09	78	19.05	0.14	1.29	78
60	500.4	11.22	-0.04	0.90	78	18.96	0.14	1.09	78
55	482.0	5.04	-0.07	0.70	78	18.88	0.14	0.90	78
50	447.6	0.00	0.00	0.00	--	18.79	0.14	0.70	78
45	422.7	0.00	0.00	0.00	--	18.71	0.14	0.50	78
40	413.7	0.00	0.00	0.00	--	18.62	0.14	0.30	78
35	417.0	-4.25	-0.02	0.47	63	18.54	0.14	0.11	78
30	417.4	-10.43	-0.09	0.27	63	18.45	0.14	-0.09	78
25	395.2	-16.61	-0.15	0.07	63	18.37	0.14	-0.29	78
20	336.9	-22.79	-0.19	-0.12	63	18.29	0.14	-0.49	78
15	252.8	-28.97	-0.23	-0.32	63	18.20	0.14	-0.68	78
10	165.7	-35.15	-0.26	-0.52	63	18.12	0.14	-0.88	78
5	96.3	-41.33	-0.29	-0.72	63	18.03	0.14	-1.08	78
0	50.9	-47.51	-0.31	-0.91	63	17.95	0.14	-1.28	78
-5	25.3	-53.69	-0.32	-1.11	63	17.86	0.14	-1.47	78
-6	21.1	-54.93	-0.32	-1.15	63	17.84	0.14	-1.51	78
-6	0.0	-65.08	-0.45	-2.56	63	-0.73	0.00	-2.57	63

SOLAR GAIN SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-10-86

Site Name : AURORA,IL FERMI, User Defined 60117862.0

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TABLE 1. SOLAR GAINS BY EXPOSURE

Bin Temp (F)	Solar Gains by Exposure (BTU/(hr-sqft)) North	NE	East	SE	South	SW	West	NW	Perim Horiz	Inter Horiz
93	9.7	15.0	22.2	23.2	33.9	67.7	66.5	32.0	0.0	0.0
90	6.9	10.7	15.7	16.5	24.1	48.0	47.1	22.6	0.0	0.0
85	6.5	10.1	14.9	15.7	23.0	45.7	44.8	21.5	0.0	0.0
80	6.2	9.6	14.2	14.9	21.8	43.3	42.4	20.3	0.0	0.0
75	5.8	9.0	13.4	14.2	20.7	40.9	40.0	19.1	0.0	0.0
70	5.5	8.5	12.6	13.4	19.6	38.6	37.7	18.0	0.0	0.0
65	5.1	7.9	11.8	12.6	18.5	36.2	35.3	16.8	0.0	0.0
60	4.8	7.4	11.0	11.8	17.4	33.9	32.9	15.6	0.0	0.0
55	4.4	6.8	10.3	11.0	16.2	31.5	30.6	14.4	0.0	0.0
50	4.1	6.3	9.5	10.3	15.1	29.2	28.2	13.3	0.0	0.0
45	3.7	5.7	8.7	9.5	14.0	26.8	25.8	12.1	0.0	0.0
40	3.4	5.2	7.9	8.7	12.9	24.4	23.5	10.9	0.0	0.0
35	3.0	4.6	7.1	7.9	11.8	22.1	21.1	9.8	0.0	0.0
30	2.7	4.1	6.4	7.2	10.6	19.7	18.8	8.6	0.0	0.0
25	2.3	3.5	5.6	6.4	9.5	17.4	16.4	7.4	0.0	0.0
20	2.0	3.0	4.8	5.6	8.4	15.0	14.0	6.3	0.0	0.0
15	1.6	2.4	4.0	4.8	7.3	12.7	11.7	5.1	0.0	0.0
10	1.2	1.9	3.2	4.1	6.2	10.3	9.3	3.9	0.0	0.0
5	0.9	1.3	2.5	3.3	5.0	8.0	6.9	2.8	0.0	0.0
0	0.5	0.8	1.7	2.5	3.9	5.6	4.6	1.6	0.0	0.0
-5	0.2	0.2	0.9	1.7	2.8	3.2	2.2	0.4	0.0	0.0
-6	0.1	0.1	0.7	1.6	2.6	2.8	1.7	0.2	0.0	0.0
-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ETD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-10-86

Site Name : AURORA,IL FERMI, User Defined 60117862.0

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TABLE 1. OCCUPIED PERIOD

Bin Temp (F)	Equivalent Temperature Differences (F) By Exposure North	NE	East	SE	South	SW	West	NW	Perim Roof	Inter Roof
93	8.0	9.9	11.2	16.5	20.0	18.5	15.0	9.3	30.4	30.4
90	5.4	6.7	7.6	11.4	13.9	12.8	10.3	6.3	21.7	21.7
85	1.0	2.2	3.1	6.7	9.1	8.1	5.7	1.8	16.4	16.4
80	-3.4	-2.2	-1.4	2.1	4.2	3.4	1.1	-2.6	11.1	11.1
75	-7.8	-6.7	-5.9	-2.6	-0.6	-1.4	-3.6	-7.1	5.8	5.8
70	-12.2	-11.2	-10.4	-7.3	-5.4	-6.1	-8.2	-11.5	0.5	0.5
65	-16.6	-15.6	-14.9	-11.9	-10.2	-10.8	-12.8	-15.9	-4.9	-4.9
60	-21.0	-20.1	-19.4	-16.6	-15.0	-15.5	-17.5	-20.4	-10.2	-10.2
55	-25.4	-24.5	-23.9	-21.3	-19.8	-20.3	-22.1	-24.8	-15.5	-15.5
50	-29.8	-29.0	-28.4	-25.9	-24.6	-25.0	-26.7	-29.3	-20.8	-20.8
45	-34.2	-33.5	-32.9	-30.6	-29.4	-29.7	-31.4	-33.7	-26.1	-26.1
40	-38.6	-37.9	-37.4	-35.3	-34.2	-34.4	-36.0	-38.1	-31.4	-31.4
35	-----	-----	-----	-----	-----	-----	-----	-----	-----	-36.7
30	-----	-----	-----	-----	-----	-----	-----	-----	-----	-42.0
25	-41.8	-41.3	-40.9	-39.3	-38.7	-38.6	-39.9	-41.5	-37.3	-47.3
20	-46.2	-45.8	-45.4	-43.9	-43.5	-43.4	-44.5	-45.9	-42.6	-52.6
15	-50.5	-50.2	-50.0	-48.6	-48.3	-48.1	-49.2	-50.3	-47.9	-57.9
10	-54.9	-54.7	-54.5	-53.3	-53.1	-52.8	-53.8	-54.8	-53.2	-63.2
5	-59.3	-59.2	-59.0	-57.9	-57.9	-57.5	-58.4	-59.2	-58.6	-68.6
0	-63.7	-63.6	-63.5	-62.6	-62.7	-62.3	-63.1	-63.7	-63.9	-73.9
-5	-68.1	-68.1	-68.0	-67.3	-67.5	-67.0	-67.7	-68.1	-69.2	-79.2
-6	-69.0	-69.0	-68.9	-68.2	-68.5	-67.9	-68.6	-69.0	-70.2	-80.2

TABLE 2. UNOCCUPIED PERIOD

90	5.4	6.7	7.6	11.4	13.9	12.8	10.3	6.3	21.7	21.7
85	1.0	2.2	3.1	6.7	9.1	8.1	5.7	1.8	16.4	16.4
80	-3.4	-2.2	-1.4	2.1	4.2	3.4	1.1	-2.6	11.1	11.1
75	-7.8	-6.7	-5.9	-2.6	-0.6	-1.4	-3.6	-7.1	5.8	5.8
70	-12.2	-11.2	-10.4	-7.3	-5.4	-6.1	-8.2	-11.5	0.5	0.5
65	-16.6	-15.6	-14.9	-11.9	-10.2	-10.8	-12.8	-15.9	-4.9	-4.9
60	-21.0	-20.1	-19.4	-16.6	-15.0	-15.5	-17.5	-20.4	-10.2	-10.2
55	-25.4	-24.5	-23.9	-21.3	-19.8	-20.3	-22.1	-24.8	-15.5	-15.5
50	-----	-----	-----	-----	-----	-----	-----	-----	-----	-20.8
45	-----	-----	-----	-----	-----	-----	-----	-----	-----	-26.1
40	-----	-----	-----	-----	-----	-----	-----	-----	-----	-31.4
35	-28.0	-27.4	-26.9	-24.9	-24.0	-24.2	-25.6	-27.6	-21.7	-36.7
30	-32.4	-31.9	-31.4	-29.6	-28.8	-28.9	-30.3	-32.0	-27.0	-42.0
25	-36.8	-36.3	-35.9	-34.3	-33.7	-33.6	-34.9	-36.5	-32.3	-47.3
20	-41.2	-40.8	-40.4	-38.9	-38.5	-38.4	-39.5	-40.9	-37.6	-52.6
15	-45.5	-45.2	-45.0	-43.6	-43.3	-43.1	-44.2	-45.3	-42.9	-57.9
10	-49.9	-49.7	-49.5	-48.3	-48.1	-47.8	-48.8	-49.8	-48.2	-63.2
5	-54.3	-54.2	-54.0	-52.9	-52.9	-52.5	-53.4	-54.2	-53.6	-68.6
0	-58.7	-58.6	-58.5	-57.6	-57.7	-57.3	-58.1	-58.7	-58.9	-73.9
-5	-63.1	-63.1	-63.0	-62.3	-62.5	-62.0	-62.7	-63.1	-64.2	-79.2
-6	-64.0	-64.0	-63.9	-63.2	-63.5	-62.9	-63.6	-64.0	-65.2	-80.2
-6	-69.0	-69.0	-69.0	-69.0	-69.0	-69.0	-69.0	-69.0	-69.0	-69.0

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0124

Bin Number : 1 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 90 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	353,112	0
Glass Transmission	121,374	0
Wall Transmission	9,948	0
Roof Transmission	8,294	0
Transmission Load For Wall Adjacent to Non-Cond Region	38,942	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	7,920	6,071
Total Room Loads	1,369,005	17,264
Total Room Tons	114.08	1.44
Total Room sqft/ton	376.13	29,826.11
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	19,353 Btu/hr	

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TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	22,176	23,049
Northeast Glass	5,640	37,224	60,078
East Glass	690	4,554	10,848
Southeast Glass	1,380	9,108	22,745
South Glass	1,380	9,108	33,230
Southwest Glass	2,340	15,444	112,359
West Glass	380	2,508	17,917
Northwest Glass	3,220	21,252	72,886
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	745	-
Southeast Wall	3,260	2,233	-
South Wall	3,260	2,711	-
Southwest Wall	5,540	4,259	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	13,813	-
Interior Roof	12,760	13,835	-

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SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86
Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0114
Bin Number : 2 Perimeter Zone Indoor DB = 78 F
Outdoor Dry Bulb = 85 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	335,496	0
Glass Transmission	70,802	0
Wall Transmission	6,082	0
Roof Transmission	6,264	0
Transmission Load For Wall Adjacent to Non-Cond Region	22,716	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	4,620	3,276
Total Room Loads	1,275,395	14,469
Total Room Tons	106.28	1.21
Total Room sqft/ton	403.73	35,588.36
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	14,616 Btu/hr	

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TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	12,936	21,871
Northeast Glass	5,640	21,714	56,975
East Glass	690	2,657	10,309
Southeast Glass	1,380	5,313	21,674
South Glass	1,380	5,313	31,685
Southwest Glass	2,340	9,009	106,844
West Glass	380	1,463	17,018
Northwest Glass	3,220	12,397	69,120
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	304	-
Southeast Wall	3,260	1,320	-
South Wall	3,260	1,770	-
Southwest Wall	5,540	2,688	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	10,431	-
Interior Roof	12,760	10,448	-

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SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0106

Bin Number : 3 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 80 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	317,881	0
Glass Transmission	20,229	0
Wall Transmission	2,217	0
Roof Transmission	4,233	0
Transmission Load For Wall Adjacent to Non-Cond Region	6,490	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	1,320	833
Total Room Loads	1,181,785	12,026
Total Room Tons	98.48	1.00
Total Room sqft/ton	435.71	42,816.48
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	9,878 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	3,696	20,693
Northeast Glass	5,640	6,204	53,873
East Glass	690	759	9,771
Southeast Glass	1,380	1,518	20,603
South Glass	1,380	1,518	30,140
Southwest Glass	2,340	2,574	101,330
West Glass	380	418	16,118
Northwest Glass	3,220	3,542	65,354
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-136	-
Southeast Wall	3,260	407	-
South Wall	3,260	830	-
Southwest Wall	5,540	1,117	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	7,050	-
Interior Roof	12,760	7,061	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0106

Bin Number : 3 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 80 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	317,881	0
Glass Transmission	20,229	0
Wall Transmission	2,217	0
Roof Transmission	4,233	0
Transmission Load For Wall Adjacent to Non-Cond Region	6,490	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	1,320	833
Total Room Loads	1,181,785	12,026
Total Room Tons	98.48	1.00
Total Room sqft/ton	435.71	42,816.48
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	9,878 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	3,696	20,693
Northeast Glass	5,640	6,204	53,873
East Glass	690	759	9,771
Southeast Glass	1,380	1,518	20,603
South Glass	1,380	1,518	30,140
Southwest Glass	2,340	2,574	101,330
West Glass	380	418	16,118
Northwest Glass	3,220	3,542	65,354
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-136	-
Southeast Wall	3,260	407	-
South Wall	3,260	830	-
Southwest Wall	5,540	1,117	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	7,050	-
Interior Roof	12,760	7,061	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0099

Bin Number : 4 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 75 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	300,265	0
Glass Transmission	-30,344	0
Wall Transmission	-1,648	0
Roof Transmission	2,203	0
Transmission Load For Wall Adjacent to Non-Cond Region	-9,736	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-1,980	-1,284
Total Room Loads	1,088,175	9,909
Total Room Tons	90.68	0.83
Total Room sqft/ton	473.20	51,964.02
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	5,140 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-5,544	19,514
Northeast Glass	5,640	-9,306	50,770
East Glass	690	-1,139	9,232
Southeast Glass	1,380	-2,277	19,532
South Glass	1,380	-2,277	28,594
Southwest Glass	2,340	-3,861	95,815
West Glass	380	-627	15,219
Northwest Glass	3,220	-5,313	61,588
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-577	-
Southeast Wall	3,260	-506	-
South Wall	3,260	-111	-
Southwest Wall	5,540	-454	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	3,669	-
Interior Roof	12,760	3,675	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0093

Bin Number : 5 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 70 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	282,649	0
Glass Transmission	-80,916	0
Wall Transmission	-5,513	0
Roof Transmission	173	0
Transmission Load For Wall Adjacent to Non-Cond Region	-25,962	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-5,280	-3,101
Total Room Loads	994,566	8,092
Total Room Tons	82.88	0.67
Total Room sqft/ton	517.73	63,631.09
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	403 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-14,784	18,336
Northeast Glass	5,640	-24,816	47,667
East Glass	690	-3,036	8,693
Southeast Glass	1,380	-6,072	18,461
South Glass	1,380	-6,072	27,049
Southwest Glass	2,340	-10,296	90,300
West Glass	380	-1,672	14,320
Northwest Glass	3,220	-14,168	57,822
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-1,017	-
Southeast Wall	3,260	-1,419	-
South Wall	3,260	-1,051	-
Southwest Wall	5,540	-2,025	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	287	-
Interior Roof	12,760	288	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0087

Bin Number : 6 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 65 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	265,033	0
Glass Transmission	-131,489	0
Wall Transmission	-9,378	0
Roof Transmission	-1,858	0
Transmission Load For Wall Adjacent to Non-Cond Region	-42,188	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-8,580	-4,641
Total Room Loads	900,956	6,552
Total Room Tons	75.08	0.55
Total Room sqft/ton	571.53	78,584.82
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-4,335 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-24,024	17,157
Northeast Glass	5,640	-40,326	44,565
East Glass	690	-4,934	8,155
Southeast Glass	1,380	-9,867	17,390
South Glass	1,380	-9,867	25,504
Southwest Glass	2,340	-16,731	84,786
West Glass	380	-2,717	13,420
Northwest Glass	3,220	-23,023	54,056
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-1,458	-
Southeast Wall	3,260	-2,332	-
South Wall	3,260	-1,992	-
Southwest Wall	5,540	-3,596	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-3,094	-
Interior Roof	12,760	-3,099	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0083

Bin Number : 7 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 60 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	247,418	0
Glass Transmission	-182,061	0
Wall Transmission	-13,243	0
Roof Transmission	-3,888	0
Transmission Load For Wall Adjacent to Non-Cond Region	-42,188	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-11,880	-5,925
Total Room Loads	823,572	5,268
Total Room Tons	68.63	0.44
Total Room sqft/ton	625.23	97,745.88
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-9,073 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-33,264	15,979
Northeast Glass	5,640	-55,836	41,462
East Glass	690	-6,831	7,616
Southeast Glass	1,380	-13,662	16,319
South Glass	1,380	-13,662	23,959
Southwest Glass	2,340	-23,166	79,271
West Glass	380	-3,762	12,521
Northwest Glass	3,220	-31,878	50,290
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-1,898	-
Southeast Wall	3,260	-3,245	-
South Wall	3,260	-2,933	-
Southwest Wall	5,540	-5,167	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-6,475	-
Interior Roof	12,760	-6,486	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0079

Bin Number : 8 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 55 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	229,802	0
Glass Transmission	-232,634	0
Wall Transmission	-17,108	0
Roof Transmission	-5,919	0
Transmission Load For Wall Adjacent to Non-Cond Region	-42,188	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-15,180	-6,974
Total Room Loads	746,189	4,219
Total Room Tons	62.18	0.35
Total Room sqft/ton	690.07	122,044.56
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-13,810 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-42,504	14,801
Northeast Glass	5,640	-71,346	38,360
East Glass	690	-8,729	7,077
Southeast Glass	1,380	-17,457	15,248
South Glass	1,380	-17,457	22,414
Southwest Glass	2,340	-29,601	73,756
West Glass	380	-4,807	11,622
Northwest Glass	3,220	-40,733	46,524
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-2,339	-
Southeast Wall	3,260	-4,158	-
South Wall	3,260	-3,873	-
Southwest Wall	5,540	-6,738	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-9,857	-
Interior Roof	12,760	-9,872	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0076

Bin Number : 9 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 50 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	212,186	0
Glass Transmission	-283,206	0
Wall Transmission	-20,973	0
Roof Transmission	-7,949	0
Transmission Load For Wall Adjacent to Non-Cond Region	-42,188	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-18,480	-7,806
Total Room Loads	668,805	3,387
Total Room Tons	55.73	0.28
Total Room sqft/ton	769.91	152,020.63
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-18,548 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-51,744	13,622
Northeast Glass	5,640	-86,856	35,257
East Glass	690	-10,626	6,539
Southeast Glass	1,380	-21,252	14,178
South Glass	1,380	-21,252	20,868
Southwest Glass	2,340	-36,036	68,242
West Glass	380	-5,852	10,722
Northwest Glass	3,220	-49,588	42,758
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-2,780	-
Southeast Wall	3,260	-5,071	-
South Wall	3,260	-4,814	-
Southwest Wall	5,540	-8,309	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-13,238	-
Interior Roof	12,760	-13,259	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0063

Bin Number : 10 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 45 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	194,570	0
Glass Transmission	-333,779	0
Wall Transmission	-24,838	0
Roof Transmission	-9,980	0
Transmission Load For Wall Adjacent to Non-Cond Region	-42,188	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-21,780	-11,595
Total Room Loads	591,421	-402
Total Room Tons	49.29	-0.03
Total Room sqft/ton	870.65	%1,281,128.88
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-23,286 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-60,984	12,444
Northeast Glass	5,640	-102,366	32,154
East Glass	690	-12,524	6,000
Southeast Glass	1,380	-25,047	13,107
South Glass	1,380	-25,047	19,323
Southwest Glass	2,340	-42,471	62,727
West Glass	380	-6,897	9,823
Northwest Glass	3,220	-58,443	38,992
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-3,220	-
Southeast Wall	3,260	-5,984	-
South Wall	3,260	-5,755	-
Southwest Wall	5,540	-9,880	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-16,619	-
Interior Roof	12,760	-16,646	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0052

Bin Number : 11 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 40 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	176,955	0
Glass Transmission	-384,351	0
Wall Transmission	-28,703	0
Roof Transmission	-12,010	0
Transmission Load For Wall Adjacent to Non-Cond Region	-42,188	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-25,080	-14,788
Total Room Loads	514,037	-3,595
Total Room Tons	42.84	-0.30
Total Room sqft/ton	1,001.72	143,237.09
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-28,023 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-70,224	11,266
Northeast Glass	5,640	-117,876	29,052
East Glass	690	-14,421	5,461
Southeast Glass	1,380	-28,842	12,036
South Glass	1,380	-28,842	17,778
Southwest Glass	2,340	-48,906	57,212
West Glass	380	-7,942	8,924
Northwest Glass	3,220	-67,298	35,226
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-3,661	-
Southeast Wall	3,260	-6,897	-
South Wall	3,260	-6,695	-
Southwest Wall	5,540	-11,451	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-20,001	-
Interior Roof	12,760	-20,032	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0043

Bin Number : 12 Perimeter Zone Indoor DB = n/a

Outdoor Dry Bulb = 35 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	0	0
Glass Transmission	0	0
Wall Transmission	0	0
Roof Transmission	-7,026	0
Transmission Load For Wall Adjacent to Non-Cond Region	-29,146	0
Lighting (65,579 W Total)	195,842	0
Misc. Elec. (88,340 W Total)	301,504	0
People (29 People Total)	7,173	6,002
Miscellaneous Internal Loads	0	0
Infiltration	0	0
Total Room Loads	468,348	6,002
Total Room Tons	39.03	0.50
Total Room sqft/ton	589.56	46,003.76
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	83,932 Btu/hr	
Roof Load to Plenum	-16,393 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	0	0
Northeast Glass	5,640	0	0
East Glass	690	0	0
Southeast Glass	1,380	0	0
South Glass	1,380	0	0
Southwest Glass	2,340	0	0
West Glass	380	0	0
Northwest Glass	3,220	0	0
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	0	-
Southeast Wall	3,260	0	-
South Wall	3,260	0	-
Southwest Wall	5,540	0	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	0	-
Interior Roof	12,760	-23,419	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0035

Bin Number : 13 Perimeter Zone Indoor DB = n/a

Outdoor Dry Bulb = 30 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	0	0
Glass Transmission	0	0
Wall Transmission	0	0
Roof Transmission	-8,042	0
Transmission Load For Wall Adjacent to Non-Cond Region	-29,146	0
Lighting (65,579 W Total)	195,842	0
Misc. Elec. (88,340 W Total)	301,504	0
People (29 People Total)	7,173	6,002
Miscellaneous Internal Loads	0	0
Infiltration	0	0
Total Room Loads	467,332	6,002
Total Room Tons	38.94	0.50
Total Room sqft/ton	590.84	46,003.76
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	83,932 Btu/hr	
Roof Load to Plenum	-18,764 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	0	0
Northeast Glass	5,640	0	0
East Glass	690	0	0
Southeast Glass	1,380	0	0
South Glass	1,380	0	0
Southwest Glass	2,340	0	0
West Glass	380	0	0
Northwest Glass	3,220	0	0
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	0	-
Southeast Wall	3,260	0	-
South Wall	3,260	0	-
Southwest Wall	5,540	0	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	0	-
Interior Roof	12,760	-26,806	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0028

Bin Number : 14 Perimeter Zone Indoor DB = 68 F

Outdoor Dry Bulb = 25 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	124,107	0
Glass Transmission	-434,924	0
Wall Transmission	-32,085	0
Roof Transmission	-16,190	0
Transmission Load For Wall Adjacent to Non-Cond Region	-32,156	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-28,380	-13,199
Total Room Loads	409,788	-2,006
Total Room Tons	34.15	-0.17
Total Room sqft/ton	1,256.55	256,677.19
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-37,777 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-79,464	7,730
Northeast Glass	5,640	-133,386	19,744
East Glass	690	-16,319	3,845
Southeast Glass	1,380	-32,637	8,823
South Glass	1,380	-32,637	13,142
Southwest Glass	2,340	-55,341	40,668
West Glass	380	-8,987	6,226
Northwest Glass	3,220	-76,153	23,929
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-4,004	-
Southeast Wall	3,260	-7,679	-
South Wall	3,260	-7,561	-
Southwest Wall	5,540	-12,840	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-23,775	-
Interior Roof	12,760	-30,192	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0022

Bin Number : 15 Perimeter Zone Indoor DB = 68 F

Outdoor Dry Bulb = 20 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	106,492	0
Glass Transmission	-485,496	0
Wall Transmission	-35,950	0
Roof Transmission	-18,221	0
Transmission Load For Wall Adjacent to Non-Cond Region	-32,156	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-31,680	-14,898
Total Room Loads	332,404	-3,705
Total Room Tons	27.70	-0.31
Total Room sqft/ton	1,549.08	138,994.70
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-42,515 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-88,704	6,552
Northeast Glass	5,640	-148,896	16,641
East Glass	690	-18,216	3,307
Southeast Glass	1,380	-36,432	7,752
South Glass	1,380	-36,432	11,597
Southwest Glass	2,340	-61,776	35,154
West Glass	380	-10,032	5,326
Northwest Glass	3,220	-85,008	20,163
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-4,445	-
Southeast Wall	3,260	-8,592	-
South Wall	3,260	-8,502	-
Southwest Wall	5,540	-14,411	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-27,156	-
Interior Roof	12,760	-33,579	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0017

Bin Number : 16 Perimeter Zone Indoor DB = 68 F

Outdoor Dry Bulb = 15 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	88,876	0
Glass Transmission	-536,069	0
Wall Transmission	-39,815	0
Roof Transmission	-20,251	0
Transmission Load For Wall Adjacent to Non-Cond Region	-32,156	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-34,980	-16,260
Total Room Loads	255,020	-5,067
Total Room Tons	21.25	-0.42
Total Room sqft/ton	2,019.13	101,618.56
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-47,252 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-97,944	5,374
Northeast Glass	5,640	-164,406	13,539
East Glass	690	-20,114	2,768
Southeast Glass	1,380	-40,227	6,681
South Glass	1,380	-40,227	10,052
Southwest Glass	2,340	-68,211	29,639
West Glass	380	-11,077	4,427
Northwest Glass	3,220	-93,863	16,397
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-4,885	-
Southeast Wall	3,260	-9,505	-
South Wall	3,260	-9,443	-
Southwest Wall	5,540	-15,982	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-30,538	-
Interior Roof	12,760	-36,966	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0013

Bin Number : 17 Perimeter Zone Indoor DB = 68 F

Outdoor Dry Bulb = 10 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	71,260	0
Glass Transmission	-586,641	0
Wall Transmission	-43,680	0
Roof Transmission	-22,281	0
Transmission Load For Wall Adjacent to Non-Cond Region	-32,156	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-38,280	-17,348
Total Room Loads	177,637	-6,155
Total Room Tons	14.80	-0.51
Total Room sqft/ton	2,898.72	83,653.88
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-51,990 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-107,184	4,195
Northeast Glass	5,640	-179,916	10,436
East Glass	690	-22,011	2,229
Southeast Glass	1,380	-44,022	5,610
South Glass	1,380	-44,022	8,507
Southwest Glass	2,340	-74,646	24,124
West Glass	380	-12,122	3,528
Northwest Glass	3,220	-102,718	12,631
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-5,326	-
Southeast Wall	3,260	-10,418	-
South Wall	3,260	-10,383	-
Southwest Wall	5,540	-17,553	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-33,919	-
Interior Roof	12,760	-40,352	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86
Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0010
Bin Number : 18 Perimeter Zone Indoor DB = 68 F
Outdoor Dry Bulb = 5 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	53,644	0
Glass Transmission	-637,214	0
Wall Transmission	-47,545	0
Roof Transmission	-24,312	0
Transmission Load For Wall Adjacent to Non-Cond Region	-32,156	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-41,580	-18,213
Total Room Loads	100,253	-7,020
Total Room Tons	8.35	-0.59
Total Room sqft/ton	5,136.20	73,347.33
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-56,728 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-116,424	3,017
Northeast Glass	5,640	-195,426	7,334
East Glass	690	-23,909	1,691
Southeast Glass	1,380	-47,817	4,539
South Glass	1,380	-47,817	6,961
Southwest Glass	2,340	-81,081	18,609
West Glass	380	-13,167	2,628
Northwest Glass	3,220	-111,573	8,865
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-5,767	-
Southeast Wall	3,260	-11,331	-
South Wall	3,260	-11,324	-
Southwest Wall	5,540	-19,124	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-37,300	-
Interior Roof	12,760	-43,739	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86
Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0008
Bin Number : 19 Perimeter Zone Indoor DB = 68 F
Outdoor Dry Bulb = 0 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	36,029	0
Glass Transmission	-687,786	0
Wall Transmission	-51,410	0
Roof Transmission	-26,342	0
Transmission Load For Wall Adjacent to Non-Cond Region	-32,156	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-44,880	-18,897
Total Room Loads	22,869	-7,704
Total Room Tons	1.91	-0.64
Total Room sqft/ton	22,515.79	66,834.60
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-61,465 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-125,664	1,839
Northeast Glass	5,640	-210,936	4,231
East Glass	690	-25,806	1,152
Southeast Glass	1,380	-51,612	3,468
South Glass	1,380	-51,612	5,416
Southwest Glass	2,340	-87,516	13,095
West Glass	380	-14,212	1,729
Northwest Glass	3,220	-120,428	5,099
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-6,207	-
Southeast Wall	3,260	-12,244	-
South Wall	3,260	-12,264	-
Southwest Wall	5,540	-20,695	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-40,682	-
Interior Roof	12,760	-47,126	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86
Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0006
Bin Number : 20 Perimeter Zone Indoor DB = 68 F
Outdoor Dry Bulb = -5 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	18,413	0
Glass Transmission	-738,359	0
Wall Transmission	-55,275	0
Roof Transmission	-28,373	0
Transmission Load For Wall Adjacent to Non-Cond Region	-32,156	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-48,180	-19,436
Total Room Loads	-54,514	-8,243
Total Room Tons	-4.54	-0.69
Total Room sqft/ton	9,445.58	62,469.99
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-66,203 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-134,904	660
Northeast Glass	5,640	-226,446	1,128
East Glass	690	-27,704	613
Southeast Glass	1,380	-55,407	2,397
South Glass	1,380	-55,407	3,871
Southwest Glass	2,340	-93,951	7,580
West Glass	380	-15,257	830
Northwest Glass	3,220	-129,283	1,333
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-6,648	-
Southeast Wall	3,260	-13,157	-
South Wall	3,260	-13,205	-
Southwest Wall	5,540	-22,266	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-44,063	-
Interior Roof	12,760	-50,512	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Occupied O.A. Humidity Ratio = 0.0006

Bin Number : 21 Perimeter Zone Indoor DB = 68 F

Outdoor Dry Bulb = -6 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	14,890	0
Glass Transmission	-748,473	0
Wall Transmission	-56,048	0
Roof Transmission	-28,779	0
Transmission Load For Wall Adjacent to Non-Cond Region	-32,156	0
Lighting (122,294 W Total)	365,214	0
Misc. Elec. (132,090 W Total)	450,823	0
People (55 People Total)	13,377	11,193
Miscellaneous Internal Loads	0	0
Infiltration	-48,840	-19,528
Total Room Loads	-69,991	-8,335
Total Room Tons	-5.83	-0.69
Total Room sqft/ton	7,356.93	61,774.57
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	156,520 Btu/hr	
Roof Load to Plenum	-67,150 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-136,752	425
Northeast Glass	5,640	-229,548	508
East Glass	690	-28,083	506
Southeast Glass	1,380	-56,166	2,183
South Glass	1,380	-56,166	3,562
Southwest Glass	2,340	-95,238	6,477
West Glass	380	-15,466	650
Northwest Glass	3,220	-131,054	580
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-6,736	-
Southeast Wall	3,260	-13,339	-
South Wall	3,260	-13,393	-
Southwest Wall	5,540	-22,580	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-44,739	-
Interior Roof	12,760	-51,190	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0124

Bin Number : 1 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 90 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	353,112	0
Glass Transmission	121,374	0
Wall Transmission	9,948	0
Roof Transmission	8,294	0
Transmission Load For Wall Adjacent to Non-Cond Region	38,942	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	2,640	2,024
Total Room Loads	894,373	5,222
Total Room Tons	74.53	0.44
Total Room sqft/ton	575.73	98,611.77
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	19,353 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	22,176	23,049
Northeast Glass	5,640	37,224	60,078
East Glass	690	4,554	10,848
Southeast Glass	1,380	9,108	22,745
South Glass	1,380	9,108	33,230
Southwest Glass	2,340	15,444	112,359
West Glass	380	2,508	17,917
Northwest Glass	3,220	21,252	72,886
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	745	-
Southeast Wall	3,260	2,233	-
South Wall	3,260	2,711	-
Southwest Wall	5,540	4,259	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	13,813	-
Interior Roof	12,760	13,835	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0114

Bin Number : 2 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 85 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	335,496	0
Glass Transmission	70,802	0
Wall Transmission	6,082	0
Roof Transmission	6,264	0
Transmission Load For Wall Adjacent to Non-Cond Region	22,716	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	1,540	1,092
Total Room Loads	802,964	4,290
Total Room Tons	66.91	0.36
Total Room sqft/ton	641.27	120,030.02
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	14,616 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	12,936	21,871
Northeast Glass	5,640	21,714	56,975
East Glass	690	2,657	10,309
Southeast Glass	1,380	5,313	21,674
South Glass	1,380	5,313	31,685
Southwest Glass	2,340	9,009	106,844
West Glass	380	1,463	17,018
Northwest Glass	3,220	12,397	69,120
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	304	-
Southeast Wall	3,260	1,320	-
South Wall	3,260	1,770	-
Southwest Wall	5,540	2,688	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	10,431	-
Interior Roof	12,760	10,448	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0106

Bin Number : 3 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 80 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	317,881	0
Glass Transmission	20,229	0
Wall Transmission	2,217	0
Roof Transmission	4,233	0
Transmission Load For Wall Adjacent to Non-Cond Region	6,490	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	440	278
Total Room Loads	711,554	3,476
Total Room Tons	59.30	0.29
Total Room sqft/ton	723.66	148,146.98
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	9,878 Btu/hr	

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TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	3,696	20,693
Northeast Glass	5,640	6,204	53,873
East Glass	690	759	9,771
Southeast Glass	1,380	1,518	20,603
South Glass	1,380	1,518	30,140
Southwest Glass	2,340	2,574	101,330
West Glass	380	418	16,118
Northwest Glass	3,220	3,542	65,354
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-136	-
Southeast Wall	3,260	407	-
South Wall	3,260	830	-
Southwest Wall	5,540	1,117	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	7,050	-
Interior Roof	12,760	7,061	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0099

Bin Number : 4 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 75 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	300,265	0
Glass Transmission	-30,344	0
Wall Transmission	-1,648	0
Roof Transmission	2,203	0
Transmission Load For Wall Adjacent to Non-Cond Region	-9,736	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-660	-428
Total Room Loads	620,144	2,770
Total Room Tons	51.68	0.23
Total Room sqft/ton	830.32	185,888.00
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	5,140 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-5,544	19,514
Northeast Glass	5,640	-9,306	50,770
East Glass	690	-1,139	9,232
Southeast Glass	1,380	-2,277	19,532
South Glass	1,380	-2,277	28,594
Southwest Glass	2,340	-3,861	95,815
West Glass	380	-627	15,219
Northwest Glass	3,220	-5,313	61,588
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-577	-
Southeast Wall	3,260	-506	-
South Wall	3,260	-111	-
Southwest Wall	5,540	-454	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	3,669	-
Interior Roof	12,760	3,675	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0093

Bin Number : 5 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 70 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	282,649	0
Glass Transmission	-80,916	0
Wall Transmission	-5,513	0
Roof Transmission	173	0
Transmission Load For Wall Adjacent to Non-Cond Region	-25,962	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-1,760	-1,034
Total Room Loads	528,735	2,164
Total Room Tons	44.06	0.18
Total Room sqft/ton	973.87	237,901.66
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	403 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-14,784	18,336
Northeast Glass	5,640	-24,816	47,667
East Glass	690	-3,036	8,693
Southeast Glass	1,380	-6,072	18,461
South Glass	1,380	-6,072	27,049
Southwest Glass	2,340	-10,296	90,300
West Glass	380	-1,672	14,320
Northwest Glass	3,220	-14,168	57,822
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-1,017	-
Southeast Wall	3,260	-1,419	-
South Wall	3,260	-1,051	-
Southwest Wall	5,540	-2,025	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	287	-
Interior Roof	12,760	288	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0087

Bin Number : 6 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 65 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	265,033	0
Glass Transmission	-131,489	0
Wall Transmission	-9,378	0
Roof Transmission	-1,858	0
Transmission Load For Wall Adjacent to Non-Cond Region	-42,188	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-2,860	-1,547
Total Room Loads	437,325	1,651
Total Room Tons	36.44	0.14
Total Room sqft/ton	1,177.43	311,857.84
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-4,335 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-24,024	17,157
Northeast Glass	5,640	-40,326	44,565
East Glass	690	-4,934	8,155
Southeast Glass	1,380	-9,867	17,390
South Glass	1,380	-9,867	25,504
Southwest Glass	2,340	-16,731	84,786
West Glass	380	-2,717	13,420
Northwest Glass	3,220	-23,023	54,056
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-1,458	-
Southeast Wall	3,260	-2,332	-
South Wall	3,260	-1,992	-
Southwest Wall	5,540	-3,596	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-3,094	-
Interior Roof	12,760	-3,099	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0083

Bin Number : 7 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 60 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	247,418	0
Glass Transmission	-182,061	0
Wall Transmission	-13,243	0
Roof Transmission	-3,888	0
Transmission Load For Wall Adjacent to Non-Cond Region	-42,188	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-3,960	-1,975
Total Room Loads	362,141	1,223
Total Room Tons	30.18	0.10
Total Room sqft/ton	1,421.88	421,036.25
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-9,073 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-33,264	15,979
Northeast Glass	5,640	-55,836	41,462
East Glass	690	-6,831	7,616
Southeast Glass	1,380	-13,662	16,319
South Glass	1,380	-13,662	23,959
Southwest Glass	2,340	-23,166	79,271
West Glass	380	-3,762	12,521
Northwest Glass	3,220	-31,878	50,290
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-1,898	-
Southeast Wall	3,260	-3,245	-
South Wall	3,260	-2,933	-
Southwest Wall	5,540	-5,167	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-6,475	-
Interior Roof	12,760	-6,486	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0079

Bin Number : 8 Perimeter Zone Indoor DB = 78 F

Outdoor Dry Bulb = 55 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	229,802	0
Glass Transmission	-232,634	0
Wall Transmission	-17,108	0
Roof Transmission	-5,919	0
Transmission Load For Wall Adjacent to Non-Cond Region	-42,188	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-5,060	-2,325
Total Room Loads	286,957	873
Total Room Tons	23.91	0.07
Total Room sqft/ton	1,794.41	589,576.88
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-13,810 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-42,504	14,801
Northeast Glass	5,640	-71,346	38,360
East Glass	690	-8,729	7,077
Southeast Glass	1,380	-17,457	15,248
South Glass	1,380	-17,457	22,414
Southwest Glass	2,340	-29,601	73,756
West Glass	380	-4,807	11,622
Northwest Glass	3,220	-40,733	46,524
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-2,339	-
Southeast Wall	3,260	-4,158	-
South Wall	3,260	-3,873	-
Southwest Wall	5,540	-6,738	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-9,857	-
Interior Roof	12,760	-9,872	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0076

Bin Number : 9 Perimeter Zone Indoor DB = n/a

Outdoor Dry Bulb = 50 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	0	0
Glass Transmission	0	0
Wall Transmission	0	0
Roof Transmission	-3,978	0
Transmission Load For Wall Adjacent to Non-Cond Region	-29,146	0
Lighting (13,806 W Total)	41,230	0
Misc. Elec. (63,100 W Total)	215,360	0
People (8 People Total)	2,050	1,715
Miscellaneous Internal Loads	0	0
Infiltration	0	0
Total Room Loads	225,516	1,715
Total Room Tons	18.79	0.14
Total Room sqft/ton	1,224.39	161,013.16
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	17,670 Btu/hr	
Roof Load to Plenum	-9,281 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	0	0
Northeast Glass	5,640	0	0
East Glass	690	0	0
Southeast Glass	1,380	0	0
South Glass	1,380	0	0
Southwest Glass	2,340	0	0
West Glass	380	0	0
Northwest Glass	3,220	0	0
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	0	-
Southeast Wall	3,260	0	-
South Wall	3,260	0	-
Southwest Wall	5,540	0	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	0	-
Interior Roof	12,760	-13,259	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0063

Bin Number : 10 Perimeter Zone Indoor DB = n/a

Outdoor Dry Bulb = 45 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	0	0
Glass Transmission	0	0
Wall Transmission	0	0
Roof Transmission	-4,994	0
Transmission Load For Wall Adjacent to Non-Cond Region	-29,146	0
Lighting (13,806 W Total)	41,230	0
Misc. Elec. (63,100 W Total)	215,360	0
People (8 People Total)	2,050	1,715
Miscellaneous Internal Loads	0	0
Infiltration	0	0
Total Room Loads	224,500	1,715
Total Room Tons	18.71	0.14
Total Room sqft/ton	1,229.93	161,013.16
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	17,670 Btu/hr	
Roof Load to Plenum	-11,652 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	0	0
Northeast Glass	5,640	0	0
East Glass	690	0	0
Southeast Glass	1,380	0	0
South Glass	1,380	0	0
Southwest Glass	2,340	0	0
West Glass	380	0	0
Northwest Glass	3,220	0	0
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	0	-
Southeast Wall	3,260	0	-
South Wall	3,260	0	-
Southwest Wall	5,540	0	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	0	-
Interior Roof	12,760	-16,646	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86
Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0052
Bin Number : 11 Perimeter Zone Indoor DB = n/a
Outdoor Dry Bulb = 40 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	0	0
Glass Transmission	0	0
Wall Transmission	0	0
Roof Transmission	-6,010	0
Transmission Load For Wall Adjacent to Non-Cond Region	-29,146	0
Lighting (13,806 W Total)	41,230	0
Misc. Elec. (63,100 W Total)	215,360	0
People (8 People Total)	2,050	1,715
Miscellaneous Internal Loads	0	0
Infiltration	0	0
Total Room Loads	223,484	1,715
Total Room Tons	18.62	0.14
Total Room sqft/ton	1,235.52	161,013.16
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	17,670 Btu/hr	
Roof Load to Plenum	-14,023 Btu/hr	

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TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	0	0
Northeast Glass	5,640	0	0
East Glass	690	0	0
Southeast Glass	1,380	0	0
South Glass	1,380	0	0
Southwest Glass	2,340	0	0
West Glass	380	0	0
Northwest Glass	3,220	0	0
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	0	-
Southeast Wall	3,260	0	-
South Wall	3,260	0	-
Southwest Wall	5,540	0	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	0	-
Interior Roof	12,760	-20,032	-

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SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0043

Bin Number : 12 Perimeter Zone Indoor DB = 63 F

Outdoor Dry Bulb = 35 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	159,339	0
Glass Transmission	-283,206	0
Wall Transmission	-20,247	0
Roof Transmission	-11,174	0
Transmission Load For Wall Adjacent to Non-Cond Region	-27,140	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-6,160	-1,759
Total Room Loads	171,475	1,439
Total Room Tons	14.29	0.12
Total Room sqft/ton	3,002.88	357,909.47
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-26,072 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-51,744	10,087
Northeast Glass	5,640	-86,856	25,949
East Glass	690	-10,626	4,923
Southeast Glass	1,380	-21,252	10,965
South Glass	1,380	-21,252	16,233
Southwest Glass	2,340	-36,036	51,698
West Glass	380	-5,852	8,024
Northwest Glass	3,220	-49,588	31,461
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-2,634	-
Southeast Wall	3,260	-4,875	-
South Wall	3,260	-4,702	-
Southwest Wall	5,540	-8,036	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-13,827	-
Interior Roof	12,760	-23,419	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0035

Bin Number : 13 Perimeter Zone Indoor DB = 63 F

Outdoor Dry Bulb = 30 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	141,723	0
Glass Transmission	-333,779	0
Wall Transmission	-24,113	0
Roof Transmission	-13,204	0
Transmission Load For Wall Adjacent to Non-Cond Region	-27,140	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-7,260	-2,552
Total Room Loads	96,292	646
Total Room Tons	8.02	0.05
Total Room sqft/ton	5,347.51	797,153.94
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-30,810 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-60,984	8,909
Northeast Glass	5,640	-102,366	22,847
East Glass	690	-12,524	4,384
Southeast Glass	1,380	-25,047	9,894
South Glass	1,380	-25,047	14,687
Southwest Glass	2,340	-42,471	46,183
West Glass	380	-6,897	7,125
Northwest Glass	3,220	-58,443	27,695
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-3,075	-
Southeast Wall	3,260	-5,788	-
South Wall	3,260	-5,643	-
Southwest Wall	5,540	-9,607	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-17,209	-
Interior Roof	12,760	-26,806	-

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SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

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BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0028

Bin Number : 14 Perimeter Zone Indoor DB = 63 F

Outdoor Dry Bulb = 25 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	124,107	0
Glass Transmission	-384,351	0
Wall Transmission	-27,978	0
Roof Transmission	-15,235	0
Transmission Load For Wall Adjacent to Non-Cond Region	-27,140	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-8,360	-3,255
Total Room Loads	21,108	-57
Total Room Tons	1.76	-0.00
Total Room sqft/ton	24,394.74	%9,070,280.00
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-35,548 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-70,224	7,730
Northeast Glass	5,640	-117,876	19,744
East Glass	690	-14,421	3,845
Southeast Glass	1,380	-28,842	8,823
South Glass	1,380	-28,842	13,142
Southwest Glass	2,340	-48,906	40,668
West Glass	380	-7,942	6,226
Northwest Glass	3,220	-67,298	23,929
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-3,515	-
Southeast Wall	3,260	-6,701	-
South Wall	3,260	-6,583	-
Southwest Wall	5,540	-11,178	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-20,590	-
Interior Roof	12,760	-30,192	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0022

Bin Number : 15 Perimeter Zone Indoor DB = 63 F

Outdoor Dry Bulb = 20 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	106,492	0
Glass Transmission	-434,924	0
Wall Transmission	-31,843	0
Roof Transmission	-17,265	0
Transmission Load For Wall Adjacent to Non-Cond Region	-27,140	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-9,460	-3,821
Total Room Loads	-54,076	-623
Total Room Tons	-4.51	-0.05
Total Room sqft/ton	9,522.18	826,600.44
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-40,285 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-79,464	6,552
Northeast Glass	5,640	-133,386	16,641
East Glass	690	-16,319	3,307
Southeast Glass	1,380	-32,637	7,752
South Glass	1,380	-32,637	11,597
Southwest Glass	2,340	-55,341	35,154
West Glass	380	-8,987	5,326
Northwest Glass	3,220	-76,153	20,163
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-3,956	-
Southeast Wall	3,260	-7,614	-
South Wall	3,260	-7,524	-
Southwest Wall	5,540	-12,749	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-23,971	-
Interior Roof	12,760	-33,579	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0017

Bin Number : 16 Perimeter Zone Indoor DB = 63 F

Outdoor Dry Bulb = 15 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	88,876	0
Glass Transmission	-485,496	0
Wall Transmission	-35,708	0
Roof Transmission	-19,296	0
Transmission Load For Wall Adjacent to Non-Cond Region	-27,140	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-10,560	-4,275
Total Room Loads	-129,260	-1,077
Total Room Tons	-10.77	-0.09
Total Room sqft/ton	3,983.61	478,047.66
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-45,023 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-88,704	5,374
Northeast Glass	5,640	-148,896	13,539
East Glass	690	-18,216	2,768
Southeast Glass	1,380	-36,432	6,681
South Glass	1,380	-36,432	10,052
Southwest Glass	2,340	-61,776	29,639
West Glass	380	-10,032	4,427
Northwest Glass	3,220	-85,008	16,397
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-4,396	-
Southeast Wall	3,260	-8,527	-
South Wall	3,260	-8,465	-
Southwest Wall	5,540	-14,320	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-27,353	-
Interior Roof	12,760	-36,966	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0013

Bin Number : 17 Perimeter Zone Indoor DB = 63 F

Outdoor Dry Bulb = 10 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	71,260	0
Glass Transmission	-536,069	0
Wall Transmission	-39,573	0
Roof Transmission	-21,326	0
Transmission Load For Wall Adjacent to Non-Cond Region	-27,140	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-11,660	-4,638
Total Room Loads	-204,443	-1,440
Total Room Tons	-17.04	-0.12
Total Room sqft/ton	2,518.64	357,618.69
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-49,760 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-97,944	4,195
Northeast Glass	5,640	-164,406	10,436
East Glass	690	-20,114	2,229
Southeast Glass	1,380	-40,227	5,610
South Glass	1,380	-40,227	8,507
Southwest Glass	2,340	-68,211	24,124
West Glass	380	-11,077	3,528
Northwest Glass	3,220	-93,863	12,631
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-4,837	-
Southeast Wall	3,260	-9,440	-
South Wall	3,260	-9,405	-
Southwest Wall	5,540	-15,891	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-30,734	-
Interior Roof	12,760	-40,352	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0010

Bin Number : 18 Perimeter Zone Indoor DB = 63 F

Outdoor Dry Bulb = 5 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	53,644	0
Glass Transmission	-586,641	0
Wall Transmission	-43,438	0
Roof Transmission	-23,356	0
Transmission Load For Wall Adjacent to Non-Cond Region	-27,140	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-12,760	-4,926
Total Room Loads	-279,627	-1,728
Total Room Tons	-23.30	-0.14
Total Room sqft/ton	1,841.45	297,957.03
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-54,498 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-107,184	3,017
Northeast Glass	5,640	-179,916	7,334
East Glass	690	-22,011	1,691
Southeast Glass	1,380	-44,022	4,539
South Glass	1,380	-44,022	6,961
Southwest Glass	2,340	-74,646	18,609
West Glass	380	-12,122	2,628
Northwest Glass	3,220	-102,718	8,865
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-5,278	-
Southeast Wall	3,260	-10,353	-
South Wall	3,260	-10,346	-
Southwest Wall	5,540	-17,462	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-34,115	-
Interior Roof	12,760	-43,739	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0008

Bin Number : 19 Perimeter Zone Indoor DB = 63 F

Outdoor Dry Bulb = 0 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	36,029	0
Glass Transmission	-637,214	0
Wall Transmission	-47,303	0
Roof Transmission	-25,387	0
Transmission Load For Wall Adjacent to Non-Cond Region	-27,140	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-13,860	-5,154
Total Room Loads	-354,811	-1,956
Total Room Tons	-29.57	-0.16
Total Room sqft/ton	1,451.25	263,224.56
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-59,236 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-116,424	1,839
Northeast Glass	5,640	-195,426	4,231
East Glass	690	-23,909	1,152
Southeast Glass	1,380	-47,817	3,468
South Glass	1,380	-47,817	5,416
Southwest Glass	2,340	-81,081	13,095
West Glass	380	-13,167	1,729
Northwest Glass	3,220	-111,573	5,099
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-5,718	-
Southeast Wall	3,260	-11,266	-
South Wall	3,260	-11,286	-
Southwest Wall	5,540	-19,033	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-37,497	-
Interior Roof	12,760	-47,126	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86

Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0006

Bin Number : 20 Perimeter Zone Indoor DB = 63 F

Outdoor Dry Bulb = -5 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	18,413	0
Glass Transmission	-687,786	0
Wall Transmission	-51,168	0
Roof Transmission	-27,417	0
Transmission Load For Wall Adjacent to Non-Cond Region	-27,140	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-14,960	-5,334
Total Room Loads	-429,995	-2,136
Total Room Tons	-35.83	-0.18
Total Room sqft/ton	1,197.50	241,109.22
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-63,973 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-125,664	660
Northeast Glass	5,640	-210,936	1,128
East Glass	690	-25,806	613
Southeast Glass	1,380	-51,612	2,397
South Glass	1,380	-51,612	3,871
Southwest Glass	2,340	-87,516	7,580
West Glass	380	-14,212	830
Northwest Glass	3,220	-120,428	1,333
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-6,159	-
Southeast Wall	3,260	-12,179	-
South Wall	3,260	-12,227	-
Southwest Wall	5,540	-20,604	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-40,878	-
Interior Roof	12,760	-50,512	-

****

SINGLE BIN LOAD SUMMARY

Building Name : CCF SUBCONSTRUCT 1/4 Date : 11-10-86
Site: AURORA,IL FERMI, User Defined 60117862.0

****

BIN DATA

Period : Unoccupied O.A. Humidity Ratio = 0.0006
Bin Number : 21 Perimeter Zone Indoor DB = 63 F
Outdoor Dry Bulb = -6 F Interior Zone Indoor DB = 78 F

BLOCK THERMAL LOAD SUMMARY

Load Component	Sensible(Btu/hr)	Latent(Btu/hr)
Solar Gain	14,890	0
Glass Transmission	-697,901	0
Wall Transmission	-51,941	0
Roof Transmission	-27,823	0
Transmission Load For Wall Adjacent to Non-Cond Region	-27,140	0
Lighting (25,746 W Total)	76,887	0
Misc. Elec. (81,850 W Total)	279,354	0
People (16 People Total)	3,822	3,198
Miscellaneous Internal Loads	0	0
Infiltration	-15,180	-5,365
Total Room Loads	-445,031	-2,167
Total Room Tons	-37.09	-0.18
Total Room sqft/ton	1,157.04	237,667.11
Perimeter Zone Floor Area	19,900 sqft	
Interior Zone Floor Area	23,010 sqft	
Lighting Load to Plenum	32,952 Btu/hr	
Roof Load to Plenum	-64,921 Btu/hr	

****

TRANSMISSION LOADS AND SOLAR GAINS BY EXPOSURE

Exposure	Area (Sqft)	Transmission (Btu/hr)	Solar Gain (Btu/hr)
North Glass	3,360	-127,512	425
Northeast Glass	5,640	-214,038	508
East Glass	690	-26,186	506
Southeast Glass	1,380	-52,371	2,183
South Glass	1,380	-52,371	3,562
Southwest Glass	2,340	-88,803	6,477
West Glass	380	-14,421	650
Northwest Glass	3,220	-122,199	580
Perimeter Skylight	0	0	0
Interior Skylight	0	0	0
North Wall	0	0	-
Northeast Wall	0	0	-
East Wall	1,630	-6,247	-
Southeast Wall	3,260	-12,361	-
South Wall	3,260	-12,415	-
Southwest Wall	5,540	-20,918	-
West Wall	0	0	-
Northwest Wall	0	0	-
Perimeter Roof	12,740	-41,554	-
Interior Roof	12,760	-51,190	-

****

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
SYSTEM COMPARISON PERFORMANCE SIMULATIONS

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
OPERATIONAL PERFORMANCE SIMULATION

DESIGN BASIS SYSTEM
WATER SOURCE HEAT PUMPS WITH EDP WASTE HEAT RECOVERY

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

SYSTEM INPUT SUMMARY

Job Name : CCF SUBCON 1/4 DESIGN SYS — Page 1
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Date : 11-11-86
Site : AURORA,IL FERMI, User Defined — 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

A. AIR HANDLING SYSTEMS

Are perimeter and interior zone on same supply fan ? <N>

>1. PERIMETER TERMINAL TYPE :

Supply fan type : Forward curved with 2-speed motor
Supply fan total static pressure = 1.50 in. wg.
Low speed = 50 % of high speed
Return fan type : Forward curved with 2-speed motor
Return fan total static pressure = 1.50 in. wg.
Low speed % of full speed = 50 %
Design supply air= 5336 cfm @ %-98 F; Vent. air= 2668 cfm
Minimum zone air flow = 50 % of design supply cfm
Are cooling terminals used for heating ? <N>
Zone heating unit type : Fan coil units
Fan coil fan avg. efficiency = 60 % ; tot. static = 1.00 in wg
Economizer type : Integrated, dry-bulb controlled
Is a ventilation reclaim device used ? <Y>
Reclaim device: Efficiency = 45 % ; Input power = 0.1 kw
Are ventilation air dampers closed for unoccupied periods ? <N>

>2. INTERIOR TERMINAL TYPE :

Supply fan type : Forward curved with 2-speed motor
Supply fan total static pressure = 1.50 in. wg.
Low speed = 50 % of high speed
Return fan type : Forward curved with 2-speed motor
Return fan total static pressure = 1.50 in. wg.
Low speed % of full speed = 50 %
Design supply air= 3344 cfm @ %-74 F; Vent. air= 1672 cfm
Minimum zone air flow = 50 % of design supply cfm
Economizer type : Integrated, dry-bulb controlled
Is a ventilation reclaim device used ? <Y>
Reclaim device: Efficiency = 45 % ; Input power = 0.1 kw
Are ventilation air dampers closed for unoccupied periods ? <N>

****

B. HEATING PLANTS

> 1 b. BLOCK AUXILIARY PLANT : REMOTE SOURCE HEATING

Is hydronic heating used ? <Y>

****

SYSTEM INPUT SUMMARY

Job Name : CCF SUBCON 1/4 DESIGN SYS — Page 2
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Date : 11-11-86
Site : AURORA,IL FERMI, User Defined — 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

C. COOLING PLANTS

Does one plant serve perimeter and interior ? <N>

>1. PERIMETER PLANT : WATER SOURCE HEAT PUMPS

Cooling:
Capacity @ 85 F entering water = 120.2 tons
KW/Ton @ 85 F entering water = 1.09 kw/ton
Heating:
Capacity @ 70 F entering water = 1721 MBH
Compressor KW @ 70 F entering water = 140.1 KW
Heat sink type = Open cooling tower
Entering water temperatures: Minimum = 60 F; Maximum = 90 F
Is condenser performance altitude adjusted ? <Y>
Outdoor air temperature for economizer cutoff = 30 F

>2. INTERIOR PLANT : WATER SOURCE HEAT PUMPS

Cooling:
Capacity @ 85 F entering water = 75.4 tons
KW/Ton @ 85 F entering water = 0.98 kw/ton
Heating:
Capacity @ 70 F entering water = 1078 MBH
Compressor KW @ 70 F entering water = 1056.0 KW

****

D. PUMPING SYSTEMS

System	PERIMETER dT, F	PERIMETER dP, ft wg	INTERIOR dT, F	INTERIOR dP, ft wg
Chilled water	0.00	0.00	0.00	0.00
Hot water	0.00	0.00	0.00	0.00
Condenser water	10.00	117.00	0.00	0.00
Ground water	0.00	0.00	0.00	0.00

****

E. NON-HVAC SYSTEMS

>1. NON-HVAC ELECTRICAL ENERGY USE

Lighting kw: Occupied = 122.3 kw; Unoccupied = 25.7 kw
Misc. kw : Occupied = 132.1 kw; Unoccupied = 81.9 kw
Other kw : Occupied = 0.0 kw; Unoccupied = 0.0 kw

>2. DHW SYSTEM (Not utilized in this system)

****

F. FUEL COSTS

>1. ELECTRICAL ENERGY USE	Period Occupied ($/kwh)	Period Unoccupied ($/kwh)
Compressor	0.050	0.050
Resistance	0.050	0.050
Inductive	0.050	0.050

>2. OTHER FUELS	Unit Cost
Natural Gas	n/a $/therm
Fuel Oil	n/a $/U.S.gal
Propane	n/a $/lb
Remote Heating	0.000 $/MBTU
Remote Cooling	n/a $/MBTU

TOTAL BUILDING ENERGY SUMMARY

Job Name : CCF SUBCON 1/4 DESIGN SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Date : 11-11-86

Period : All
Zone : Block
Serial Number:
60117862.0

****

HVAC ENERGY Component	Annual Cost ($/yr)	Energy or Fuel Units Consumed	DOE RUF (1000 BTU)	DOE RIF (1000 BTU)
Electric (Occ)	10786	206805 kwh/yr	2398933	705824
Electric (Unocc)	12136	188441 kwh/yr	2185918	643150
Natural Gas	0	0 therms/yr	0	0
Fuel Oil	0	0 U.S. gal/yr	0	0
Propane	0	0 lb/yr	0	0
Remote Heating	0	0 MBTU/yr	0	0
Remote Cooling	0	0 MBTU/yr	0	0
HVAC Total	22922		4584851	1348974
NON-HVAC ENERGY				
Electric (Occ)	39793	795864 kwh/yr	9232025	2716285
Electric (Unocc)	30296	605916 kwh/yr	7028627	2067992
Non-HVAC Total	70089		16260652	4784276
Grand Total	93011		20845503	6133250
Total/Sq.Ft.	2.17		485.80	142.93

HVAC Summary:

HVAC Total Cost	=	0.53 $/Sq.Ft./yr
	=	24.64 % of Total Cost
Total HVAC Electrical Energy	=	9.21 kwh/Sq.Ft./yr
	=	21.99 % of Total Electrical Energy
Non-Electrical HVAC Energy	=	0.00 % of Total Energy

Key:

1 kwh	= 11600 BTU RUF; 3412 BTU RIF
1 therm nat gas	= 100000 BTU RUF and RIF
1 U.S. gal oil	= 138700 BTU RUF and RIF
1 Imp. gal oil	= 168000 BTU RUF and RIF
1 lb propane	= 21680 BTU RUF and RIF
RUF	= Resource utilization factor (Source value)
RIF	= Resource impact factor (Point of use value)
MBH	= 1000 BTU/hr
MBTU	= Million BTU

ANNUAL OPERATING COSTS

Job Name : CCF SUBCON 1/4 DESIGN SYS Page 1
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-11-86
Site : AURORA,IL FERMI, User Defined 60117862.0
Scope of Analysis : Cooling and Heating Systems

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A. AIR HANDLING SYSTEMS (ANNUAL FAN OPERATING COST = $550)

Are perimeter and interior zone on same supply fan ? <N>

>1. PERIMETER TERMINAL TYPE : VAV

Supply fan type : Forward curved with 2-speed motor
Supply fan total static pressure = 1.50 in. wg.
Low speed = 50 % of high speed
Return fan type : Forward curved with 2-speed motor
Return fan total static pressure = 1.50 in. wg.
Low speed % of full speed = 50 %
Design supply air= 5336 cfm @ %-98 F; Vent. air= 2668 cfm
Minimum zone air flow = 50 % of design supply cfm
Are cooling terminals used for heating ? <N>
Zone heating unit type : Fan coil units
Fan coil fan avg. efficiency = 60 % ; tot. static = 1.00 in wg
Economizer type : Integrated, dry-bulb controlled
Is a ventilation reclaim device used ? <Y>
Reclaim device: Efficiency = 45 % ; Input power = 0.1 kw
Are ventilation air dampers closed for unoccupied periods ? <N>

>2. INTERIOR TERMINAL TYPE : VAV

Supply fan type : Forward curved with 2-speed motor
Supply fan total static pressure = 1.50 in. wg.
Low speed = 50 % of high speed
Return fan type : Forward curved with 2-speed motor
Return fan total static pressure = 1.50 in. wg.
Low speed % of full speed = 50 %
Design supply air= 3344 cfm @ %-74 F; Vent. air= 1672 cfm
Minimum zone air flow = 50 % of design supply cfm
Economizer type : Integrated, dry-bulb controlled
Is a ventilation reclaim device used ? <Y>
Reclaim device: Efficiency = 45 % ; Input power = 0.1 kw
Are ventilation air dampers closed for unoccupied periods ? <N>

****

B. HEATING PLANTS (ANNUAL HEATING PLANT OPERATING COST = $3,159)

> 1 b. BLOCK AUXILIARY PLANT : REMOTE SOURCE HEATING

Is hydronic heating used ? <Y>

****

ANNUAL OPERATING COSTS

Job Name : CCF SUBCON 1/4 DESIGN SYS — Page 2
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Date : 11-11-86
Site : AURORA,IL FERMI, User Defined — 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

C. COOLING PLANTS (ANNUAL COOLING PLANT OPERATING COST = $14,423)

Does one plant serve perimeter and interior ? <N>

>1. PERIMETER PLANT : WATER SOURCE HEAT PUMPS

Cooling:
Capacity @ 85 F entering water = 120.2 tons
KW/Ton @ 85 F entering water = 1.09 kw/ton
Heating:
Capacity @ 70 F entering water = 1721 MBH
Compressor KW @ 70 F entering water = 140.1 KW
Heat sink type = Open cooling tower
Entering water temperatures: Minimum = 60 F; Maximum = 90 F
Is condenser performance altitude adjusted ? <Y>
Outdoor air temperature for economizer cutoff = 30 F

>2. INTERIOR PLANT : WATER SOURCE HEAT PUMPS

Cooling:
Capacity @ 85 F entering water = 75.4 tons
KW/Ton @ 85 F entering water = 0.98 kw/ton
Heating:
Capacity @ 70 F entering water = 1078 MBH
Compressor KW @ 70 F entering water = 1056.0 KW

****

D. PUMPING SYSTEMS (ANNUAL PUMP OPERATING COST = $4,789)

System	PERIMETER dT, F	PERIMETER dP, ft wg	INTERIOR dT, F	INTERIOR dP, ft wg
Chilled water	0.00	0.00	0.00	0.00
Hot water	0.00	0.00	0.00	0.00
Condenser water	10.00	117.00	0.00	0.00
Ground water	0.00	0.00	0.00	0.00

****

E. NON-HVAC SYSTEMS (ANNUAL NON-HVAC OPERATING COST = $70,089)

>1. NON-HVAC ELECTRICAL ENERGY USE

Lighting kw: Occupied = 122.3 kw; Unoccupied = 25.7 kw
Misc. kw : Occupied = 132.1 kw; Unoccupied = 81.9 kw
Other kw : Occupied = 0.0 kw; Unoccupied = 0.0 kw

>2. DHW SYSTEM (Not utilized in this system)

****

F. FUEL COSTS (GRAND TOTAL ANNUAL OPERATING COST = $93,011)

>1. ELECTRICAL ENERGY USE	Period Occupied ($/kwh)	Period Unoccupied ($/kwh)
Compressor	0.050	0.050
Resistance	0.050	0.050
Inductive	0.050	0.050

>2. OTHER FUELS	Unit Cost
Natural Gas	n/a $/therm
Fuel Oil	n/a $/U.S.gal
Propane	n/a $/lb
Remote Heating	0.000 $/MBTU
Remote Cooling	n/a $/MBTU

COOLING PLANT COSTS

Job Name : CCF SUBCON 1/4 DESIGN SYS — Date : 11-11-86

Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Serial Number:

Site Name : AURORA,IL FERMI, User Defined — 60117862.0

Bin Temp (F)	Bin Hours hr/yr	Perimeter Cooling Plant Coil Load MBH	Input KW	Cost $/yr	Interior Cooling Plant Coil Load MBH	Input KW	Cost $/yr
OCCUPIED PERIOD							
90	25.8	1153.2	99.0	127.7	773.7	57.5	74.1
85	59.4	1000.8	83.4	247.8	724.1	51.5	153.1
80	145.3	859.1	69.4	504.3	677.8	46.1	334.9
75	237.7	727.2	56.9	676.0	634.5	41.1	488.6
70	270.6	603.9	45.7	618.7	594.0	36.6	494.6
65	264.5	500.4	36.7	485.3	556.1	32.5	429.2
60	255.0	401.9	28.7	366.2	533.2	29.4	374.9
55	244.7	301.5	21.9	267.6	511.5	27.4	335.6
50	232.1	193.3	15.2	176.6	490.9	26.4	306.5
45	229.5	47.4	6.0	69.1	456.5	24.7	283.3
40	237.6	0.0	0.0	0.0	425.0	26.1	309.9
35	238.5	0.0	0.0	0.0	396.0	24.6	293.5
30	218.2	0.0	0.0	0.0	368.6	23.2	253.1
25	174.5	0.0	0.0	0.0	441.7	26.9	235.0
20	122.4	0.0	0.0	0.0	428.0	26.2	160.6
15	78.1	0.0	0.0	0.0	415.1	25.6	99.9
10	46.1	0.0	0.0	0.0	402.9	25.0	57.5
5	25.1	0.0	0.0	0.0	391.3	24.4	30.6
0	12.7	0.0	0.0	0.0	380.1	23.8	15.1
-5	6.2	0.0	0.0	0.0	369.3	23.2	7.2
-6	4.6	0.0	0.0	0.0	367.2	20.1	4.6
Total Costs				$3539.5			$4741.7
UNOCCUPIED PERIOD							
90	14.6	734.1	63.9	46.7	418.0	31.4	22.9
85	36.3	698.9	58.5	106.1	382.7	27.5	50.0
80	99.3	588.8	47.6	236.5	354.4	24.2	120.2
75	215.3	484.2	38.0	408.6	326.9	21.1	227.7
70	357.6	378.4	28.9	517.1	300.1	18.3	327.6
65	463.3	266.3	20.2	468.8	274.1	15.7	364.0
60	500.4	141.4	12.0	299.7	260.3	14.5	362.9
55	482.0	0.0	0.0	0.0	247.1	16.8	404.5
50	447.6	0.0	0.0	0.0	234.5	16.1	360.5
45	422.7	0.0	0.0	0.0	213.7	15.0	316.6
40	413.7	0.0	0.0	0.0	194.5	13.9	288.3
35	417.0	0.0	0.0	0.0	176.8	13.0	270.3
30	417.4	0.0	0.0	0.0	159.9	12.0	251.1
25	395.2	0.0	0.0	0.0	181.4	13.2	261.2
20	336.9	0.0	0.0	0.0	172.2	9.7	163.8
15	252.8	0.0	0.0	0.0	163.5	9.2	116.8
10	165.7	0.0	0.0	0.0	155.2	8.8	72.8
5	96.3	0.0	0.0	0.0	147.1	8.3	40.2
0	50.9	0.0	0.0	0.0	139.4	7.9	20.1
-5	25.3	0.0	0.0	0.0	131.8	7.5	9.5
-6	21.1	0.0	0.0	0.0	130.3	7.4	7.8
Total Costs				$2083.5			$4058.7

PERIMETER AND BLOCK AUXILIARY HEATING PLANT COSTS

Job Name : CCF SUBCON 1/4 DESIGN SYS — Date : 11-11-86

Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Serial Number:

Site Name : AURORA,IL FERMI, User Defined — 60117862.0

Bin Temp (F)	Bin Hours hr/yr	Coil Load MBH	Primary Plant Output MBH	Primary Plant Input KW	Primary Plant Cost $/yr	Auxiliary Plant Output MBH	Auxiliary Plant Input MBH	Auxiliary Plant Cost $/yr
OCCUPIED PERIOD								
90	25.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85	59.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80	145.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75	237.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70	270.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65	264.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60	255.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	244.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	232.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	229.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	237.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	238.5	24.8	24.8	2.0	24.4	0.0	0.0	0.0
30	218.2	28.7	28.7	2.4	25.8	0.0	0.0	0.0
25	174.5	87.3	87.3	7.2	62.8	0.0	0.0	0.0
20	122.4	172.2	172.2	14.2	86.9	0.0	0.0	0.0
15	78.1	257.1	257.1	21.2	82.8	0.0	0.0	0.0
10	46.1	342.0	342.0	28.2	65.0	0.0	0.0	0.0
5	25.1	426.9	426.9	35.2	44.2	0.0	0.0	0.0
0	12.7	511.8	511.8	42.2	26.8	0.0	0.0	0.0
-5	6.2	596.7	596.7	49.2	15.3	0.0	0.0	0.0
-6	4.6	613.6	613.6	50.6	11.6	5.0	5.0	0.0
Total Costs					$445.7			$0.0
UNOCCUPIED PERIOD								
90	14.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85	36.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80	99.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75	215.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70	357.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65	463.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60	500.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	482.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	447.6	16.3	16.3	1.3	30.2	0.0	0.0	0.0
45	422.7	22.8	22.8	1.9	39.7	0.0	0.0	0.0
40	413.7	29.2	29.2	2.4	49.9	0.0	0.0	0.0
35	417.0	84.9	84.9	7.0	146.1	0.0	0.0	0.0
30	417.4	167.6	167.6	13.8	288.6	0.0	0.0	0.0
25	395.2	250.3	250.3	20.6	408.0	0.0	0.0	0.0
20	336.9	333.0	333.0	27.5	462.7	33.8	33.8	0.0
15	252.8	415.7	415.7	34.3	433.4	103.6	103.6	0.0
10	165.7	498.4	498.4	41.1	340.6	172.9	172.9	0.0
5	96.3	581.1	581.1	47.9	230.8	241.9	241.9	0.0
0	50.9	663.8	663.8	54.8	139.3	310.5	310.5	0.0
-5	25.3	746.5	746.5	61.6	77.9	379.0	379.0	0.0
-6	21.1	763.0	763.0	62.9	66.4	392.6	392.6	0.0
Total Costs					$2713.6			$0.0

INTERIOR HEATING PLANT COSTS

Job Name : CCF SUBCON 1/4 DESIGN SYS — Date : 11 11-86

Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Serial Number:

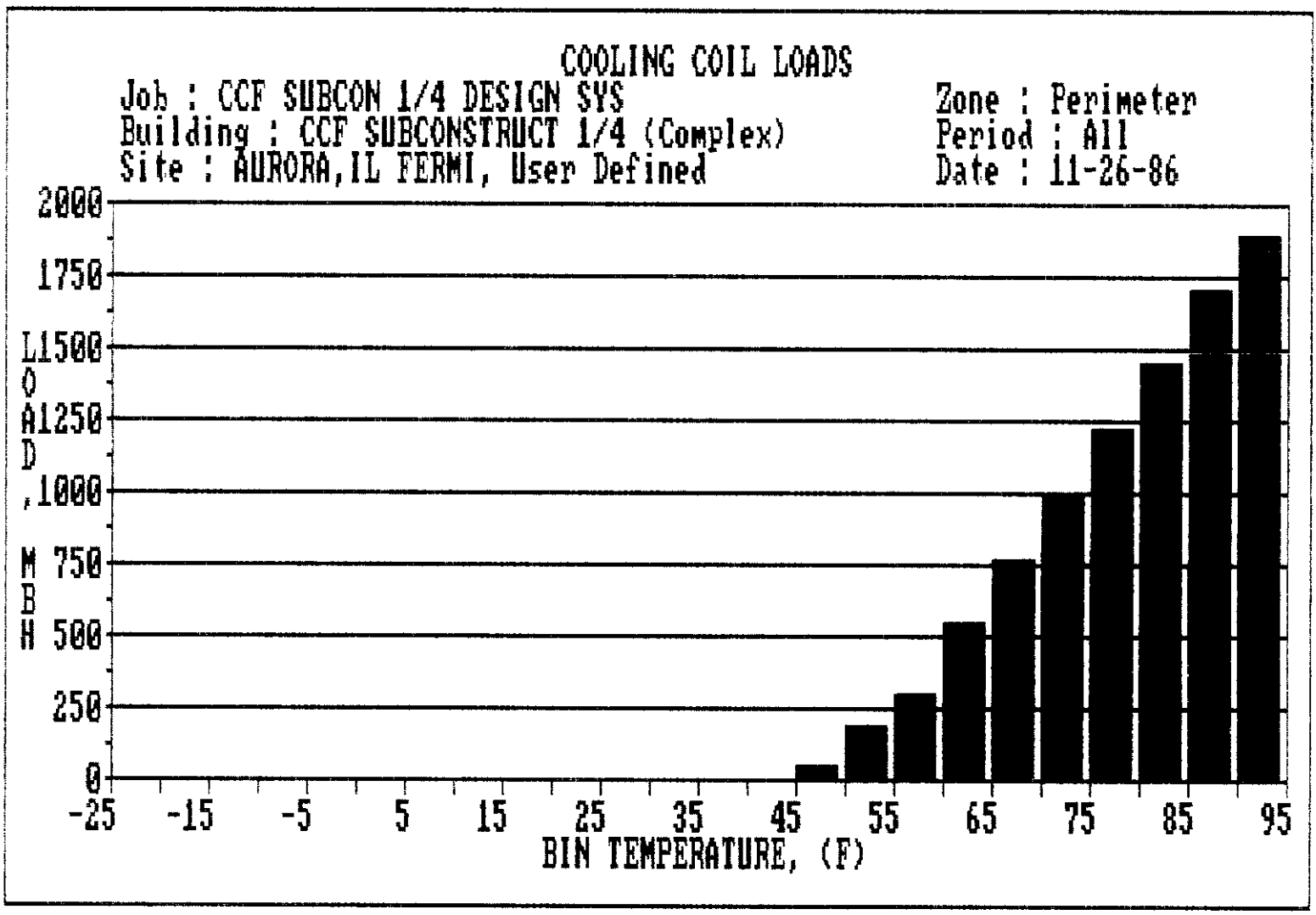
Site Name : AURORA,IL FERMI, User Defined — 60117862.0

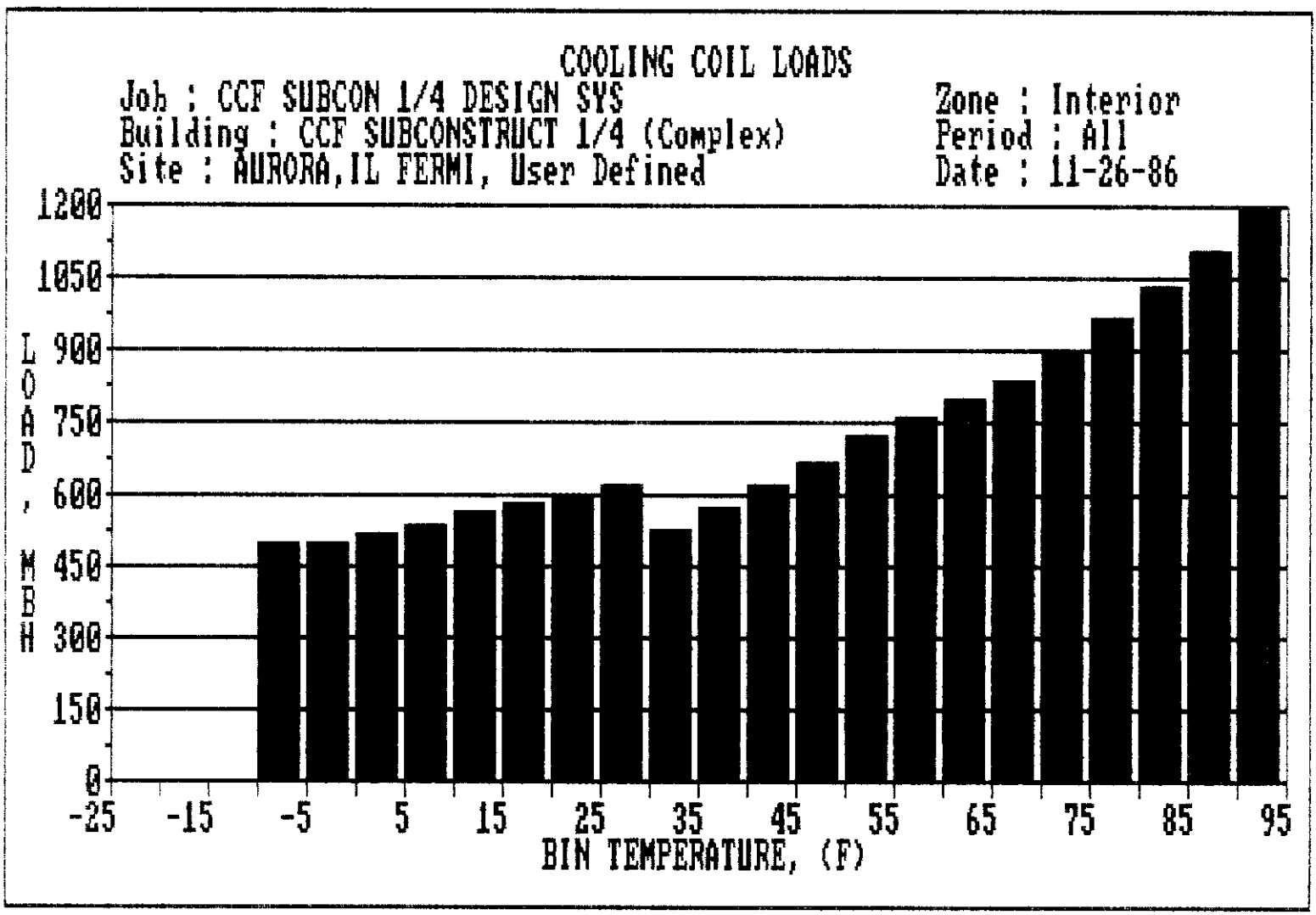
Bin Temp (F)	Bin Hours hr/yr	Coil Load MBH	Primary Plant Output MBH	Input KW	Cost $/yr	No Auxiliary Plant Used
			OCCUPIED PERIOD			
90	25.8	0.0	0.0	0.0	0.0	
85	59.4	0.0	0.0	0.0	0.0	
80	145.3	0.0	0.0	0.0	0.0	
75	237.7	0.0	0.0	0.0	0.0	
70	270.6	0.0	0.0	0.0	0.0	
65	264.5	0.0	0.0	0.0	0.0	
60	255.0	0.0	0.0	0.0	0.0	
55	244.7	0.0	0.0	0.0	0.0	
50	232.1	0.0	0.0	0.0	0.0	
45	229.5	0.0	0.0	0.0	0.0	
40	237.6	0.0	0.0	0.0	0.0	
35	238.5	0.0	0.0	0.0	0.0	
30	218.2	0.0	0.0	0.0	0.0	
25	174.5	0.0	0.0	0.0	0.0	
20	122.4	0.0	0.0	0.0	0.0	
15	78.1	0.0	0.0	0.0	0.0	
10	46.1	0.0	0.0	0.0	0.0	
5	25.1	0.0	0.0	0.0	0.0	
0	12.7	0.0	0.0	0.0	0.0	
-5	6.2	0.0	0.0	0.0	0.0	
-6	4.6	0.0	0.0	0.0	0.0	
Total Costs					$0.0	
			UNOCCUPIED PERIOD			
90	14.6	0.0	0.0	0.0	0.0	
85	36.3	0.0	0.0	0.0	0.0	
80	99.3	0.0	0.0	0.0	0.0	
75	215.3	0.0	0.0	0.0	0.0	
70	357.6	0.0	0.0	0.0	0.0	
65	463.3	0.0	0.0	0.0	0.0	
60	500.4	0.0	0.0	0.0	0.0	
55	482.0	0.0	0.0	0.0	0.0	
50	447.6	0.0	0.0	0.0	0.0	
45	422.7	0.0	0.0	0.0	0.0	
40	413.7	0.0	0.0	0.0	0.0	
35	417.0	0.0	0.0	0.0	0.0	
30	417.4	0.0	0.0	0.0	0.0	
25	395.2	0.0	0.0	0.0	0.0	
20	336.9	0.0	0.0	0.0	0.0	
15	252.8	0.0	0.0	0.0	0.0	
10	165.7	0.0	0.0	0.0	0.0	
5	96.3	0.0	0.0	0.0	0.0	
0	50.9	0.0	0.0	0.0	0.0	
-5	25.3	0.0	0.0	0.0	0.0	
-6	21.1	0.0	0.0	0.0	0.0	
Total Costs					$0.0	

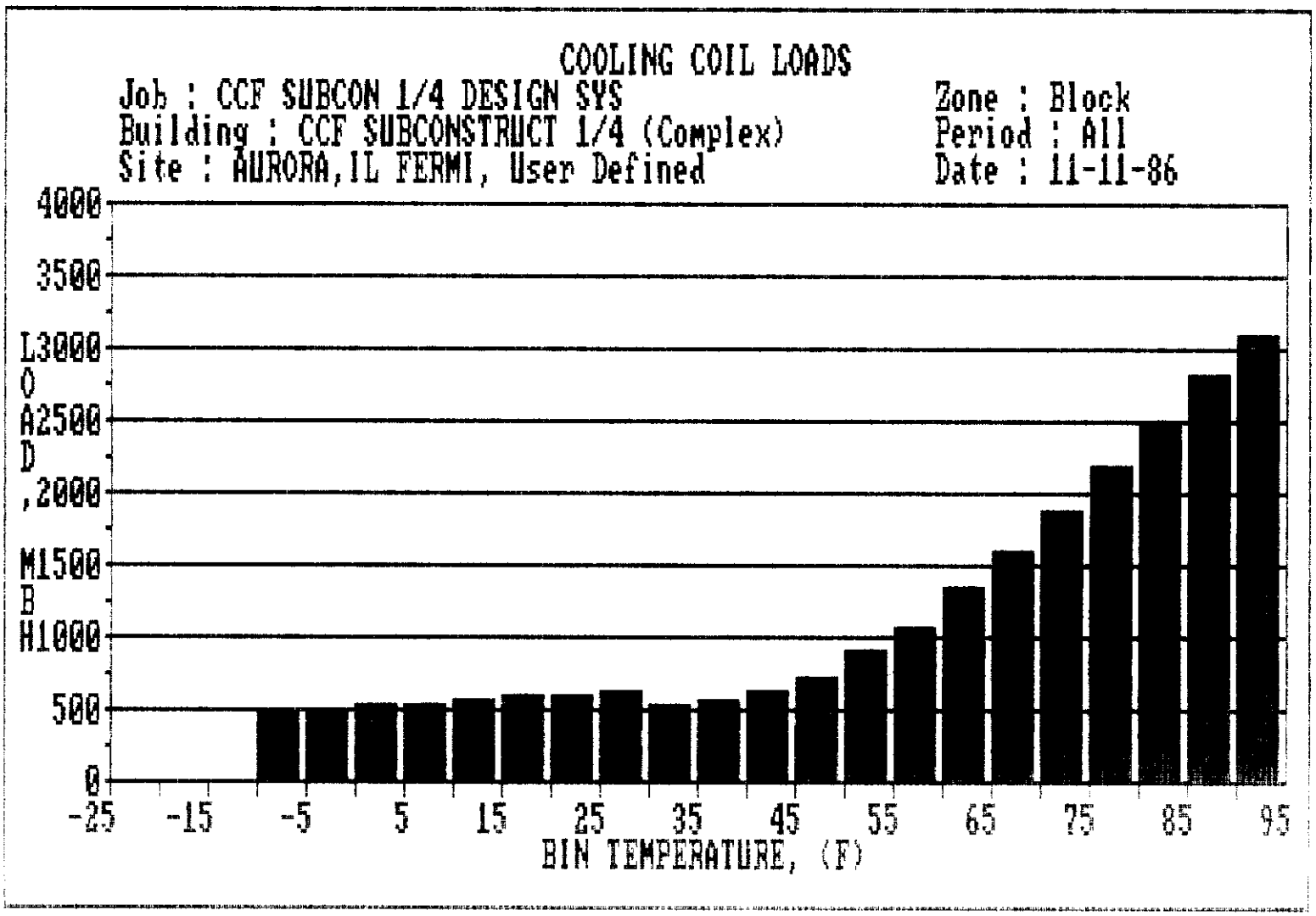
FAN AND PUMP COSTS

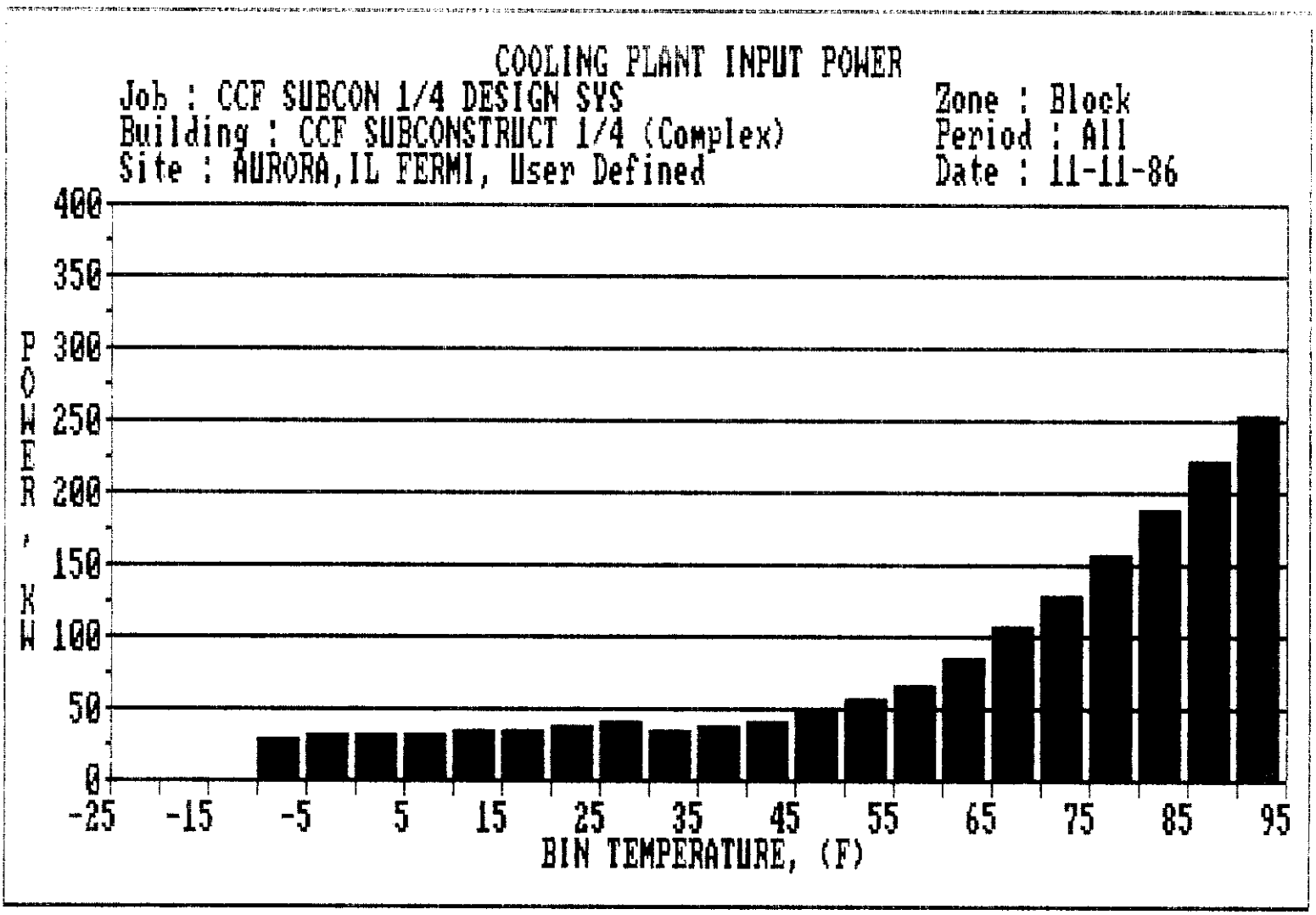
Job Name : CCF SUBCON 1/4 DESIGN SYS — Date : 11-11-86
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Serial Number:
Site Name : AURORA,IL FERMI, User Defined — 60117862.0

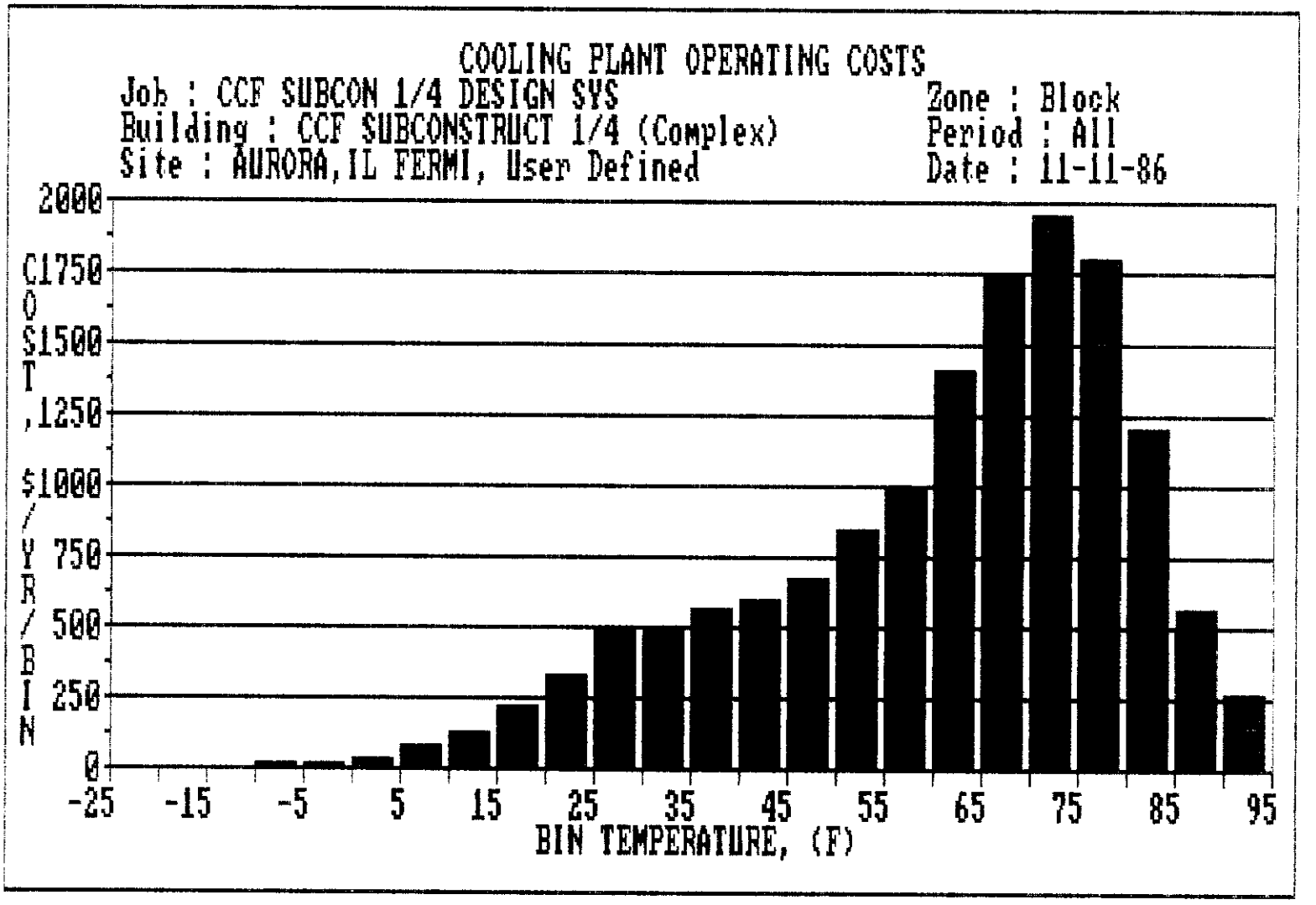
Bin Temp (F)	Bin Hours hr/yr	Perimeter Input KW	Perimeter Fans Cost $/yr	Interior Input KW	Interior Fans Cost $/yr	All Input KW	Pumps Cost $/yr
OCCUPIED PERIOD							
90	25.8	2.5	3.2	2.0	2.6	10.9	14.0
85	59.4	2.1	6.2	2.0	5.8	10.9	32.3
80	145.3	1.8	12.8	1.9	13.7	10.9	79.1
75	237.7	1.5	17.3	1.8	21.6	10.9	129.4
70	270.6	0.1	2.0	1.7	23.7	10.9	147.3
65	264.5	0.1	2.0	1.7	22.2	10.9	143.9
60	255.0	0.1	1.9	1.7	21.4	10.9	138.8
55	244.7	0.1	1.8	1.7	20.4	10.9	133.2
50	232.1	0.1	1.7	1.7	19.3	10.9	126.3
45	229.5	0.1	1.7	1.7	19.0	10.9	124.9
40	237.6	0.1	1.8	1.7	19.6	10.9	129.3
35	238.5	0.1	1.8	1.6	19.6	11.0	131.0
30	218.2	0.1	1.6	1.6	17.9	11.0	119.8
25	174.5	1.3	11.4	1.6	14.3	11.0	95.8
20	122.4	1.3	8.0	1.6	10.0	11.0	67.2
15	78.1	1.3	5.1	1.6	6.3	11.0	42.9
10	46.1	1.3	3.0	1.6	3.7	11.0	25.3
5	25.1	1.3	1.6	1.6	2.0	11.0	13.8
0	12.7	1.3	0.8	1.6	1.0	11.0	7.0
-5	6.2	1.3	0.4	1.6	0.5	11.0	3.4
-6	4.6	1.3	0.3	1.6	0.4	11.0	2.5
Total Costs			$86.5		$265.2		$1707.2
UNOCCUPIED PERIOD							
90	14.6	1.5	1.1	0.8	0.6	11.0	8.0
85	36.3	1.2	2.2	0.1	0.2	10.9	19.8
80	99.3	0.1	0.7	0.1	0.5	10.9	54.0
75	215.3	0.1	1.6	0.1	1.0	10.9	117.2
70	357.6	0.1	2.7	0.1	1.7	10.9	194.6
65	463.3	0.1	3.5	0.1	2.2	10.9	252.1
60	500.4	0.1	3.7	0.1	2.3	10.9	272.3
55	482.0	0.1	3.6	0.1	2.3	10.9	262.3
50	447.6	0.1	3.3	0.1	2.1	11.0	245.8
45	422.7	0.1	3.2	0.1	2.0	11.0	232.1
40	413.7	0.1	3.1	0.1	1.9	11.0	227.2
35	417.0	1.3	27.2	0.1	1.9	11.0	229.0
30	417.4	1.3	27.3	0.1	2.0	11.0	229.2
25	395.2	1.3	25.8	0.1	1.8	11.0	217.0
20	336.9	1.3	22.0	0.1	1.6	11.0	185.0
15	252.8	1.3	16.5	0.1	1.2	11.0	138.8
10	165.7	1.3	10.8	0.1	0.8	11.0	91.0
5	96.3	1.3	6.3	0.1	0.5	11.0	52.9
0	50.9	1.3	3.3	0.1	0.2	11.0	28.0
-5	25.3	1.3	1.7	0.1	0.1	11.0	13.9
-6	21.1	1.3	1.4	0.1	0.1	11.0	11.6
Total Costs			$171.0		$26.8		$3082.0

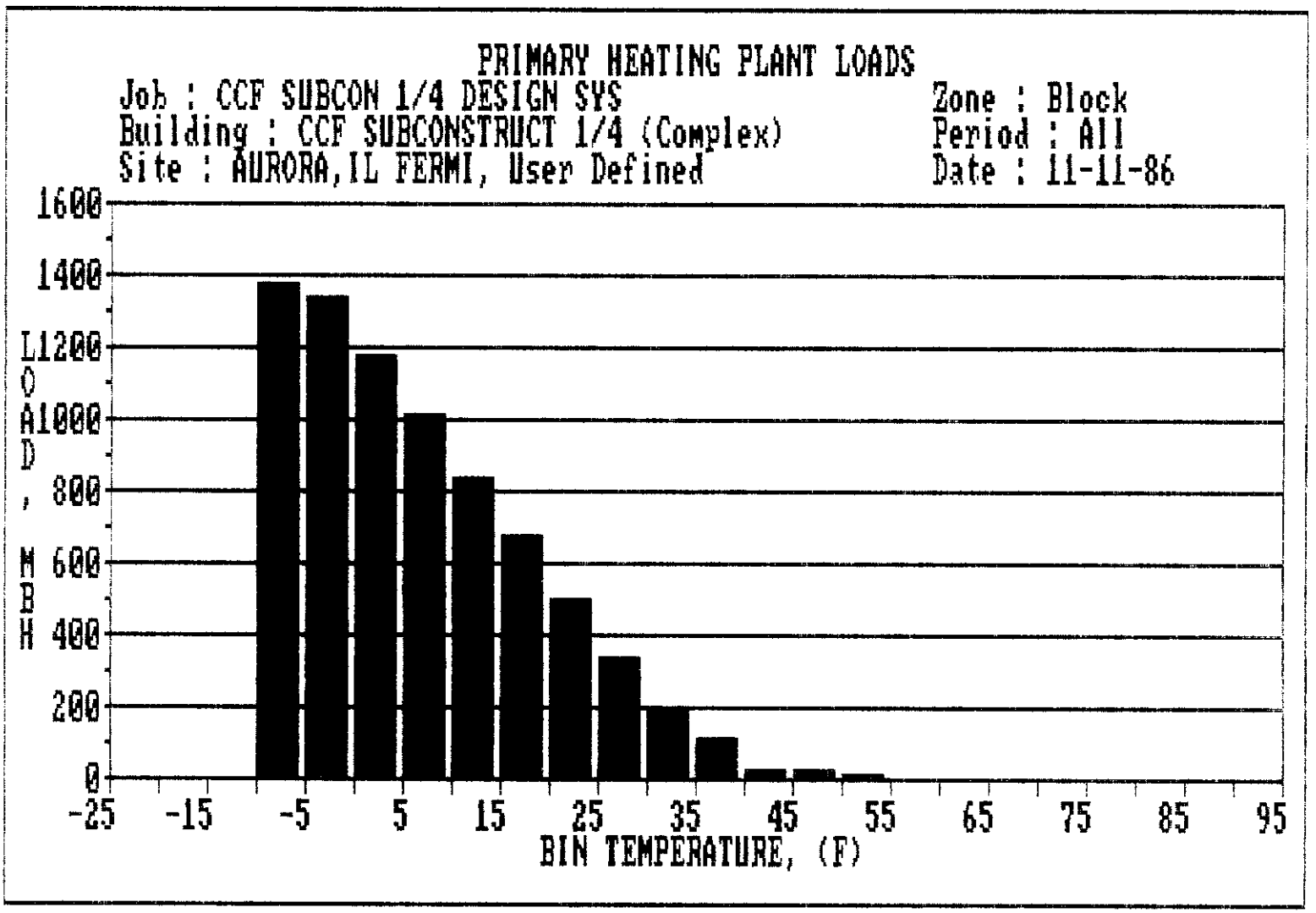

COOLING COIL LOADS
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Perimeter
Period : All
Date : 11-26-86
LOAD, MBH
2000
1750
1500
1250
1000
750
500
250
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

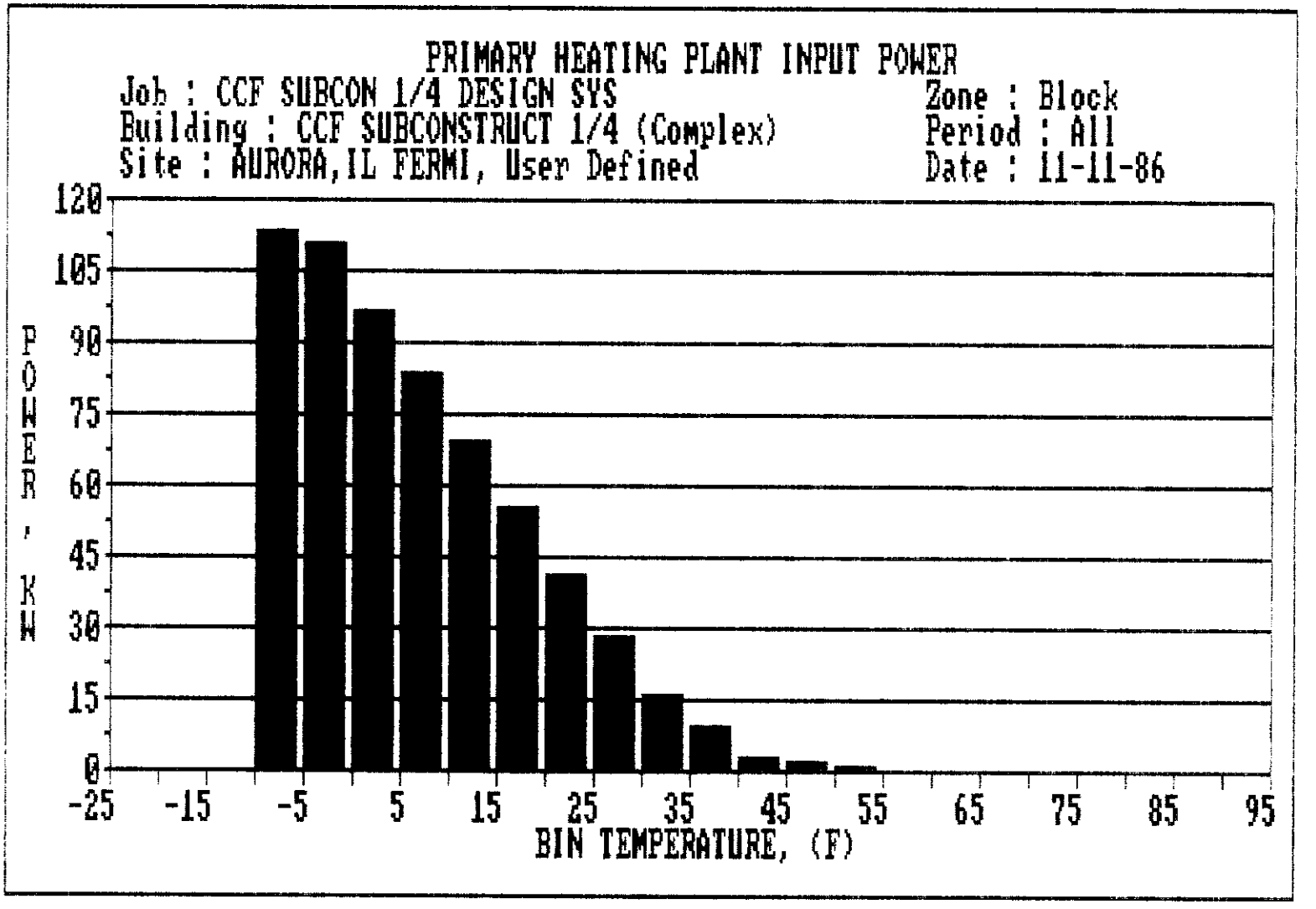

COOLING COIL LOADS
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Interior
Period : All
Date : 11-26-86
LOAD, MBH
1200
1050
900
750
600
450
300
150
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

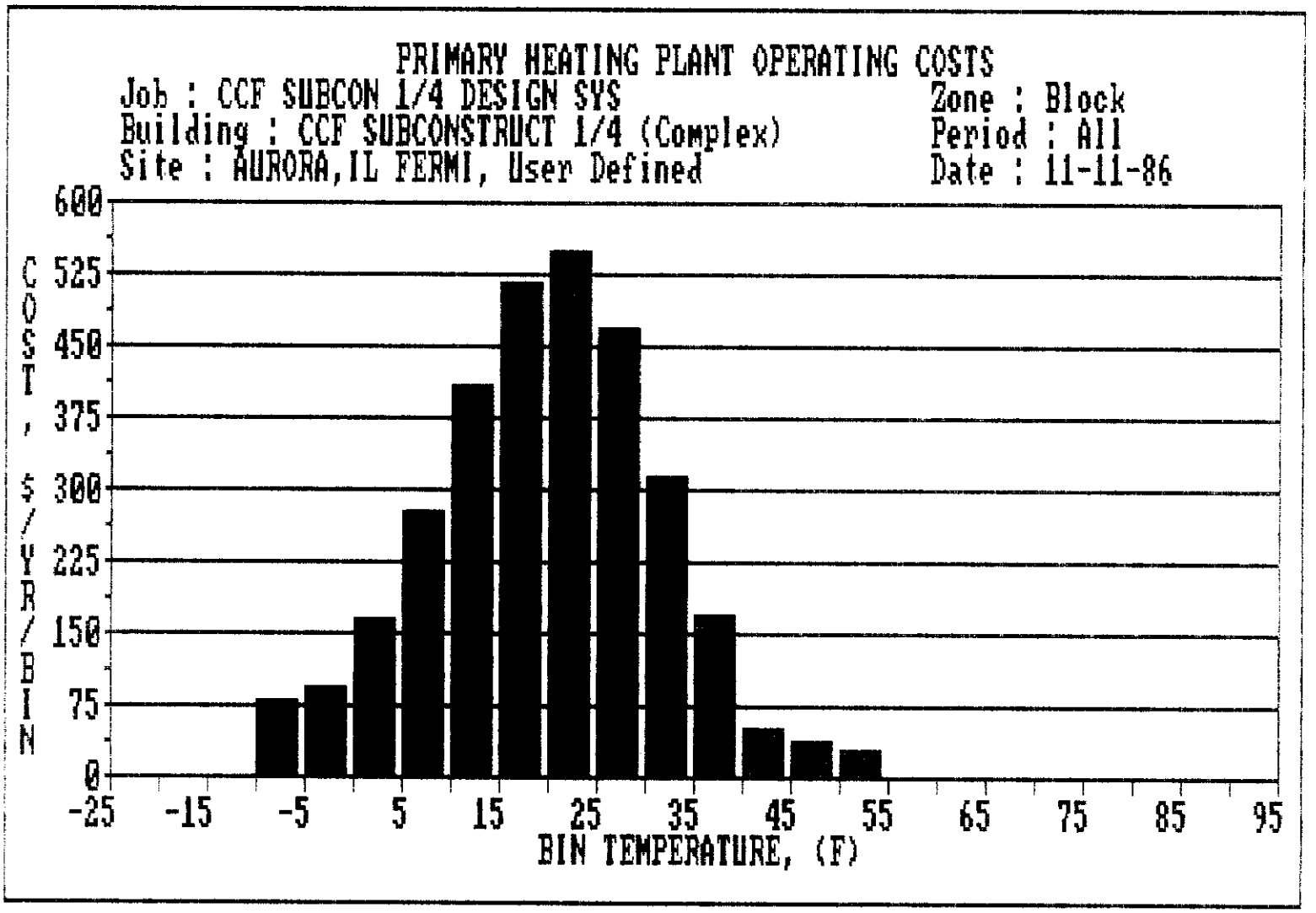

COOLING COIL LOADS
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
LOAD, MBH
4000
3500
3000
2500
2000
1500
1000
500
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

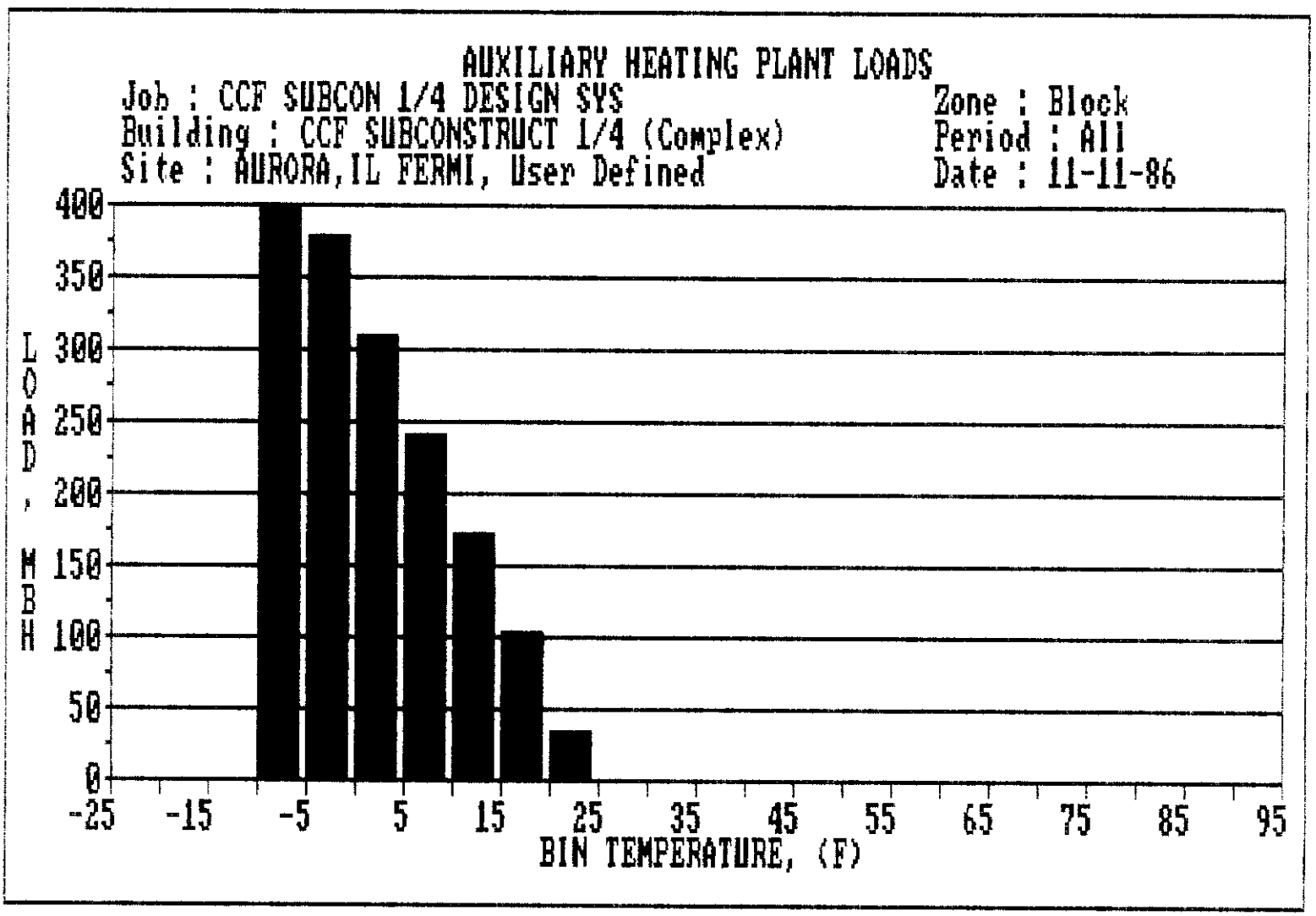

COOLING PLANT INPUT POWER
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
POWER, KW
400
350
300
250
200
150
100
50
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

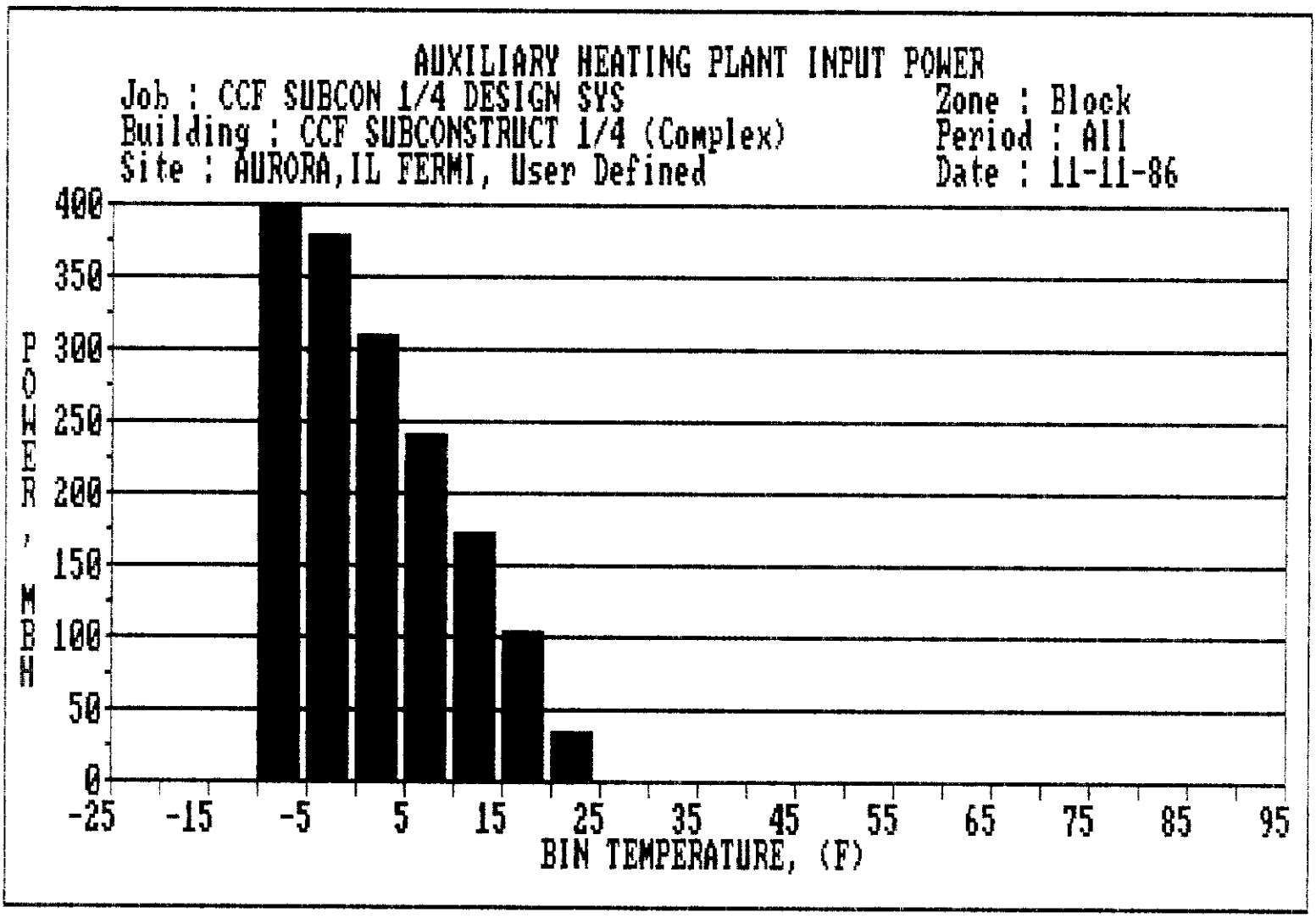

COOLING PLANT OPERATING COSTS
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
COST $/YR/BIN
2000
1750
1500
1250
1000
750
500
250
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

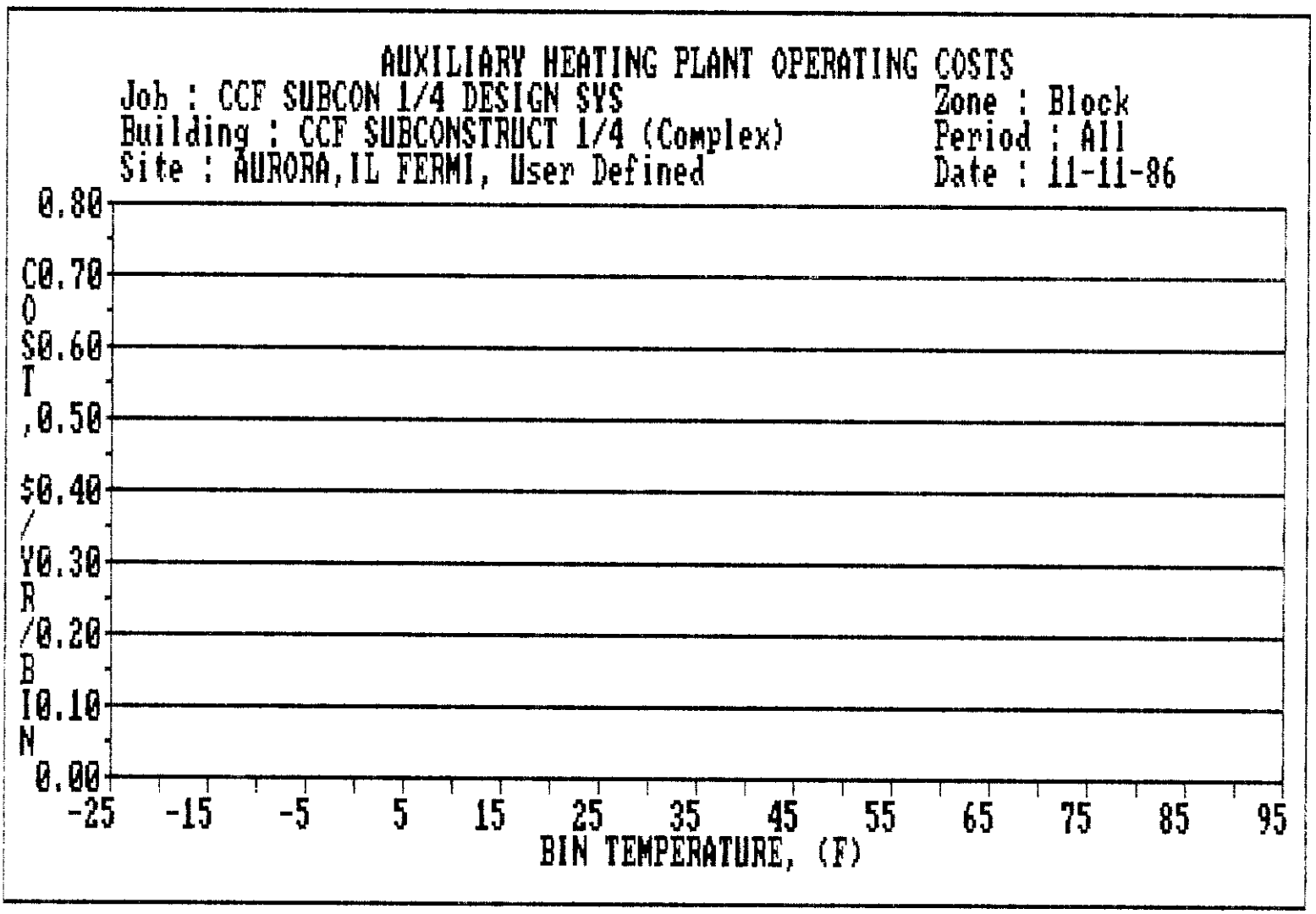

PRIMARY HEATING PLANT LOADS
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
LOAD, MBH
1600
1400
1200
1000
800
600
400
200
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

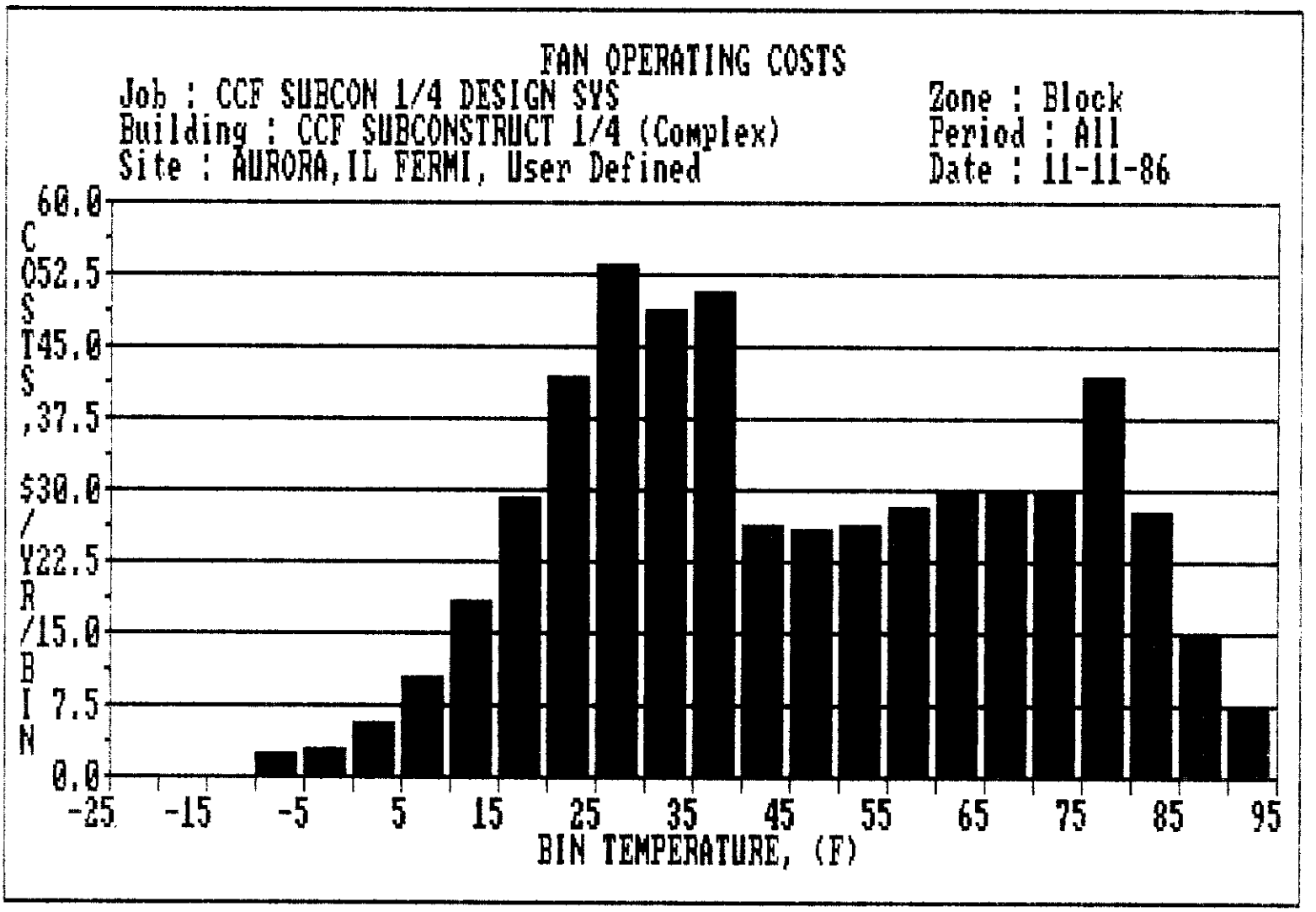

PRIMARY HEATING PLANT INPUT POWER
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
POWER, KW
120
105
90
75
60
45
30
15
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT OPERATING COSTS
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
COST, $/YR/BIN
600
525
450
375
300
225
150
75
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


AUXILIARY HEATING PLANT LOADS
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
LOAD, MBH
400
350
300
250
200
150
100
50
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


AUXILIARY HEATING PLANT INPUT POWER
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
POWER, MBH
400
350
300
250
200
150
100
50
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


AUXILIARY HEATING PLANT OPERATING COSTS
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
COST, $/YR/BIN
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


FAN OPERATING COSTS
Job : CCF SUBCON 1/4 DESIGN SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
COSTS $/YR/BIN
60.0
52.5
45.0
37.5
30.0
22.5
15.0
7.5
0.0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
OPERATIONAL PERFORMANCE SIMULATION

ALTERNATE COMPARISON SYSTEM NUMBER 1
VARIABLE AIR VOLUME WITH CENTRIFUGAL CHILLERS AND ICW FREE COOLING ECONOMIZER

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

SYSTEM INPUT SUMMARY

Job Name : CCF SUBCON 1/4 VAV SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Scope of Analysis : Cooling and Heating Systems

Date : 11-21-86
60117862.0

****

A. AIR HANDLING SYSTEMS

Are perimeter and interior zone on same supply fan ? <N>

>1. PERIMETER TERMINAL TYPE : VAV REHEAT

Supply fan type : Backward inclined or airfoil with inlet vanes
Supply fan total static pressure = 4.00 in. wg.
Return fan type : Backward inclined or airfoil with inlet vanes
Return fan total static pressure = 2.00 in. wg.
Design supply air= 40771 cfm @ 55 F; Vent. air= 2668 cfm
Minimum zone air flow = 30 % of design supply cfm
Economizer type : Integrated, enthalpy controlled
Is a ventilation reclaim device used ? <N>
Are ventilation air dampers closed for unoccupied periods ? <N>

>2. INTERIOR TERMINAL TYPE : VAV

Supply fan type : Backward inclined or airfoil with inlet vanes
Supply fan total static pressure = 4.00 in. wg.
Return fan type : Backward inclined or airfoil with inlet vanes
Return fan total static pressure = 2.00 in. wg.
Design supply air= 22029 cfm @ 55 F; Vent. air= 1672 cfm
Minimum zone air flow = 30 % of design supply cfm
Economizer type : Integrated, enthalpy controlled
Is a ventilation reclaim device used ? <N>
Are ventilation air dampers closed for unoccupied periods ? <N>

****

B. HEATING PLANTS

Does one primary heating plant serve perimeter and interior ? <Y>

> 1 . BLOCK PLANT : ELECTRICAL RESISTANCE

Is hydronic heating used ? <Y>

****

SYSTEM INPUT SUMMARY

Job Name : CCF SUBCON 1/4 VAV SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Scope of Analysis : Cooling and Heating Systems

Date : 11-21-86
60117862.0

****

C. COOLING PLANTS

Does one plant serve perimeter and interior ? <Y>

>1. BLOCK PLANT : CENTRIFUGAL WATER COOLED CHILLER
Capacity @ 85 F entering water = 195.6 tons
KW/Ton @ 85 F entering water = 0.85 kw/ton
Is hydronic cooling used ? <Y>
Is chilled water reset used ? <N>
Is condenser performance altitude adjusted ? <Y>
Heat sink type : Open cooling tower
Minimum entering water temperature = 35 F
Is a hydronic economizer used ? <Y> ; Economizer efficiency = 100 %
Number of sequenced chillers = 1

****

D. PUMPING SYSTEMS

System	PERIMETER dT, F	PERIMETER dP, ft wg	INTERIOR dT, F	INTERIOR dP, ft wg
Chilled water	10.00	60.00	0.00	0.00
Hot water	20.00	60.00	0.00	0.00
Condenser water	10.00	60.00	0.00	0.00
Ground water	0.00	0.00	0.00	0.00

****

E. NON-HVAC SYSTEMS

>1. NON-HVAC ELECTRICAL ENERGY USE
Lighting kw: Occupied = 122.3 kw; Unoccupied = 25.7 kw
Misc. kw : Occupied = 132.1 kw; Unoccupied = 81.9 kw
Other kw : Occupied = 0.0 kw; Unoccupied = 0.0 kw

>2. DHW SYSTEM (Not utilized in this system)

****

F. FUEL COSTS

>1. ELECTRICAL ENERGY USE	Period Occupied ($/kwh)	Period Unoccupied ($/kwh)
Compressor	0.050	0.050
Resistance	0.050	0.050
Inductive	0.050	0.050

>2. OTHER FUELS	Unit Cost
Natural Gas	n/a $/therm
Fuel Oil	n/a $/U.S.gal
Propane	n/a $/lb
Remote Heating	n/a $/MBTU
Remote Cooling	n/a $/MBTU

TOTAL BUILDING ENERGY SUMMARY

Job Name : CCF SUBCON 1/4 VAV SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Date : 11-11-86

Period : All
Zone : Block
Serial Number:
60117862.0

****

HVAC ENERGY Component	Annual Cost ($/yr)	Energy or Fuel Units Consumed	DOE RUF (1000 BTU)	DOE RIF (1000 BTU)
Electric (Occ)	13911	278213 kwh/yr	3227266	949540
Electric (Unocc)	22150	442998 kwh/yr	5138778	1511952
Natural Gas	0	0 therms/yr	0	0
Fuel Oil	0	0 U.S. gal/yr	0	0
Propane	0	0 lb/yr	0	0
Remote Heating	0	0 MBTU/yr	0	0
Remote Cooling	0	0 MBTU/yr	0	0
HVAC Total	36061		8366044	2461492
NON-HVAC ENERGY				
Electric (Occ)	39793	795864 kwh/yr	9232025	2716285
Electric (Unocc)	30296	605916 kwh/yr	7028627	2067992
Non-HVAC Total	70089		16260652	4784276
Grand Total	106150		24626696	7245768
Total/Sq.Ft.	2.47		573.92	168.86

HVAC Summary:

HVAC Total Cost	=	0.84 $/Sq.Ft./yr
	=	33.97 % of Total Cost
Total HVAC Electrical Energy	=	16.81 kwh/Sq.Ft./yr
	=	33.97 % of Total Electrical Energy
Non-Electrical HVAC Energy	=	0.00 % of Total Energy

Key:

1 kwh	= 11600 BTU RUF; 3412 BTU RIF
1 therm nat gas	= 100000 BTU RUF and RIF
1 U.S. gal oil	= 138700 BTU RUF and RIF
1 Imp. gal oil	= 168000 BTU RUF and RIF
1 lb propane	= 21680 BTU RUF and RIF
RUF	= Resource utilization factor (Source value)
RIF	= Resource impact factor (Point of use value)
MBH	= 1000 BTU/hr
MBTU	= Million BTU

ANNUAL OPERATING COSTS

Job Name : CCF SUBCON 1/4 VAV SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-11-86
Site : AURORA,IL FERMI, User Defined 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

A. AIR HANDLING SYSTEMS (ANNUAL FAN OPERATING COST = $9,370)

Are perimeter and interior zone on same supply fan ? <N>

>1. PERIMETER TERMINAL TYPE : VAV REHEAT

Supply fan type : Backward inclined or airfoil with inlet vanes
Supply fan total static pressure = 4.00 in. wg.
Return fan type : Backward inclined or airfoil with inlet vanes
Return fan total static pressure = 2.00 in. wg.
Design supply air= 40771 cfm @ 55 F; Vent. air= 2668 cfm
Minimum zone air flow = 30 % of design supply cfm
Economizer type : Integrated, enthalpy controlled
Is a ventilation reclaim device used ? <N>
Are ventilation air dampers closed for unoccupied periods ? <N>

>2. INTERIOR TERMINAL TYPE : VAV

Supply fan type : Backward inclined or airfoil with inlet vanes
Supply fan total static pressure = 4.00 in. wg.
Return fan type : Backward inclined or airfoil with inlet vanes
Return fan total static pressure = 2.00 in. wg.
Design supply air= 22029 cfm @ 55 F; Vent. air= 1672 cfm
Minimum zone air flow = 30 % of design supply cfm
Economizer type : Integrated, enthalpy controlled
Is a ventilation reclaim device used ? <N>
Are ventilation air dampers closed for unoccupied periods ? <N>

****

B. HEATING PLANTS (ANNUAL HEATING PLANT OPERATING COST = $14,567)

Does one primary heating plant serve perimeter and interior ? <Y>

> 1 . BLOCK PLANT : ELECTRICAL RESISTANCE

Is hydronic heating used ? <Y>

****

ANNUAL OPERATING COSTS

Job Name : CCF SUBCON 1/4 VAV SYS — Page 2
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Date : 11-11-86
Site : AURORA,IL FERMI, User Defined — 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

C. COOLING PLANTS (ANNUAL COOLING PLANT OPERATING COST = $8,402)

Does one plant serve perimeter and interior ? <Y>

>1. BLOCK PLANT : CENTRIFUGAL WATER COOLED CHILLER
Capacity @ 85 F entering water = 193.5 tons
KW/Ton @ 85 F entering water = 0.85 kw/ton
Is hydronic cooling used ? <Y>
Is chilled water reset used ? <N>
Is condenser performance altitude adjusted ? <Y>
Heat sink type : Open cooling tower
Minimum entering water temperature = 35 F
Is a hydronic economizer used ? <Y> ; Economizer efficiency = 100 %
Number of sequenced chillers = 1

****

D. PUMPING SYSTEMS (ANNUAL PUMP OPERATING COST = $3,721)

System	PERIMETER dT, F	PERIMETER dP, ft wg	INTERIOR dT, F	INTERIOR dP, ft wg
Chilled water	10.00	60.00	0.00	0.00
Hot water	20.00	120.00	0.00	0.00
Condenser water	10.00	60.00	0.00	0.00
Ground water	0.00	0.00	0.00	0.00

****

E. NON-HVAC SYSTEMS (ANNUAL NON-HVAC OPERATING COST = $70,089)

>1. NON-HVAC ELECTRICAL ENERGY USE
Lighting kw: Occupied = 122.3 kw; Unoccupied = 25.7 kw
Misc. kw : Occupied = 132.1 kw; Unoccupied = 81.9 kw
Other kw : Occupied = 0.0 kw; Unoccupied = 0.0 kw

>2. DHW SYSTEM (Not utilized in this system)

****

F. FUEL COSTS (GRAND TOTAL ANNUAL OPERATING COST = $106,150)

>1. ELECTRICAL ENERGY USE	Period Occupied ($/kwh)	Period Unoccupied ($/kwh)
Compressor	0.050	0.050
Resistance	0.050	0.050
Inductive	0.050	0.050

>2. OTHER FUELS	Unit Cost
Natural Gas	n/a $/therm
Fuel Oil	n/a $/U.S.gal
Propane	n/a $/lb
Remote Heating	n/a $/MBTU
Remote Cooling	n/a $/MBTU

COOLING PLANT COSTS

Job Name : CCF SUBCON 1/4 VAV SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site Name : AURORA,IL FERMI, User Defined

Date : 11-11-86
Serial Number:
60117862.0

Bin Temp (F)	Bin Hours hr/yr	Block Cooling Plant Coil Load MBH	Input KW	Cost $/yr
OCCUPIED PERIOD				
90	25.8	1897.2	119.8	154.5
85	59.4	1724.2	101.5	301.4
80	145.3	1562.3	86.7	630.2
75	237.7	1410.5	75.0	891.0
70	270.6	922.6	59.5	805.4
65	264.5	528.9	44.6	590.0
60	255.0	250.0	36.3	462.3
55	244.7	67.8	31.7	387.9
50	232.1	0.0	0.0	0.0
45	229.5	0.0	0.0	0.0
40	237.6	0.0	0.0	0.0
35	238.5	0.0	0.0	0.0
30	218.2	0.0	0.0	0.0
25	174.5	0.0	0.0	0.0
20	122.4	0.0	0.0	0.0
15	78.1	0.0	0.0	0.0
10	46.1	0.0	0.0	0.0
5	25.1	0.0	0.0	0.0
0	12.7	0.0	0.0	0.0
-5	6.2	0.0	0.0	0.0
-6	4.6	0.0	0.0	0.0
Total Costs				$4222.8
UNOCCUPIED PERIOD				
90	14.6	1127.0	74.1	54.1
85	36.3	984.1	63.6	115.4
80	99.3	849.7	55.3	274.7
75	215.3	722.9	48.9	526.4
70	357.6	474.5	43.0	768.5
65	463.3	282.9	37.1	858.5
60	500.4	149.4	33.5	839.2
55	482.0	32.6	30.8	742.8
50	447.6	0.0	0.0	0.0
45	422.7	0.0	0.0	0.0
40	413.7	0.0	0.0	0.0
35	417.0	0.0	0.0	0.0
30	417.4	0.0	0.0	0.0
25	395.2	0.0	0.0	0.0
20	336.9	0.0	0.0	0.0
15	252.8	0.0	0.0	0.0
10	165.7	0.0	0.0	0.0
5	96.3	0.0	0.0	0.0
0	50.9	0.0	0.0	0.0
-5	25.3	0.0	0.0	0.0
-6	21.1	0.0	0.0	0.0
Total Costs				$4179.5

BLOCK HEATING PLANT COSTS

Job Name : CCF SUBCON 1/4 VAV SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site Name : AURORA,IL FERMI, User Defined

Date : 11-11-86
Serial Number:
60117862.0

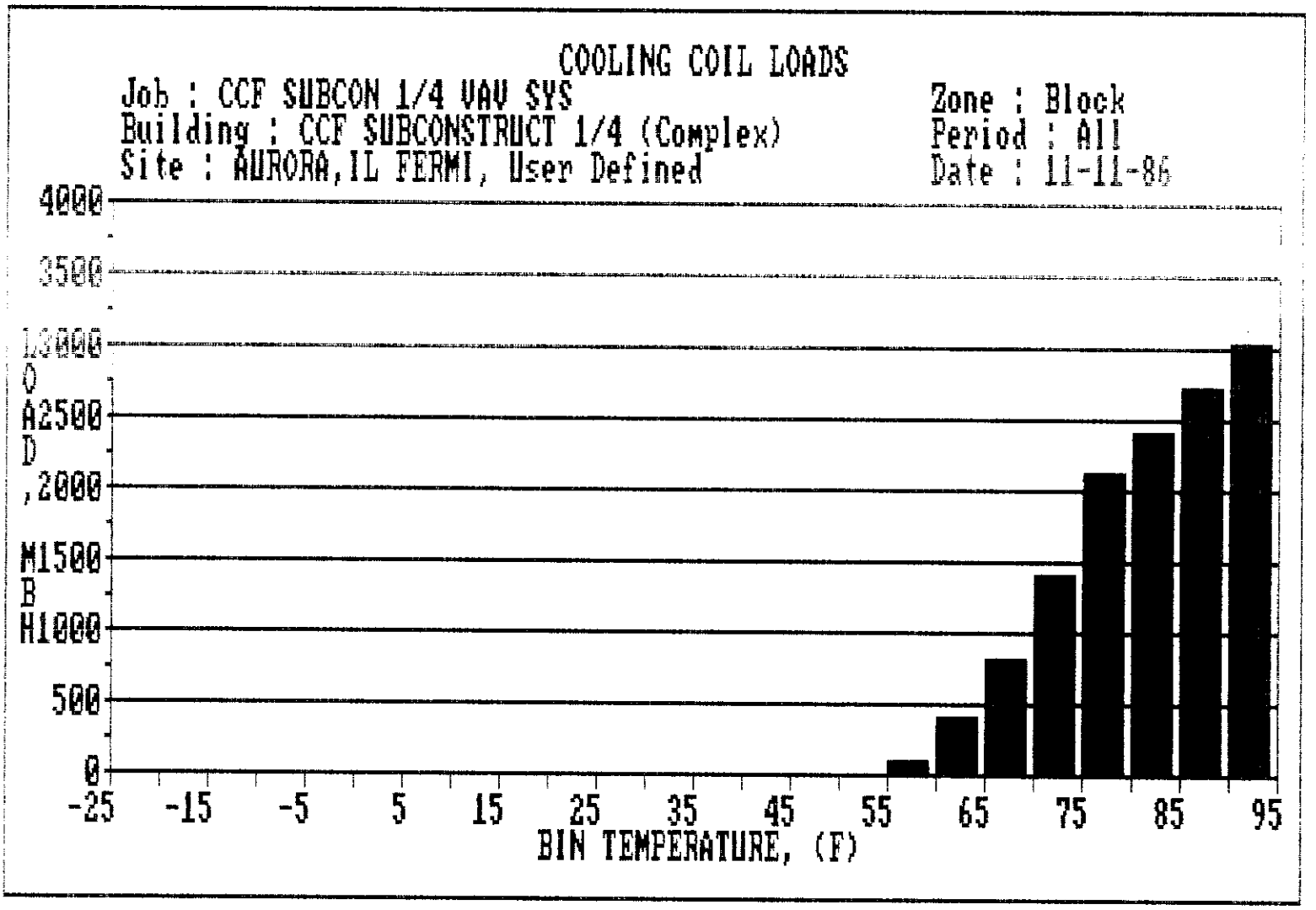
Bin Temp (F)	Bin Hours hr/yr	Coil Load MBH	Primary Plant Output MBH	Input KW	Cost $/yr	No Auxiliary Plant Used
			OCCUPIED PERIOD			
90	25.8	0.0	0.0	0.0	0.0	
85	59.4	0.0	0.0	0.0	0.0	
80	145.3	0.0	0.0	0.0	0.0	
75	237.7	0.0	0.0	0.0	0.0	
70	270.6	0.0	0.0	0.0	0.0	
65	264.5	0.0	0.0	0.0	0.0	
60	255.0	0.0	0.0	0.0	0.0	
55	244.7	35.7	35.7	10.5	127.9	
50	232.1	112.0	112.0	32.8	381.0	
45	229.5	188.4	188.4	55.2	633.5	
40	237.6	264.8	264.8	77.6	921.6	
35	238.5	2.3	2.3	0.7	8.1	
30	218.2	6.7	6.7	2.0	21.4	
25	174.5	15.4	15.4	4.5	39.2	
20	122.4	98.3	98.3	28.8	176.3	
15	78.1	181.3	181.3	53.1	207.5	
10	46.1	264.3	264.3	77.4	178.5	
5	25.1	347.3	347.3	101.8	127.7	
0	12.7	430.3	430.3	126.1	80.1	
-5	6.2	513.2	513.2	150.4	46.6	
-6	4.6	529.8	529.8	155.2	35.7	
Total Costs					$2985.1	
			UNOCCUPIED PERIOD			
90	14.6	0.0	0.0	0.0	0.0	
85	36.3	0.0	0.0	0.0	0.0	
80	99.3	0.0	0.0	0.0	0.0	
75	215.3	0.0	0.0	0.0	0.0	
70	357.6	21.5	21.5	6.3	112.7	
65	463.3	100.7	100.7	29.5	683.4	
60	500.4	174.9	174.9	51.2	1281.8	
55	482.0	249.0	249.0	73.0	1758.4	
50	447.6	0.0	0.0	0.0	0.0	
45	422.7	0.0	0.0	0.0	0.0	
40	413.7	0.0	0.0	0.0	0.0	
35	417.0	43.7	43.7	12.8	266.7	
30	417.4	124.4	124.4	36.5	760.9	
25	395.2	205.2	205.2	60.1	1188.2	
20	336.9	286.0	286.0	83.8	1411.6	
15	252.6	366.8	366.8	107.5	1358.4	
10	165.7	447.6	447.6	131.1	1086.5	
5	96.3	528.4	528.4	154.8	745.4	
0	50.9	609.1	609.1	178.5	454.2	
-5	25.3	689.9	689.9	202.1	255.7	
-6	21.1	706.1	706.1	206.9	218.3	
Total Costs					$11582.2	

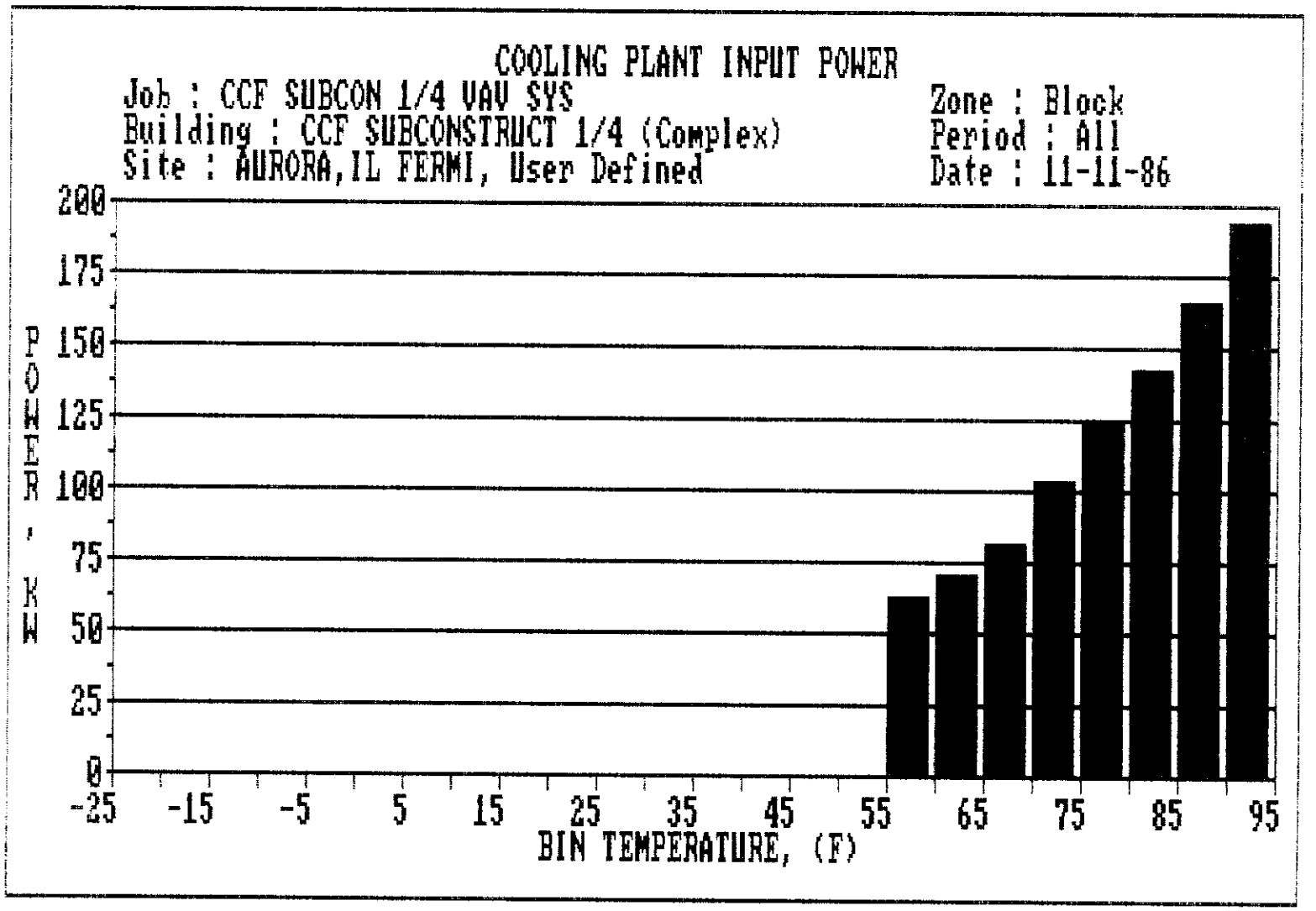
FAN AND PUMP COSTS

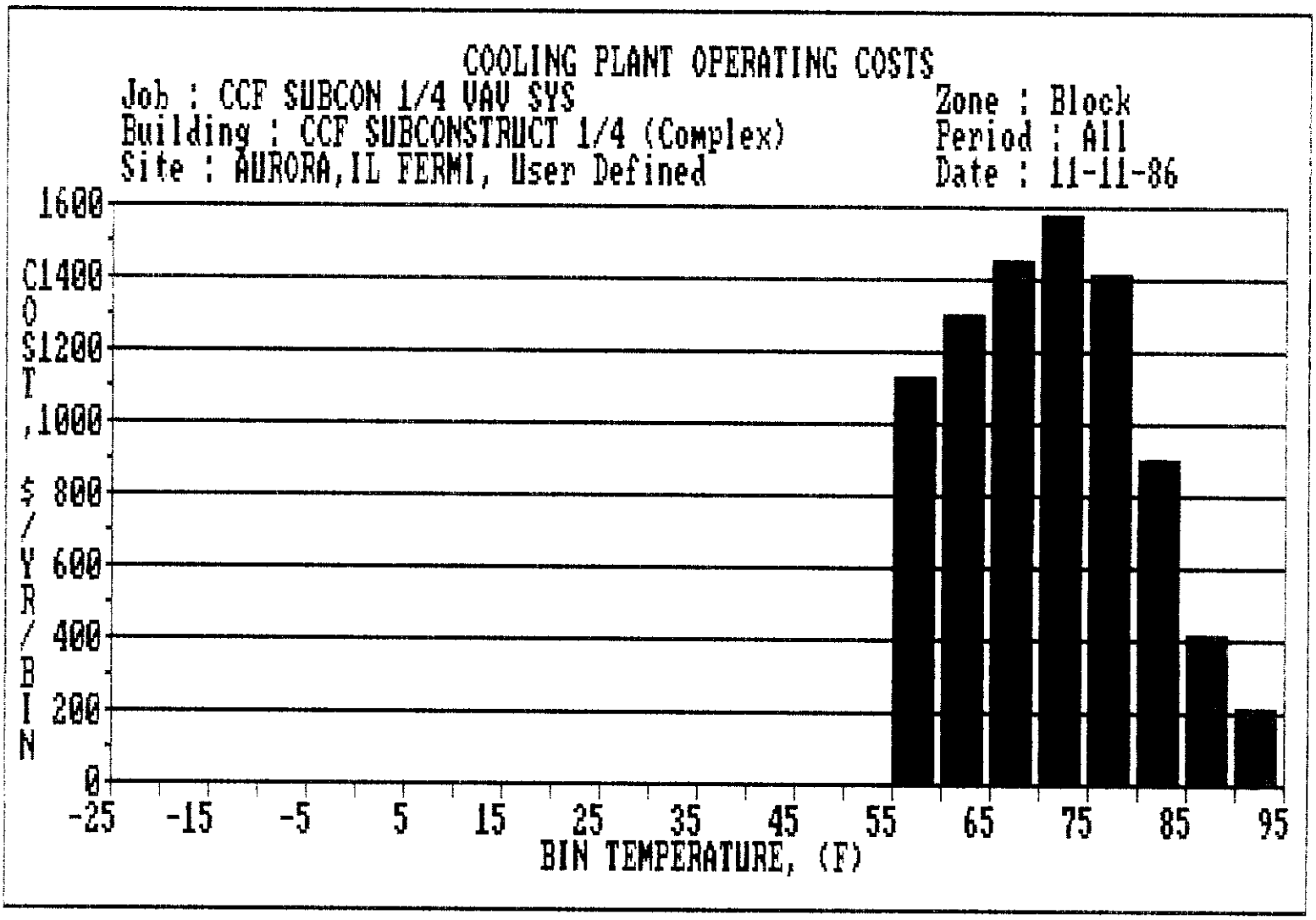
Job Name : CCF SUBCON 1/4 VAV SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site Name : AURORA,IL FERMI, User Defined

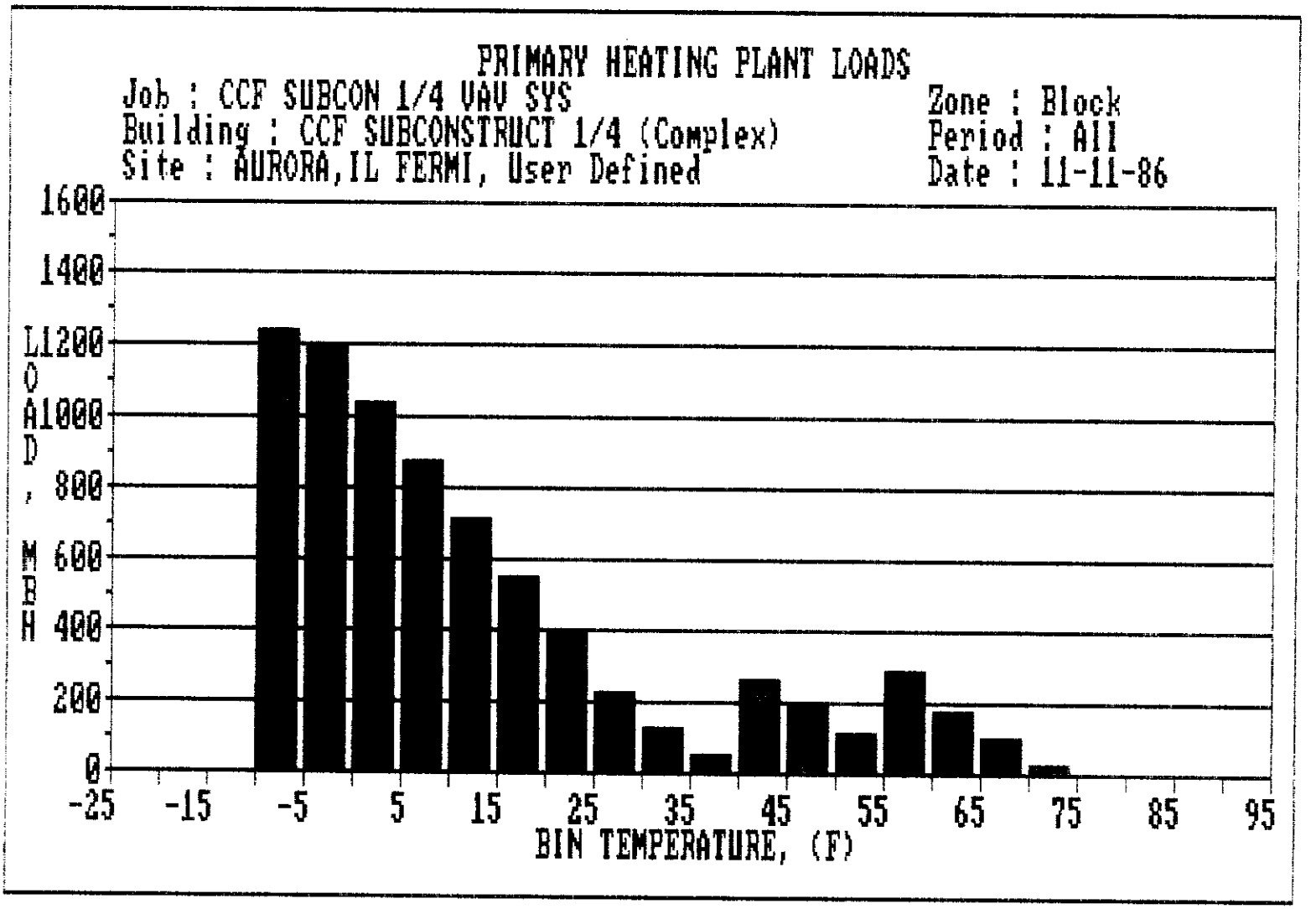
Date : 11-11-86
Serial Number:
60117862.0

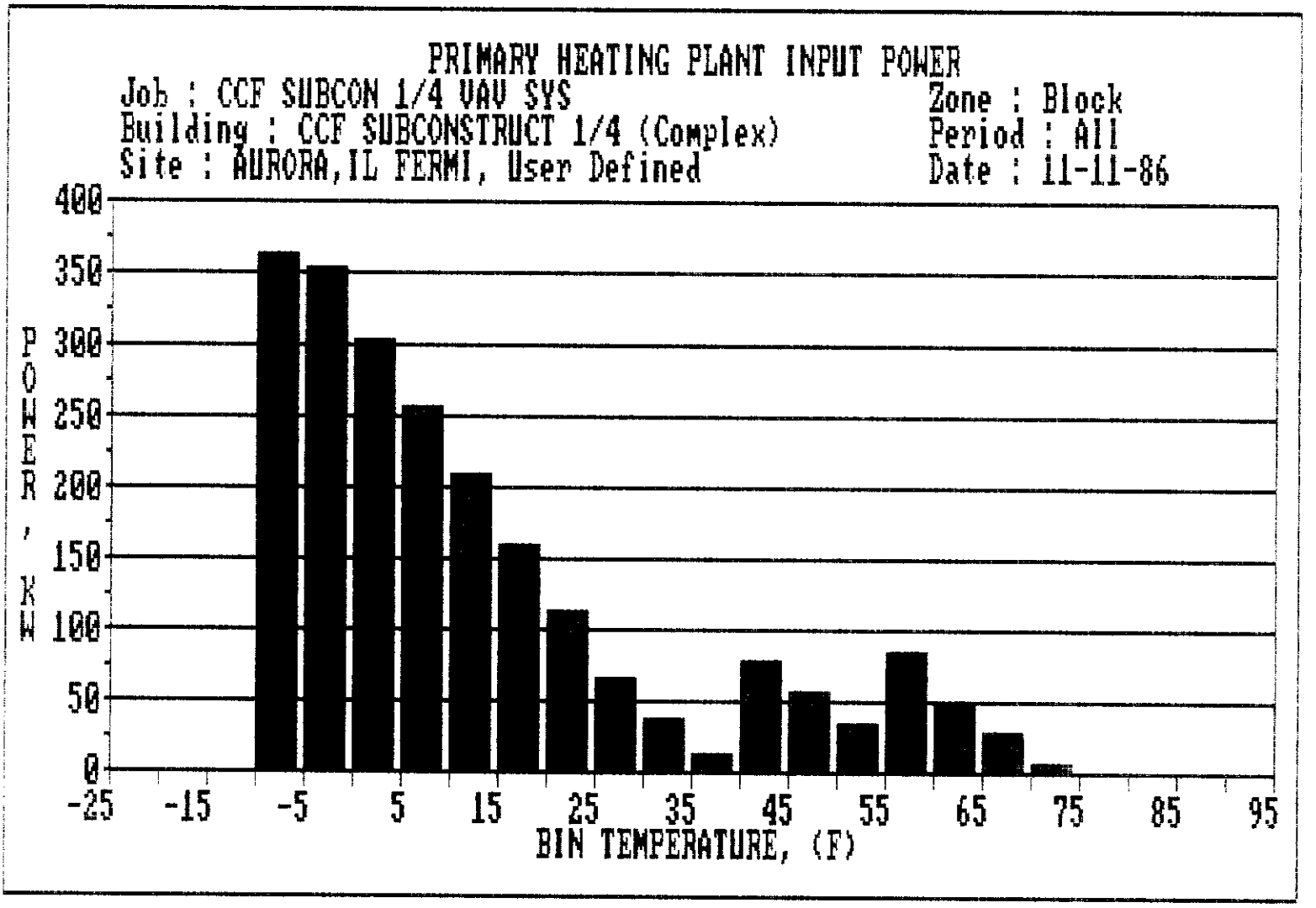
Bin Temp (F)	Bin Hours hr/yr	Perimeter Fans Input KW	Perimeter Fans Cost $/yr	Interior Fans Input KW	Interior Fans Cost $/yr	All Pumps Input KW	All Pumps Cost $/yr
OCCUPIED PERIOD							
90	25.8	36.6	47.2	28.6	36.9	15.4	19.8
85	59.4	29.8	88.7	27.2	80.7	15.4	45.7
80	145.3	24.2	175.5	25.8	187.4	15.4	111.7
75	237.7	19.4	230.2	24.5	290.9	15.4	182.7
70	270.6	15.4	207.7	23.2	314.0	15.4	208.0
65	264.5	12.0	158.4	22.0	290.9	15.4	203.3
60	255.0	9.3	118.5	21.9	279.2	15.4	196.0
55	244.7	8.0	98.0	21.8	266.7	18.4	225.7
50	232.1	8.0	93.0	21.7	251.8	3.1	35.6
45	229.5	8.0	91.9	21.6	247.9	3.1	35.2
40	237.6	8.0	95.2	21.5	255.5	3.1	36.5
35	238.5	8.0	95.5	21.4	255.3	3.1	36.6
30	218.2	8.0	87.4	21.3	232.5	3.1	33.5
25	174.5	8.0	69.9	21.2	185.1	3.1	26.8
20	122.4	8.0	49.0	21.1	129.3	3.1	18.8
15	78.1	8.0	31.3	21.0	82.1	3.1	12.0
10	46.1	8.0	18.5	20.9	48.2	3.1	7.1
5	25.1	8.0	10.1	20.8	26.2	3.1	3.9
0	12.7	8.0	5.1	20.7	13.2	3.1	1.9
-5	6.2	8.0	2.5	20.6	6.4	3.1	1.0
-6	4.6	8.0	1.8	20.6	4.7	3.1	0.7
Total Costs			$1775.4		$3484.9		$1442.5
UNOCCUPIED PERIOD							
90	14.6	20.2	14.8	9.0	6.6	15.4	11.2
85	36.3	16.2	29.3	8.4	15.3	15.4	27.9
80	99.3	12.7	63.3	7.9	39.2	15.4	76.3
75	215.3	9.9	106.1	7.4	79.3	15.4	165.5
70	357.6	8.0	143.3	6.9	122.9	18.4	329.8
65	463.3	8.0	185.6	6.4	148.3	18.4	427.3
60	500.4	8.0	200.5	6.4	159.2	18.4	461.5
55	482.0	8.0	193.1	6.3	152.4	18.4	444.5
50	447.6	8.0	179.3	6.3	140.7	0.0	0.0
45	422.7	8.0	169.3	6.2	132.1	0.0	0.0
40	413.7	8.0	165.7	6.2	128.5	0.0	0.0
35	417.0	8.0	167.1	6.2	128.7	3.1	64.0
30	417.4	8.0	167.2	6.1	128.1	3.1	64.0
25	395.2	8.0	158.3	6.1	120.5	3.1	60.6
20	336.9	8.0	135.0	6.1	102.1	3.1	51.7
15	252.8	8.0	101.3	6.0	76.2	3.1	38.8
10	165.7	8.0	66.4	6.0	49.6	3.1	25.4
5	96.3	8.0	38.6	6.0	28.7	3.1	14.8
0	50.9	8.0	20.4	5.9	15.1	3.1	7.8
-5	25.3	8.0	10.1	5.9	7.4	3.1	3.9
-6	21.1	8.0	8.5	5.9	6.2	3.1	3.2
Total Costs			$2323.0		$1786.8		$2278.4

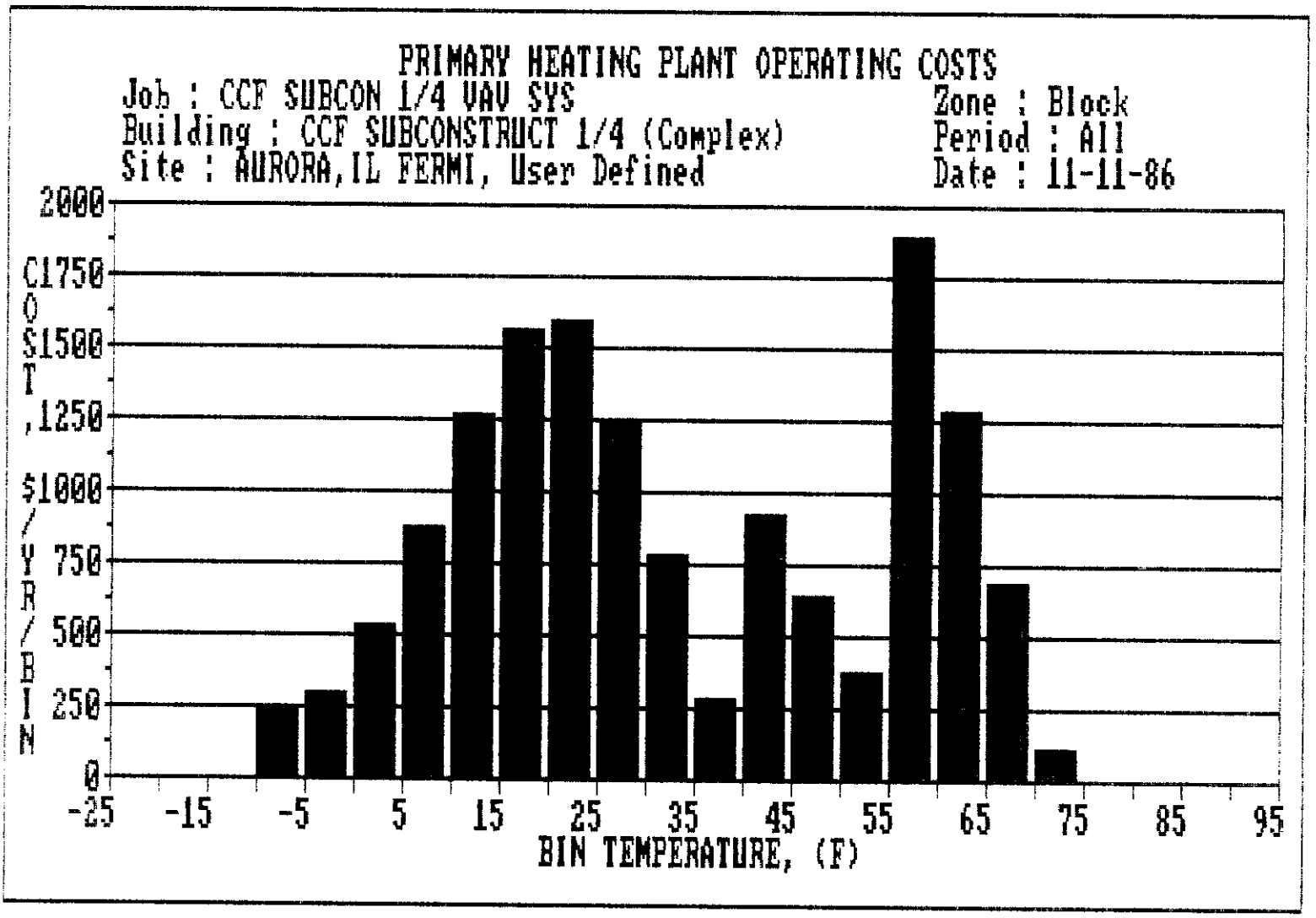

COOLING COIL LOADS
Job : CCF SUBCON 1/4 VAV SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
4000
3500
3000
2500
2000
1500
1000
500
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

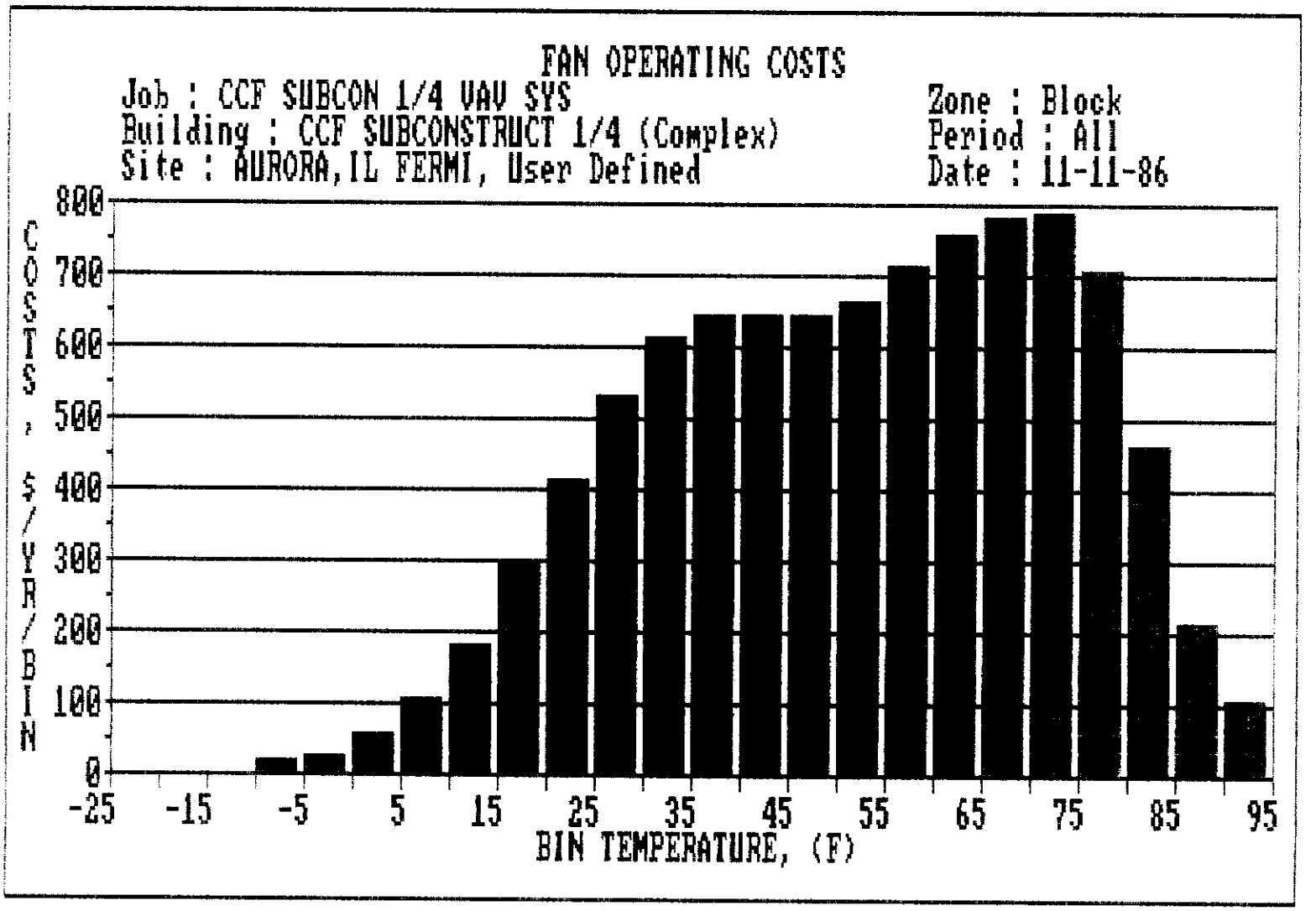

COOLING PLANT INPUT POWER
Job : CCF SUBCON 1/4 VAV SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
POWER, KW
200
175
150
125
100
75
50
25
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


COOLING PLANT OPERATING COSTS
Job : CCF SUBCON 1/4 VAV SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
COST $/YR/BIN
1600
1400
1200
1000
800
600
400
200
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT LOADS
Job : CCF SUBCON 1/4 VAV SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
LOAD, MBH
1600
1400
1200
1000
800
600
400
200
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT INPUT POWER
Job : CCF SUBCON 1/4 VAV SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
POWER, KW
400
350
300
250
200
150
100
50
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT OPERATING COSTS
Job : CCF SUBCON 1/4 VAV SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
COST $/YR/BIN
2000
1750
1500
1250
1000
750
500
250
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


FAN OPERATING COSTS
Job : CCF SUBCON 1/4 VAV SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
COSTS, $/YR/BIN
800
700
600
500
400
300
200
100
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
OPERATIONAL PERFORMANCE SIMULATION

ALTERNATE COMPARISON SYSTEM NUMBER 2
FOUR PIPE FAN COILS WITH CENTRIFUGAL CHILLERS, OA HX & ICW FREE COOLING ECON.

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

SYSTEM INPUT SUMMARY

Job Name : CCF SUBCON 1/4 4PFC SYS Page 1
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-21-86
Site : AURORA,IL FERMI, User Defined 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

A. AIR HANDLING SYSTEMS

Are perimeter and interior zone on same supply fan ? <N>

>1. PERIMETER TERMINAL TYPE : 4-PIPE FAN COIL

Supply fan avg. efficiency = 60 %
Supply fan total static pressure = 1.00 in. wg.
Design supply air= 44326 cfm @ 55 F; Vent. air= 2668 cfm
Is variable supply temperature control used ? <Y>
An economizer is not used.
Is a ventilation reclaim device used ? <N>
Are ventilation air dampers closed for unoccupied periods ? <N>

>2. INTERIOR TERMINAL TYPE : PARALLEL FAN POWERED MIXING BOXES

Supply fan type : Backward inclined or airfoil
Supply fan total static pressure = 4.00 in. wg.
Secondary supply fan avg efficiency = 60 %
Secondary supply fan total static pressure = 1.00 in. wg.
Design supply air= 22029 cfm @ 55 F; Vent. air= 1672 cfm
Minimum zone air flow = 30 % of design supply cfm
An economizer is not used.
Is a ventilation reclaim device used ? <N>
Are ventilation air dampers closed for unoccupied periods ? <N>

****

B. HEATING PLANTS

Does one primary heating plant serve perimeter and interior ? <Y>

> 1 . BLOCK PLANT : ELECTRICAL RESISTANCE

Is hydronic heating used ? <Y>

****

SYSTEM INPUT SUMMARY

Job Name : CCF SUBCON 1/4 4PFC SYS — Page 2
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Date : 11-21-86
Site : AURORA,IL FERMI, User Defined — 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

C. COOLING PLANTS

Does one plant serve perimeter and interior ? <Y>

>1. BLOCK PLANT : CENTRIFUGAL WATER COOLED CHILLER
Capacity @ 85 F entering water = 195.6 tons
KW/Ton @ 85 F entering water = 0.85 kw/ton
Is hydronic cooling used ? <Y>
Is chilled water reset used ? <Y>
Is condenser performance altitude adjusted ? <Y>
Heat sink type : Open cooling tower
Minimum entering water temperature = 35 F
Is a hydronic economizer used ? <Y> ; Economizer efficiency = 100 %
Number of sequenced chillers = 1

****

D. PUMPING SYSTEMS

System	PERIMETER dT, F	PERIMETER dP, ft wg	INTERIOR dT, F	INTERIOR dP, ft wg
Chilled water	10.00	60.00	0.00	0.00
Hot water	20.00	60.00	0.00	0.00
Condenser water	10.00	60.00	0.00	0.00
Ground water	0.00	0.00	0.00	0.00

****

E. NON-HVAC SYSTEMS

>1. NON-HVAC ELECTRICAL ENERGY USE
Lighting kw: Occupied = 122.3 kw; Unoccupied = 25.7 kw
Misc. kw : Occupied = 132.1 kw; Unoccupied = 81.9 kw
Other kw : Occupied = 0.0 kw; Unoccupied = 0.0 kw

>2. DHW SYSTEM (Not utilized in this system)

****

F. FUEL COSTS

>1. ELECTRICAL ENERGY USE	Period Occupied ($/kwh)	Period Unoccupied ($/kwh)
Compressor	0.050	0.050
Resistance	0.050	0.050
Inductive	0.050	0.050

>2. OTHER FUELS	Unit Cost
Natural Gas	n/a $/therm
Fuel Oil	n/a $/U.S.gal
Propane	n/a $/lb
Remote Heating	n/a $/MBTU
Remote Cooling	n/a $/MBTU

TOTAL BUILDING ENERGY SUMMARY

Job Name : CCF SUBCON 1/4 4PFC SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Date : 11-21-86

Period : All
Zone : Block
Serial Number:
60117862.0

****

HVAC ENERGY Component	Annual Cost ($/yr)	Energy or Fuel Units Consumed	DOE RUF (1000 BTU)	DOE RIF (1000 BTU)
Electric (Occ)	12282	245639 kwh/yr	2849408	838365
Electric (Unocc)	21195	423897 kwh/yr	4917204	1446760
Natural Gas	0	0 therms/yr	0	0
Fuel Oil	0	0 U.S. gal/yr	0	0
Propane	0	0 lb/yr	0	0
Remote Heating	0	0 MBTU/yr	0	0
Remote Cooling	0	0 MBTU/yr	0	0
HVAC Total	33477		7766611	2285124
NON-HVAC ENERGY				
Electric (Occ)	39793	795864 kwh/yr	9232025	2716285
Electric (Unocc)	30296	605916 kwh/yr	7028627	2067992
Non-HVAC Total	70089		16260652	4784276
Grand Total	103566		24027263	7069401
Total/Sq.Ft.	2.41		559.95	164.75

HVAC Summary:

HVAC Total Cost	=	0.78 $/Sq.Ft./yr
	=	32.32 % of Total Cost
Total HVAC Electrical Energy	=	15.60 kwh/Sq.Ft./yr
	=	32.32 % of Total Electrical Energy
Non-Electrical HVAC Energy	=	0.00 % of Total Energy

Key:

1 kwh	= 11600 BTU RUF; 3412 BTU RIF
1 therm nat gas	= 100000 BTU RUF and RIF
1 U.S. gal oil	= 138700 BTU RUF and RIF
1 Imp. gal oil	= 168000 BTU RUF and RIF
1 lb propane	= 21680 BTU RUF and RIF
RUF	= Resource utilization factor (Source value)
RIF	= Resource impact factor (Point of use value)
MBH	= 1000 BTU/hr
MBTU	= Million BTU

ANNUAL OPERATING COSTS

Job Name : CCF SUBCON 1/4 4PFC SYS Page 1
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-21-86
Site : AURORA,IL FERMI, User Defined 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

A. AIR HANDLING SYSTEMS (ANNUAL FAN OPERATING COST = $8,532)

Are perimeter and interior zone on same supply fan ? <N>

>1. PERIMETER TERMINAL TYPE : 4-PIPE FAN COIL

Supply fan avg. efficiency = 60 %
Supply fan total static pressure = 1.00 in. wg.
Design supply air= 44326 cfm @ 55 F; Vent. air= 2668 cfm
Is variable supply temperature control used ? <Y>
An economizer is not used.
Is a ventilation reclaim device used ? <N>
Are ventilation air dampers closed for unoccupied periods ? <N>

>2. INTERIOR TERMINAL TYPE : PARALLEL FAN POWERED MIXING BOXES

Supply fan type : Backward inclined or airfoil
Supply fan total static pressure = 4.00 in. wg.
Secondary supply fan avg efficiency = 60 %
Secondary supply fan total static pressure = 1.00 in. wg.
Design supply air= 22029 cfm @ 55 F; Vent. air= 1672 cfm
Minimum zone air flow = 30 % of design supply cfm
An economizer is not used.
Is a ventilation reclaim device used ? <N>
Are ventilation air dampers closed for unoccupied periods ? <N>

****

B. HEATING PLANTS (ANNUAL HEATING PLANT OPERATING COST = $12,572)

Does one primary heating plant serve perimeter and interior ? <Y>

> 1 . BLOCK PLANT : ELECTRICAL RESISTANCE

Is hydronic heating used ? <Y>

****

ANNUAL OPERATING COSTS

Job Name : CCF SUBCON 1/4 4PFC SYS — Page 2
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Date : 11-21-86
Site : AURORA,IL FERMI, User Defined — 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

C. COOLING PLANTS (ANNUAL COOLING PLANT OPERATING COST = $5,211)

Does one plant serve perimeter and interior ? <Y>

>1. BLOCK PLANT : CENTRIFUGAL WATER COOLED CHILLER
Capacity @ 85 F entering water = 195.6 tons
KW/Ton @ 85 F entering water = 0.85 kw/ton
Is hydronic cooling used ? <Y>
Is chilled water reset used ? <Y>
Is condenser performance altitude adjusted ? <Y>
Heat sink type : Open cooling tower
Minimum entering water temperature = 35 F
Is a hydronic economizer used ? <Y> ; Economizer efficiency = 100 %
Number of sequenced chillers = 1

****

D. PUMPING SYSTEMS (ANNUAL PUMP OPERATING COST = $7,162)

System	PERIMETER dT, F	PERIMETER dP, ft wg	INTERIOR dT, F	INTERIOR dP, ft wg
Chilled water	10.00	60.00	0.00	0.00
Hot water	20.00	60.00	0.00	0.00
Condenser water	10.00	60.00	0.00	0.00
Ground water	0.00	0.00	0.00	0.00

****

E. NON-HVAC SYSTEMS (ANNUAL NON-HVAC OPERATING COST = $70,089)

>1. NON-HVAC ELECTRICAL ENERGY USE
Lighting kw: Occupied = 122.3 kw; Unoccupied = 25.7 kw
Misc. kw : Occupied = 132.1 kw; Unoccupied = 81.9 kw
Other kw : Occupied = 0.0 kw; Unoccupied = 0.0 kw

>2. DHW SYSTEM (Not utilized in this system)

****

F. FUEL COSTS (GRAND TOTAL ANNUAL OPERATING COST = $103,566)

>1. ELECTRICAL ENERGY USE	Period Occupied ($/kwh)	Period Unoccupied ($/kwh)
Compressor	0.050	0.050
Resistance	0.050	0.050
Inductive	0.050	0.050

>2. OTHER FUELS	Unit Cost
Natural Gas	n/a $/therm
Fuel Oil	n/a $/U.S.gal
Propane	n/a $/lb
Remote Heating	n/a $/MBTU
Remote Cooling	n/a $/MBTU

COOLING PLANT COSTS

Job Name : CCF SUBCON 1/4 4PFC SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site Name : AURORA,IL FERMI, User Defined

Date : 11-21-86
Serial Number:
60117862.0

Bin Temp (F)	Bin Hours hr/yr	Block Cooling Plant Coil Load MBH	Input kW	Cost $/yr
OCCUPIED PERIOD				
90	25.8	1767.2	113.3	146.1
85	59.4	1411.0	93.3	277.2
80	145.8	1469.2	76.9	558.5
75	237.7	1340.8	63.4	753.2
70	270.6	1213.8	51.9	701.8
65	264.5	1088.1	42.2	558.2
60	255.0	980.5	34.8	443.9
55	244.7	873.5	2.9	35.0
50	232.1	767.0	2.9	33.2
45	229.5	659.0	2.9	32.8
40	237.6	554.6	2.9	34.0
35	238.5	519.1	2.9	34.1
30	218.2	508.2	2.9	31.2
25	174.5	497.4	2.9	24.9
20	122.4	486.5	2.9	17.5
15	78.1	475.8	2.9	11.2
10	46.1	465.0	2.9	6.6
5	25.1	454.3	2.9	3.6
0	12.7	443.6	2.9	1.8
-5	6.2	432.9	2.9	0.9
-6	4.6	430.8	2.9	0.7
Total Costs				$3706.3
UNOCCUPIED PERIOD				
90	14.6	1075.6	66.7	48.7
85	36.3	953.1	54.5	99.0
80	99.3	832.0	44.2	219.7
75	215.3	711.9	35.7	384.6
70	357.6	592.9	2.9	51.1
65	463.3	474.9	2.9	66.2
60	500.4	375.1	2.9	71.5
55	482.0	275.6	2.9	68.9
50	447.6	233.6	2.9	64.0
45	422.7	226.6	2.9	60.4
40	413.7	219.7	2.9	59.1
35	417.0	212.8	2.9	59.6
30	417.4	205.9	2.9	59.7
25	395.2	199.1	2.9	56.5
20	336.9	192.3	2.9	48.2
15	252.8	185.5	2.9	36.1
10	165.7	178.8	2.9	23.7
5	96.3	172.1	2.9	13.8
0	50.9	165.4	2.9	7.3
-5	25.3	158.8	2.9	3.6
-6	21.1	157.4	2.9	3.0
Total Costs				$1504.7

BLOCK HEATING PLANT COSTS

Job Name : CCF SUBCON 1/4 4PFC SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site Name : AURORA,IL FERMI, User Defined

Date : 11-21-86
Serial Number:
60117862.0

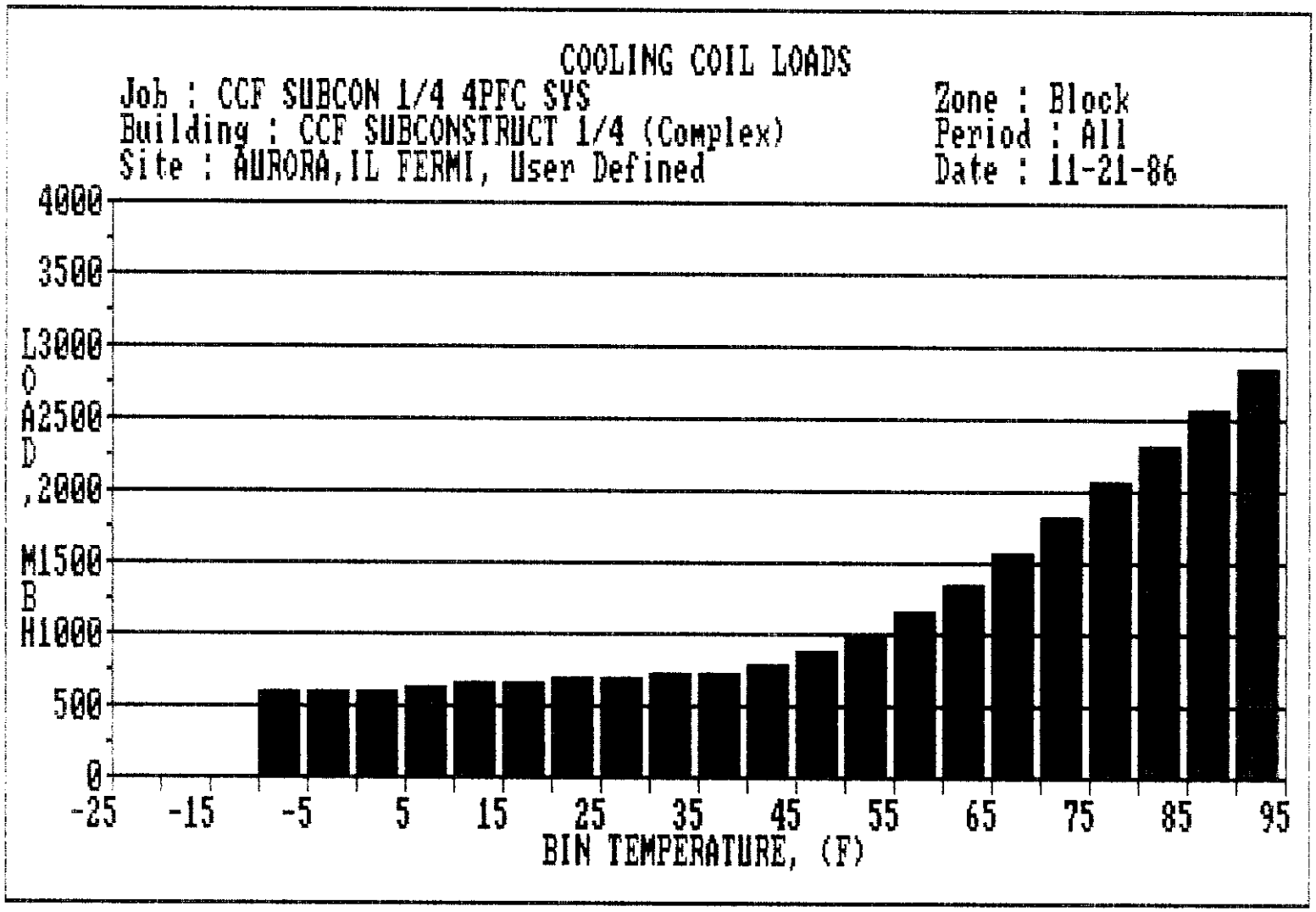
Bin Temp (F)	Bin Hours hr/yr	Coil Load MBH	Primary Plant Output MBH	Input KW	Cost $/yr	No Auxiliary Plant Used
OCCUPIED PERIOD						
90	25.8	0.0	0.0	0.0	0.0	
85	59.4	0.0	0.0	0.0	0.0	
80	145.3	0.0	0.0	0.0	0.0	
75	237.7	0.0	0.0	0.0	0.0	
70	270.6	0.0	0.0	0.0	0.0	
65	264.5	0.0	0.0	0.0	0.0	
60	255.0	0.0	0.0	0.0	0.0	
55	244.7	0.0	0.0	0.0	0.0	
50	232.1	0.0	0.0	0.0	0.0	
45	229.5	0.0	0.0	0.0	0.0	
40	237.6	0.0	0.0	0.0	0.0	
35	238.5	64.0	64.0	18.8	223.7	
30	218.2	78.7	78.7	23.1	251.6	
25	174.5	94.0	94.0	27.5	240.2	
20	122.4	187.4	187.4	54.9	336.0	
15	78.1	280.8	280.8	82.3	321.3	
10	46.1	374.2	374.2	109.6	252.7	
5	25.1	467.6	467.6	137.0	171.9	
0	12.7	561.0	561.0	164.4	104.4	
-5	6.2	654.4	654.4	191.7	59.4	
-6	4.6	673.1	673.1	197.2	45.4	
Total Costs					$2006.6	
UNOCCUPIED PERIOD						
90	14.6	0.0	0.0	0.0	0.0	
85	36.3	0.0	0.0	0.0	0.0	
80	99.3	0.0	0.0	0.0	0.0	
75	215.3	0.0	0.0	0.0	0.0	
70	357.6	0.0	0.0	0.0	0.0	
65	463.3	0.0	0.0	0.0	0.0	
60	500.4	0.0	0.0	0.0	0.0	
55	482.0	0.0	0.0	0.0	0.0	
50	447.6	5.3	5.3	1.6	35.0	
45	422.7	20.0	20.0	5.9	123.9	
40	413.7	34.7	34.7	10.2	210.2	
35	417.0	94.7	94.7	27.8	578.8	
30	417.4	186.0	186.0	54.5	1137.1	
25	395.2	277.2	277.2	81.2	1604.7	
20	336.9	368.4	368.4	107.9	1818.1	
15	252.8	459.6	459.6	134.7	1702.1	
10	165.7	550.8	550.8	161.4	1337.0	
5	96.3	642.0	642.0	188.1	905.7	
0	50.9	733.2	733.2	214.8	546.7	
-5	25.3	824.4	824.4	241.6	305.6	
-6	21.1	842.7	842.7	246.9	260.5	
Total Costs					$10565.4	

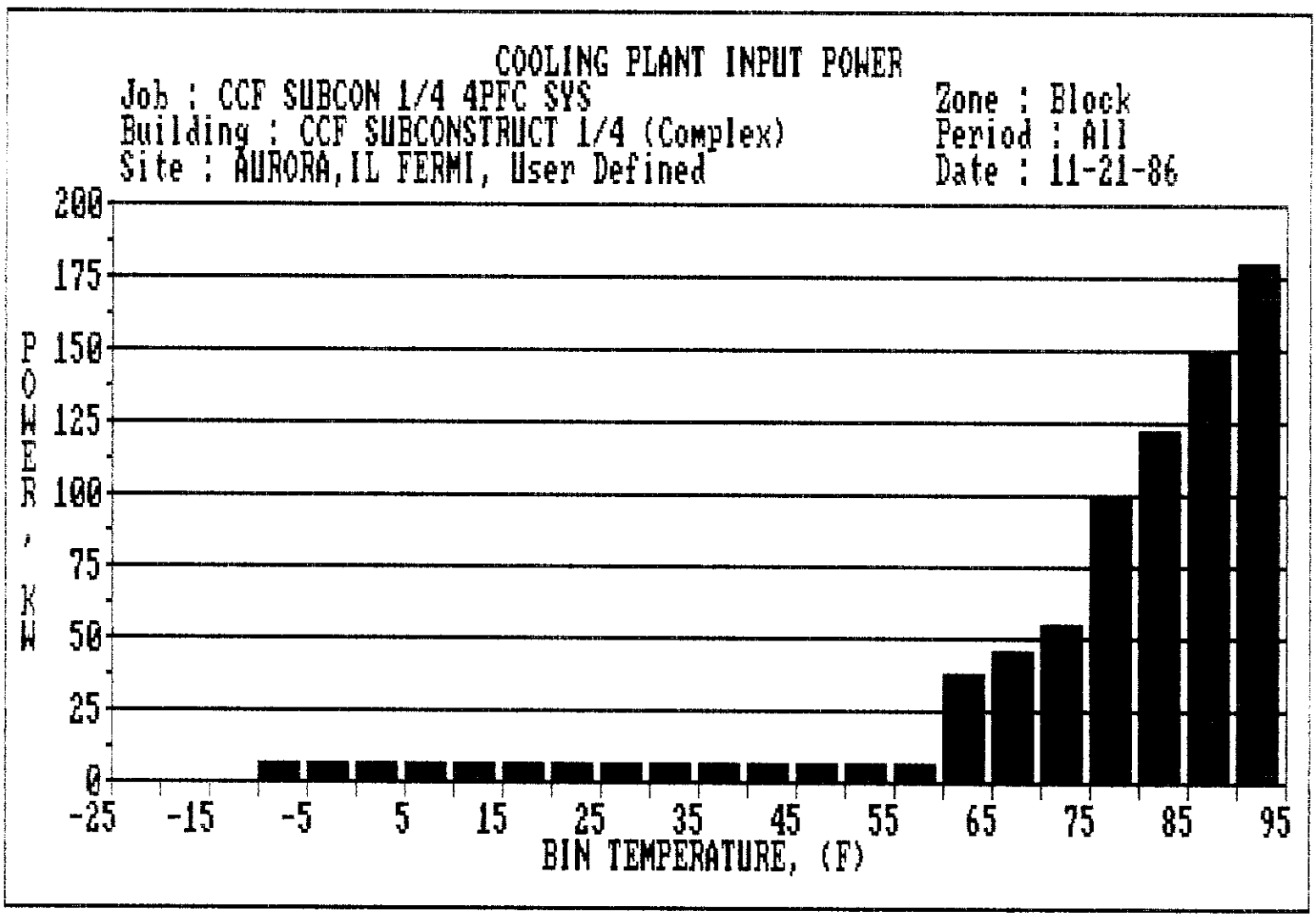
FAN AND PUMP COSTS

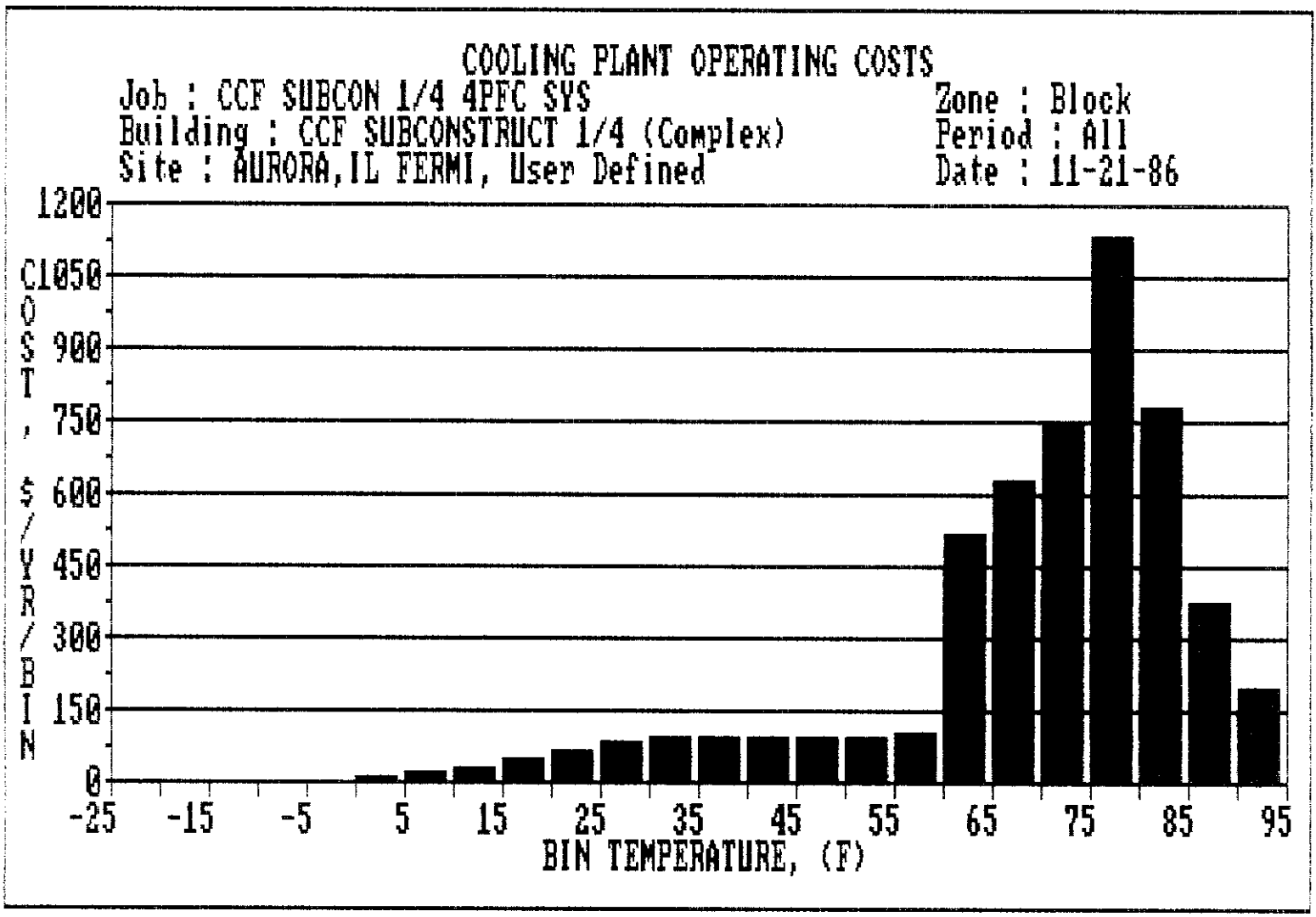
Job Name : CCF SUBCON 1/4 4PFC SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site Name : AURORA,IL FERMI, User Defined

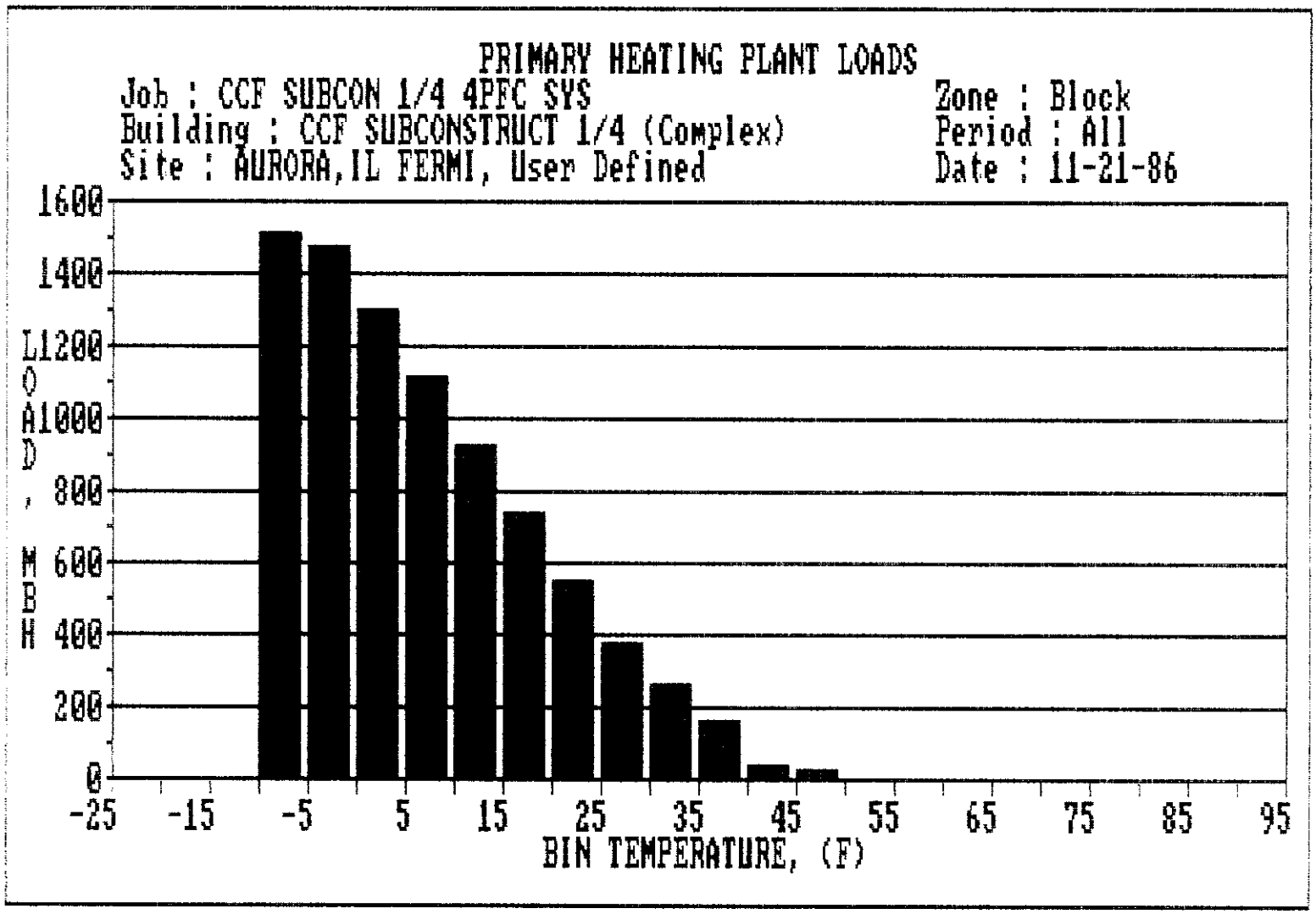
Date : 11-21-86
Serial Number:
60117362.0

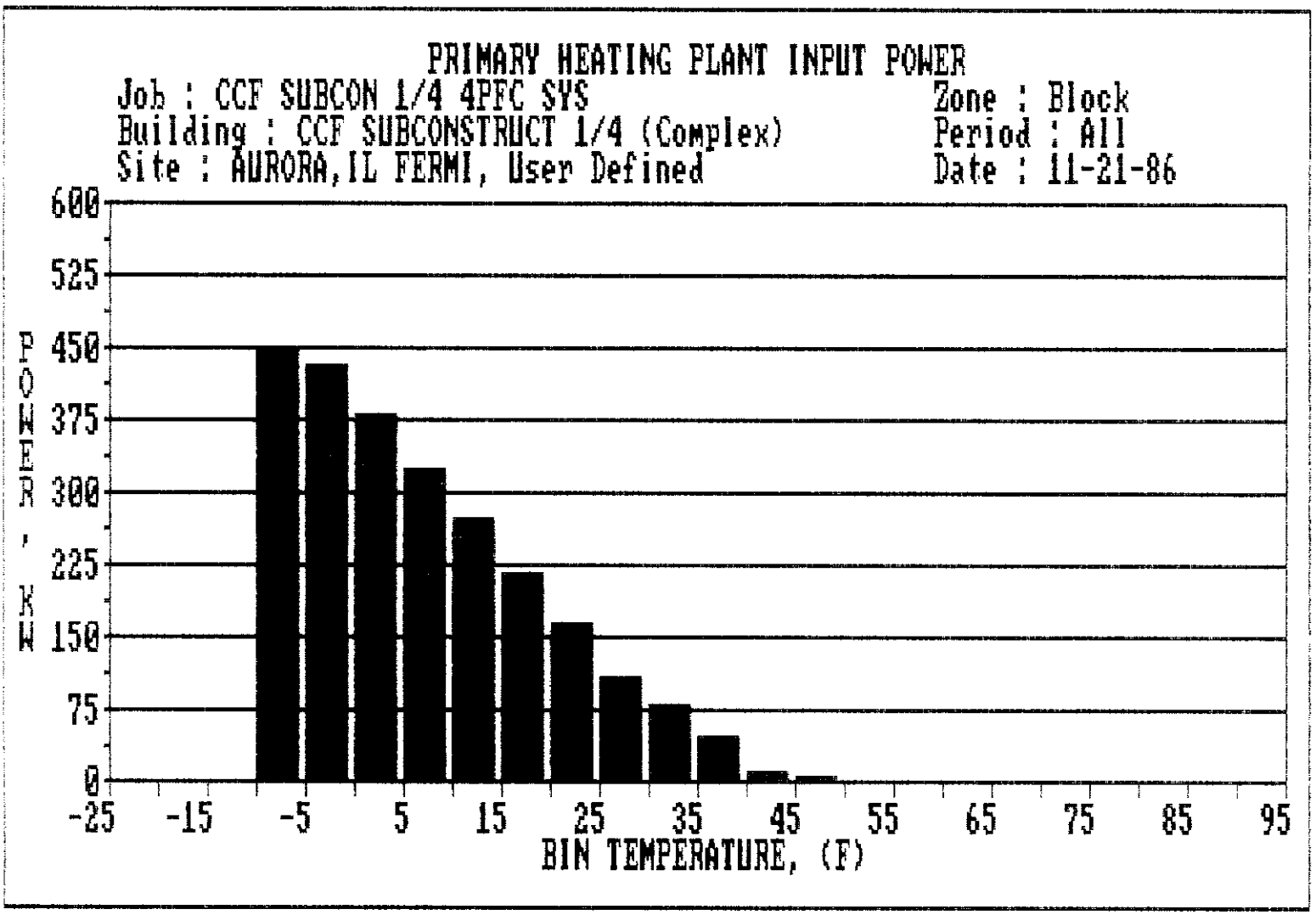
Bin Temp (F)	Bin Hours hr/yr	Perimeter Input KW	Perimeter Fans Cost $/yr	Interior Fans Input KW	Interior Fans Cost $/yr	All Pumps Input KW	All Pumps Cost $/yr
OCCUPIED PERIOD							
90	25.8	9.6	12.4	18.4	23.7	15.5	20.1
85	59.4	9.6	28.6	17.9	53.3	15.5	46.2
80	145.3	9.6	69.9	17.5	127.4	15.5	112.9
75	237.7	9.6	114.3	17.1	203.4	15.5	184.7
70	270.6	9.6	130.1	16.7	225.8	15.5	210.3
65	264.5	9.6	127.2	16.3	215.2	15.5	205.6
60	255.0	9.6	122.6	16.2	207.0	15.5	198.2
55	244.7	9.6	117.6	16.2	198.2	15.5	190.2
50	232.1	9.6	111.6	16.2	187.6	15.5	180.4
45	229.5	9.6	110.3	16.1	185.1	15.5	178.4
40	237.6	9.6	114.2	16.1	191.2	15.5	184.7
35	238.5	9.6	114.7	16.1	191.5	17.2	204.6
30	218.2	9.6	104.9	16.0	174.9	17.2	187.2
25	174.5	9.6	83.9	16.0	139.5	17.2	149.7
20	122.4	9.6	58.8	16.0	97.7	17.2	105.0
15	78.1	9.6	37.5	15.9	62.2	17.2	67.0
10	46.1	9.6	22.2	15.9	36.6	17.2	39.5
5	25.1	9.6	12.1	15.9	19.9	17.2	21.5
0	12.7	9.6	6.1	15.8	10.0	17.2	10.9
-5	6.2	9.6	3.0	15.8	4.9	17.2	5.3
-6	4.6	9.6	2.2	15.8	3.6	17.2	3.9
Total Costs			$1504.1		$2558.8		$2506.1
UNOCCUPIED PERIOD							
90	14.6	9.6	7.0	9.1	6.7	15.5	11.3
85	36.3	9.6	17.5	8.5	15.5	15.5	28.2
80	99.3	9.6	47.7	8.0	39.6	15.5	77.2
75	215.3	9.6	103.5	7.4	79.9	15.5	167.3
70	357.6	9.6	171.9	6.9	122.8	15.5	277.9
65	463.3	9.6	222.7	6.3	146.6	15.5	360.1
60	500.4	9.6	240.6	6.3	157.2	15.5	388.9
55	482.0	9.6	231.7	6.2	150.3	15.5	374.6
50	447.6	9.6	215.2	6.2	138.6	17.2	383.9
45	422.7	9.6	203.2	6.1	130.0	17.2	362.6
40	413.7	9.6	198.9	6.1	126.3	17.2	354.9
35	417.0	9.6	200.5	6.1	126.4	17.2	357.7
30	417.4	9.6	200.7	6.0	125.6	17.2	358.0
25	395.2	9.6	190.0	6.0	118.0	17.2	339.0
20	336.9	9.6	162.0	5.9	99.9	17.2	289.0
15	252.8	9.6	121.5	5.9	74.4	17.2	216.8
10	165.7	9.6	79.7	5.8	48.4	17.2	142.1
5	96.3	9.6	46.3	5.8	27.9	17.2	82.6
0	50.9	9.6	24.5	5.8	14.6	17.2	43.7
-5	25.3	9.6	12.2	5.7	7.2	17.2	21.7
-6	21.1	9.6	10.1	5.7	6.0	17.2	18.1
Total Costs			$2707.4		$1761.8		$4655.6

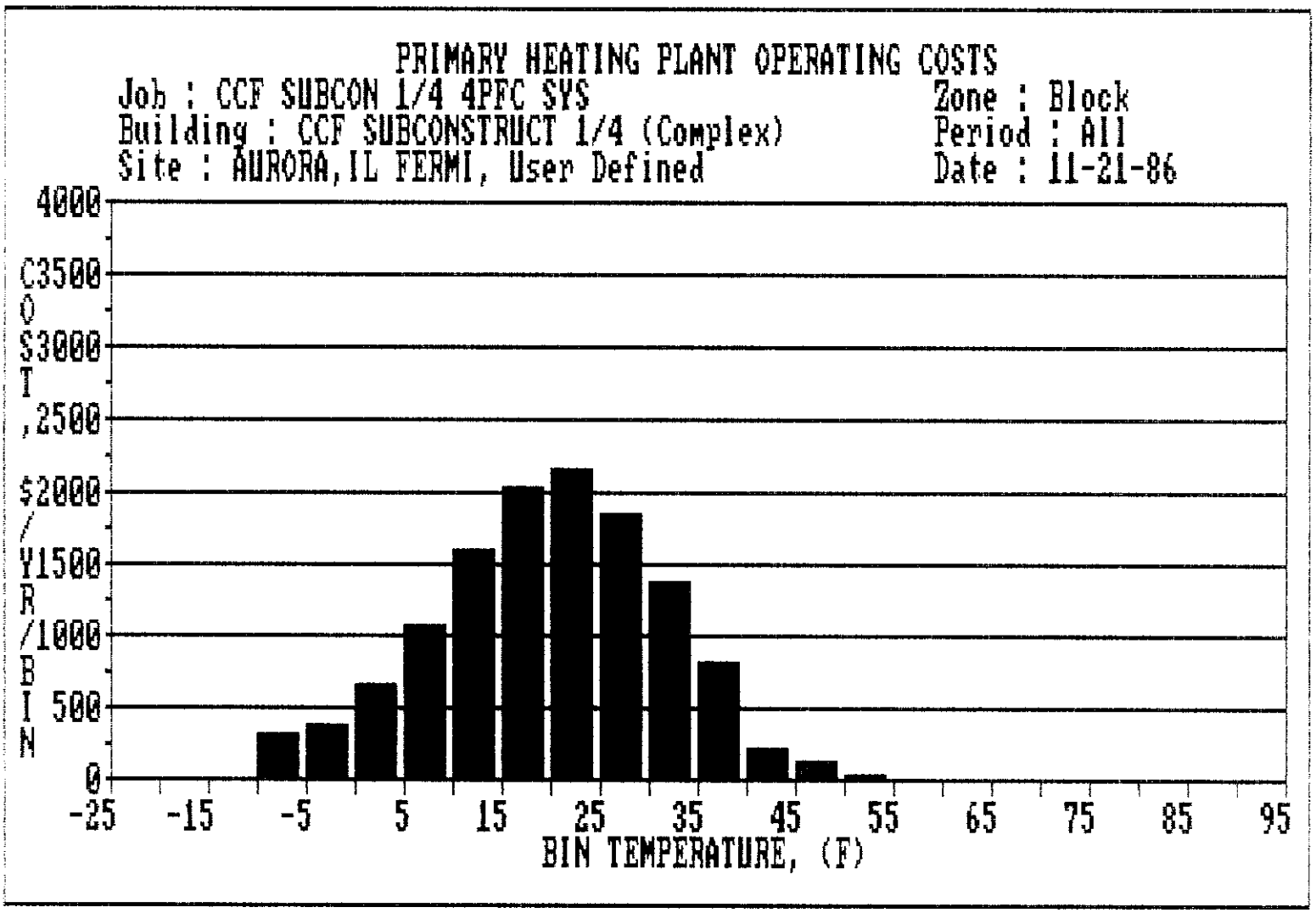

COOLING COIL LOADS
Job : CCF SUBCON 1/4 4PFC SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-21-86
LOAD, MBH
4000
3500
3000
2500
2000
1500
1000
500
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

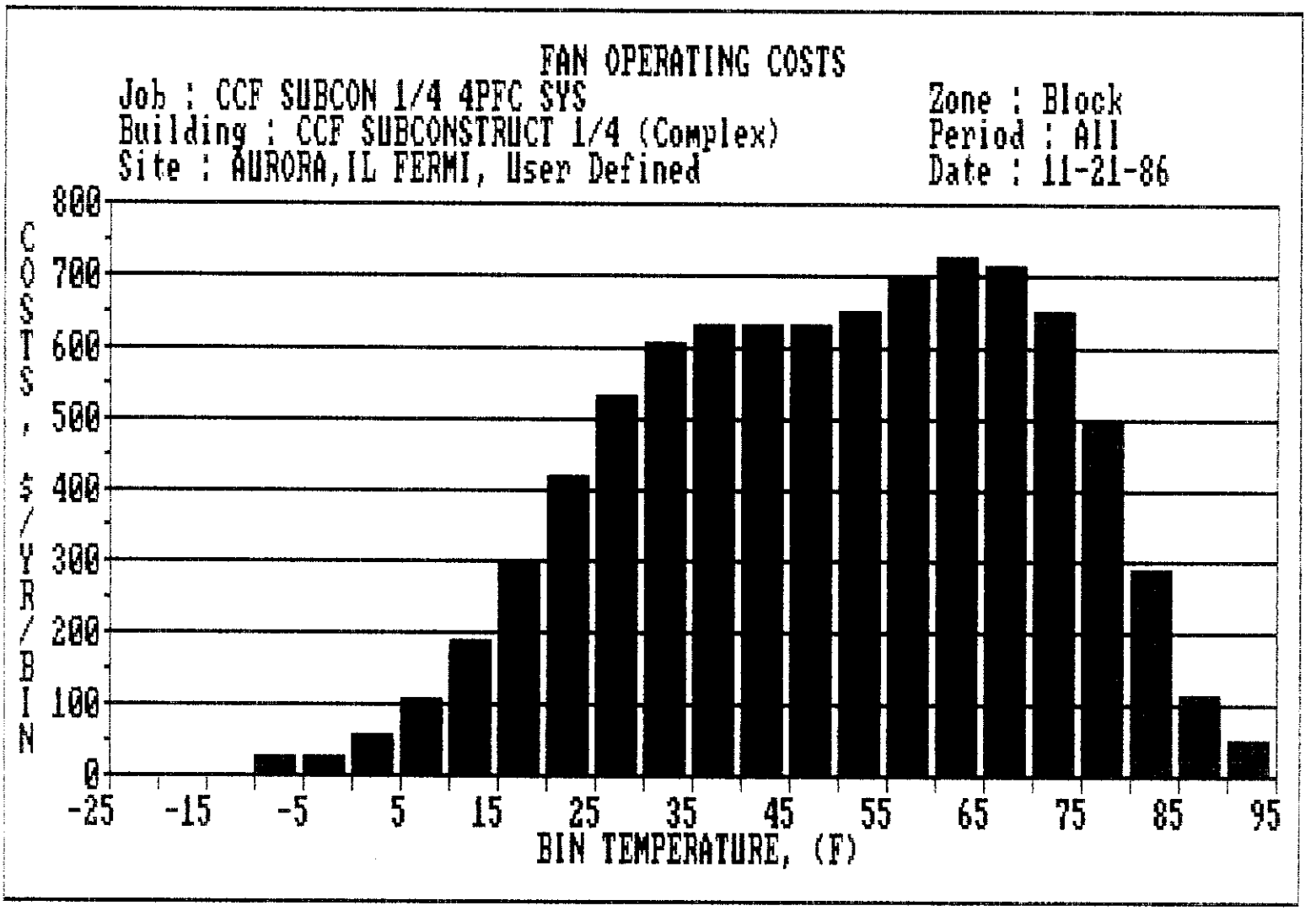

COOLING PLANT INPUT POWER
Job : CCF SUBCON 1/4 4PFC SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-21-86
POWER, KW
200
175
150
125
100
75
50
25
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


COOLING PLANT OPERATING COSTS
Job : CCF SUBCON 1/4 4PFC SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-21-86
COST, $/YR/BIN
1200
1050
900
750
600
450
300
150
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT LOADS
Job : CCF SUBCON 1/4 4PFC SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-21-86
LOAD, MBH
1600
1400
1200
1000
800
600
400
200
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT INPUT POWER
Job : CCF SUBCON 1/4 4PFC SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-21-86
POWER, KW
600
525
450
375
300
225
150
75
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT OPERATING COSTS
Job : CCF SUBCON 1/4 4PFC SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-21-86
COST $/YR/BIN
4000
3500
3000
2500
2000
1500
1000
500
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


FAN OPERATING COSTS
Job : CCF SUBCON 1/4 4PFC SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-21-86
COSTS, $/YR/BIN
800
700
600
500
400
300
200
100
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
OPERATIONAL PERFORMANCE SIMULATION

ALTERNATE COMPARISON SYSTEM NUMBER 3
TRIPLE DECK MULTIZONE WITH CENTRIFUGAL CHILLERS AND ICW FREE COOLING ECON.

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

SYSTEM INPUT SUMMARY

Job Name : CCF SUBCON 1/4 ZDMZ SYS Page 1
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-26-86
Site : AURORA,IL FERMI, User Defined 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

A. AIR HANDLING SYSTEMS

Are perimeter and interior zone on same supply fan ? <Y>

1. BLOCK TERMINAL TYPE : BYPASS MULTIZONE

Supply fan type : Backward inclined or airfoil
Supply fan total static pressure = 4.00 in. wg.
Return fan type : Backward inclined or airfoil
Return fan total static pressure = 2.00 in. wg.
Design supply air= 62800 cfm @ 55 F; Vent. air= 4340 cfm
Hot deck supply air temperature = 100 F
Economizer type : Integrated, enthalpy controlled
Is a ventilation reclaim device used ? <N>
Are ventilation air dampers closed for unoccupied periods ? <N>

****

B. HEATING PLANTS

Does one primary heating plant serve perimeter and interior ? <Y>

1 . BLOCK PLANT : ELECTRICAL RESISTANCE

Is hydronic heating used ? <Y>

****

SYSTEM INPUT SUMMARY

Job Name : CCF SUBCON 1/4 3DMZ SYS — Page 2
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Date : 11-26-86
Site : AURORA,IL FERMI, User Defined — 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

C. COOLING PLANTS

Does one plant serve perimeter and interior ? <Y>

>1. BLOCK PLANT : CENTRIFUGAL WATER COOLED CHILLER
Capacity @ 85 F entering water = 195.6 tons
KW/Ton @ 85 F entering water = 0.85 kw/ton
Is hydronic cooling used ? <Y>
Is chilled water reset used ? <N>
Is condenser performance altitude adjusted ? <Y>
Heat sink type : Open cooling tower
Minimum entering water temperature = 35 F
Is a hydronic economizer used ? <Y> ; Economizer efficiency = 100 %
Number of sequenced chillers = 1

****

D. PUMPING SYSTEMS

System	PERIMETER dT, F	PERIMETER dP, ft wg	INTERIOR dT, F	INTERIOR dP, ft wg
Chilled water	10.00	60.00	0.00	0.00
Hot water	20.00	60.00	0.00	0.00
Condenser water	0.00	60.00	0.00	0.00
Ground water	0.00	0.00	0.00	0.00

****

E. NON-HVAC SYSTEMS

>1. NON-HVAC ELECTRICAL ENERGY USE
Lighting kw: Occupied = 122.3 kw; Unoccupied = 25.7 kw
Misc. kw : Occupied = 132.1 kw; Unoccupied = 81.9 kw
Other kw : Occupied = 0.0 kw; Unoccupied = 0.0 kw

>2. DHW SYSTEM (Not utilized in this system)

****

F. FUEL COSTS

>1. ELECTRICAL ENERGY USE	Period Occupied ($/kwh)	Period Unoccupied ($/kwh)
Compressor	0.050	0.050
Resistance	0.050	0.050
Inductive	0.050	0.050

>2. OTHER FUELS	Unit Cost
Natural Gas	n/a $/therm
Fuel Oil	n/a $/U.S.gal
Propane	n/a $/lb
Remote Heating	n/a $/MBTU
Remote Cooling	n/a $/MBTU

TOTAL BUILDING ENERGY SUMMARY

Job Name : CCF SUBCON 1/4 3DMZ SYS — Period : All
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Zone : Block
Site : AURORA,IL FERMI, User Defined — Serial Number: 60117862.0
Date : 11-11-86

HVAC ENERGY Component	Annual Cost ($/yr)	Energy or Fuel Units Consumed	DOE RUF (1000 BTU)	DOE RIF (1000 BTU)
Electric (Occ)	19168	383364 kwh/yr	4447022	1308421
Electric (Unocc)	32386	647728 kwh/yr	7513647	2210696
Natural Gas	0	0 therms/yr	0	0
Fuel Oil	0	0 U.S. gal/yr	0	0
Propane	0	0 lb/yr	0	0
Remote Heating	0	0 MBTU/yr	0	0
Remote Cooling	0	0 MBTU/yr	0	0
HVAC Total	51555		11960669	3519118
NON-HVAC ENERGY				
Electric (Occ)	39793	795864 kwh/yr	9232025	2716285
Electric (Unocc)	30296	605916 kwh/yr	7028627	2067992
Non-HVAC Total	70089		16260652	4784276
Grand Total	121644		28221321	8303394
Total/Sq.Ft.	2.83		657.69	193.51

HVAC Summary:

HVAC Total Cost	=	1.20 $/Sq.Ft./yr
	=	42.38 % of Total Cost
Total HVAC Electrical Energy	=	24.03 kwh/Sq.Ft./yr
	=	42.38 % of Total Electrical Energy
Non-Electrical HVAC Energy	=	-0.00 % of Total Energy

Key:

1 kwh	= 11600 BTU RUF; 3412 BTU RIF
1 therm nat gas	= 100000 BTU RUF and RIF
1 U.S. gal oil	= 138700 BTU RUF and RIF
1 Imp. gal oil	= 168000 BTU RUF and RIF
1 lb propane	= 21680 BTU RUF and RIF
RUF	= Resource utilization factor (Source value)
RIF	= Resource impact factor (Point of use value)
MBH	= 1000 BTU/hr
MBTU	= Million BTU

ANNUAL OPERATING COSTS

Job Name : CCF SUBCON 1/4 3DMZ SYS

Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-11-86

Site : AURORA,IL FERMI, User Defined 60117862.0

Scope of Analysis : Cooling and Heating Systems

****

A. AIR HANDLING SYSTEMS (ANNUAL FAN OPERATING COST = $35,801)

Are perimeter and interior zone on same supply fan ? <Y>

>1. BLOCK TERMINAL TYPE : BYPASS MULTIZONE

Supply fan type : Backward inclined or airfoil

Supply fan total static pressure = 4.00 in. wg.

Return fan type : Backward inclined or airfoil

Return fan total static pressure = 2.00 in. wg.

Design supply air= 62800 cfm @ 55 F; Vent. air= 4340 cfm

Hot deck supply air temperature = 100 F

Economizer type : Integrated, enthalpy controlled

Is a ventilation reclaim device used ? <N>

Are ventilation air dampers closed for unoccupied periods ? <N>

****

B. HEATING PLANTS (ANNUAL HEATING PLANT OPERATING COST = $2,477)

Does one primary heating plant serve perimeter and interior ? <Y>

> 1 . BLOCK PLANT : ELECTRICAL RESISTANCE

Is hydronic heating used ? <Y>

****

ANNUAL OPERATING COSTS

Job Name : CCF SUBCON 1/4 3DMZ SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-11-86
Site : AURORA,IL FERMI, User Defined 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

C. COOLING PLANTS (ANNUAL COOLING PLANT OPERATING COST = $7,250)

Does one plant serve perimeter and interior ? <Y>

>1. BLOCK PLANT : CENTRIFUGAL WATER COOLED CHILLER
Capacity @ 85 F entering water = 191.3 tons
KW/Ton @ 85 F entering water = 0.85 kw/ton
Is hydronic cooling used ? <Y>
Is chilled water reset used ? <N>
Is condenser performance altitude adjusted ? <Y>
Heat sink type : Open cooling tower
Minimum entering water temperature = 35 F
Is a hydronic economizer used ? <Y> ; Economizer efficiency = 100 %
Number of sequenced chillers = 1

****

D. PUMPING SYSTEMS (ANNUAL PUMP OPERATING COST = $6,028)

System	PERIMETER dT, F	PERIMETER dP, ft wg	INTERIOR dT, F	INTERIOR dP, ft wg
Chilled water	10.00	60.00	0.00	0.00
Hot water	20.00	60.00	0.00	0.00
Condenser water	10.00	60.00	0.00	0.00
Ground water	0.00	0.00	0.00	0.00

****

E. NON-HVAC SYSTEMS (ANNUAL NON-HVAC OPERATING COST = $70,089)

>1. NON-HVAC ELECTRICAL ENERGY USE
Lighting kw: Occupied = 122.3 kw; Unoccupied = 25.7 kw
Misc. kw : Occupied = 132.1 kw; Unoccupied = 81.9 kw
Other kw : Occupied = 0.0 kw; Unoccupied = 0.0 kw

>2. DHW SYSTEM (Not utilized in this system)

****

F. FUEL COSTS (GRAND TOTAL ANNUAL OPERATING COST = $121,644)

>1. ELECTRICAL ENERGY USE	Period Occupied ($/kwh)	Period Unoccupied ($/kwh)
Compressor	0.050	0.050
Resistance	0.050	0.050
Inductive	0.050	0.050

>2. OTHER FUELS	Unit Cost
Natural Gas	n/a $/therm
Fuel Oil	n/a $/U.S.gal
Propane	n/a $/lb
Remote Heating	n/a $/MBTU
Remote Cooling	n/a $/MBTU

COOLING PLANT COSTS

Job Name : CCF SUBCON 1/4 3DMZ SYS — Date : 11-11-86

Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Serial Number:

Site Name : AURORA,IL FERMI, User Defined — 60117862.0

Bin Temp (F)	Bin Hours hr/yr	Block Cooling Plant Coil Load MBH	Input KW	Cost $/yr
OCCUPIED PERIOD				
90	25.8	1955.8	107.4	138.5
85	59.4	1810.8	89.7	266.5
80	145.3	1668.9	75.1	545.9
75	237.7	1283.8	65.4	777.7
70	270.6	680.1	43.5	589.1
65	264.5	244.0	33.4	442.0
60	255.0	284.2	32.0	408.2
55	244.7	324.5	30.7	375.1
50	232.1	364.7	2.8	32.4
45	229.5	405.0	2.8	32.1
40	237.6	445.2	2.8	33.2
35	238.5	226.0	2.8	33.3
30	218.2	225.0	2.8	30.5
25	174.5	254.5	2.8	24.4
20	122.4	294.8	2.8	17.1
15	78.1	335.0	2.8	10.9
10	46.1	332.7	2.8	6.4
5	25.1	321.7	2.8	3.5
0	12.7	310.8	2.8	1.8
-5	6.2	299.9	2.8	0.9
-6	4.6	297.7	2.8	0.6
Total Costs				$3770.3
UNOCCUPIED PERIOD				
90	14.6	1352.1	77.2	56.4
85	36.3	1211.4	65.0	118.0
80	99.3	1073.5	55.2	273.9
75	215.3	720.6	46.0	495.6
70	357.6	175.6	33.7	602.0
65	463.3	115.8	31.8	736.5
60	500.4	154.8	31.1	778.1
55	482.0	193.9	2.8	67.4
50	447.6	255.3	2.8	62.6
45	422.7	257.2	2.8	59.1
40	413.7	259.1	2.8	57.8
35	417.0	210.0	2.8	58.3
30	417.4	137.7	2.8	58.4
25	395.2	65.4	2.8	55.2
20	336.9	0.0	0.0	0.0
15	252.8	0.0	0.0	0.0
10	165.7	0.0	0.0	0.0
5	96.3	0.0	0.0	0.0
0	50.9	0.0	0.0	0.0
-5	25.3	0.0	0.0	0.0
-6	21.1	0.0	0.0	0.0
Total Costs				$3479.3

BLOCK HEATING PLANT COSTS

Job Name : CCF SUBCON 1/4 3DMZ SYS — Date : 11-11-86

Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Serial Number:

Site Name : AURORA,IL FERMI, User Defined — 60117862.0

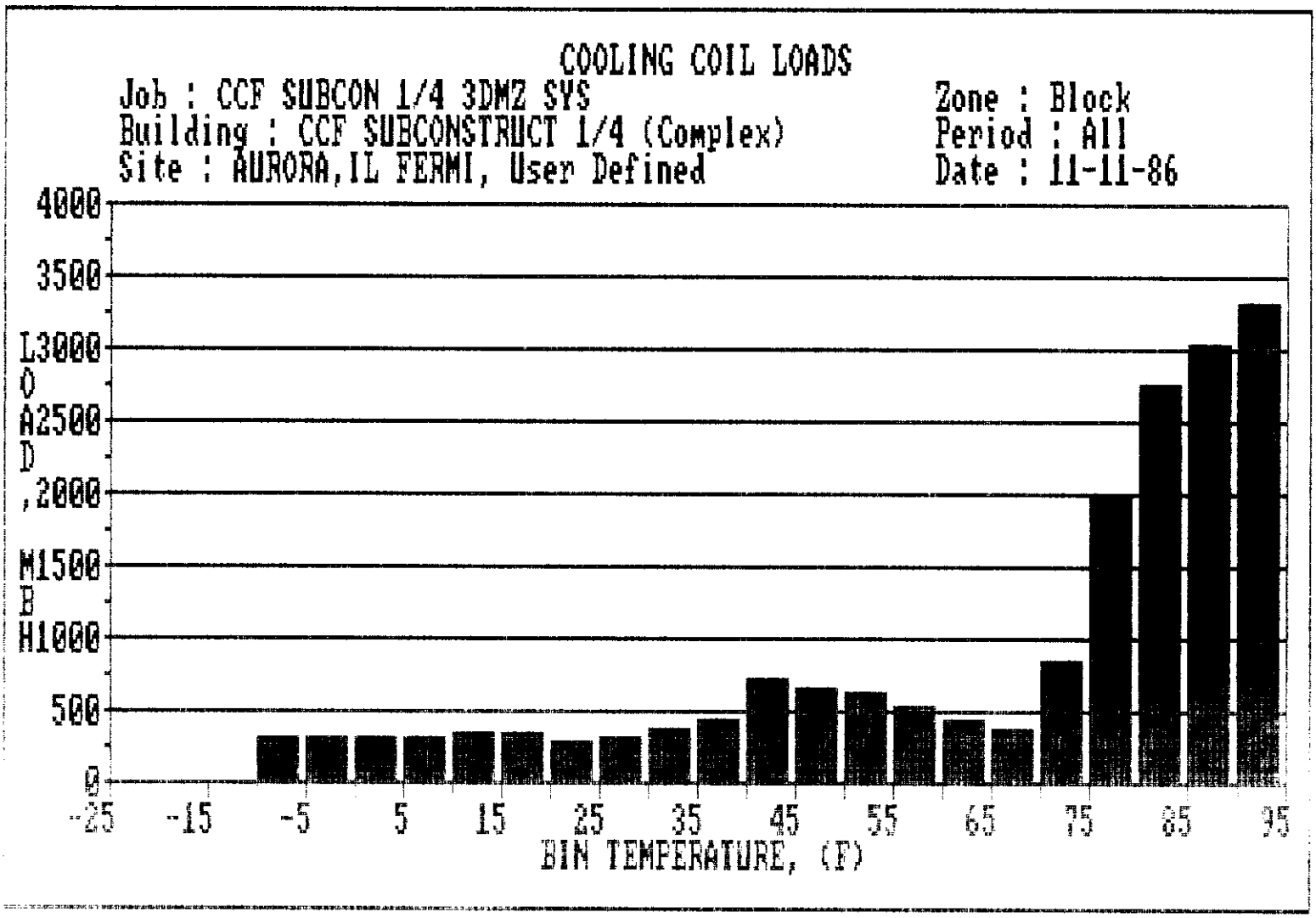
Bin Temp (F)	Bin Hours hr/yr	Coil Load MBH	Primary Plant Output MBH	Input KW	Cost $/yr	No Auxiliary Plant Used
			OCCUPIED PERIOD			
90	25.8	0.0	0.0	0.0	0.0	
85	59.4	0.0	0.0	0.0	0.0	
80	145.3	0.0	0.0	0.0	0.0	
75	237.7	0.0	0.0	0.0	0.0	
70	270.6	0.0	0.0	0.0	0.0	
65	264.5	0.0	0.0	0.0	0.0	
60	255.0	0.0	0.0	0.0	0.0	
55	244.7	0.0	0.0	0.0	0.0	
50	232.1	0.0	0.0	0.0	0.0	
45	229.5	0.0	0.0	0.0	0.0	
40	237.6	0.0	0.0	0.0	0.0	
35	238.5	0.0	0.0	0.0	0.0	
30	218.2	0.0	0.0	0.0	0.0	
25	174.5	0.0	0.0	0.0	0.0	
20	122.4	0.0	0.0	0.0	0.0	
15	78.1	0.0	0.0	0.0	0.0	
10	46.1	78.8	78.8	23.1	53.2	
5	25.1	173.6	173.6	50.9	63.8	
0	12.7	268.3	268.3	78.6	49.9	
-5	6.2	363.0	363.0	106.4	33.0	
-6	4.6	382.0	382.0	111.9	25.7	
Total Costs					$225.7	
			UNOCCUPIED PERIOD			
90	14.6	0.0	0.0	0.0	0.0	
85	36.3	0.0	0.0	0.0	0.0	
80	99.3	0.0	0.0	0.0	0.0	
75	215.3	0.0	0.0	0.0	0.0	
70	357.6	0.0	0.0	0.0	0.0	
65	463.3	0.0	0.0	0.0	0.0	
60	500.4	0.0	0.0	0.0	0.0	
55	482.0	0.0	0.0	0.0	0.0	
50	447.6	0.0	0.0	0.0	0.0	
45	422.7	0.0	0.0	0.0	0.0	
40	413.7	0.0	0.0	0.0	0.0	
35	417.0	0.0	0.0	0.0	0.0	
30	417.4	0.0	0.0	0.0	0.0	
25	395.2	0.0	0.0	0.0	0.0	
20	336.9	18.8	18.8	5.5	92.6	
15	252.8	122.2	122.2	35.8	452.7	
10	165.7	225.7	225.7	66.1	547.9	
5	96.3	329.2	329.2	96.4	464.4	
0	50.9	432.6	432.6	126.8	322.6	
-5	25.3	536.1	536.1	157.1	198.7	
-6	21.1	556.8	556.8	163.1	172.1	
Total Costs					$2250.9	

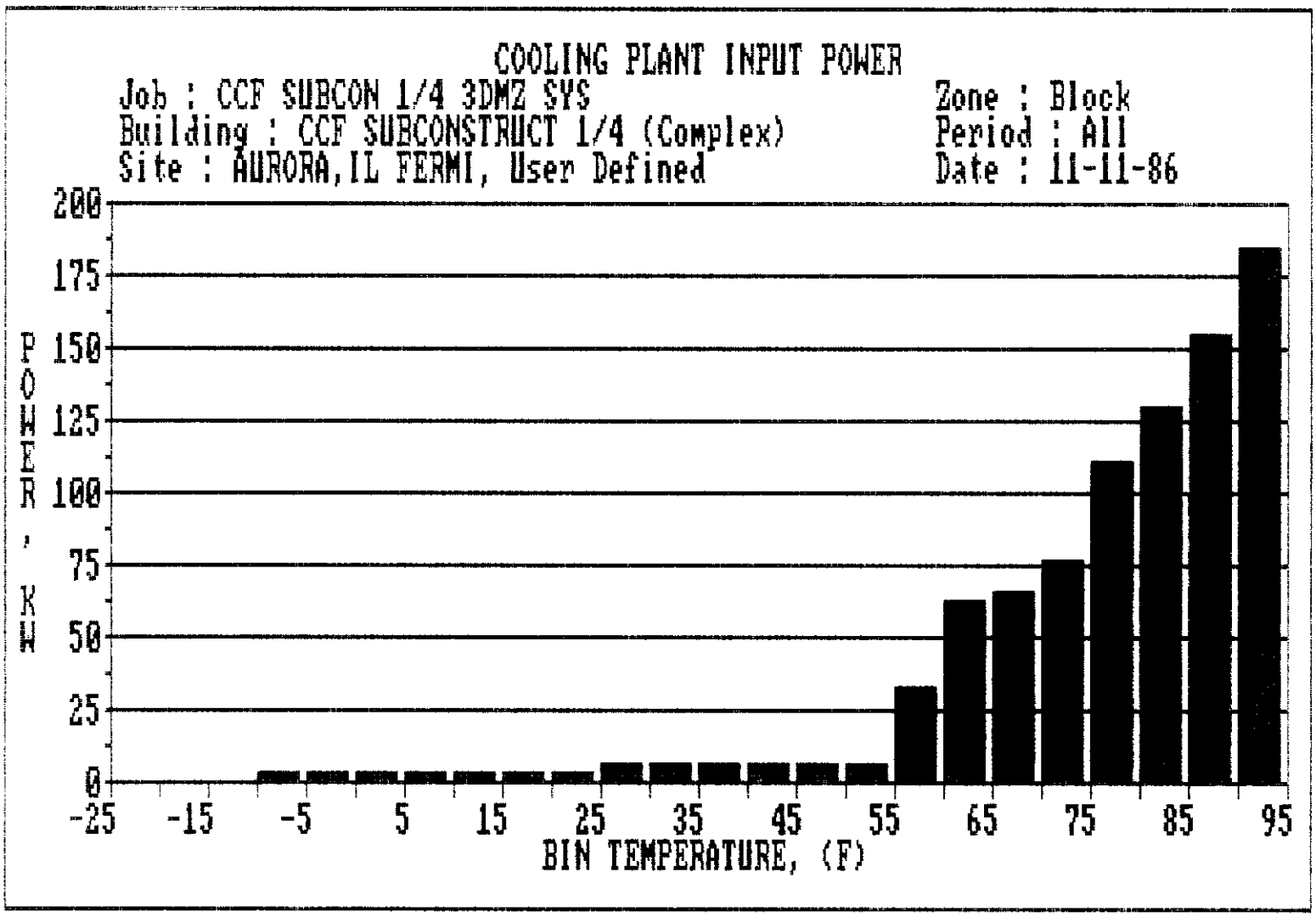
FAN AND PUMP COSTS

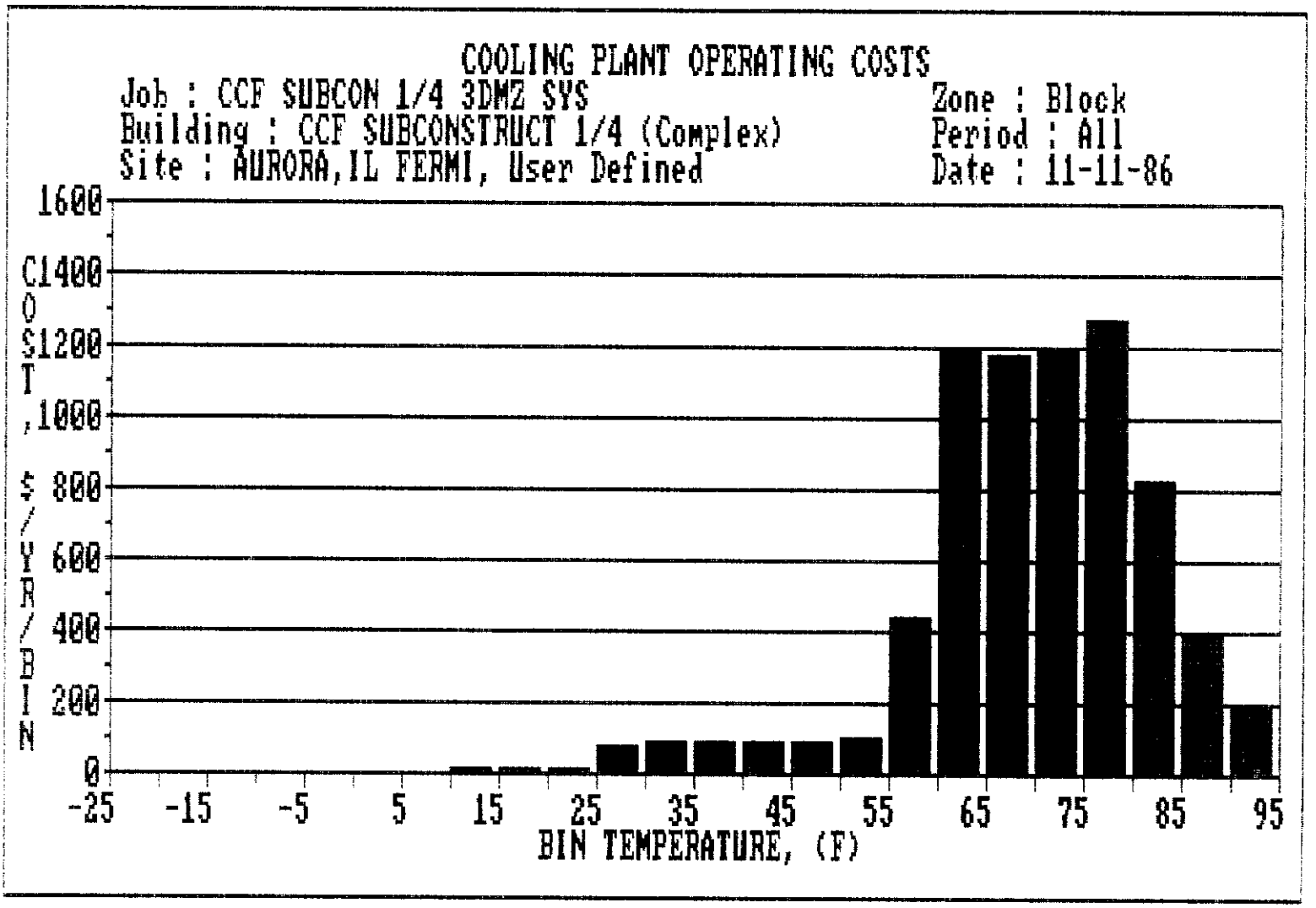
Job Name : CCF SUBCON 1/4 3DMZ SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site Name : AURORA,IL FERMI, User Defined

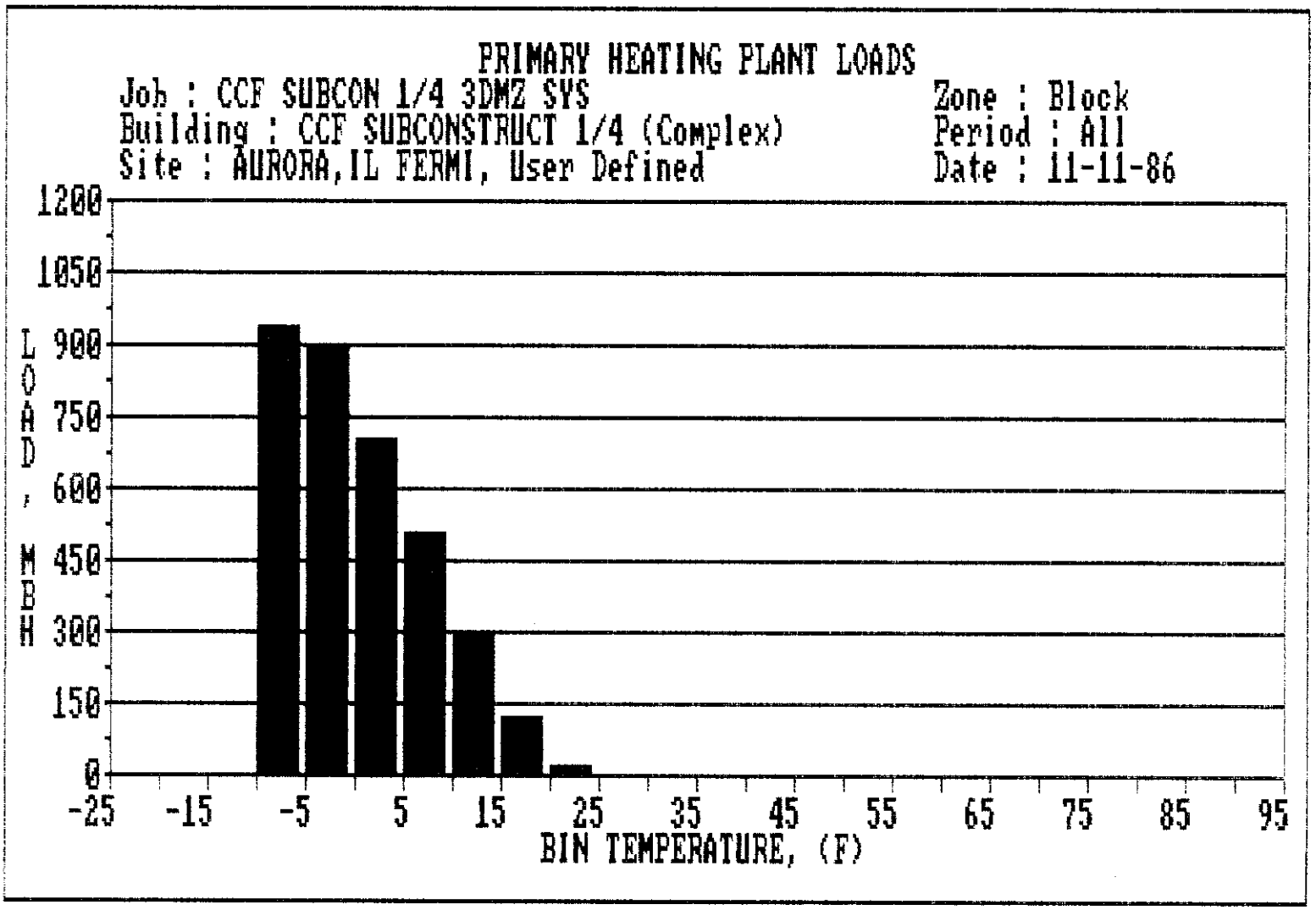
Date : 11-11-86
Serial Number:
60117862.0

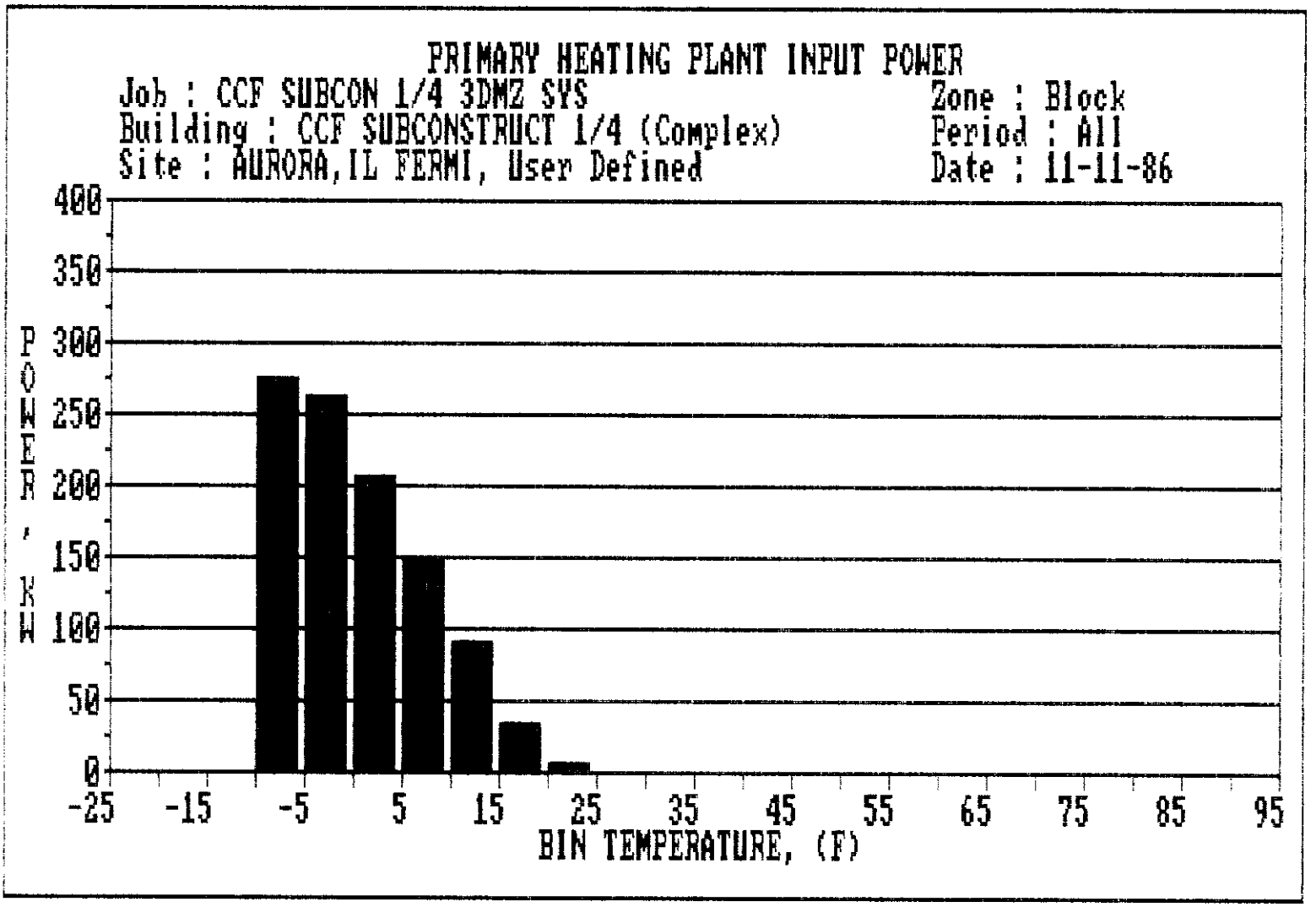
Bin Temp (F)	Bin Hours hr/yr	Block Fans Input KW	Block Fans Cost $/yr		All Pumps Input KW	All Pumps Cost $/yr
				OCCUPIED PERIOD		
90	25.8	81.7	105.4		15.2	19.6
85	59.4	81.7	242.8		15.2	45.1
80	145.3	81.7	593.8		15.2	110.4
75	237.7	81.7	971.4		15.2	180.7
70	270.6	81.7	1105.9		15.2	205.7
65	264.5	81.7	1081.0		15.2	201.0
60	255.0	81.7	1042.1		15.2	193.8
55	244.7	81.7	1000.0		15.2	186.0
50	232.1	81.7	948.6		15.2	176.4
45	229.5	81.7	937.9		15.2	174.4
40	237.6	81.7	971.0		15.2	180.6
35	238.5	81.7	974.7		15.2	181.3
30	218.2	81.7	891.7		15.2	165.8
25	174.5	81.7	713.2		15.2	132.6
20	122.4	81.7	500.2		15.2	93.0
15	78.1	81.7	319.2		15.2	59.4
10	46.1	81.7	188.4		16.9	39.1
5	25.1	81.7	102.6		16.9	21.3
0	12.7	81.7	51.9		16.9	10.8
-5	6.2	81.7	25.3		16.9	5.3
-6	4.6	81.7	18.8		16.9	3.9
Total Costs			$12786.0			$2386.2
				UNOCCUPIED PERIOD		
90	14.6	81.7	59.7		15.2	11.1
85	36.3	81.7	148.4		15.2	27.6
80	99.3	81.7	405.8		15.2	75.5
75	215.3	81.7	879.9		15.2	163.6
70	357.6	81.7	1461.4		15.2	271.8
65	463.3	81.7	1893.4		15.2	352.1
60	500.4	81.7	2045.0		15.2	380.3
55	482.0	81.7	1969.8		15.2	366.4
50	447.6	81.7	1829.3		15.2	340.2
45	422.7	81.7	1727.5		15.2	321.3
40	413.7	81.7	1690.7		15.2	314.4
35	417.0	81.7	1704.2		15.2	316.9
30	417.4	81.7	1705.8		15.2	317.3
25	395.2	81.7	1615.1		15.2	300.4
20	336.9	81.7	1376.9		1.7	29.4
15	252.8	81.7	1033.1		1.7	22.0
10	165.7	81.7	677.2		1.7	14.4
5	96.3	81.7	393.6		1.7	8.4
0	50.9	81.7	208.0		1.7	4.4
-5	25.3	81.7	103.4		1.7	2.2
-6	21.1	81.7	86.2		1.7	1.8
Total Costs			$23014.5			$3641.7

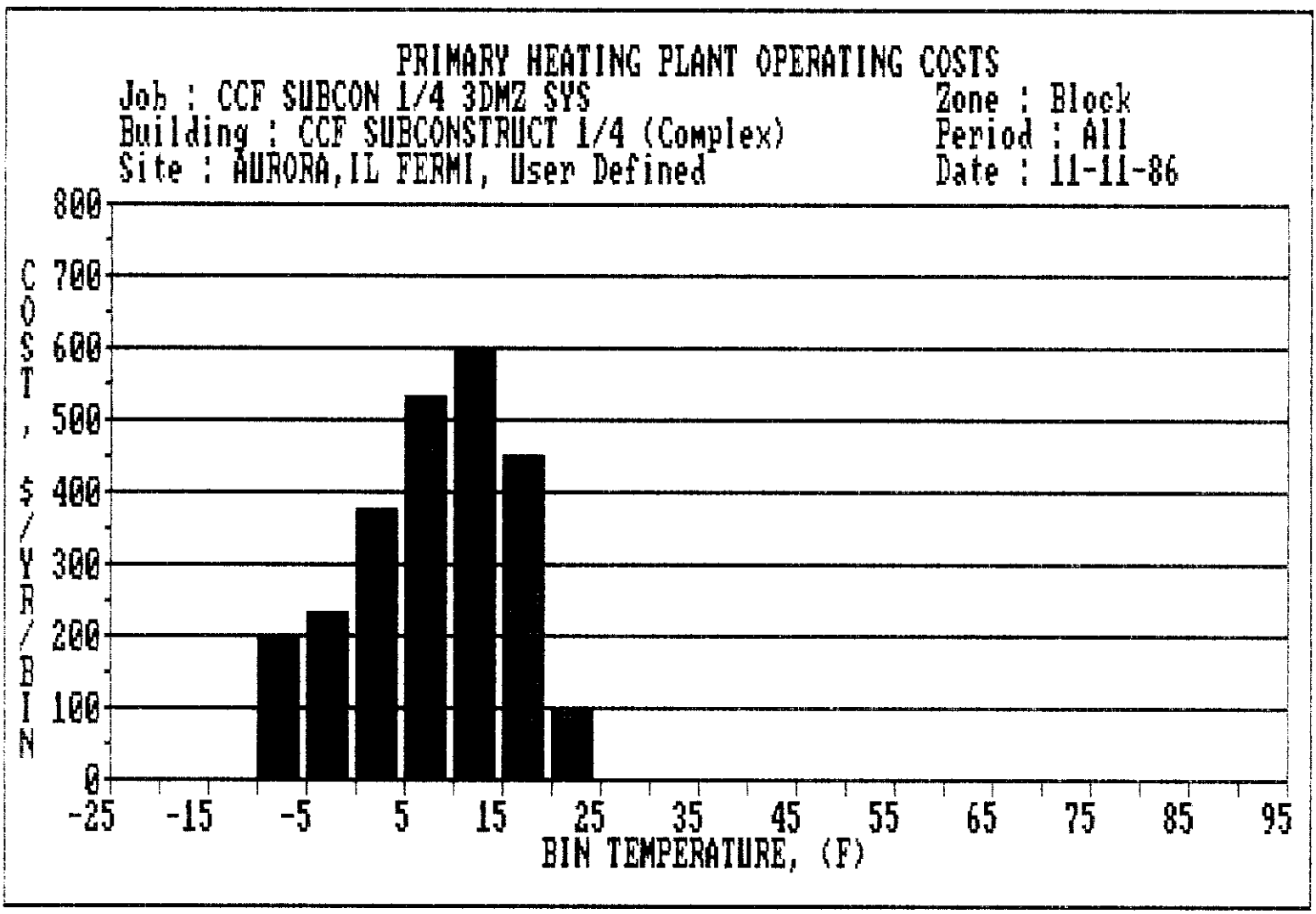

COOLING COIL LOADS
Job : CCF SUBCON 1/4 3DMZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
LOAD, MBH
4000
3500
3000
2500
2000
1500
1000
500
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

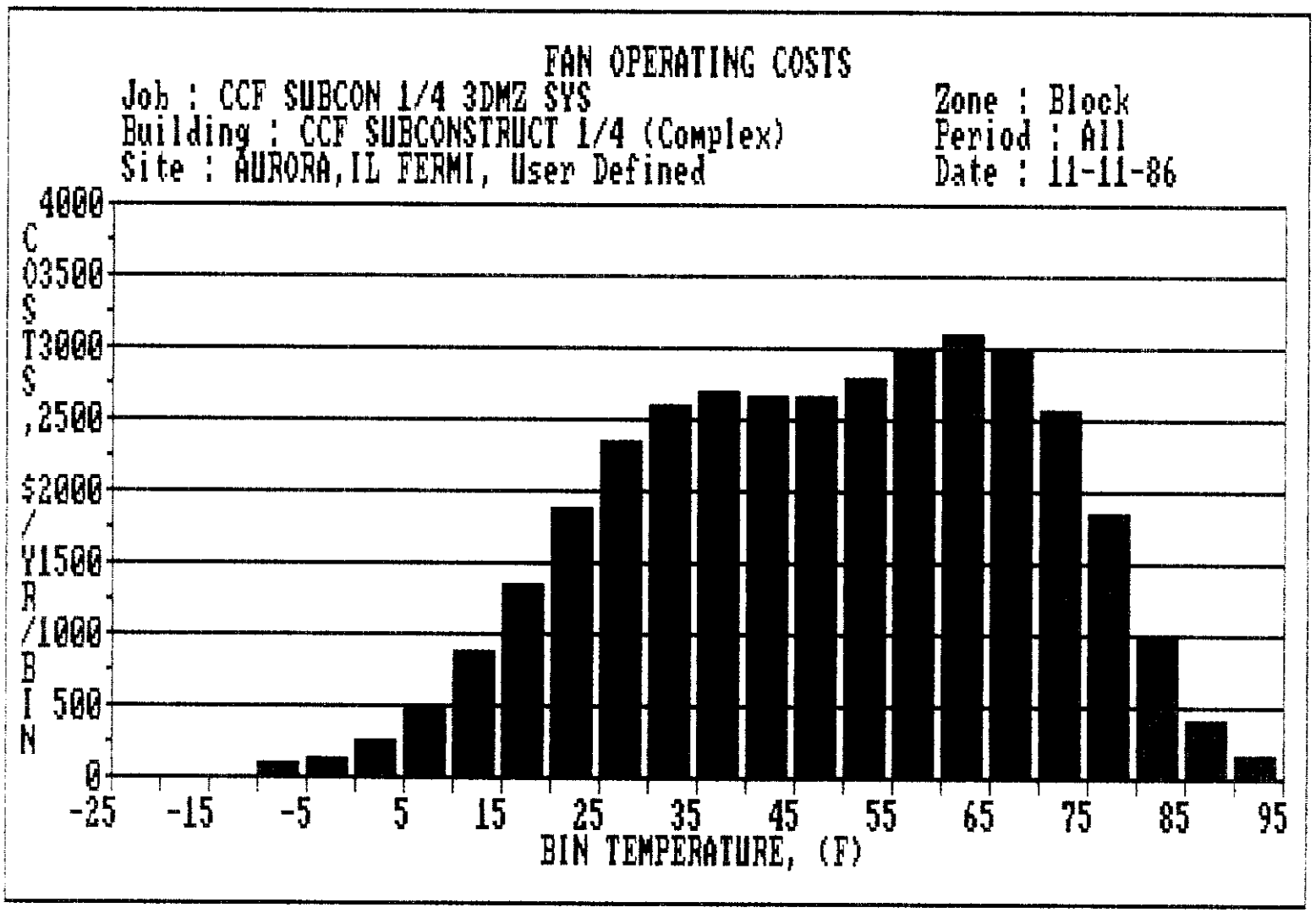

COOLING PLANT INPUT POWER
Job : CCF SUBCON 1/4 3DMZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
POWER, KW
200
175
150
125
100
75
50
25
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


COOLING PLANT OPERATING COSTS
Job : CCF SUBCON 1/4 3DMZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
COST $/YR/BIN
1600
1400
1200
1000
800
600
400
200
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT LOADS
Job : CCF SUBCON 1/4 3DMZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
LOAD, MBH
1200
1050
900
750
600
450
300
150
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT INPUT POWER
Job : CCF SUBCON 1/4 3DMZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
POWER, KW
400
350
300
250
200
150
100
50
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT OPERATING COSTS
Job : CCF SUBCON 1/4 3DMZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
COST, $/YR/BIN
800
700
600
500
400
300
200
100
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


FAN OPERATING COSTS
Job : CCF SUBCON 1/4 3DMZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
COSTS $/YR/BIN
4000
3500
3000
2500
2000
1500
1000
500
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
OPERATIONAL PERFORMANCE SIMULATION

ALTERNATE COMPARISON SYSTEM NUMBER 4
TYPICAL FY1975 DESIGN
MULTIZONE WITH CENTRIFUGAL CHILLERS AND ICW FREE COOLING ECONOMIZER

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

SYSTEM INPUT SUMMARY

Job Name : CCF SUBCON 1/4 1975MZ SYS Page 1
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-26-86
Site : AURORA,IL FERMI, User Defined 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

A. AIR HANDLING SYSTEMS

Are perimeter and interior zone on same supply fan ? <Y>

>1. BLOCK TERMINAL TYPE : MULTIZONE

Supply fan type : Backward inclined or airfoil

Supply fan total static pressure = 4.00 in. wg.

Return fan type : Backward inclined or airfoil

Return fan total static pressure = 2.00 in. wg.

Design supply air= 62800 cfm @ 55 F; Vent. air= 4340 cfm

Hot deck supply air temperature = 100 F

Outdoor air temperature at which heating begins = 55 F

An economizer is not used.

Is a ventilation reclaim device used ? <N>

Are ventilation air dampers closed for unoccupied periods ? <N>

****

B. HEATING PLANTS

Does one primary heating plant serve perimeter and interior ? <Y>

> 1 . BLOCK PLANT : ELECTRICAL RESISTANCE

Is hydronic heating used ? <Y>

****

SYSTEM INPUT SUMMARY

Job Name : CCF SUBCON 1/4 1975MZ SYS — Page 2
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Date : 11-26-86
Site : AURORA,IL FERMI, User Defined — 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

C. COOLING PLANTS

Does one plant serve perimeter and interior ? <Y>

>1. BLOCK PLANT : CENTRIFUGAL WATER COOLED CHILLER
Capacity @ 85 F entering water = 195.6 tons
KW/Ton @ 85 F entering water = 0.85 kw/ton
Is hydronic cooling used ? <Y>
Is chilled water reset used ? <N>
Is condenser performance altitude adjusted ? <Y>
Heat sink type : Open cooling tower
Minimum entering water temperature = 35 F
Is a hydronic economizer used ? <Y> ; Economizer efficiency = 100 %
Number of sequenced chillers = 1

****

D. PUMPING SYSTEMS

System	PERIMETER dT, F	PERIMETER dP, ft wg	INTERIOR dT, F	INTERIOR dP, ft wg
Chilled water	10.00	60.00	0.00	0.00
Hot water	20.00	60.00	0.00	0.00
Condenser water	0.00	60.00	0.00	0.00
Ground water	0.00	0.00	0.00	0.00

****

E. NON-HVAC SYSTEMS

>1. NON-HVAC ELECTRICAL ENERGY USE
Lighting kw: Occupied = 122.3 kw; Unoccupied = 25.7 kw
Misc. kw : Occupied = 132.1 kw; Unoccupied = 81.9 kw
Other kw : Occupied = 0.0 kw; Unoccupied = 0.0 kw

>2. DHW SYSTEM (Not utilized in this system)

****

F. FUEL COSTS

>1. ELECTRICAL ENERGY USE	Period Occupied ($/kwh)	Period Unoccupied ($/kwh)
Compressor	0.050	0.050
Resistance	0.050	0.050
Inductive	0.050	0.050

>2. OTHER FUELS	Unit Cost
Natural Gas	n/a $/therm
Fuel Oil	n/a $/U.S.gal
Propane	n/a $/lb
Remote Heating	n/a $/MBTU
Remote Cooling	n/a $/MBTU

TOTAL BUILDING ENERGY SUMMARY

Job Name : CCF SUBCON 1/4 1975MZ SYS — Period : All
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Zone : Block
Site : AURORA,IL FERMI, User Defined — Serial Number:
Date : 11-11-86 — 60117862.0

****

HVAC ENERGY Component	Annual Cost ($/yr)	Energy or Fuel Units Consumed	DOE RUF (1000 BTU)	DOE RIF (1000 BTU)
Electric (Occ)	31420	628391 kwh/yr	7289338	2144699
Electric (Unocc)	65340	1306799 kwh/yr	15158866	4460104
Natural Gas	0	0 therms/yr	0	0
Fuel Oil	0	0 U.S. gal/yr	0	0
Propane	0	0 lb/yr	0	0
Remote Heating	0	0 MBTU/yr	0	0
Remote Cooling	0	0 MBTU/yr	0	0
HVAC Total	96759		22448204	6604803
NON-HVAC ENERGY				
Electric (Occ)	39793	795864 kwh/yr	9232025	2716285
Electric (Unocc)	30296	605916 kwh/yr	7028627	2067992
Non-HVAC Total	70089		16260652	4784276
Grand Total	166849		38708856	11389080
Total/Sq.Ft.	3.89		902.09	265.42

HVAC Summary:

HVAC Total Cost	=	2.25 $/Sq.Ft./yr
	=	57.99 % of Total Cost
Total HVAC Electrical Energy	=	45.10 kwh/Sq.Ft./yr
	=	57.99 % of Total Electrical Energy
Non-Electrical HVAC Energy	=	0.00 % of Total Energy

Key:

1 kwh	= 11600 BTU RUF; 3412 BTU RIF
1 therm nat gas	= 100000 BTU RUF and RIF
1 U.S. gal oil	= 138700 BTU RUF and RIF
1 Imp. gal oil	= 168000 BTU RUF and RIF
1 lb propane	= 21680 BTU RUF and RIF
RUF	= Resource utilization factor (Source value)
RIF	= Resource impact factor (Point of use value)
MBH	= 1000 BTU/hr
MBTU	= Million BTU

ANNUAL OPERATING COSTS

Job Name : CCF SUBCON 1/4 1975MZ SYS Page 1
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) Date : 11-11-86
Site : AURORA,IL FERMI, User Defined 60117862.0
Scope of Analysis : Cooling and Heating Systems

****

A. AIR HANDLING SYSTEMS (ANNUAL FAN OPERATING COST = $35,901)

Are perimeter and interior zone on same supply fan ? <Y>

>1. BLOCK TERMINAL TYPE : MULTIZONE

Supply fan type : Backward inclined or airfoil

Supply fan total static pressure = 4.00 in. wg.

Return fan type : Backward inclined or airfoil

Return fan total static pressure = 2.00 in. wg.

Design supply air= 62800 cfm @ 55 F; Vent. air= 4340 cfm

Hot deck supply air temperature = 100 F

Outdoor air temperature at which heating begins = 55 F

An economizer is not used.

Is a ventilation reclaim device used ? <N>

Are ventilation air dampers closed for unoccupied periods ? <N>

****

B. HEATING PLANTS (ANNUAL HEATING PLANT OPERATING COST = $44,447)

Does one primary heating plant serve perimeter and interior ? <Y>

> 1 . BLOCK PLANT : ELECTRICAL RESISTANCE

Is hydronic heating used ? <Y>

****

ANNUAL OPERATING COSTS

Job Name : CCF SUBCON 1/4 1975MZ SYS — Page 2

Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Date : 11-11-86

Site : AURORA,IL FERMI, User Defined — 60117862.0

Scope of Analysis : Cooling and Heating Systems

****

C. COOLING PLANTS (ANNUAL COOLING PLANT OPERATING COST = $9,347)

Does one plant serve perimeter and interior ? <Y>

>1. BLOCK PLANT : CENTRIFUGAL WATER COOLED CHILLER

Capacity @ 85 F entering water = 191.3 tons

KW/Ton @ 85 F entering water = 0.85 kw/ton

Is hydronic cooling used ? <Y>

Is chilled water reset used ? <N>

Is condenser performance altitude adjusted ? <Y>

Heat sink type : Open cooling tower

Minimum entering water temperature = 35 F

Is a hydronic economizer used ? <Y> ; Economizer efficiency = 100 %

Number of sequenced chillers = 1

****

D. PUMPING SYSTEMS (ANNUAL PUMP OPERATING COST = $7,165)

System	PERIMETER dT, F	PERIMETER dP, ft wg	INTERIOR dT, F	INTERIOR dP, ft wg
Chilled water	10.00	60.00	0.00	0.00
Hot water	20.00	60.00	0.00	0.00
Condenser water	10.00	60.00	0.00	0.00
Ground water	0.00	0.00	0.00	0.00

****

E. NON-HVAC SYSTEMS (ANNUAL NON-HVAC OPERATING COST = $70,089)

>1. NON-HVAC ELECTRICAL ENERGY USE

Lighting kw: Occupied = 122.3 kw; Unoccupied = 25.7 kw

Misc. kw : Occupied = 132.1 kw; Unoccupied = 81.9 kw

Other kw : Occupied = 0.0 kw; Unoccupied = 0.0 kw

>2. DHW SYSTEM (Not utilized in this system)

****

F. FUEL COSTS (GRAND TOTAL ANNUAL OPERATING COST = $166,849)

>1. ELECTRICAL ENERGY USE	Period Occupied ($/kwh)	Period Unoccupied ($/kwh)
Compressor	0.050	0.050
Resistance	0.050	0.050
Inductive	0.050	0.050

>2. OTHER FUELS	Unit Cost
Natural Gas	n/a $/therm
Fuel Oil	n/a $/U.S.gal
Propane	n/a $/lb
Remote Heating	n/a $/MBTU
Remote Cooling	n/a $/MBTU

COOLING PLANT COSTS

Job Name : CCF SUBCON 1/4 1975MZ SYS — Date : 11-11-86
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Serial Number:
Site Name : AURORA,IL FERMI, User Defined — 60117862.0

Bin Temp (F)	Bin Hours hr/yr	Block Cooling Plant Coil Load MBH	Input KW	Cost $/yr
OCCUPIED PERIOD				
90	25.8	1955.8	107.4	138.5
85	59.4	1810.8	89.7	266.5
80	145.3	1668.9	75.1	545.9
75	237.7	1529.6	63.2	750.8
70	270.6	1393.0	53.5	723.8
65	264.5	1258.7	45.8	605.4
60	255.0	1147.4	40.1	511.6
55	244.7	1373.6	40.3	492.6
50	232.1	1306.8	33.6	389.9
45	239.5	1241.4	2.8	32.1
40	237.6	1177.4	2.8	33.2
35	238.5	1020.1	2.8	33.3
30	218.2	999.3	2.8	30.5
25	174.5	995.6	2.8	24.4
20	122.4	942.2	2.8	17.1
15	78.1	890.3	2.8	10.9
10	46.1	839.8	2.8	6.4
5	25.1	790.7	2.8	3.5
0	12.7	743.0	2.8	1.8
-5	6.2	696.7	2.8	0.9
-6	4.6	687.6	2.8	0.6
Total Costs				$4619.9
UNOCCUPIED PERIOD				
90	14.6	1352.1	77.2	56.4
85	36.3	1211.4	65.0	118.0
80	99.3	1073.5	55.2	273.9
75	215.3	938.3	47.3	509.5
70	357.6	805.5	41.2	736.9
65	463.3	675.0	36.6	846.7
60	500.4	571.0	33.5	837.6
55	482.0	1028.4	35.9	864.2
50	447.6	862.9	2.8	62.6
45	422.7	842.2	2.8	59.1
40	413.7	821.6	2.8	57.8
35	417.0	788.0	2.8	58.3
30	417.4	742.2	2.8	58.4
25	395.2	697.6	2.8	55.2
20	336.9	654.5	2.8	47.1
15	252.8	612.7	2.8	35.3
10	165.7	572.3	2.8	23.2
5	96.3	533.3	2.8	13.5
0	50.9	495.6	2.8	7.1
-5	25.3	459.3	2.8	3.5
-6	21.1	452.2	2.8	2.9
Total Costs				$4727.1

BLOCK HEATING PLANT COSTS

Job Name : CCF SUBCON 1/4 1975MZ SYS — Date : 11-11-86
Building Name : CCF SUBCONSTRUCT 1/4 (Complex) — Serial Number:
Site Name : AURORA,IL FERMI, User Defined — 60117862.0

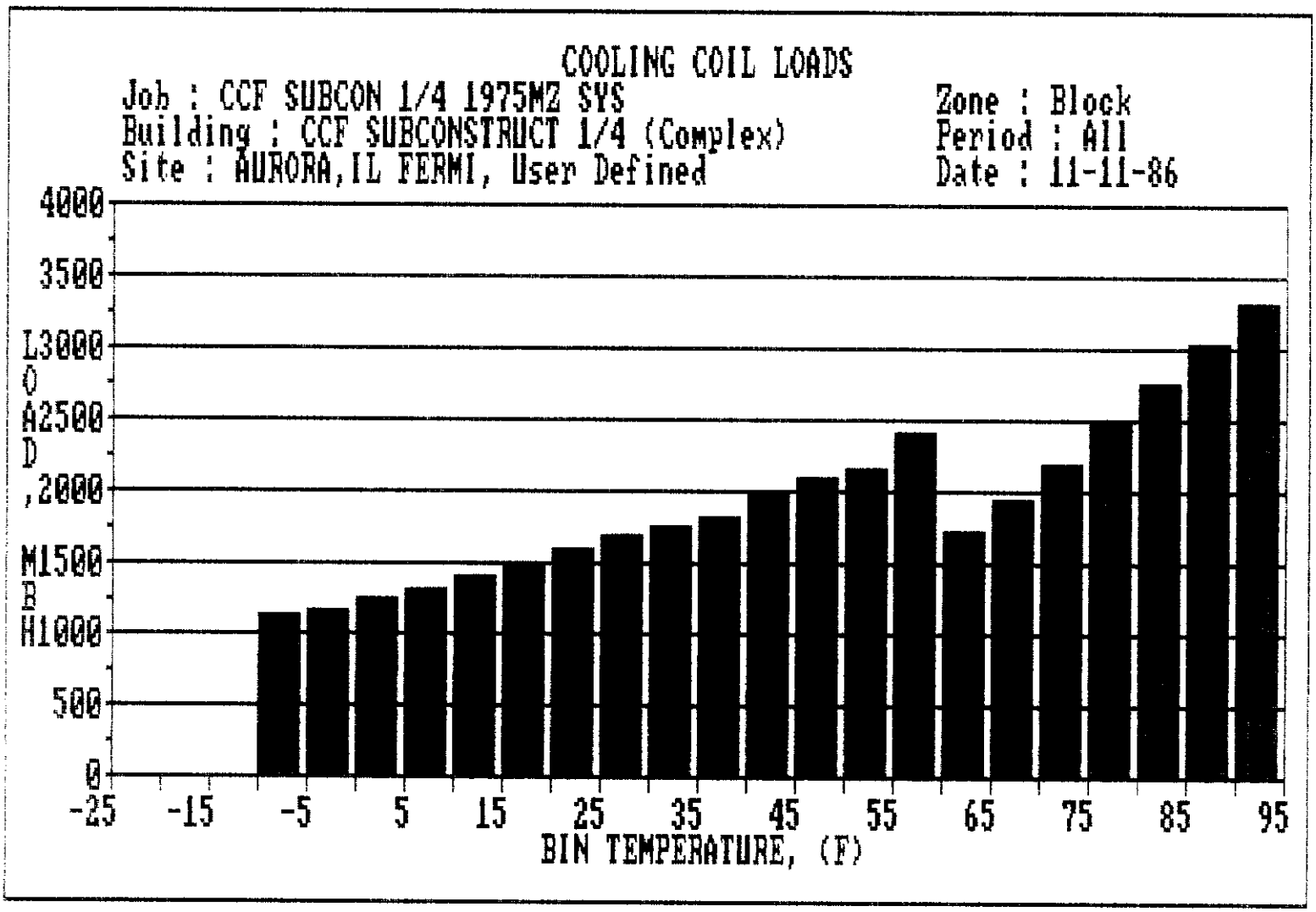
Bin Temp (F)	Bin Hours hr/yr	Coil Load MBH	Primary Plant Output MBH	Input KW	Cost $/yr	No Auxiliary Plant Used
			OCCUPIED PERIOD			
90	25.8	0.0	0.0	0.0	0.0	
85	59.4	0.0	0.0	0.0	0.0	
80	145.3	0.0	0.0	0.0	0.0	
75	237.7	0.0	0.0	0.0	0.0	
70	270.6	0.0	0.0	0.0	0.0	
65	264.5	0.0	0.0	0.0	0.0	
60	255.0	0.0	0.0	0.0	0.0	
55	244.7	331.8	331.8	97.2	1189.6	
50	232.1	370.7	370.7	108.6	1260.4	
45	229.5	410.9	410.9	120.4	1381.6	
40	237.6	452.6	452.6	132.6	1575.4	
35	238.5	390.7	390.7	114.5	1365.0	
30	218.2	396.9	396.9	116.3	1268.7	
25	174.5	424.7	424.7	124.4	1085.8	
20	122.4	477.1	477.1	139.8	855.4	
15	78.1	530.8	530.8	155.5	607.3	
10	46.1	586.0	586.0	171.7	395.7	
5	25.1	642.5	642.5	188.3	236.3	
0	12.7	700.5	700.5	205.2	130.3	
-5	6.2	759.9	759.9	222.6	69.0	
-6	4.6	771.9	771.9	226.2	52.0	
Total Costs					$11472.6	
			UNOCCUPIED PERIOD			
90	14.6	0.0	0.0	0.0	0.0	
85	36.3	0.0	0.0	0.0	0.0	
80	99.3	0.0	0.0	0.0	0.0	
75	215.3	0.0	0.0	0.0	0.0	
70	357.6	0.0	0.0	0.0	0.0	
65	463.3	0.0	0.0	0.0	0.0	
60	500.4	0.0	0.0	0.0	0.0	
55	482.0	560.9	560.9	164.3	3960.4	
50	447.6	444.2	444.2	130.1	2912.5	
45	422.7	450.6	450.6	132.0	2790.5	
40	413.7	457.1	457.1	133.9	2770.3	
35	417.0	496.4	496.4	145.4	3032.6	
30	417.4	554.0	554.0	162.3	3387.6	
25	395.2	612.9	612.9	179.6	3548.7	
20	336.9	673.3	673.3	197.3	3322.9	
15	252.8	734.9	734.9	215.3	2721.8	
10	165.7	798.0	798.0	233.8	1937.1	
5	96.3	862.4	862.4	252.7	1216.7	
0	50.9	928.2	928.2	272.0	692.1	
-5	25.3	995.4	995.4	291.6	368.9	
-6	21.1	1008.9	1008.9	295.6	311.9	
Total Costs					$32974.1	

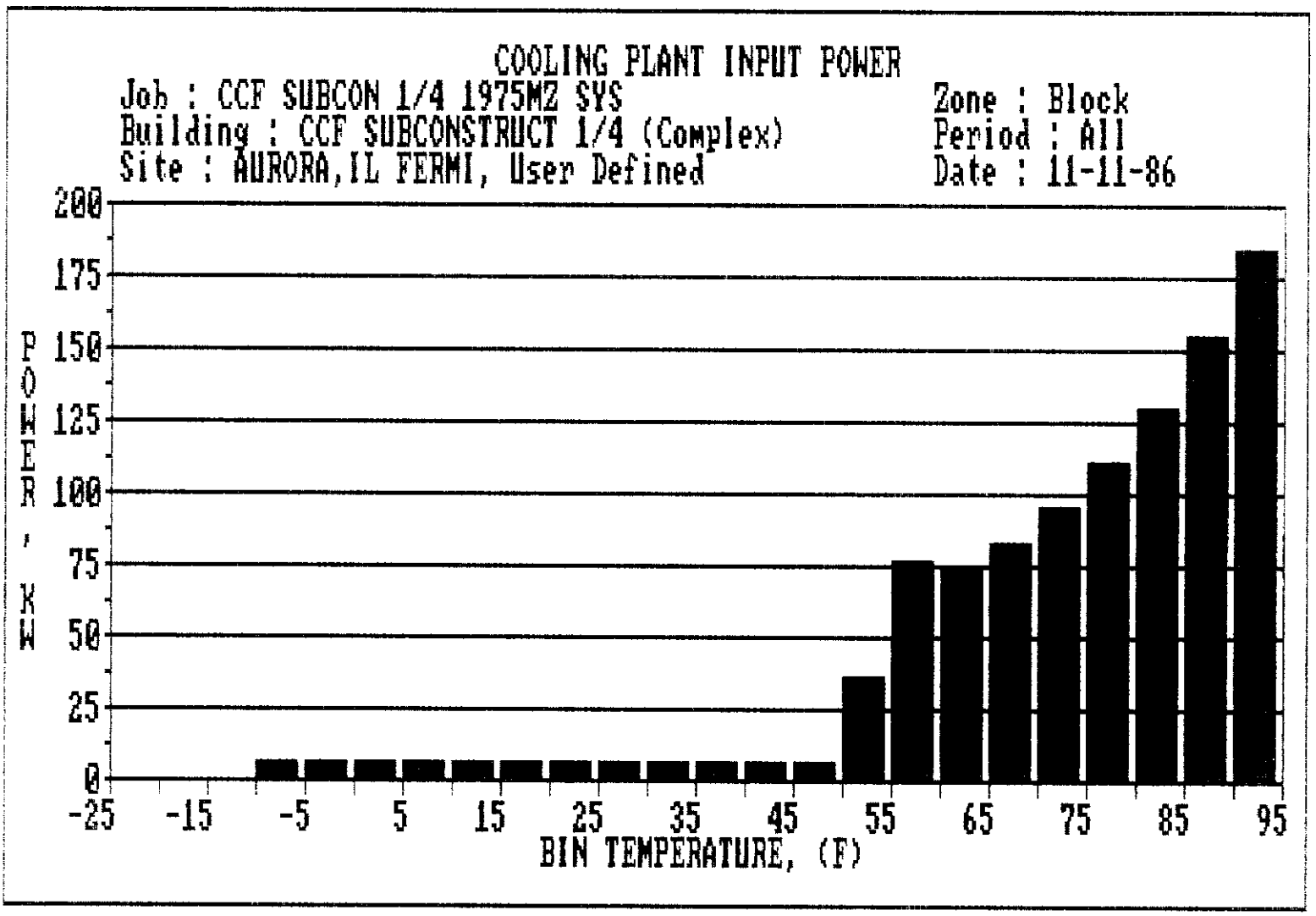
FAN AND PUMP COSTS

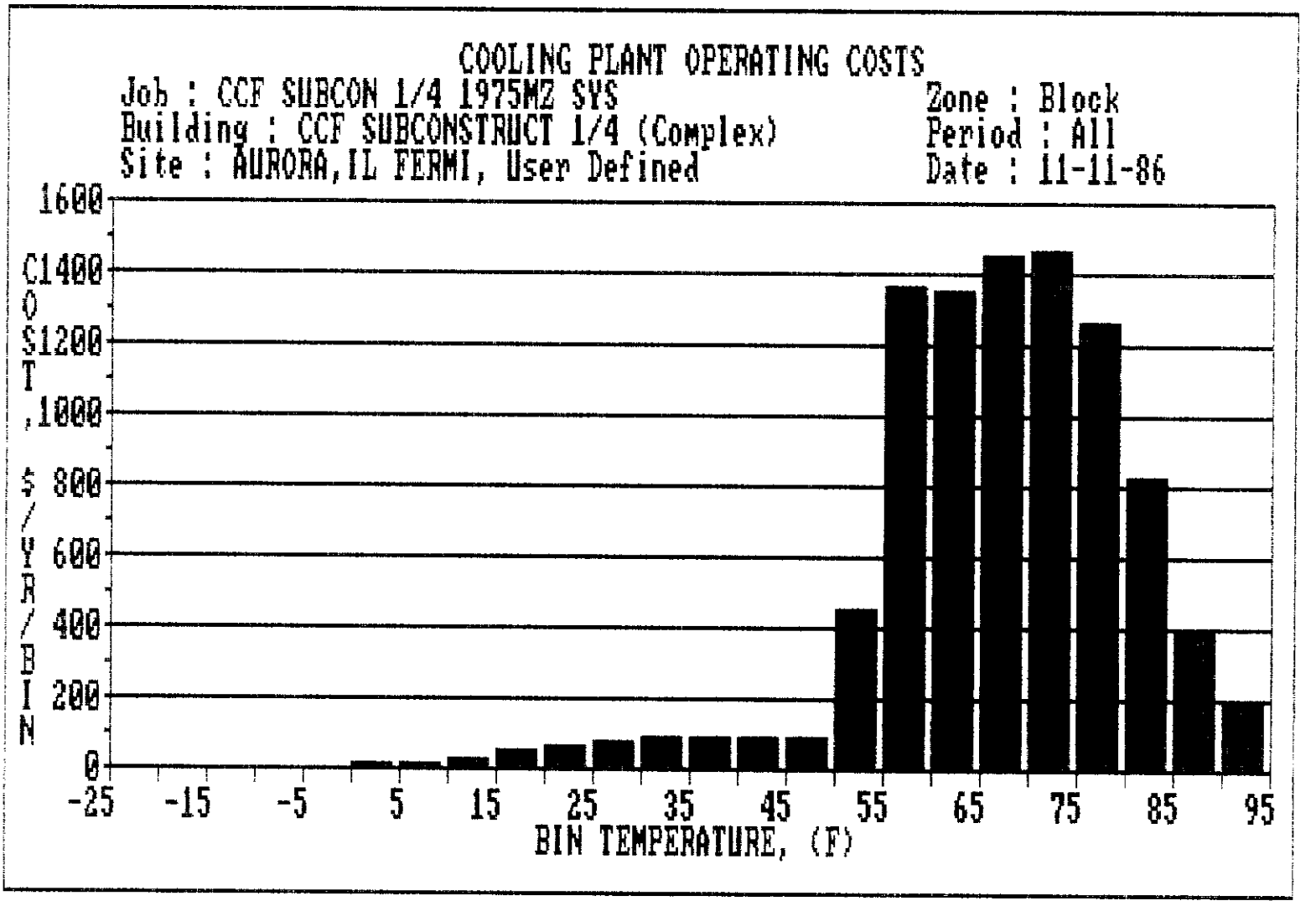
Job Name : CCF SUBCON 1/4 1975MZ SYS
Building Name : CCF SUBCONSTRUCT 1/4 (Complex)
Site Name : AURORA,IL FERMI, User Defined

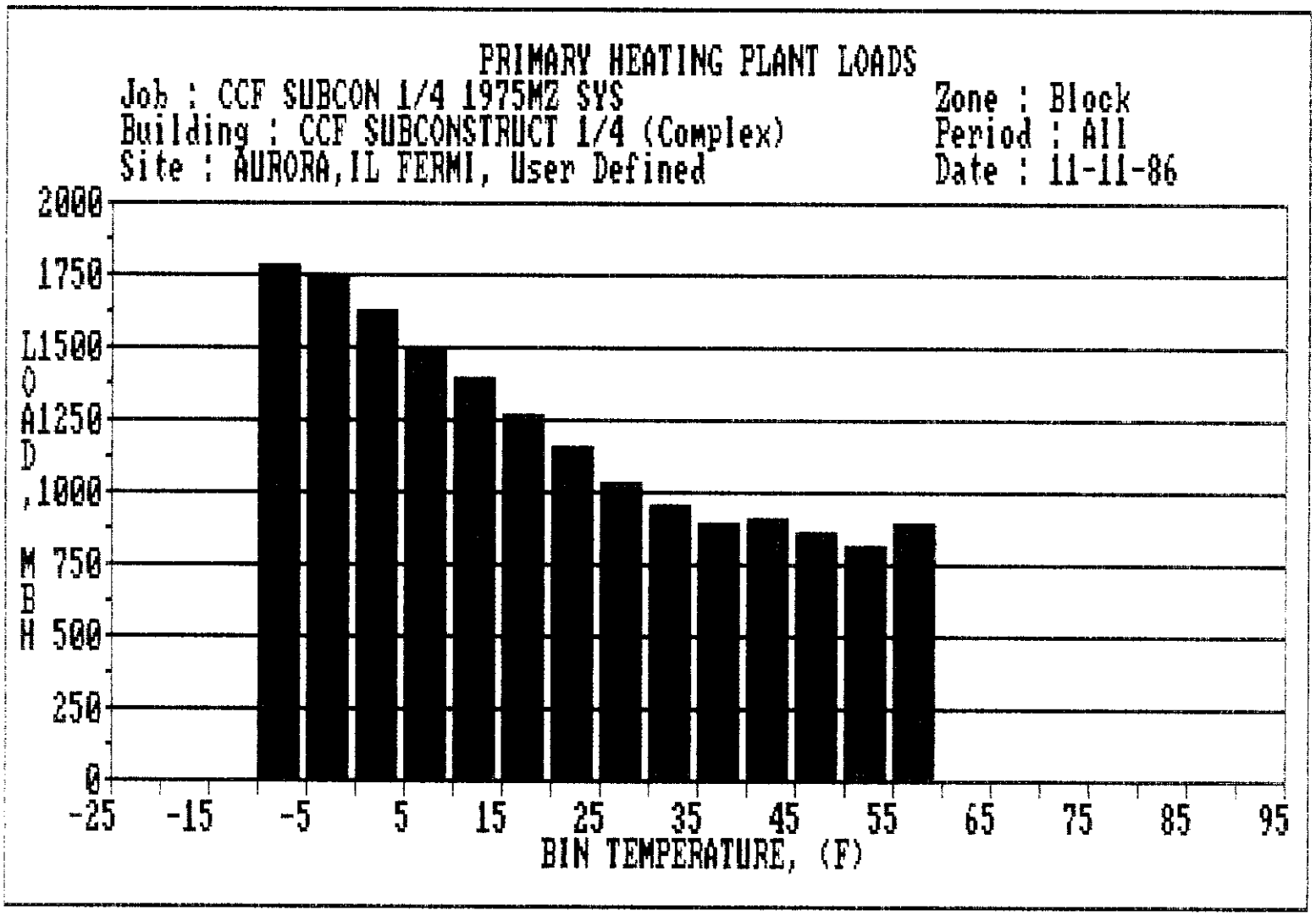
Date : 11-11-86
Serial Number:
60117862.0

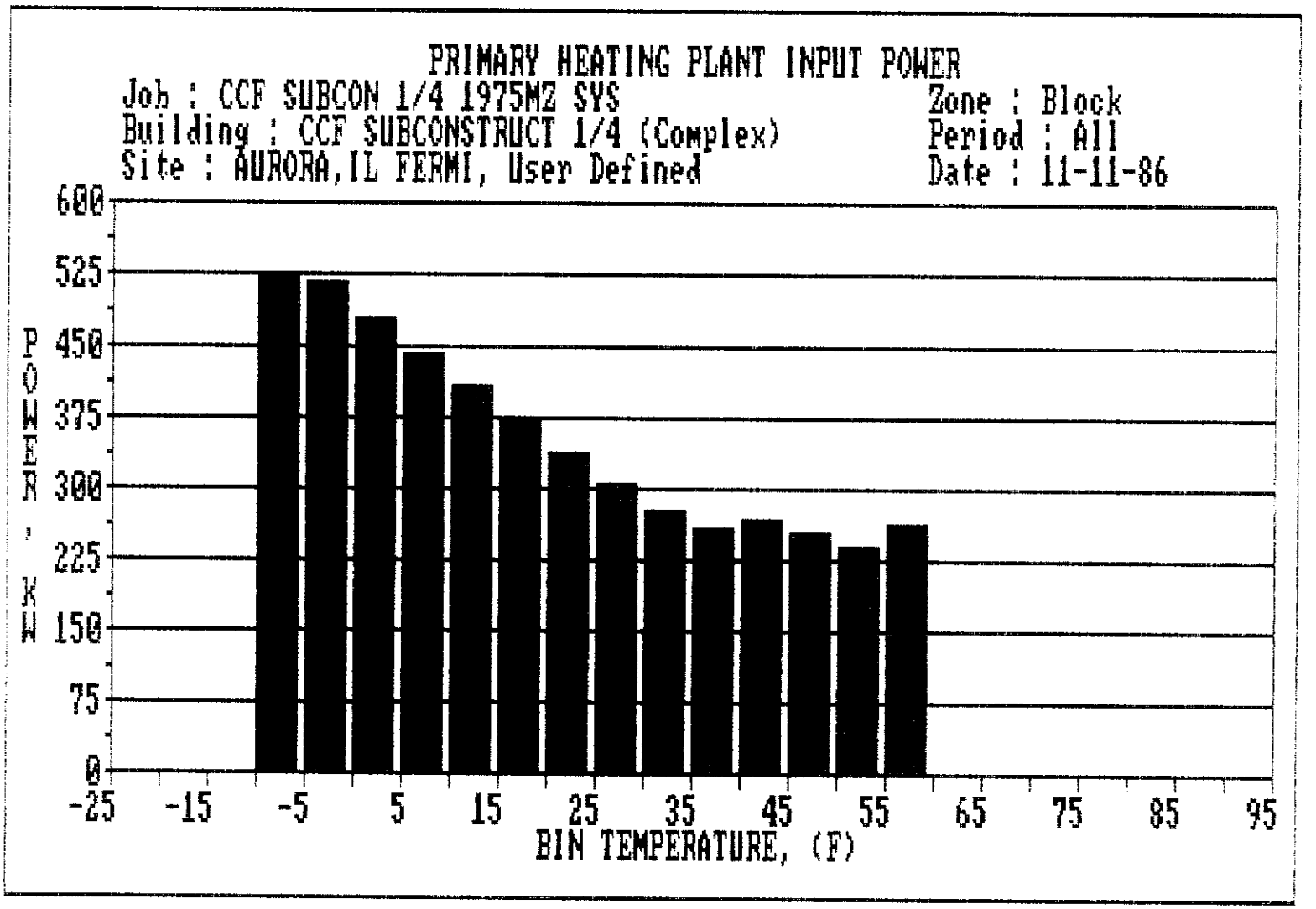
Bin Temp (F)	Bin Hours hr/yr	Block Fans Input KW	Block Fans Cost $/yr		All Pumps Input KW	All Pumps Cost $/yr
				OCCUPIED PERIOD		
90	25.8	81.7	105.4		15.2	19.6
85	59.4	81.7	242.0		15.2	45.1
80	145.3	81.7	593.8		15.2	110.4
75	237.7	81.7	971.4		15.2	180.7
70	270.6	81.7	1105.9		15.2	205.7
65	264.5	81.7	1081.0		15.2	201.0
60	255.0	81.7	1042.1		15.2	193.8
55	244.7	81.7	1000.0		16.9	207.3
50	232.1	81.7	948.6		16.9	196.6
45	229.5	81.7	937.9		16.9	194.4
40	237.6	81.7	971.0		16.9	201.3
35	238.5	81.7	974.7		16.9	202.1
30	218.2	81.7	891.7		16.9	184.9
25	174.5	81.7	713.2		16.9	147.8
20	122.4	81.7	500.2		16.9	103.7
15	78.1	81.7	319.2		16.9	66.2
10	46.1	81.7	188.4		16.9	39.1
5	25.1	81.7	102.6		16.9	21.3
0	12.7	81.7	51.9		16.9	10.8
-5	6.2	81.7	25.3		16.9	5.3
-6	4.6	81.7	18.8		16.9	3.9
Total Costs			$12786.0			$2541.0
				UNOCCUPIED PERIOD		
90	14.6	81.7	59.7		15.2	11.1
85	36.3	81.7	148.4		15.2	27.6
80	99.3	81.7	405.8		15.2	75.5
75	215.3	81.7	879.9		15.2	163.6
70	357.6	81.7	1461.4		15.2	271.8
65	463.3	81.7	1893.4		15.2	352.1
60	500.4	81.7	2045.0		15.2	380.3
55	482.0	81.7	1969.8		16.9	408.4
50	447.6	81.7	1829.3		16.9	379.2
45	422.7	81.7	1727.5		16.9	358.1
40	413.7	81.7	1690.7		16.9	350.5
35	417.0	81.7	1704.2		16.9	353.3
30	417.4	81.7	1705.8		16.9	353.6
25	395.2	81.7	1615.1		16.9	334.8
20	336.9	81.7	1376.9		16.9	285.4
15	252.8	81.7	1033.1		16.9	214.2
10	165.7	81.7	677.2		16.9	140.4
5	96.3	81.7	393.6		16.9	81.6
0	50.9	81.7	208.0		16.9	43.1
-5	25.3	81.7	103.4		16.9	21.4
-6	21.1	81.7	86.2		16.9	17.9
Total Costs			$23014.5			$4624.1

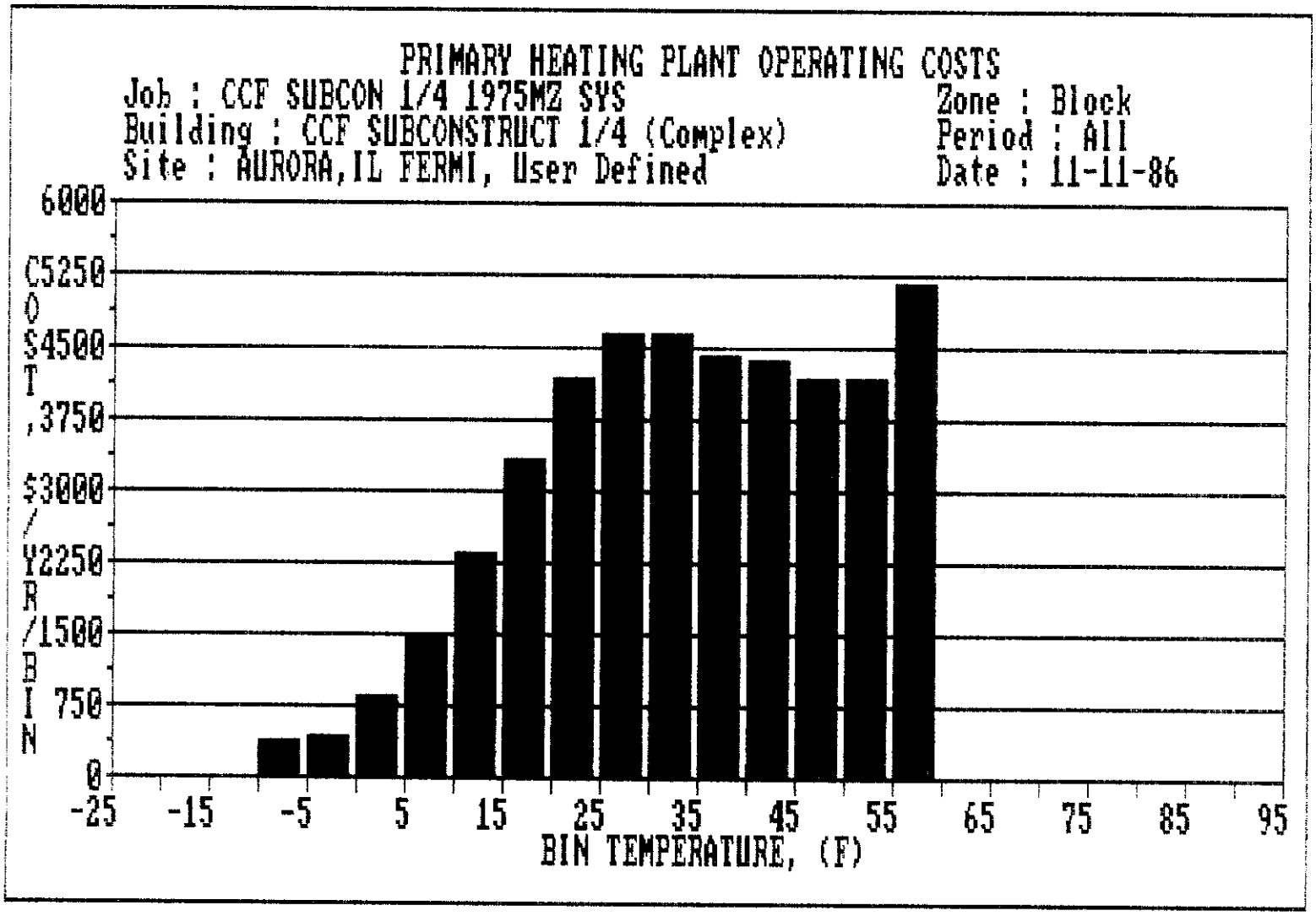

COOLING COIL LOADS
Job : CCF SUBCON 1/4 1975MZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
LOAD, MBH
4000
3500
3000
2500
2000
1500
1000
500
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

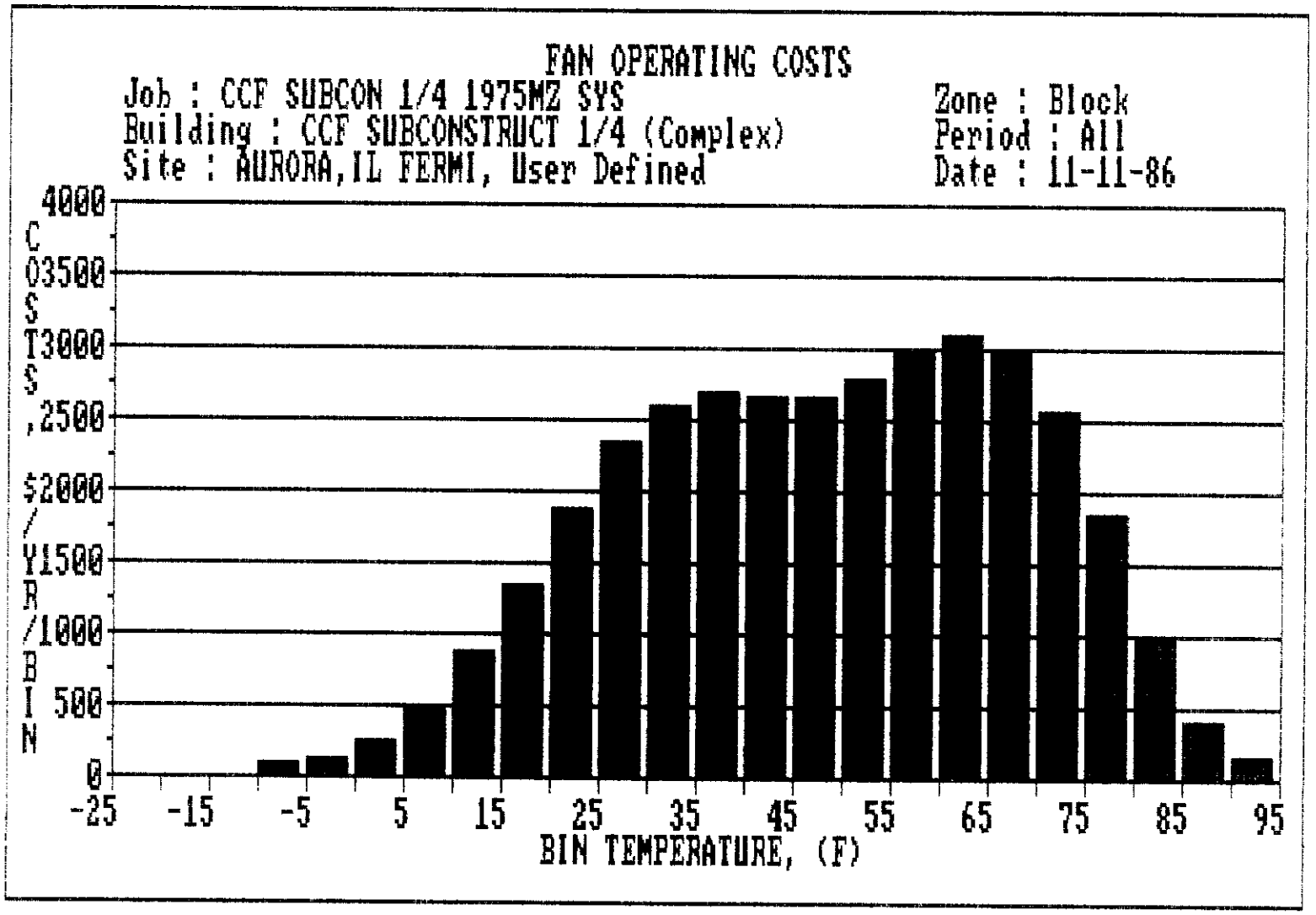

COOLING PLANT INPUT POWER
Job : CCF SUBCON 1/4 1975MZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
POWER, KW
200
175
150
125
100
75
50
25
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


COOLING PLANT OPERATING COSTS
Job : CCF SUBCON 1/4 1975MZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
$/YR/BIN COST
1600
1400
1200
1000
800
600
400
200
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT LOADS
Job : CCF SUBCON 1/4 1975MZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
LOAD, MBH
2000
1750
1500
1250
1000
750
500
250
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT INPUT POWER
Job : CCF SUBCON 1/4 1975MZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
POWER, KW
600
525
450
375
300
225
150
75
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


PRIMARY HEATING PLANT OPERATING COSTS
Job : CCF SUBCON 1/4 1975MZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
6000
C5250
O
$4500
T
,3750
$3000
/
Y2250
R
/1500
B
I 750
N
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)


FAN OPERATING COSTS
Job : CCF SUBCON 1/4 1975MZ SYS
Building : CCF SUBCONSTRUCT 1/4 (Complex)
Site : AURORA,IL FERMI, User Defined
Zone : Block
Period : All
Date : 11-11-86
COSTS $/YR/BIN
4000
3500
3000
2500
2000
1500
1000
500
0
-25
-15
-5
5
15
25
35
45
55
65
75
85
95
BIN TEMPERATURE, (F)

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
SYSTEMS LIFE CYCLE COST ANALYSIS
AND
PAYBACK CALCULATIONS

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
LIFE CYCLE COST ANALYSIS
FOR
DESIGN BASIS SYSTEM
WATER SOURCE HEAT PUMPS

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

PROJECT NAME : CCF SUBCON 1/4 DESIGN SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $344000/195.6 = $1759/TON

ESTIMATE YEAR : 1986
COMMISSION YEAR : 1988
LAST STUDY YEAR : 2008

**** NON-FINANCED CASH DEBITS/CREDITS ****

YEAR	AMOUNT
1986	344000.00

**** FINANCE INSTRUMENTS ****

NOTE 1 PRINCIPAL (1986 EST.) = $ 0.00
(0 EST.) = $ 0.00
INSTRUMENT = NONE

NOTE 2 PRINCIPAL (1986 EST.) = $ 0.00
(0 EST.) = $ 0.00
INSTRUMENT = NONE

**** FUEL COSTS ****

1986 EST. OF FUEL 1 = $ 22922.00 (ELEC.)
2 = $ 0.00
3 = $ 0.00

**** MAINTENANCE COST ****

1986 EST. OF MAINT. = $ 2000.00

**** DISCOUNT/INTEREST/ESCALATION RATES ****

		FINANCE %		ESCALATION %			
YEAR	% DISC.	LOAN1	LOAN2	FUEL1	FUEL2	FUEL3	MAIN.
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	7.90	0.00	0.00	8.40	0.00	0.00	9.00
1988	7.90	0.00	0.00	8.40	0.00	0.00	9.00
1989	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1990	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1991	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1992	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1993	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1994	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1995	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1996	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1997	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1998	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1999	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2000	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2001	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2002	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2003	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2004	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2005	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2006	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2007	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2008	7.90	0.00	0.00	8.80	0.00	0.00	9.00

**** UNIFIED PRESENT WORTH LIFE CYCLE COST ****

PROJECT NAME : CCF SUBCON 1/4 DESIGN SYS
ANALYST NAME : S.F.KRSTULOVICH
COMMENTS : $344000/195.6 = $1759/TON

YEAR		1986	1987	1988	1989	1990
CASH	$	344000.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	0.00	0.00	23134.93	23327.90	23522.48
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	0.00	0.00	2040.99	2061.79	2082.81
YEAR'S	$	344000.00	0.00	25175.91	25389.69	25605.29
CUM.	$	344000.00	344000.00	369175.91	394565.59	420170.88

YEAR		1991	1992	1993	1994	1995
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	23718.68	23916.52	24116.02	24317.17	24520.00
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2104.05	2125.50	2147.16	2169.05	2191.17
YEAR'S	$	25822.73	26042.02	26263.18	26486.22	26711.17
CUM.	$	445993.59	472035.62	498298.81	524785.06	551496.25

YEAR		1996	1997	1998	1999	2000
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	24724.52	24930.75	25138.70	25348.38	25559.82
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2213.51	2236.07	2258.87	2281.90	2305.16
YEAR'S	$	26938.03	27166.82	27397.57	27630.28	27864.97
CUM.	$	578434.25	605601.06	632998.62	660628.88	688493.88

YEAR		2001	2002	2003	2004	2005
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	25773.02	25987.99	26204.76	26423.34	26643.73
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2328.66	2352.40	2376.38	2400.61	2425.08
YEAR'S	$	28101.68	28340.39	28581.14	28823.94	29068.81
CUM.	$	716595.56	744935.94	773517.06	802341.00	831409.81

YEAR		2006	2007	2008	2009	2010
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	26865.97	27090.06	27316.02	0.00	0.00
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2449.80	2474.78	2500.01	0.00	0.00
YEAR'S	$	29315.77	29564.84	29816.03	0.00	0.00
CUM.	$	860725.56	890290.38	920106.38	920106.38	920106.38

FERMILAB COST ESTIMATE	PROJECT TITLE: CENTRAL COMPUTING FACILITY - TITLE 2 PHASE 2 - SUPERSTRUCTURE	PROJECT NO. 10-5-3	DATE 10 SEPT. 86	REVISION DATE 16 SEPT. 86	PAGE 19/27
SECTION CES	QUANTITIES BY JG / PRICES BY JG	CHECKED BY WN			

DISTRIBUTION OF ITEMIZED COST

ITEM NO.	DESCRIPTION OF WORK ITEMS	QUANTITY	UNIT	(1) UNIT	(1) AMOUNT	(2) UNIT	(2) AMOUNT	(3) UNIT	(3) AMOUNT
8.3	COOLING/HEATING WATER SYSTEM								
	CHILLERS 100 TON RECIP.	2	EA	31,000	62,000				
	INSTALL CHILLERS	2	EA	6,000	12,000				
	HT. EXCHANGER, CHW. PLATE & FR. 300GPM	1	EA		6,000				
	[redacted]					20,000			
	AUX. ELEC. BOILER, 210 KW	1	EA		8,100				
	[redacted]					29,000			
	CHILLED WATER PUMPS, 300GPM, 70'	2	EA	2000	4,000				
	HT. RECLAIM WTR. PUMPS	2	EA	3500	~~5,000~~	7000			
	EXPANSION TANKS, 50 GAL.	2	EA	300	~~600~~	300			
	[redacted]						900		
8.4	COMPUTER RM. A/C UNIT								
	PACKAGE, SELF CONT. 10 TON	12	EA	14,700	176,400				
	INSTALL SELF CONT. UNITS	12	EA	1,100	13,200				
	CEILING A/C UNITS, SELF CONT. 2 TON	~~12~~ 2	EA	3500	~~50,400~~	7000			
	WATER DETECTORS	~~12~~ 24	EA	150	~~1,800~~	3600			
							241,800		

TOTAL COSTS = $344,000
(ACTUAL EST.) ÷ 195.6 TONS AC
$1759 PER TON AC

FERMILAB COST ESTIMATE	PROJECT TITLE: CENTRAL COMPUTING FACILITY - TITLE 2, PHASE 2 - SUPERSTRUCTURE	PROJECT NO. 10-5-3	DATE 10 SEPT. 86	REVISION DATE 16 SEPT. 86	PAGE 20/27
SECTION CES	QUANTITIES BY JG / PRICES BY JG	CHECKED BY WN			

DISTRIBUTION OF ITEMIZED COST

ITEM NO.	DESCRIPTION OF WORK ITEMS	QUANTITY	UNIT	(1) UNIT	(1) AMOUNT	(2) UNIT	(2) AMOUNT	(3) UNIT	(3) AMOUNT
8.5	CENT. VENTILATION UNITS								
	FAN, AXIAL, SUPPLY, 8000 CFM	1	EA		3000	2 SPEED			
	FAN, " EXHAUST 4000 CFM	1	EA		2500	2 SPEED "			
	HT. RECOVERY WHEEL	1	EA		8000				
	FREE HTG. COIL	~~2~~	~~EA~~	~~1500~~	~~[illegible]~~	~~[illegible]~~	1500		
	HUMIDIFIER	2	EA	2500	~~[illegible]~~	~~[illegible]~~	5000		
	FILTER SET (PRE & HE)	1	EA	1000	~~[illegible]~~	~~[illegible]~~	1000		
	ELEC. BASEBOARD HTRS 750 WATT	2	EA	100	200				
	UNIT HEATER VENT UNITS								
	FANS, AXIAL S.&E 4000 CFM	2	EA	2500	5000	2 SPEED			
	HT. RECOVERY WHEEL	1	EA		5000				
	FREE HTG. COILS	1	EA		1000				
	HUMIDIFIER, 100 LB.	2	EA	2500	~~[illegible]~~		5000		
	FILTER SET, (PRE & HE)	1	EA		1000				
	WALL FANS 8" ø	3	EA	150	~~[illegible]~~		500		
	TOILET EXH. FAN, AXIAL, 4000 CFM	1	EA		2500	2 SPEED			
	WALL EXH. FANS, 1000 CFM	2	EA	500	1000				
	WALL LOUVERS, 42 x 42	3	EA	200	600				
	UNIT HEATERS 25 KW	2	EA	1200	2400				
	UNIT HEATERS 5 KW	10	EA	400	4000				44,000
8.6	HEAT PUMP UNITS								
	~~3/4 TON~~ 1 TON	6	EA	1200	7200				
	~~1 1/4 TON~~ 1 1/2 TON	9 ~~24~~	EA	1400	~~[illegible]~~		12,600		
	2 TON	21 ~~33~~	EA	1500	~~[illegible]~~		31,500		
	3 TON	24 ~~[illegible]~~	EA	1800	~~[illegible]~~		43,200		
	5 TON	13	EA	3500			45,500		~~101,700~~

FERMILAB COST ESTIMATE	PROJECT TITLE: CENTRAL COMPUTING FACILITY - TITLE 2 PHASE 2 - SUPERSTRUCTURE	PROJECT NO. 10-5-3	DATE 10 SEPT. 86	REVISION DATE 16 SEPT. 86	PAGE 21/27
SECTION CES	QUANTITIES BY JG / PRICES BY JG	CHECKED BY WN			

DISTRIBUTION OF ITEMIZED COST

ITEM NO.	DESCRIPTION OF WORK ITEMS	QUANTITY	UNIT	(1) UNIT	(1) AMOUNT	(2) UNIT	(2) AMOUNT	(3) UNIT	(3) AMOUNT
8.7	HVAC DUCTWORK:								
	TOILET EXH. DUCTWORK 12X12X200'	1200	LB	3.50	4200	UNLINED			
	GRILLES 12X12	14	EA	25	300				
	FIRE DAMPERS 12X12	4	EA	25	100				
	COMP. ROOM DUCTWORK, 16X16X400'	3400	LB	3.50	11,900	INTERN. LINED			
	LIEBERT UNIT OUTLET ELBOWS	12	EA	500	6000				
	FLEX DUCT 12"ϕ	70	L.F.	5.00	400				
	DUCT INSUL. 1"	2200	S.F.	1.75	3900				
	FIRE DAMPERS	7	EA	25	200				
	GRILLES	12	EA	25	300				
	GEN'L. VENT. DUCTS, 16X16X250'	2200	LB	3.50	7700		1300		
	" 8X12X600'	3300	LB	3.50	11,600		2000		
	" 36X8X250'	3000	LB	3.50	10,500		2000		
	INSULATE DUCT 1"	4300	S.F.	1.75	7500				
	FLEX. DUCT 6"ϕ	400	L.F	4.00	1600				
	DAMPERS 6"ϕ	78	EA	15	1200				
	VOLUME DAMPERS, MOTORIZED	26	EA	150	600				
	HEAT PUMP DUCTWORK	13							
	RETURN PLENUM 24X24	~~106~~	EA	100	~~[illegible]~~	7300			
	OUTLET DUCTS 16X16X850' 8300	~~7500~~	LB	3.50	~~[illegible]~~	29,100	6000		
	FLEX DUCT 12"ϕ 1800	~~1600~~	L.F	5.00	~~[illegible]~~	9000			
	DUCT INSUL. 1" 5000	~~4400~~	S.F	1.75	~~[illegible]~~	8800			
	GRILLES 300	~~200~~	EA	25	~~[illegible]~~	7500			
	FIRE DAMPERS 21	~~14~~	EA	25	~~[illegible]~~	600	~~125,400~~		
	FIRE/SMOKE DAMPERS	14	EA	500	7000				

FERMILAB COST ESTIMATE	PROJECT TITLE: CENTRAL COMPUTING FACILITY - TITLE 2, PHASE 2 - SUPERSTRUCTURE	PROJECT NO. 10-5-3	DATE 10 SEPT. 86	REVISION DATE 16 SEPT. 86	PAGE 23/27
SECTION CES	QUANTITIES BY JG / PRICES BY JG	CHECKED BY WN			

DISTRIBUTION OF ITEMIZED COST

ITEM NO.	DESCRIPTION OF WORK ITEMS	QUANTITY	UNIT	(1) UNIT	(1) AMOUNT	(2) UNIT	(2) AMOUNT	(3) UNIT	(3) AMOUNT
8.8									
	H.R. PIPING, SCH. 10 VLT. 6"ϕ	~~500~~	L.F.	28	~~14,000~~	28,000			
	" " 4"ϕ	500	L.F.	17	8500				
	" " 3"ϕ	400	L.F.	13	5200				
	" " 2½"ϕ	200	L.F.	12	2400				
	" " 2"ϕ	800 ~~200~~	L.F.	10	~~2000~~	8000			
	" SCH. 40, BLK 1½"ϕ	200	L.F.	8	1600				
	" 1"ϕ	300	L.F.	5.00	1500				
	" ¾"ϕ	600	L.F.	4.00	2400				
	VALVES, 6"ϕ BUTT.	10	EA	350	3500				
	3/4 ϕ BALL 200	~~140~~	EA	15	~~2100~~	3000			
	ACCESS. & MISC. VALVES	LOT			4000				
	HUMIDIFIER WATER PIPING	1400							
	1/2"ϕ COPPER "K"	~~1200~~	L.F.	6.00	~~7200~~	8400			
	1/2"ϕ INSUL.	~~1400~~	L.F.	3.00	~~3600~~	4200			
	1/2"ϕ BALL VALVES	30 ~~20~~	EA	25	~~500~~	800			
	CONDENSATE DRAIN PIPING	1600							
	1 1/4"ϕ COPPER "K"	~~1200~~	L.F.	11.00	~~13,200~~	17,600			
	1/2"ϕ COPPER "K" 1000 ~~600~~		L.F.	6.00	~~3600~~	6000	147,300		
8.9.	HVAC CONTROLS								
	D.D.C. CONTROLS				~~75,000~~	85,000			
	HEAT PUMP & MISC. HVAC. CONTROLS				~~20,000~~	30,000	105,000		

Building Designation	Air Conditioning, Heating And Ventilating System Description	Subcontract Standard Unit Price Per Ton Of Cooling Capacity Range	Average
A, D, E, I, P, S, U, X, Y	1. Packaged Thru Wall Unit. Self contained Air Conditioning Unit with auxillary electric heating coil. Complete with wall sleeve, electric cord and plug and exterior caulking. (3/4 thru 2 Ton increments).	$ 775.00 To $ 945.00	$ 860.00
A, D, E, I, P, S, U, X, Y	2. Packaged Heat Pump. Thru wall self contained unit with auxiliary electric heating coil. Complete with wall sleeve, electric cord, plug and exterior caulking. (3/4 thru 2 Ton increments).	$1050.00 To $1280.00	$1165.00
A, D, E, G, H, I, K, M, Q, S, X, Y	3. Residential Electric Furnaces. With top mounted evaporator and remote air cooled electrically operated condensing unit. System complete with piping, forced air ductwork, controls and electrical connections. (2 thru 10 Tons).	$1205.00 To $1475.00	$1340.00
B, C, D, E, F, G, H, I, J, K, O, Q, S, V, X, Z	4. Roof Top Packaged Units. Combination heating-cooling unit (electric or gas) complete with curb, starters, controls and prefabricated supply-return air duct assembly. (2 thru 15 Ton increments).	$1235.00 To $1505.00	$1370.00
B, D, E, F, G, K, L, M, N, O, Q, X, Z	5. Self-Contained Water Cooled Draw-Thru Units. Air handling unit with integral compressor, condensing section, coils, filters and cabinet for mounting directly in space. System complete with cooling tower, pump, piping, controls and air diffuser discharge head. Heating by use of electric heaters. (20 thru 60 Tons).	$1245.00 To $1525.00	$1385.00
A, D, E, G, H, I, K, M, Q, S, X, Y	6. Residential Gas Furnace. With top mounted evaporator and remote air cooled electrically operated condensing unit. Complete with piping, forced air ductwork, controls and electrical connections. (2 thru 10 Tons).	$1290.00 To $1580.00	$1435.00
B, F, G, H, I, K, M, N, O, Q, V, W,	7. Self-Contained Water Cooled Multizone Units. Using electric duct heaters. System complete with cooling tower, pumps, piping, controls, starters, insulated duct system. Average 350 CFM Per Outlet. (15 thru)	$1425.00 To $1745.00	$1585.00
A, I, P, Q, S, T, U, V	8. Incremental Heat Pump Units. Closed water loop system using floor mounted units, cast iron hot water boilers, liquid cooler, piping, controls and interior self-contained central air handling units. (3/4 thru 2 Ton increments).	$1440.00 To $1760.00	$1600.00
H, I, J, M, N, O, U, V, Z	(electric or gas) complete with curb, starters, controls and fiberglass ductwork based on 400 CFM Per Outlet. (10 thru 50 Ton increments).	[illegible] To $1805.00	[illegible]
B, C, F, G, I, M, N, O, R, V, W, Z	10. Multizone Two Pipe All Electric System. Complete with chillers and electric duct heaters, pump, piping, expansion tank, controls and insulated duct system based on 350 CFM Per Outlet. (50 thru 1000 Tons).	$1500.00 To $1830.00	$1665.00
B, C, F, G, I, M, N, O, R, V, W, Z	11. Multizone Four Pipe System. Chilled and hot water system complete with chillers, cast iron hot water boilers, pumps, expansion tanks, piping, controls, starters and insulated ductwork based on 350 CFM Per Outlet. (50 thru 1000 Tons).	$1580.00 To $1931.00	$1755.00
C, F, I, V	12. Low Pressure Variable Air Volume System. Using chilled water draw thru air handling units with ceiling boxes delivering air to space or to return air ceiling plenum. Heating by baseboard electric perimeter heat and electric unit heaters below roof area. (50 thru 200 Tons).	$1825.00 To $2235.00	$2030.00
C, J, V, W	13. High Pressure Variable Air Volume Reheat All Electric System. Using central built up fan-coil system with high velocity ductwork to Variable Air Volume boxes containing electric duct coils and flexible duct to slot type ceiling diffusers, centrifugal chillers, cooling towers, piping, controls, starters, pumps and expansion tank. Average box size 500 CFM. (200 thru 1000 Tons).	$1930.00 To $2360.00	$2145.00
C, R, W	14. High Pressure Variable Air Volume Induction Box Electric Reheat System. All electric, using central built up Fan-Coil System with high velocity duct to above the ceiling type air induction boxes containing electric duct coils and low pressure fiberglass ductwork serving flexible duct run to ceiling diffusers. Complete with centrifugal chillers, cooling towers, piping, pumps, controls, starters and expansion tanks. Average box size 750 CFM. (200 thru 1000 Tons).	$2010.00 To $2460.00	$2235.00

BALLPARK COSTS (BY COMPARISON)

See Notes on Page 4.
(Continued on following page)

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FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
LIFE CYCLE COST ANALYSIS
FOR
ALTERNATE SYSTEM NUMBER 1
VARIABLE AIR VOLUME

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

PROJECT NAME : CCF SUBCON 1/4 VAV SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $397068/195.6 = $2030/TON

ESTIMATE YEAR : 1986
COMMISSION YEAR : 1988
LAST STUDY YEAR : 2008

**** NON-FINANCED CASH DEBITS/CREDITS ****

YEAR	AMOUNT
1986	397068.00

**** FINANCE INSTRUMENTS ****

NOTE 1 PRINCIPAL (1986 EST.) = $ 0.00
(0 EST.) = $ 0.00
INSTRUMENT = NONE

NOTE 2 PRINCIPAL (1986 EST.) = $ 0.00
(0 EST.) = $ 0.00
INSTRUMENT = NONE

**** FUEL COSTS ****

1986 EST. OF FUEL 1 = $ 36061.00 (ELEC.)
2 = $ 0.00
3 = $ 0.00

**** MAINTENANCE COST ****

1986 EST. OF MAINT. = $ 2500.00

**** DISCOUNT/INTEREST/ESCALATION RATES ****

		FINANCE %		ESCALATION %			
YEAR	% DISC.	LOAN1	LOAN2	FUEL1	FUEL2	FUEL3	MAIN.
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	7.90	0.00	0.00	8.40	0.00	0.00	9.00
1988	7.90	0.00	0.00	8.40	0.00	0.00	9.00
1989	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1990	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1991	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1992	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1993	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1994	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1995	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1996	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1997	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1998	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1999	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2000	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2001	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2002	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2003	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2004	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2005	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2006	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2007	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2008	7.90	0.00	0.00	8.80	0.00	0.00	9.00

**** UNIFIED PRESENT WORTH LIFE CYCLE COST ****

PROJECT NAME : CCF SUBCON 1/4 VAV SYS
ANALYST NAME : S.F.KRSTULOVICH
COMMENTS : $397068/195.6 = $2030/TON

YEAR		1986	1987	1988	1989	1990
CASH	$	397068.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	0.00	0.00	36395.98	36699.56	37005.68
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	0.00	0.00	2551.23	2577.24	2603.52
YEAR'S	$	397068.00	0.00	38947.22	39276.81	39609.20
CUM.	$	397068.00	397068.00	436015.22	475292.03	514901.22

YEAR		1991	1992	1993	1994	1995
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	37314.35	37625.59	37939.43	38255.89	38574.98
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2630.06	2656.87	2683.96	2711.32	2738.96
YEAR'S	$	39944.41	40282.46	40623.39	40967.21	41313.95
CUM.	$	554845.62	595128.06	635751.44	676718.62	718032.56

YEAR		1996	1997	1998	1999	2000
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	38896.74	39221.18	39548.33	39878.20	40210.83
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2766.88	2795.09	2823.58	2852.37	2881.45
YEAR'S	$	41663.62	42016.27	42371.91	42730.57	43092.28
CUM.	$	759696.19	801712.44	844084.38	886814.94	929907.19

YEAR		2001	2002	2003	2004	2005
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	40546.23	40884.43	41225.45	41569.32	41916.05
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2910.82	2940.50	2970.48	3000.76	3031.35
YEAR'S	$	43457.06	43824.93	44195.93	44570.08	44947.40
CUM.	$	973364.25	1017189.19	1061385.12	1105955.25	1150902.62

YEAR		2006	2007	2008	2009	2010
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	42265.68	42618.22	42973.70	0.00	0.00
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	3062.25	3093.47	3125.01	0.00	0.00
YEAR'S	$	45327.93	45711.69	46098.71	0.00	0.00
CUM.	$	1196230.50	1241942.25	1288041.00	1288041.00	1288041.00

Building Designation		Air Conditioning, Heating And Ventilating System Description	Subcontract Standard Unit Price Per Ton Of Cooling Capacity Range	Average
A, D, E, I, P, S, U, X, Y	1.	Packaged Thru Wall Unit. Self contained Air Conditioning Unit with auxillary electric heating coil. Complete with wall sleeve, electric cord and plug and exterior caulking. (3/4 thru 2 Ton increments).	$ 775.00 To $ 945.00	$ 860.00
A, D, E, I, P, S, U, X, Y	2.	Packaged Heat Pump. Thru wall self contained unit with auxiliary electric heating coil. Complete with wall sleeve, electric cord, plug and exterior caulking. (3/4 thru 2 Ton increments).	$1050.00 To $1280.00	$1165.00
A, D, E, G, H, I, K, M, Q, S, X, Y	3.	Residential Electric Furnaces. With top mounted evaporator and remote air cooled electrically operated condensing unit. System complete with piping, forced air ductwork, controls and electrical connections. (2 thru 10 Tons).	$1205.00 To $1475.00	$1340.00
B, C, D, E, F, G, H, I, J, K, O, Q, S, V, X, Z	4.	Roof Top Packaged Units. Combination heating-cooling unit (electric or gas) complete with curb, starters, controls and prefabricated supply-return air duct assembly. (2 thru 15 Ton increments).	$1235.00 To $1505.00	$1370.00
B, D, E, F, G, K, L, M, N, O, Q, X, Z	5.	Self-Contained Water Cooled Draw-Thru Units. Air handling unit with integral compressor, condensing section, coils, filters and cabinet for mounting directly in space. System complete with cooling tower, pump, piping, controls and air diffuser discharge head. Heating by use of electric heaters. (20 thru 60 Tons).	$1245.00 To $1525.00	$1385.00
A, D, E, G, H, I, K, M, Q, S, X, Y	6.	Residential Gas Furnace. With top mounted evaporator and remote air cooled electrically operated condensing unit. Complete with piping, forced air ductwork, controls and electrical connections. (2 thru 10 Tons).	$1290.00 To $1580.00	$1435.00
B, F, G, H, I, K, M, N, O, Q, V, W, Z	7.	Self-Contained Water Cooled Multizone Units. Using electric duct heaters. System complete with cooling tower, pumps, piping, controls, starters, insulated duct system. Average 350 CFM Per Outlet. (15 thru) 50 Tons).	$1425.00 To $1745.00	$1585.00
A, I, P, Q, S, T, U, V	8.	Incremental Heat Pump Units. Closed water loop system using floor mounted units, cast iron hot water boilers, liquid cooler, piping, controls and interior self-contained central air handling units. (3/4 thru 2 Ton increments).	$1440.00 To $1760.00	$1600.00
B, C, F, G, H, I, J, M, N, O, U, V, Z	9.	Roof Top Multizone System. Packaged combination heating-cooling unit (electric or gas) complete with curb, starters, controls and fiberglass ductwork based on 400 CFM Per Outlet. (10 thru 50 Ton increments).	$1475.00 To $1805.00	$1640.00
B, C, F, G, I, M, N, O, R, V, W, Z	10.	Multizone Two Pipe All Electric System. Complete with chillers and electric duct heaters, pump, piping, expansion tank, controls and insulated duct system based on 350 CFM Per Outlet. (50 thru 1000 Tons).	$1500.00 To $1830.00	$1665.00
B, C, F, G, I, M, N, O, R, V, W, Z	11.	Multizone Four Pipe System. Chilled and hot water system complete with chillers, cast iron hot water boilers, pumps, expansion tanks, piping, controls, starters and insulated ductwork based on 350 CFM	$1580.00 To $1931.00	$1755.00
C, F, I, V	12.	Low Pressure Variable Air Volume System. Using chilled water draw thru air handling units with ceiling boxes delivering air to space or to return air ceiling plenum. Heating by baseboard electric perimeter heat and electric unit heaters below roof area. (50 thru 200 Tons).	$1825.00 To $2235.00	$2030.00
		central built up fan-coil system with high velocity ductwork to Variable Air Volume boxes containing electric duct coils and flexible duct to slot type ceiling diffusers, centrifugal chillers, cooling towers, piping, controls, starters, pumps and expansion tank. Average box size 500 CFM. (200 thru 1000 Tons).	$1930.00 To $2360.00	$2145.00
C, R, W	14.	High Pressure Variable Air Volume Induction Box Electric Reheat System. All electric, using central built up Fan-Coil System with high velocity duct to above the ceiling type air induction boxes containing electric duct coils and low pressure fiberglass ductwork serving flexible duct run to ceiling diffusers. Complete with centrifugal chillers, cooling towers, piping, pumps, controls, starters and expansion tanks. Average box size 750 CFM. (200 thru 1000 Tons).	$2010.00 To $2460.00	$2235.00

BALLPARK COSTS (AVG. USED)

See Notes on Page 4.
(Continued on following page)

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FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
LIFE CYCLE COST ANALYSIS
FOR
ALTERNATE SYSTEM NUMBER 2
FOUR PIPE FAN COIL

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

PROJECT NAME : CCF SUBCON 1/4 4PFC SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $524208/195.6 = $2680/TON

ESTIMATE YEAR : 1986
COMMISSION YEAR : 1988
LAST STUDY YEAR : 2008

**** NON-FINANCED CASH DEBITS/CREDITS ****

YEAR	AMOUNT
1986	524208.00

**** FINANCE INSTRUMENTS ****

NOTE 1 PRINCIPAL (1986 EST.) = $ 0.00
(0 EST.) = $ 0.00
INSTRUMENT = NONE

NOTE 2 PRINCIPAL (1986 EST.) = $ 0.00
(0 EST.) = $ 0.00
INSTRUMENT = NONE

**** FUEL COSTS ****

1986 EST. OF FUEL 1 = $ 33477.00 (ELEC.)
2 = $ 0.00
3 = $ 0.00

**** MAINTENANCE COST ****

1986 EST. OF MAINT. = $ 2000.00

**** DISCOUNT/INTEREST/ESCALATION RATES ****

		FINANCE %		ESCALATION %			
YEAR	% DISC.	LOAN1	LOAN2	FUEL1	FUEL2	FUEL3	MAIN.
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	7.90	0.00	0.00	8.40	0.00	0.00	9.00
1988	7.90	0.00	0.00	8.40	0.00	0.00	9.00
1989	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1990	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1991	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1992	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1993	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1994	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1995	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1996	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1997	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1998	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1999	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2000	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2001	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2002	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2003	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2004	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2005	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2006	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2007	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2008	7.90	0.00	0.00	8.80	0.00	0.00	9.00

**** UNIFIED PRESENT WORTH LIFE CYCLE COST ****

PROJECT NAME : CCF SUBCON 1/4 4PFC SYS
ANALYST NAME : S.F.KRSTULOVICH
COMMENTS : $524208/195.6 = $2680/TON

YEAR		1986	1987	1988	1989	1990
CASH	$	524208.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	0.00	0.00	33787.98	34069.80	34353.98
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	0.00	0.00	2040.99	2061.79	2082.81
YEAR'S	$	524208.00	0.00	35828.96	36131.60	36436.80
CUM.	$	524208.00	524208.00	560036.94	596168.56	632605.38

YEAR		1991	1992	1993	1994	1995
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	34640.53	34929.47	35220.82	35514.61	35810.84
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2104.05	2125.50	2147.16	2169.05	2191.17
YEAR'S	$	36744.58	37054.97	37367.99	37683.66	38002.00
CUM.	$	669349.94	706404.88	743772.88	781456.56	819458.56

YEAR		1996	1997	1998	1999	2000
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	36109.54	36410.73	36714.43	37020.67	37329.47
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2213.51	2236.07	2258.87	2281.90	2305.16
YEAR'S	$	38323.04	38646.80	38973.30	39302.57	39634.62
CUM.	$	857781.62	896428.44	935401.75	974704.31	1014338.94

YEAR		2001	2002	2003	2004	2005
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	37640.83	37954.80	38271.38	38590.61	38912.49
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2328.66	2352.40	2376.38	2400.61	2425.08
YEAR'S	$	39969.49	40307.20	40647.76	40991.21	41337.57
CUM.	$	1054308.38	1094615.62	1135263.38	1176254.62	1217592.25

YEAR		2006	2007	2008	2009	2010
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	39237.06	39564.34	39894.35	0.00	0.00
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2449.80	2474.78	2500.01	0.00	0.00
YEAR'S	$	41686.87	42039.12	42394.36	0.00	0.00
CUM.	$	1259279.12	1301318.25	1343712.62	1343712.62	1343712.62

BALLPARK COSTS (AVG. USED)

Building Designation		Air Conditioning, Heating And Ventilating System Description	Subcontract Standard Unit Price Per Ton Of Cooling Capacity Range	Average
C, J, V, W	15.	High Pressure Variable Air Volume Hot Water Reheat System. Using central built up fan-coil system with high velocity duct to variable air volume boxes containing hot water coils. System complete with hot water boilers flexible duct run to slot type ceiling diffusers, centrifugal chillers, cooling towers, piping, pumps, starters and expansion tanks. Average box size 500 CFM. (200 thru 1000 Tons).	$2150.00 To 2630.00	$2390.00
C, R, W	16.	High Pressure Variable Air Volume Induction Box Hot Water Reheat System. Using central built up fan-coil system with high velocity duct to above ceiling air induction boxes containing hot water reheat coils and low pressure ductwork serving flexible duct run out to ceiling diffusers. Complete with centrifugal chillers, cooling towers, hot water boilers, pumps, piping, starters, controls and expansion tank. Average box size 750 CFM. (200 thru 1000 Tons).	$2165.00 To $2645.00	$2405.00
A, C, I, J, P, R, S, T, U, V, W	17.	Fan-Coil Two Pipe All Electric System. Complete with chillers, concealed type Fan-Coil Units using integral electric strip heaters, piping, controls and central Air Handling Units on each floor for interior ventilation. (50 thru 1000 Tons).	$2185.00 To $2670.00	$2425.00
C, J, N, R, W	18.	High Pressure Dual-Duct Variable Air Volume System. Using built up air handling units and high velocity duct to dual inlet boxes. The cold duct is a Variable Air Volume duct and the hot duct connects to a cold duct in peak cooling requirements. System complete with centrifugal chillers, cooling towers, hot water boilers, pumps, piping, starters, controls, expansion tanks and flexible duct to slot type ceiling diffusers. Average box size 750 CFM. (200 thru 1000 Tons).	$2225.00 To $2715.00	$2470.00
C, J, N, R, W	19.	High Pressure Dual-Duct System. Using built up air handling units and high velocity duct to dual inlet boxes and low pressure ductwork serving flexible duct run to standard ceiling diffusers. System complete with centrifugal chillers, cooling towers, hot water boilers, pumps, piping, starters, controls and expansion tanks. Average box size 750 CFM.	$2275.00 To $2785.00	$2530.00
A, C, I, J, P, R, S, T, U, V, W	20.	Fan-Coil Four Pipe Chilled And Hot Water System. Complete with chillers, cooling towers, hot water boilers, pumps, expansion tanks, piping, controls and concealed type (2 coil) Fan-Coil Units with central Air Handling Units on each floor for interior ventilation. (50 thru 1000 Tons).	$2410.00 To $2950.00	$2680.00
P, R, S, T, U, V, W		condensers in centrifugal chillers and 105° F hot water boilers. System complete with cooling towers, chillers, boilers, concealed type (2 coil) fan-coil units, piping, controls, expansion tanks, pumps, with central Air Handling Units on each floor for interior ventilators. Note: Storage tanks are not included. (200 thru 1000 Tons).	$2545.00 To $3115.00	$2830.00
C, R, S, W	22.	High Pressure Induction System. Two pipe all electric type using high pressure primary air and secondary chilled water cooling and integral electric strip heaters in each concealed type induction box. System complete with High Pressure Primary fan-coil, High Pressure ductwork, piping, controls, centrifugal chillers, cooling towers, expansion tanks and central high pressure double duct system for interior. (200 thru 1000 Tons).	$2680.00 To $3275.00	$2975.00
C, R, S, U, W	23.	High Pressure Induction System. Four pipe using high pressure primary air and secondary chilled and/or hot water in each concealed type induction box. System complete with High Pressure Primary fan-coil, High Pressure ductwork, piping, controls, centrifugal chillers, cooling towers, steam boiler with hot water convertor, feed water system, pumps and piping and central high pressure constant volume double duct system for interior. (200 thru 1000 Tons).	$2960.00 To $3620.00	$3290.00

Notes:

1. All systems based on the following design conditions:

   Inside Temperature @ 75°F
   Outside Summer Temperature @ 100°F Dry Bulb (78°F Wet Bulb)
   Outside Winter Temperature @ 0°F

2. Motor Starters are included in System Costs shown. Motor Starters to be installed by Electrical Contractor as part of the scope of work covered in Account 16-101.

3. Controls and Wiring are included in System Costs shown.

4. Electrical Power Wiring is not included; see Account 16-101 and add for same.

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RICHARDSON ENGINEERING SERVICES, INC

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
LIFE CYCLE COST ANALYSIS
FOR
ALTERNATE SYSTEM NUMBER 3
BYPASS MULTIZONE

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

PROJECT NAME : CCF SUBCON 1/4 30MZ SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $343278/195.6 = $1755/TON

ESTIMATE YEAR : 1986
COMMISSION YEAR : 1988
LAST STUDY YEAR : 2008

**** NON-FINANCED CASH DEBITS/CREDITS ****

YEAR	AMOUNT
1986	343278.00

**** FINANCE INSTRUMENTS ****

NOTE 1 PRINCIPAL (1986 EST.) = $ 0.00
(0 EST.) = $ 0.00
INSTRUMENT = NONE

NOTE 2 PRINCIPAL (1986 EST.) = $ 0.00
(0 EST.) = $ 0.00
INSTRUMENT = NONE

**** FUEL COSTS ****

1986 EST. OF FUEL 1 = $ 51555.00 (ELEC.)
2 = $ 0.00
3 = $ 0.00

**** MAINTENANCE COST ****

1986 EST. OF MAINT. = $ 2500.00

**** DISCOUNT/INTEREST/ESCALATION RATES ****

		FINANCE %		ESCALATION %			
YEAR	% DISC.	LOAN1	LOAN2	FUEL1	FUEL2	FUEL3	MAIN.
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	7.90	0.00	0.00	8.40	0.00	0.00	9.00
1988	7.90	0.00	0.00	8.40	0.00	0.00	9.00
1989	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1990	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1991	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1992	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1993	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1994	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1995	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1996	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1997	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1998	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1999	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2000	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2001	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2002	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2003	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2004	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2005	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2006	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2007	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2008	7.90	0.00	0.00	8.80	0.00	0.00	9.00

**** UNIFIED PRESENT WORTH LIFE CYCLE COST ****

PROJECT NAME : CCF SUBCON 1/4 3DMZ SYS
ANALYST NAME : S.F.KRSTULOVICH
COMMENTS : $343278/195.6 = $1755/TON

YEAR		1986	1987	1988	1989	1990
CASH	$	343278.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	0.00	0.00	52033.91	52467.93	52905.57
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	0.00	0.00	2551.23	2577.24	2603.52
YEAR'S	$	343278.00	0.00	54585.14	55045.17	55509.09
CUM.	$	343278.00	343278.00	397863.12	452908.28	508417.38

YEAR		1991	1992	1993	1994	1995
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	53346.86	53791.83	54240.52	54692.94	55149.14
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2630.06	2656.87	2683.96	2711.32	2738.96
YEAR'S	$	55976.92	56448.70	56924.47	57404.26	57888.10
CUM.	$	564394.31	620843.00	677767.50	735171.75	793059.88

YEAR		1996	1997	1998	1999	2000
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	55609.14	56072.98	56540.69	57012.30	57487.84
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2766.88	2795.09	2823.58	2852.37	2881.45
YEAR'S	$	58376.02	58868.07	59364.27	59864.67	60369.29
CUM.	$	851435.88	910303.94	969668.19	1029532.88	1089902.12

YEAR		2001	2002	2003	2004	2005
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	57967.35	58450.86	58938.40	59430.01	59925.72
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2910.82	2940.50	2970.48	3000.76	3031.35
YEAR'S	$	60878.18	61391.36	61908.88	62430.77	62957.07
CUM.	$	1150780.25	1212171.62	1274080.50	1336511.25	1399468.38

YEAR		2006	2007	2008	2009	2010
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	60425.57	60929.58	61437.80	0.00	0.00
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	3062.25	3093.47	3125.01	0.00	0.00
YEAR'S	$	63487.82	64023.06	64562.81	0.00	0.00
CUM.	$	1462956.25	1526979.25	1591542.00	1591542.00	1591542.00

Building Designation		Air Conditioning, Heating And Ventilating System Description	Subcontract Standard Unit Price Per Ton Of Cooling Capacity Range	Average
A, D, E, I, P, S, U, X, Y	1.	Packaged Thru Wall Unit. Self contained Air Conditioning Unit with auxillary electric heating coil. Complete with wall sleeve, electric cord and plug and exterior caulking. (3/4 thru 2 Ton increments).	$ 775.00 To $ 945.00	$ 860.00
A, D, E, I, P, S, U, X, Y	2.	Packaged Heat Pump. Thru wall self contained unit with auxiliary electric heating coil. Complete with wall sleeve, electric cord, plug and exterior caulking. (3/4 thru 2 Ton increments).	$1050.00 To $1280.00	$1165.00
A, D, E, G, H, I, K, M, Q, S, X, Y	3.	Residential Electric Furnaces. With top mounted evaporator and remote air cooled electrically operated condensing unit. System complete with piping, forced air ductwork, controls and electrical connections. (2 thru 10 Tons).	$1205.00 To $1475.00	$1340.00
B, C, D, E, F, G, H, I, J, K, O, Q, S, V, X, Z	4.	Roof Top Packaged Units. Combination heating-cooling unit (electric or gas) complete with curb, starters, controls and prefabricated supply-return air duct assembly. (2 thru 15 Ton increments).	$1235.00 To $1505.00	$1370.00
B, D, E, F, G, K, L, M, N, O, Q, X, Z	5.	Self-Contained Water Cooled Draw-Thru Units. Air handling unit with integral compressor, condensing section, coils, filters and cabinet for mounting directly in space. System complete with cooling tower, pump, piping, controls and air diffuser discharge head. Heating by use of electric heaters. (20 thru 60 Tons).	$1245.00 To $1525.00	$1385.00
A, D, E, G, H, I, K, M, Q, S, X, Y	6.	Residential Gas Furnace. With top mounted evaporator and remote air cooled electrically operated condensing unit. Complete with piping, forced air ductwork, controls and electrical connections. (2 thru 10 Tons).	$1290.00 To $1580.00	$1435.00
B, F, G, H, I, K, M, N, O, Q, V, W, Z	7.	Self-Contained Water Cooled Multizone Units. Using electric duct heaters. System complete with cooling tower, pumps, piping, controls, starters, insulated duct system. Average 350 CFM Per Outlet. (15 thru) 50 Tons).	$1425.00 To $1745.00	$1585.00
A, I, P, Q, S, T, U, V	8.	Incremental Heat Pump Units. Closed water loop system using floor mounted units, cast iron hot water boilers, liquid cooler, piping, controls and interior self-contained central air handling units. (3/4 thru 2 Ton increments).	$1440.00 To $1760.00	$1600.00
B, C, F, G, H, I, J, M, N, O, U, V, Z	9.	Roof Top Multizone System. Packaged combination heating-cooling unit (electric or gas) complete with curb, starters, controls and fiberglass ductwork based on 400 CFM Per Outlet. (10 thru 50 Ton increments).	$1475.00 To $1805.00	$1640.00
B, C, F, G, I, M, N, O,	10.	Multizone Two Pipe All Electric System. Complete with chillers and electric duct heaters, pump, piping, expansion tank, controls and	$1500.00 To	$1665.00
B, C, F, G, I, M, N, O, R, V, W, Z	11.	Multizone Four Pipe System. Chilled and hot water system complete with chillers, cast iron hot water boilers, pumps, expansion tanks, piping, controls, starters and insulated ductwork based on 350 CFM Per Outlet. (50 thru 1000 Tons).	$1580.00 To $1931.00	$1755.00
		air handling units with ceiling boxes delivering air to space or to return air ceiling plenum. Heating by baseboard electric perimeter heat and electric unit heaters below roof area. (50 thru 200 Tons).	To $2235.00	$2030.00
C, J, V, W	13.	High Pressure Variable Air Volume Reheat All Electric System. Using central built up fan-coil system with high velocity ductwork to Variable Air Volume boxes containing electric duct coils and flexible duct to slot type ceiling diffusers, centrifugal chillers, cooling towers, piping, controls, starters, pumps and expansion tank. Average box size 500 CFM. (200 thru 1000 Tons).	$1930.00 To $2360.00	$2145.00
C, R, W	14.	High Pressure Variable Air Volume Induction Box Electric Reheat System. All electric, using central built up Fan-Coil System with high velocity duct to above the ceiling type air induction boxes containing electric duct coils and low pressure fiberglass ductwork serving flexible duct run to ceiling diffusers. Complete with centrifugal chillers, cooling towers, piping, pumps, controls, starters and expansion tanks. Average box size 750 CFM. (200 thru 1000 Tons).	$2010.00 To $2460.00	$2235.00

BALLPARK COSTS (AVG. USED)

See Notes on Page 4.
(Continued on following page)

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FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
LIFE CYCLE COST ANALYSIS
FOR
ALTERNATE SYSTEM NUMBER 4
FY1975 MULTIZONE

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

PROJECT NAME : CCF SUBCON 1/4 1975MZ SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $343278/195.6 = $1755/TON

ESTIMATE YEAR : 1986
COMMISSION YEAR : 1988
LAST STUDY YEAR : 2008

**** NON-FINANCED CASH DEBITS/CREDITS ****

YEAR	AMOUNT
1986	343278.00

**** FINANCE INSTRUMENTS ****

NOTE 1 PRINCIPAL (1986 EST.) = $ 0.00
(0 EST.) = $ 0.00
INSTRUMENT = NONE

NOTE 2 PRINCIPAL (1986 EST.) = $ 0.00
(0 EST.) = $ 0.00
INSTRUMENT = NONE

**** FUEL COSTS ****

1986 EST. OF FUEL 1 = $ 96759.00 (ELEC.)
2 = $ 0.00
3 = $ 0.00

**** MAINTENANCE COST ****

1986 EST. OF MAINT. = $ 2500.00

**** DISCOUNT/INTEREST/ESCALATION RATES ****

		FINANCE %		ESCALATION %			
YEAR	% DISC.	LOAN1	LOAN2	FUEL1	FUEL2	FUEL3	MAIN.
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	7.90	0.00	0.00	8.40	0.00	0.00	9.00
1988	7.90	0.00	0.00	8.40	0.00	0.00	9.00
1989	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1990	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1991	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1992	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1993	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1994	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1995	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1996	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1997	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1998	7.90	0.00	0.00	8.80	0.00	0.00	9.00
1999	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2000	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2001	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2002	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2003	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2004	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2005	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2006	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2007	7.90	0.00	0.00	8.80	0.00	0.00	9.00
2008	7.90	0.00	0.00	8.80	0.00	0.00	9.00

**** UNIFIED PRESENT WORTH LIFE CYCLE COST ****

PROJECT NAME : CCF SUBCON 1/4 1975MZ SYS
ANALYST NAME : S.F.KRSTULOVICH
COMMENTS : $343278/195.6 = $1755/TON

YEAR		1986	1987	1988	1989	1990
CASH	$	343278.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	0.00	0.00	97657.82	98472.40	99293.77
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	0.00	0.00	2551.23	2577.24	2603.52
YEAR'S	$	343278.00	0.00	100209.06	101049.63	101897.28
CUM.	$	343278.00	343278.00	443487.06	544536.69	646434.00

YEAR		1991	1992	1993	1994	1995
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	100121.99	100957.12	101799.22	102648.33	103504.53
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2630.06	2656.87	2683.96	2711.32	2738.96
YEAR'S	$	102752.05	103613.99	104483.17	105359.65	106243.48
CUM.	$	749186.06	852800.06	957283.25	1062642.88	1168886.38

YEAR		1996	1997	1998	1999	2000
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	104367.87	105238.41	106116.21	107001.33	107893.84
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2766.88	2795.09	2823.58	2852.37	2881.45
YEAR'S	$	107134.75	108033.49	108939.79	109853.70	110775.28
CUM.	$	1276021.12	1384054.62	1492994.38	1602848.12	1713623.38

YEAR		2001	2002	2003	2004	2005
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	108793.80	109701.26	110616.28	111538.95	112469.30
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	2910.82	2940.50	2970.48	3000.76	3031.35
YEAR'S	$	111704.63	112641.76	113586.76	114539.70	115500.65
CUM.	$	1825328.00	1937969.75	2051556.50	2166096.20	2281597.00

YEAR		2006	2007	2008	2009	2010
CASH	$	0.00	0.00	0.00	0.00	0.00
MORT.1	$	0.00	0.00	0.00	0.00	0.00
MORT.2	$	0.00	0.00	0.00	0.00	0.00
FUEL 1	$	113407.41	114353.35	115307.17	0.00	0.00
FUEL 2	$	0.00	0.00	0.00	0.00	0.00
FUEL 3	$	0.00	0.00	0.00	0.00	0.00
MAINT.	$	3062.25	3093.47	3125.01	0.00	0.00
YEAR'S	$	116469.66	117446.81	118432.18	0.00	0.00
CUM.	$	2398066.80	2515513.50	2633945.80	2633945.80	2633945.80

Building Designation	Air Conditioning, Heating And Ventilating System Description	Subcontract Standard Unit Price Per Ton Of Cooling Capacity Range	Average
A, D, E, I, P, S, U, X, Y	1. Packaged Thru Wall Unit. Self contained Air Conditioning Unit with auxillary electric heating coil. Complete with wall sleeve, electric cord and plug and exterior caulking. (3/4 thru 2 Ton increments).	$ 775.00 To $ 945.00	$ 860.00
A, D, E, I, P, S, U, X, Y	2. Packaged Heat Pump. Thru wall self contained unit with auxiliary electric heating coil. Complete with wall sleeve, electric cord, plug and exterior caulking. (3/4 thru 2 Ton increments).	$1050.00 To $1280.00	$1165.00
A, D, E, G, H, I, K, M, Q, S, X, Y	3. Residential Electric Furnaces. With top mounted evaporator and remote air cooled electrically operated condensing unit. System complete with piping, forced air ductwork, controls and electrical connections. (2 thru 10 Tons).	$1205.00 To $1475.00	$1340.00
B, C, D, E, F, G, H, I, J, K, O, Q, S, V, X, Z	4. Roof Top Packaged Units. Combination heating-cooling unit (electric or gas) complete with curb, starters, controls and prefabricated supply-return air duct assembly. (2 thru 15 Ton increments).	$1235.00 To $1505.00	$1370.00
B, D, E, F, G, K, L, M, N, O, Q, X, Z	5. Self-Contained Water Cooled Draw-Thru Units. Air handling unit with integral compressor, condensing section, coils, filters and cabinet for mounting directly in space. System complete with cooling tower, pump, piping, controls and air diffuser discharge head. Heating by use of electric heaters. (20 thru 60 Tons).	$1245.00 To $1525.00	$1385.00
A, D, E, G, H, I, K, M, Q, S, X, Y	6. Residential Gas Furnace. With top mounted evaporator and remote air cooled electrically operated condensing unit. Complete with piping, forced air ductwork, controls and electrical connections. (2 thru 10 Tons).	$1290.00 To $1580.00	$1435.00
B, F, G, H, I, K, M, N, O, Q, V, W, Z	7. Self-Contained Water Cooled Multizone Units. Using electric duct heaters. System complete with cooling tower, pumps, piping, controls, starters, insulated duct system. Average 350 CFM Per Outlet. (15 thru) 50 Tons).	$1425.00 To $1745.00	$1585.00
A, I, P, Q, S, T, U, V	8. Incremental Heat Pump Units. Closed water loop system using floor mounted units, cast iron hot water boilers, liquid cooler, piping, controls and interior self-contained central air handling units. (3/4 thru 2 Ton increments).	$1440.00 To $1760.00	$1600.00
B, C, F, G, H, I, J, M, N, O, U, V, Z	9. Roof Top Multizone System. Packaged combination heating-cooling unit (electric or gas) complete with curb, starters, controls and fiberglass ductwork based on 400 CFM Per Outlet. (10 thru 50 Ton increments).	$1475.00 To $1805.00	$1640.00
B, C, F, G, I, M, N, O	10. Multizone Two Pipe All Electric System. Complete with chillers and electric duct heaters, pump, piping, expansion tank, controls and	$1500.00 To	$1665.00
B, C, F, G, I, M, N, O, R, V, W, Z	11. Multizone Four Pipe System. Chilled and hot water system complete with chillers, cast iron hot water boilers, pumps, expansion tanks, piping, controls, starters and insulated ductwork based on 350 CFM Per Outlet. (50 thru 1000 Tons).	$1580.00 To $1931.00	$1755.00
	air handling units with ceiling boxes delivering air to space or to return air ceiling plenum. Heating by baseboard electric perimeter heat and electric unit heaters below roof area. (50 thru 200 Tons).	To $2235.00	[illegible]
C, J, V, W	13. High Pressure Variable Air Volume Reheat All Electric System. Using central built up fan-coil system with high velocity ductwork to Variable Air Volume boxes containing electric duct coils and flexible duct to slot type ceiling diffusers, centrifugal chillers, cooling towers, piping, controls, starters, pumps and expansion tank. Average box size 500 CFM. (200 thru 1000 Tons).	$1930.00 To $2360.00	$2145.00
C, R, W	14. High Pressure Variable Air Volume Induction Box Electric Reheat System. All electric, using central built up Fan-Coil System with high velocity duct to above the ceiling type air induction boxes containing electric duct coils and low pressure fiberglass ductwork serving flexible duct run to ceiling diffusers. Complete with centrifugal chillers, cooling towers, piping, pumps, controls, starters and expansion tanks. Average box size 750 CFM. (200 thru 1000 Tons).	$2010.00 To $2460.00	$2235.00

BALLPARK COSTS (AVG. USED)

See Notes on Page 4.
(Continued on following page)

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FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
LIFE CYCLE COST ANALYSIS
UNIFIED PRESENT WORTH COMPARISONS
FOR
ALL SYSTEMS

12 NOVEMBER, 1984
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

**** UPW LIFE CYCLE COST COMPARISON ****

FILE NO. : LCC1.DAT
PROJECT : CCF SUBCON 1/4 DESIGN SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $344000/195.6 = $1759/TON

FILE NO. : LCC2.DAT
PROJECT : CCF SUBCON 1/4 VAV SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $397068/195.6 = $2030/TON

YEAR	(A) FILE 1 $	(B) FILE 2 $	(A-B) YR'S $	(A-B) CUM. $
1986	344000.00	397068.00	-53068.00	-53068.00
1987	0.00	0.00	0.00	-53068.00
1988	25175.91	38947.22	-13771.31	-66839.31
1989	25389.69	39276.81	-13887.12	-80726.44
1990	25605.29	39609.20	-14003.91	-94730.35
1991	25822.73	39944.41	-14121.68	-108852.03
1992	26042.02	40282.46	-14240.44	-123092.48
1993	26263.18	40623.39	-14360.21	-137452.69
1994	26486.22	40967.21	-14480.99	-151933.69
1995	26711.17	41313.95	-14602.78	-166536.47
1996	26938.03	41663.62	-14725.59	-181262.06
1997	27166.82	42016.27	-14849.45	-196111.50
1998	27397.57	42371.91	-14974.34	-211085.84
1999	27630.28	42730.57	-15100.29	-226186.13
2000	27864.97	43092.28	-15227.31	-241413.44
2001	28101.68	43457.06	-15355.38	-256768.81
2002	28340.39	43824.93	-15484.54	-272253.38
2003	28581.14	44195.93	-15614.79	-287868.19
2004	28823.94	44570.08	-15746.14	-303614.31
2005	29068.81	44947.40	-15878.59	-319492.91
2006	29315.77	45327.93	-16012.16	-335505.06
2007	29564.84	45711.69	-16146.85	-351651.91
2008	29816.03	46098.71	-16282.68	-367934.59

*** APPARENT BREAK-EVEN YEAR = 1988 ***

**** UPW LIFE CYCLE COST COMPARISON ****

FILE NO. : LCC1.DAT
PROJECT : CCF SUBCON 1/4 DESIGN SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $344000/195.6 = $1759/TON

FILE NO. : LCC3.DAT
PROJECT : CCF SUBCON 1/4 4PFC SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $524208/195.6 = $2680/TON

YEAR	(A) FILE 1 $	(B) FILE 2 $	(A-B) YR'S $	(A-B) CUM. $
1986	344000.00	524208.00	-180208.00	-180208.00
1987	0.00	0.00	0.00	-180208.00
1988	25175.91	35828.96	-10653.05	-190861.06
1989	25389.69	36131.60	-10741.91	-201602.97
1990	25605.29	36436.80	-10831.51	-212434.47
1991	25822.73	36744.58	-10921.85	-223356.31
1992	26042.02	37054.97	-11012.95	-234369.27
1993	26263.18	37367.99	-11104.81	-245474.06
1994	26486.22	37683.66	-11197.44	-256671.50
1995	26711.17	38002.00	-11290.83	-267962.34
1996	26938.03	38323.04	-11385.01	-279347.34
1997	27166.82	38646.80	-11479.98	-290827.34
1998	27397.57	38973.30	-11575.73	-302403.09
1999	27630.28	39302.57	-11672.29	-314075.38
2000	27864.97	39634.62	-11769.65	-325845.03
2001	28101.68	39969.49	-11867.81	-337712.84
2002	28340.39	40307.20	-11966.81	-349679.62
2003	28581.14	40647.76	-12066.62	-361746.25
2004	28823.94	40991.21	-12167.27	-373913.53
2005	29068.81	41337.57	-12268.76	-386182.28
2006	29315.77	41686.87	-12371.10	-398553.38
2007	29564.84	42039.12	-12474.28	-411027.66
2008	29816.03	42394.36	-12578.33	-423605.97

*** APPARENT BREAK-EVEN YEAR = 1988 ***

**** UPW LIFE CYCLE COST COMPARISON ****

FILE NO. : LCC1.DAT
PROJECT : CCF SUBCON 1/4 DESIGN SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $344000/195.6 = $1759/TON

FILE NO. : LCC4.DAT
PROJECT : CCF SUBCON 1/4 3DMZ SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $343278/195.6 = $1755/TON

YEAR	(A) FILE 1 $	(B) FILE 2 $	(A-B) YR'S $	(A-B) CUM. $
1986	344000.00	343278.00	722.00	722.00
1987	0.00	0.00	0.00	722.00
1988	25175.91	54585.14	-29409.23	-28687.23
1989	25389.69	55045.17	-29655.48	-58342.72
1990	25605.29	55509.09	-29903.80	-88246.52
1991	25822.73	55976.92	-30154.19	-118400.70
1992	26042.02	56448.70	-30406.68	-148807.39
1993	26263.18	56924.47	-30661.29	-179468.69
1994	26486.22	57404.26	-30918.04	-210386.73
1995	26711.17	57888.10	-31176.93	-241563.67
1996	26938.03	58376.02	-31437.99	-273001.66
1997	27166.82	58868.07	-31701.25	-304702.91
1998	27397.57	59364.27	-31966.70	-336669.62
1999	27630.28	59864.67	-32234.39	-368904.03
2000	27864.97	60369.29	-32504.32	-401408.34
2001	28101.68	60878.18	-32776.50	-434184.84
2002	28340.39	61391.36	-33050.97	-467235.81
2003	28581.14	61908.88	-33327.74	-500563.56
2004	28823.94	62430.77	-33606.83	-534170.38
2005	29068.81	62957.07	-33888.26	-568058.62
2006	29315.77	63487.82	-34172.05	-602230.69
2007	29564.84	64023.06	-34458.22	-636688.94
2008	29816.03	64562.81	-34746.78	-671435.75

*** APPARENT BREAK-EVEN YEAR = 1988 ***

**** UPW LIFE CYCLE COST COMPARISON ****

FILE NO. : LCC1.DAT
PROJECT : CCF SUBCON 1/4 DESIGN SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $344000/195.6 = $1759/TON

FILE NO. : LCC5.DAT
PROJECT : CCF SUBCON 1/4 1975MZ SYS
ANALYST : S.F.KRSTULOVICH
COMMENTS : $343278/195.6 = $1755/TON

YEAR	(A) FILE 1 $	(B) FILE 2 $	(A-B) YR'S $	(A-B) CUM. $
1986	344000.00	343278.00	722.00	722.00
1987	0.00	0.00	0.00	722.00
1988	25175.91	100209.10	-75033.19	-74311.19
1989	25389.69	101049.60	-75659.91	-149971.09
1990	25605.29	101897.30	-76292.01	-226263.09
1991	25822.73	102752.00	-76929.27	-303192.38
1992	26042.02	103614.00	-77571.98	-380764.34
1993	26263.18	104483.20	-78220.02	-458984.38
1994	26486.22	105359.60	-78873.38	-537857.75
1995	26711.17	106243.50	-79532.33	-617390.06
1996	26938.03	107134.80	-80196.77	-697586.88
1997	27166.82	108033.50	-80866.68	-778453.56
1998	27397.57	108939.80	-81542.23	-859995.81
1999	27630.28	109853.70	-82223.42	-942219.25
2000	27864.97	110775.30	-82910.33	-1025129.50
2001	28101.68	111704.60	-83602.92	-1108732.50
2002	28340.39	112641.80	-84301.41	-1193033.88
2003	28581.14	113586.80	-85005.66	-1278039.50
2004	28823.94	114539.70	-85715.77	-1363755.25
2005	29068.81	115500.60	-86431.79	-1450187.12
2006	29315.77	116469.70	-87153.94	-1537341.12
2007	29564.84	117446.80	-87881.95	-1625223.00
2008	29816.03	118432.20	-88616.17	-1713839.25

*** APPARENT BREAK-EVEN YEAR = 1988 ***

FERMILAB CENTRAL COMPUTING FACILITY

SUBCONSTRUCTION 1/4
SIMPLE PAYBACK CALCULATIONS
FOR
ALL SYSTEMS

12 NOVEMBER, 1986
ANALYST: S.F.KRSTULOVICH

FERMILAB CONSTRUCTION ENGINEERING SERVICES

CCF SUBCONSTRUCT 1/4
SIMPLE PAYBACK

INPUT VALUES	DESIGN SYS	VAV SYS
INITIAL TOTAL COST	$ 344,000	$ 397,068
ANNUAL OPERATING COST	$ 22,922	$ 36,061
ANNUAL MAINTENANCE COST	$ 2,000	$ 2,500
SALVAGE VALUE AT YEAR 20	$ 0	$ 0

	DESIGN SYS EXPENSES		VAV SYS EXPENSES	
YEAR	ANNUAL	CUMULATIVE	ANNUAL	CUMULATIVE
INITIAL	$ 344,000	$ 344,000	$ 397,068	$ 397,068
1	$ 24,922	$ 368,922	$ 38,561	$ 435,629
2	$ 24,922	$ 393,844	$ 38,561	$ 474,190
3	$ 24,922	$ 418,766	$ 38,561	$ 512,751
4	$ 24,922	$ 443,688	$ 38,561	$ 551,312
5	$ 24,922	$ 468,610	$ 38,561	$ 589,873
6	$ 24,922	$ 493,532	$ 38,561	$ 628,434
7	$ 24,922	$ 518,454	$ 38,561	$ 666,995
8	$ 24,922	$ 543,376	$ 38,561	$ 705,556
9	$ 24,922	$ 568,298	$ 38,561	$ 744,117
10	$ 24,922	$ 593,220	$ 38,561	$ 782,678
11	$ 24,922	$ 618,142	$ 38,561	$ 821,239
12	$ 24,922	$ 643,064	$ 38,561	$ 859,800
13	$ 24,922	$ 667,986	$ 38,561	$ 898,361
14	$ 24,922	$ 692,908	$ 38,561	$ 936,922
15	$ 24,922	$ 717,830	$ 38,561	$ 975,483
16	$ 24,922	$ 742,752	$ 38,561	$1,014,044
17	$ 24,922	$ 767,674	$ 38,561	$1,052,605
18	$ 24,922	$ 792,596	$ 38,561	$1,091,166
19	$ 24,922	$ 817,518	$ 38,561	$1,129,727
20	$ 24,922	$ 842,440	$ 38,561	$1,168,288
SALVAGE	($ 0)	$ 842,440	($ 0)	$1,168,288

TOTAL COST OF DESIGN SYS FOR 20 YEARS IS $ 842,440
TOTAL COST OF VAV SYS FOR 20 YEARS IS $1,168,288

CCF SUBCONSTRUCT 1/4
SIMPLE PAYBACK

INPUT VALUES	DESIGN SYS	4PFC SYS
INITIAL TOTAL COST	$ 344,000	$ 524,208
ANNUAL OPERATING COST	$ 22,922	$ 33,477
ANNUAL MAINTENANCE COST	$ 2,000	$ 2,000
SALVAGE VALUE AT YEAR 20	$ 0	$ 0

	DESIGN SYS EXPENSES		4PFC SYS EXPENSES	
YEAR	ANNUAL	CUMULATIVE	ANNUAL	CUMULATIVE
INITIAL	$ 344,000	$ 344,000	$ 524,208	$ 524,208
1	$ 24,922	$ 368,922	$ 35,477	$ 559,685
2	$ 24,922	$ 393,844	$ 35,477	$ 595,162
3	$ 24,922	$ 418,766	$ 35,477	$ 630,639
4	$ 24,922	$ 443,688	$ 35,477	$ 666,116
5	$ 24,922	$ 468,610	$ 35,477	$ 701,593
6	$ 24,922	$ 493,532	$ 35,477	$ 737,070
7	$ 24,922	$ 518,454	$ 35,477	$ 772,547
8	$ 24,922	$ 543,376	$ 35,477	$ 808,024
9	$ 24,922	$ 568,298	$ 35,477	$ 843,501
10	$ 24,922	$ 593,220	$ 35,477	$ 878,978
11	$ 24,922	$ 618,142	$ 35,477	$ 914,455
12	$ 24,922	$ 643,064	$ 35,477	$ 949,932
13	$ 24,922	$ 667,986	$ 35,477	$ 985,409
14	$ 24,922	$ 692,908	$ 35,477	$1,020,886
15	$ 24,922	$ 717,830	$ 35,477	$1,056,363
16	$ 24,922	$ 742,752	$ 35,477	$1,091,840
17	$ 24,922	$ 767,674	$ 35,477	$1,127,317
18	$ 24,922	$ 792,596	$ 35,477	$1,162,794
19	$ 24,922	$ 817,518	$ 35,477	$1,198,271
20	$ 24,922	$ 842,440	$ 35,477	$1,233,748
SALVAGE	($ 0)	$ 842,440	($ 0)	$1,233,748

TOTAL COST OF DESIGN SYS FOR 20 YEARS IS $ 842,440
TOTAL COST OF 4PFC SYS FOR 20 YEARS IS $1,233,748

CCF SUBCONSTRUCT 1/4
SIMPLE PAYBACK

INPUT VALUES	DESIGN SYS	3DMZ SYS
INITIAL TOTAL COST	$ 344,000	$ 343,278
ANNUAL OPERATING COST	$ 22,922	$ 51,555
ANNUAL MAINTENANCE COST	$ 2,000	$ 2,500
SALVAGE VALUE AT YEAR 20	$ 0	$ 0

	DESIGN SYS EXPENSES		3DMZ SYS EXPENSES	
YEAR	ANNUAL	CUMULATIVE	ANNUAL	CUMULATIVE
INITIAL	$ 344,000	$ 344,000	$ 343,278	$ 343,278
1	$ 24,922	$ 368,922	$ 54,055	$ 397,333
2	$ 24,922	$ 393,844	$ 54,055	$ 451,388
3	$ 24,922	$ 418,766	$ 54,055	$ 505,443
4	$ 24,922	$ 443,688	$ 54,055	$ 559,498
5	$ 24,922	$ 468,610	$ 54,055	$ 613,553
6	$ 24,922	$ 493,532	$ 54,055	$ 667,608
7	$ 24,922	$ 518,454	$ 54,055	$ 721,663
8	$ 24,922	$ 543,376	$ 54,055	$ 775,718
9	$ 24,922	$ 568,298	$ 54,055	$ 829,773
10	$ 24,922	$ 593,220	$ 54,055	$ 883,828
11	$ 24,922	$ 618,142	$ 54,055	$ 937,883
12	$ 24,922	$ 643,064	$ 54,055	$ 991,938
13	$ 24,922	$ 667,986	$ 54,055	$1,045,993
14	$ 24,922	$ 692,908	$ 54,055	$1,100,048
15	$ 24,922	$ 717,830	$ 54,055	$1,154,103
16	$ 24,922	$ 742,752	$ 54,055	$1,208,158
17	$ 24,922	$ 767,674	$ 54,055	$1,262,213
18	$ 24,922	$ 792,596	$ 54,055	$1,316,268
19	$ 24,922	$ 817,518	$ 54,055	$1,370,323
20	$ 24,922	$ 842,440	$ 54,055	$1,424,378
SALVAGE	($ 0)	$ 842,440	($ 0)	$1,424,378

PAYBACK FOR DESIGN SYS OCCURS AFTER 0.0 YEARS ($ 344,618)

TOTAL COST OF DESIGN SYS FOR 20 YEARS IS $ 842,440
TOTAL COST OF 3DMZ SYS FOR 20 YEARS IS $1,424,378

CCF SUBCONSTRUCT 1/4
SIMPLE PAYBACK

INPUT VALUES	DESIGN SYS	1975MZ SYS
INITIAL TOTAL COST	$ 344,000	$ 343,278
ANNUAL OPERATING COST	$ 22,922	$ 96,759
ANNUAL MAINTENANCE COST	$ 2,000	$ 2,500
SALVAGE VALUE AT YEAR 20	$ 0	$ 0

	DESIGN SYS EXPENSES		1975MZ SYS EXPENSES	
YEAR	ANNUAL	CUMULATIVE	ANNUAL	CUMULATIVE
INITIAL	$ 344,000	$ 344,000	$ 343,278	$ 343,278
1	$ 24,922	$ 368,922	$ 99,259	$ 442,537
2	$ 24,922	$ 393,844	$ 99,259	$ 541,796
3	$ 24,922	$ 418,766	$ 99,259	$ 641,055
4	$ 24,922	$ 443,688	$ 99,259	$ 740,314
5	$ 24,922	$ 468,610	$ 99,259	$ 839,573
6	$ 24,922	$ 493,532	$ 99,259	$ 938,832
7	$ 24,922	$ 518,454	$ 99,259	$1,038,091
8	$ 24,922	$ 543,376	$ 99,259	$1,137,350
9	$ 24,922	$ 568,298	$ 99,259	$1,236,609
10	$ 24,922	$ 593,220	$ 99,259	$1,335,868
11	$ 24,922	$ 618,142	$ 99,259	$1,435,127
12	$ 24,922	$ 643,064	$ 99,259	$1,534,386
13	$ 24,922	$ 667,986	$ 99,259	$1,633,645
14	$ 24,922	$ 692,908	$ 99,259	$1,732,904
15	$ 24,922	$ 717,830	$ 99,259	$1,832,163
16	$ 24,922	$ 742,752	$ 99,259	$1,931,422
17	$ 24,922	$ 767,674	$ 99,259	$2,030,681
18	$ 24,922	$ 792,596	$ 99,259	$2,129,940
19	$ 24,922	$ 817,518	$ 99,259	$2,229,199
20	$ 24,922	$ 842,440	$ 99,259	$2,328,458
SALVAGE	($ 0)	$ 842,440	($ 0)	$2,328,458

PAYBACK FOR DESIGN SYS OCCURS AFTER 0.0 YEARS ($ 344,242)

TOTAL COST OF DESIGN SYS FOR 20 YEARS IS $ 842,440
TOTAL COST OF 1975MZ SYS FOR 20 YEARS IS $2,328,458