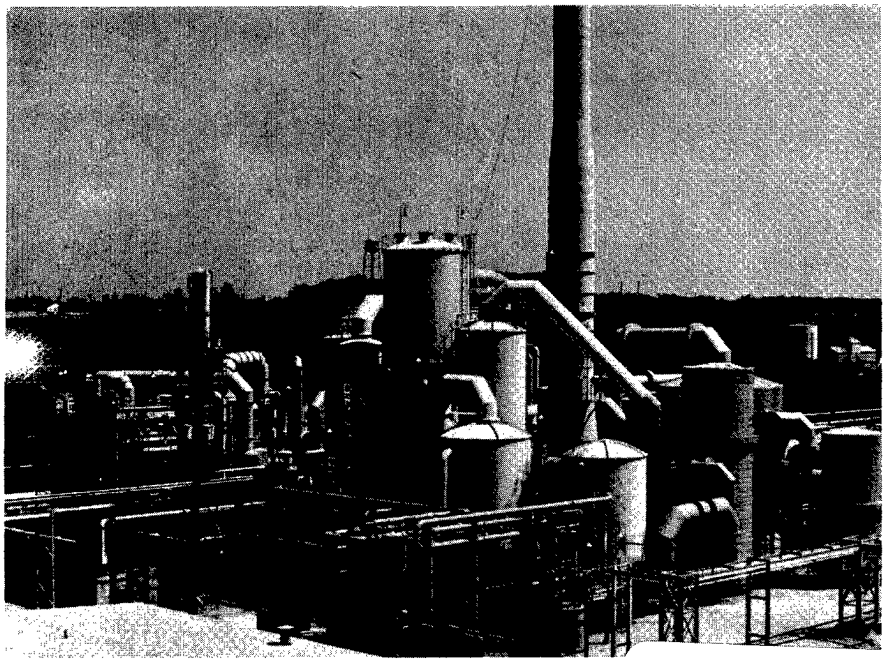
FINAL SUBMISSION
EXECUTIVE SUMMARY

JOLIET
ARMY AMMUNITION PLANT

ENERGY ENGINEERING ANALYSIS



Prepared for

The Department of the Army
Omaha District
Corps of Engineers
Contract No. DACA45-80-C-0090

By

Sanders & Thomas, Inc.
An STV Engineers Professional Firm
Consulting Engineers
Pottstown, Pennsylvania 19464

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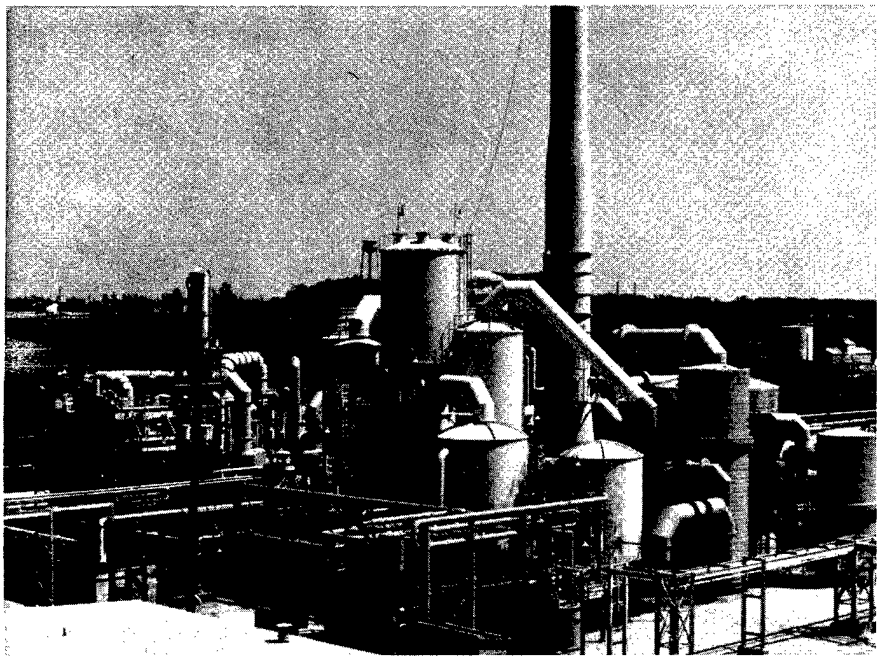

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PROJECT ABSTRACT

ENERGY ENGINEERING ANALYSIS
JOLIET ARMY AMMUNITION PLANT

This analysis is undertaken to assist the Joliet Army Ammunition Plant (JAAP) in meeting the goals established in the Army Facilities Energy Plan to reduce energy consumption by 20 percent by FY 85.

Projects selected for implementation as a result of this analysis will enable JAAP to achieve the FY 85 goal. These projects have been divided into standby status and mobilization status. Total annual energy savings for standby status from project implementation will be approximately 296,000 MBTU's. The total cost of project implementation is estimated at $2.8 million. If mobilization status projects (including Increment F projects), are implemented annual energy savings will be approximately 417,000 MBTU's during periods of full mobilization. The cost of implementing mobilization status projects (including Increment F projects), is estimated at $4.6 million.

USE OF THE REPORT

This Energy Engineering Analysis consists of a main report, which describes the existing and anticipated energy use trends, and defines and summarizes specific energy conservation projects recommended to achieve the goals stated in the Army Facilities Energy Plan. Appendices and the Annual Energy Consumption Summary include building information, weather data, cost data, and detailed computer-generated and manual calculations for each individual project.

The Energy Engineering Analysis will enable ammunition plant personnel to identify energy conservation measures and meet Army energy reduction goals.

The report includes:

- Energy consumption by fuel type;
- energy consumption trends;
- ECAM projects;
- Increment F and G Project;
- other potential projects;
- quick-fix management form; and
- descriptions of analyzed buildings.

In addition, the Analysis is a detailed data base consisting of:

- An analysis of building energy use;
- Energy Conservation Measures applied to each analyzed building to be improved; and
- a set of marked-up prints from the survey indicating the conditions when surveyed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0

PROJECT REQUIREMENT

This energy engineering analysis is a systematic program of projects that will lead to energy consumption reductions at the Joliet Army Ammunition Plant (JAAP) without compromising the mission of the plant, and in compliance with all applicable environmental and Occupational Safety and Health Administration regulations. Reduced energy consumption is a stated goal of the Army Facilities Energy Plan.

The projects included in this analysis are grouped into five increments:

- A - Energy Conservation and Management Program (ECAM) projects for buildings and processes,
- B - ECAM projects for utilities and energy distribution systems,
- E - Feasibility of central boiler plants,
- F - Energy Saving Modifications within the Facility Engineer's Funding Control, and
- G - Maintenance, repair, and minor construction projects.

2.0

PLANT DESCRIPTION

JAAP is the army's largest ammunition plant with over 1,500 buildings on a 22,500 acre site 11 miles south of Joliet, Illinois. The location of the plant is shown on Figure 1: Joliet Army Ammunition Plant Location Map. Figure 2: General Site Map, shows the various area designations at the plant. Photographs of typical areas and related projects appear at the end of this report.

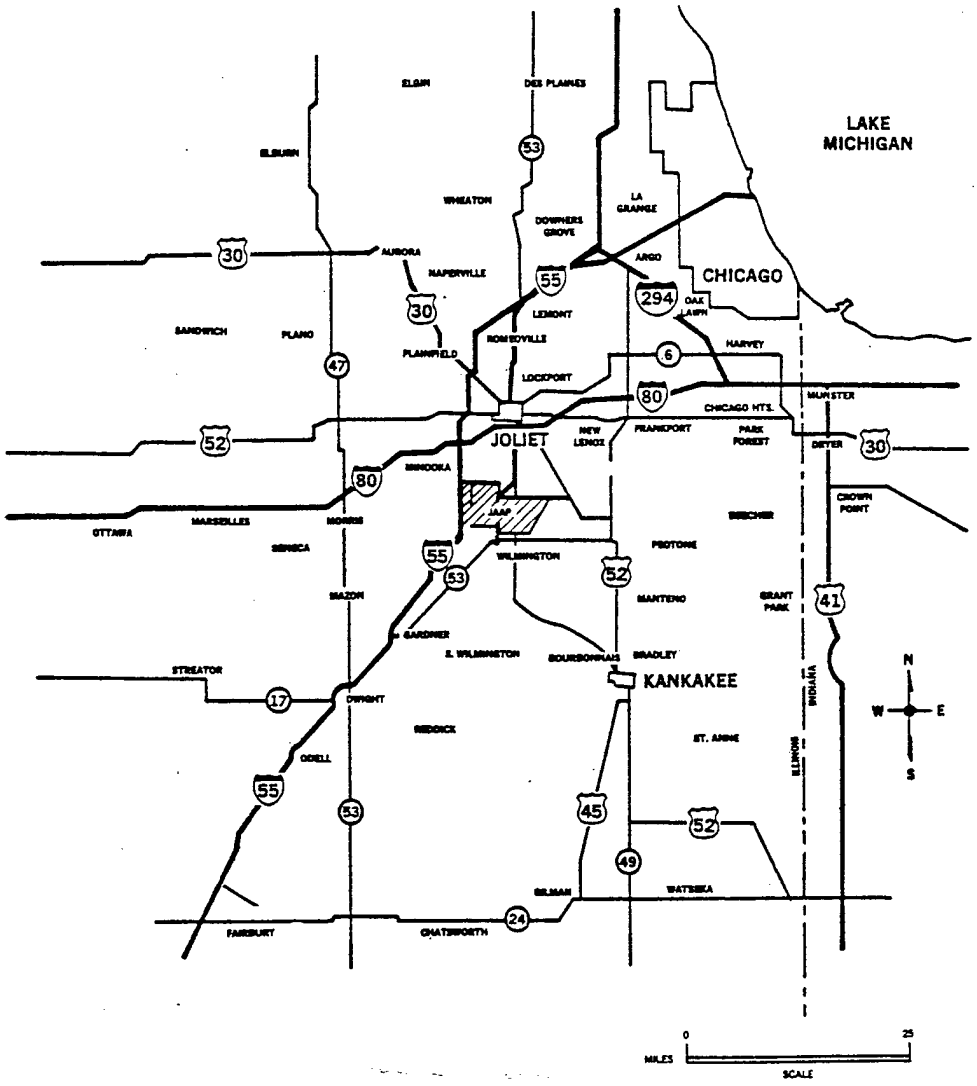


FIGURE 1
JOLIET ARMY AMMUNITION PLANT
LOCATION MAP

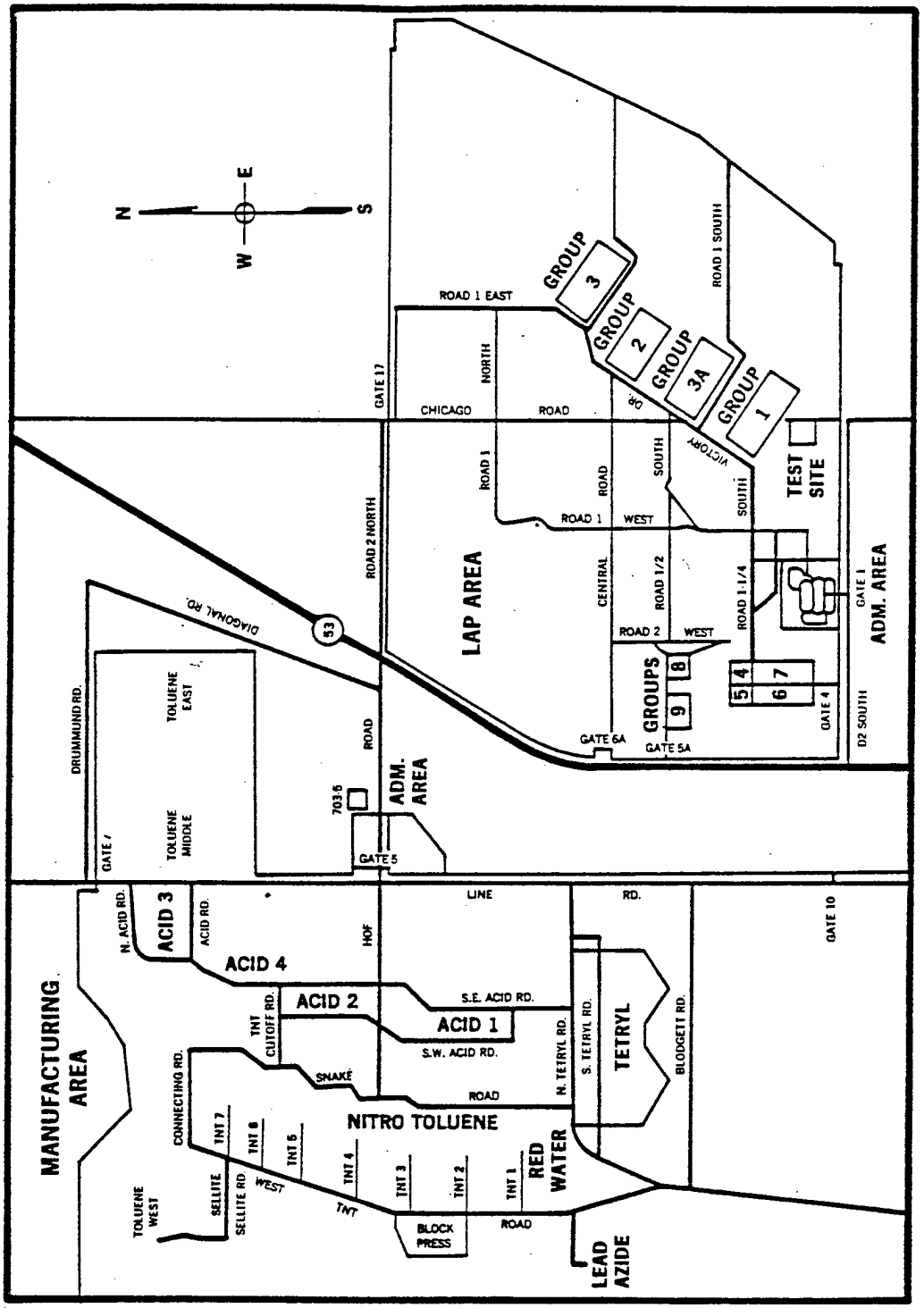


FIGURE 2
JOLIET ARMY AMMUNITION PLANT
GENERAL SITE MAP

3.0

ARMY FACILITIES ENERGY PLAN

The Army Facilities Energy Plan sets short and long range energy goals for the Army and provides policy and planning guidance for the development of detailed facility energy plans. The Army's energy goals in effect at the time of our scope of work, compared to present goals, are as shown in Table 1: Comparison of Army Facilities Plan Energy Goals.

The program recommended in this EEA report is consistent with revised Army Facilities Energy Plan goals as stated in the plan's 26 October 1981 version.

TABLE 1

COMPARISON OF ARMY FACILITIES ENERGY PLAN GOALS

ITEM	1 OCT '78	26 OCT '81
Reduce total consumption by:	25% by FY 85 50% by FY 2000	20% by FY 85 40% by FY 2000
Energy from coal and RDF	10% by FY 85	N.M.
Solar energy	1% by FY 85	N.M.
Natural gas	Eliminate use by FY 2000	N.M.
Petroleum fuels	Reduce by 75% by FY 2000	N.M.
Capability for synthetic gases	N.M.	By FY 2000
Heating oil consumption	N.M.	Reduce by 75% by FY 2000

N.M. — Not Mentioned

4.0

SOURCE ENERGY CONSUMPTION

Table 2: Source Energy Consumption, compares consumption from FY 1975, the base year for the Study, with consumption during FY 1979. Fuel consumption over the period dropped considerably as a result of the shutdown of the plant's process facilities.

TABLE 2

SOURCE ENERGY CONSUMPTION

FY 1975 AND 1979

	FY 1975		FY 1979	
Source	**Cost ($000)**	**MBTU's (000)**	**Cost ($000)**	**MBTU's (000)**
Electricity	$1,093	746	$ 344	135
Fuel Oil No. 2	48	24	17	5
Natural Gas	1,081	1,259	808	353
Propane Gas	285	79	-0-	-0-
Totals	$2,507	2,108	$1,169	493

Current fuel consumption is primarily attributed to building as opposed to process requirements. Consumption varies depending upon the number of degree days experienced. Electrical consumption is relatively constant throughout the year.

JAAP is currently 98 percent on standby status and its energy usage is limited to building heating, cooling and lighting, and utility systems. During active periods, the plant's energy consumption increases due to process requirements.

5.0

TYPICAL BUILDING ENERGY CONSUMPTION

Table 3: Typical Building Energy Consumption, is compiled using calculated data from Appendix II of the Energy Engineering Analysis: Annual Energy Consumption.

TABLE 3

TYPICAL BUILDING ENERGY CONSUMPTION

BUILDING NO.	NAME	CONSUMPTION MBTU/YR
1-3	Receiving & Painting	8,104
1-8	Change House, Men	2,679
60-1	Administration	6,800
70-5	Material Warehouse	1,413
70-7	Machine Shop	3,747
704-7	Supervisor's Office	3,492
812-1	Acid & Fume Recovery House	1,383

6.0

PROJECT EXECUTION

This energy engineering analysis was conducted in the following phases:

- Field surveys and data gathering for buildings, processes, and distribution systems.
- Analysis of projects for applicability to JAAP and energy savings potential in relation to cost.
- Review and verification by JAAP personnel to select projects for implementation.
- Preparation of Project Programming Documents.

7.0

ENERGY CONSERVATION OPPORTUNITIES

The following energy conservation opportunities were investigated and found to be viable:

Insulation	Modify Hot Water Heater Controls
Storm Windows	Install Shower Flow Restrictors
Caulking	Reduce Ventilation Requirements
Weatherstripping	Heat Destratification
Load Dock Seals	Blowdown Heat Recovery
Reduce Glass Area	Boiler Modulating Controls
Reduce Lighting Levels	Install Economizers
Replace Incandescent Fixtures	Install New Burners
Install Fluorescent Fixtures	Reduce Street Lighting
Install High-Efficiency Fixtures	Insulate Steam Lines
Oxygen Control for Boilers	Return Condensate
	Process Energy Recovery

The following conservation opportunities were studied but found not viable because of low ECM

- Improve power factor
- High-efficiency motor replacement
- FM radio controls
- Decentralize domestic hot water heaters
- Reclaim heat from hot refrigerant gas
- Install chiller controls
- Replace chillers

8.0

SUMMARY OF PROJECTS

Table 4: Summary of Projects, presents those energy conservation projects selected for implementation as a result of this study.

TABLE 4

SUMMARY OF PROJECTS

	Annual MBTU Savings	FY 84 TIC ($000)
FY 82		
• JAAP Package Boiler Project	271,900	1,957
FY 84		
• Selected ECAM Projects		
(Standby)	17,960	618
• (Mobilization)	345,190	3,667
• Viable Projects Not Selected		
(Standby)	1,000	72
(Mobilization)	538,420	10,186
• Increment G Projects		
(Standby)	6,400	184
(Mobilization)	12,450	182
TOTAL	921,420	14,909
• Increment E Projects (Central Boiler Plants)	---	64,240
TOTAL	---	79,149

INCREMENT F PROJECTS*	Annual MBTU Savings	Total Investment
• Potential Projects (Mobilization)	59,460	724

*Implementation of funded Increment F projects will be scheduled by the Facilities Engineer.

9.0

PROJECTED ENERGY TRENDS

Figure 3: Standby Status — Projected Energy Consumption, shows the projected energy consumption trend over the period FY 1975 to FY 2000. From FY 1982 to FY 1985, when the energy projects will be implemented, energy use will be reduced by about 290,000 MBTU's per year and building energy use from 130 to 30 KBTU's per gross square foot. Section 2.13 of the Energy Engineering Analysis presents FY 1983 and FY 1984 plant projects.

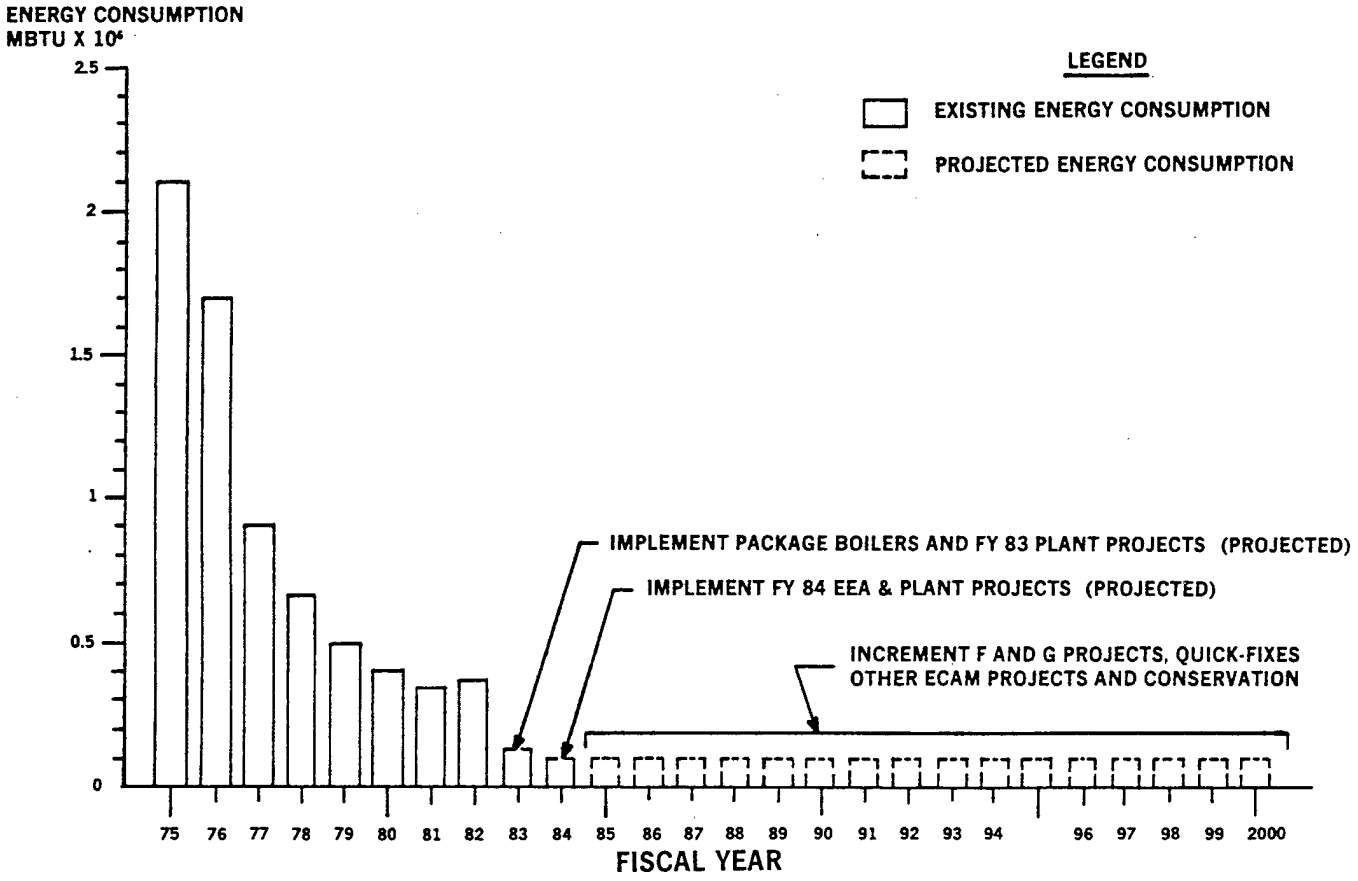


FIGURE 3
STANDBY STATUS-PROJECTED ENERGY CONSUMPTION

10.0
PROJECTED ENERGY COSTS

In Table 5: Projected Energy Costs, the April 1981 energy costs from Appendix I-G of the Energy Engineering Analysis are projected to 1985. Escalation rates are derived from EIRS and DOE guidelines.

TABLE 5
PROJECTED ENERGY COSTS

	1 APR 81	1 OCT 83		1 OCT 84		1 OCT 85	
ENERGY	**$/MBTU**	**Escalation**	**$/MBTU**	**Escalation**	**$/MBTU**	**Escalation**	**$/MBTU**
Natural Gas	2.76	1.4628	4.04	1.6353	4.51	1.8160	5.01
No. 2 Fuel Oil	4.81	1.2889	6.20	1.3779	6.63	1.4658	7.05
Electricity W/demand reduction	2.84	1.3630	3.87	1.4857	4.22	1.6099	4.57
W/O demand reduction	3.32	1.3630	4.53	1.4857	4.93	1.6099	5.34

11.0

JAAP PACKAGE BOILER PROJECT

JAAP personnel have developed a project to install package boilers when power house operations are discontinued. The power house is designed to provide high-pressure steam for process purposes. Using power house steam for space heat is costlier and uses more water than package boilers. The package boilers will save energy by permitting the power house to shutdown. This is a viable project and the energy savings are included in the total energy savings figure for FY 1982 to FY 1985 energy projects.

Project Calculation Summary

- Annual Energy Savings: 271, 900 MBTU's
- FY 82 Annual Cost Savings: $1,322,000
- Benefits: $32,572,000
- FY 82 CWE: $1,957,000
- FY 82 TIC: $1,957,000
- ECR: 138.9
- BCR: 16.6
- SAP: 1.4 years

12.0

ECAM PROJECTS SELECTED FOR IMPLEMENTATION.

ECAM Projects selected by JAAP personnel at the Review and Verification Meeting are presented in Table 6-1: ECAM Projects Selected for Implementation. Projects are separated by standby or mobilization status and listed in order of descending ECR.

TABLE 6

ECAM PROJECTS SELECTED FOR IMPLEMENTATION

Project No.	Project Title	Annual MBTU Savings	Annual Cost Savings ($000)	Benefits ($000)	CWE ($000)	TIC ($000)	SAP	BCR	ECR
	FY 84 Standby Status								
6-6	Repair Damaged Insulation on 150 PSIG Steam System, Manufacturing Area — Standby Status	5,440	42	833	70	74	1.7	11.3	78.0
5-1	Insulate Roofs for Selected Buildings — Standby Status	7,590	56	1,114	281	295	5.0	3.8	27.0
5-2	Insulate Walls for Selected Buildings — Standby Status	4,930	37	741	236	249	6.4	3.0	20.8
	SUBTOTALS	17,960	135	2,688	587	618			
	FY 84 Mobilization Status								
10-2	Preheat Boiler Feedwater with Cooling Tower Return Water — Mobilization Status	179,000	259	9,025	594	625	0.4	43.8	301.3
7-8	Improve LAP Boiler Plants — Mobilization Status	27,300	208	4,173	272	286	1.3	14.6	100.3
6-3	Repair Damaged Insulation on 150 PSIG Steam System, Manufacturing Area — Mobilization Status	19,360	148	2,962	194	204	1.3	14.5	99.6
5-10	Insulate Roofs on Selected Buildings — Mobilization Status	8,530	62	1,235	112	118	1.8	10.5	76.1
5-11	Insulate Walls on Selected Buildings — Mobilization Status	6,820	48	956	120	127	2.3	8.2	56.7

TABLE 6

ECAM PROJECTS SELECTED FOR IMPLEMENTATION (CONT'D)

Project No.	Project Title	Annual MBTU Savings	Annual Cost Savings ($000)	Benefits ($000)	CWE ($000)	TIC ($000)	SAP	BCR	ECR
5-8	Insulate Roofs and Walls, Repair Condensate Return System, Group 2 — Mobilization Status	21,190	162	3,241	380	400	2.4	8.1	55.8
5-7	Insulate Roofs and Walls, Repair Condensate Return System, Group 1 — Mobilization Status	40,160	306	6,144	801	853	2.6	7.2	50.1
5-9	Insulate Roofs and Walls, Repair Condensate Return System, Group 3 — Mobilization Status	35,350	270	5,407	782	823	2.9	6.6	45.2
5-15	Insulate Roofs and Walls on Selected Buildings — Mobilization Status	7,480	56	1,118	220	231	3.9	4.8	34.0
	SUBTOTAL	345,190	1,519	34,261	3,475	3,667			

13.0

VIABLE PROJECTS NOT SELECTED FOR IMPLEMENTATION BY JAAP

Table 7: Viable Projects Not Selected for Implementation by JAAP, shows those projects not selected for Implementation by JAAP personnel because though viable, anticipated procedural changes at the plant would make these projects unnecessary and other projects have accomplished the same purpose. Projects are separated by standby and mobilization status and listed in order of descending ECR.

TABLE 7

VIABLE PROJECTS NOT SELECTED FOR IMPLEMENTATION BY JAAP

Project No.	Project Title	Annual MBTU Savings	FY 84 CWE ($000)	FY 84 TIC ($000)	SAP	BCR	ECR
	FY 84 Standby Status						
6-3**	New Insulation of 150 PSIG Steam Distribution System, Manufacturing Area	17,300	877	923	11.6	1.6	19.7
5-16	Family Housing Improvements	1,000	65	72	72	8.5	1.1
	SUBTOTAL	1,000	65	72			
	FY 84 Mobilization Status						
9-2	Recover Heat from Redwater Condensate	238,400	2,135	2,247	2.0	9.3	111.7
7-9	Replace Combustion Controls in North Plant	89,600	1,061	1,117	2.7	7.0	84.4
10-1	Coordinate Steam Plant Output with Steam Producing Processes	112,000	1,751	1,843	3.6	5.3	63.9
7-1**	Improve LAP Boiler Plants — Group 1	30,300	640	674	2.8	6.9	47.3
7-3**	Improve LAP Boiler Plants — Group 3	28,500	683	719	3.1	6.1	41.8
6-5**	Repair Condensate Return System	52,750	1,300	1,368	3.2	5.9	40.6
6-4**	Replace Existing Insulation on 150 and 300 PSIG Steam Distribution Systems, Manufacturing Area	84,600	2,453	2,582	6.6	2.9	34.5
7-7**	Improve LAP Boiler Plants — Group 70	8,800	389	410	5.8	3.3	22.6
7-6	Improve LAP Boiler Plants — Group 60	6,900	323	340	6.1	3.1	21.4
7-2	Improve LAP Boiler Plants — Group 2	6,000	321	338	7.0	2.7	18.8

TABLE 7

VIABLE PROJECTS NOT SELECTED FOR IMPLEMENTATION BY JAAP (CONT'D)

Project No.	Project Title	Annual MBTU Savings	FY 84 CWE ($000)	FY 84 TIC ($000)	SAP	BCR	ECR
~~7-4~~	Improve LAP Boiler Plants — Group 5	4,600	282	8.0 2.4	16.4		
~~7-5~~	Improve LAP Boiler Plants — Group 7	4,600	282	297	8.0	2.4	16.4
6-1	Remove Existing Incandescent and Mercury Vapor Street and Area Lighting Fixtures and Replace with High-Pressure Sodium Fixtures	17,800	1,242	1,307	11.7	1.4	14.4
	SUBTOTAL	684,930	12,901	13,722			
	ADJUSTMENT	-146,510	-3,361	-3,536			
	ADJUSTED SUBTOTAL	538,420	9,540	10,186			
Adjustments					**Project Allocated To Project No.**		
6-4	Replace Existing Insulation on 150 and 300 PSIG Steam Distribution Systems, Manufacturing Area	67,100	1,884	1,983	6-3		
6-5	Repair Condensate Return System	47,060	1,205	1,268	5-7, 5-8, 5-9		
7-1	Improve LAP Boiler Plants — Group 1	20,830	188	197	7-8		
7-3	Improve LAP Boiler Plants — Group 3	9,010	60	63	7-8		
7-7	Improve LAP Boiler Plants — Group 70	2,510	24	25	7-8		
	TOTAL ADJUSTMENT	146,510	3,361	3,536			

*Project 6-7 is supplanted by selected ECAM project 6-6 and is not included in the subtotal.

**Portions of projects 6-4, 6-5, 7-1, 7-3 and 7-7 have been allocated to selected ECAM projects. These duplications of energy savings and cost are listed below this table and are deducted to obtain the adjusted subtotal.

14.0

INCREMENT "G" — MINOR CONSTRUCTION, MAINTENANCE AND REPAIR PROJECTS

Table 8: Increment "G" — Minor Construction, Maintenance and Repair Projects, lists qualifying projects by descending ECR.

TABLE 8

INCREMENT "G" MINOR CONSTRUCTION MAINTENANCE AND REPAIR PROJECTS

Project No.	Project Title	Annual MBTU Savings	FY 84 Annual Cost Savings ($000)	CwE FY 84 TIC ($000)	BCR	ECR	SAP	Manhours
FY 84 Standby Status								
5-6	Reduce the Number of Lamps in Selected Buildings	640	3.3	8.9	6.6	75.8	2.6	440
5-3	Insulate Windows or Install Storm Windows on Selected Bldgs. — Standby Status	1,360	10.3	23	9.0	62.6	2.1	1,150
5-5	Replace Lighting Fixtures in Selected Bldgs. — Standby Status	620	3.2	29	2.0	22.6	8.7	1,450
5-4	Weatherstrip and Caulk Windows and Doors on Selected Bldgs. — Standby Status	340	2.6	19	1.8	18.7	7.0	950
5-16	Family Housing Improvements — Standby Status	1,000	7.6	72	1.1	15.4	8.5	3,600
12-1	Insulate Steam and Condensate Return Lines — Bldg. 714	150	0.67	1.5	8.7	103.7	2.2	30
12-2	Heat Destratification - Bldg 716 -2	260	1.2	5.4	2.8	52.0	4.4	88
	Heat Destratification - Bldg 717	1,620	7.1	18.2	5.1	93.8	2.4	301
	Heat Destratification - Bldg 718 -1	220	0.95	4.3	2.9	53.3	4.3	74
	SUBTOTAL	6,400	38	184				
FY 84 Mobilization Status								
5-14	Replace Lighting Fixtures in Selected Bldgs. — Mobilization Status	8,600	44	92	8.7	98.8	2.0	4,600
5-12	Insulate Windows and/or Install Storm Windows on Selected Bldgs. — Mobilization Status	2,510	19	30	12.3	86.7	1.5	1,500
5-13	Weatherstrip and Caulk Windows and Doors on Selected Bldgs. — Mobilization Status	1,340	10	10	2.2	23.5	5.6	3,000
	SUBTOTAL	12,450	73	182				

15.0

ENERGY CONSERVATION MEASURES NOT MEETING ECAM CRITERIA

Those portions of ECM through 8 not included in selected ECAM projects or Increment "G" projects are summarized in Table 9: Energy Conservation Measures Not Meeting ECAM Criteria. A complete itemization of individual building projects from which future implementation selection could be made appears in Appendix III of the Energy Engineering Analysis dated May 14, 1982.

TABLE 9

ENERGY CONSERVATION MEASURES NOT MEETING ECAM CRITERIA*

ECM No.		Annual MBTU Savings	FY 84 CWE ($000)	FY 84 TIC ($000)	ECR
2	Improve Wall & Roof U-Values	58,600	1,438	1,613	
4	Install Storm Windows	2,590	104	109	24.9
5	Weatherstrip & Caulk Windows & Doors	8,120	500	526	16.2
6	Install Self-Contained Thermostatic Valves on Radiation	10,600	1,601	1,685	6.6
7	Replace Lighting Fixtures & Lamps	61,180	7,151	8.6	
8	Reduce the Number of Lamps	240	0.6	0.7	398.0
	TOTAL	148,830	11,007	11,684	

*Those portion of ECM Nos. 2 through 8, not included in selected ECAM projects or Increment "G" projects, are summarized in this table.

16.0

NON-VIABLE OR OUT-OF-SCOPE PROJECTS.

Table 10: Non-Viable or Out-of-Scope Projects, lists those energy conservation projects not in accordance with ECAM guidance or not included within the scope of work.

TABLE 10

NON-VIABLE OR OUT-OF-SCOPE PROJECTS

I NON-VIABLE PROJECTS

Project	Annual Savings	FY 84 ($000)
EMCS Projects (includes ECM No.'s 9 and 10)*	3,500	616

II OUT-OF-SCOPE PROJECTS

Install Low Capacity Burner on One Boiler, North Power Plant

Preheat Spent Acid from TNT Lines

(AFR) Replace John Zinc Unit with Scrubber

(AOP) Preheat Tail Gases with Process Gas

(AOP) Adjust Loading on Compressor and Hot Gas Expander

(AOP) Use Molecular Sieve Instead of Tail Gas Incinerator

(DSN) Use Steam Absorption Chiller Instead of Electric-Driven

(NAC) Use Thermo Plastic Lined Transfer Piping to Acid Recovery Buildings Eliminate Cooling Requirement

Preheat Feed to Concentrator Tower on Acid Recovery Building

TABLE 10
NON-VIABLE OR OUT-OF-SCOPE PROJECTS (CONT'D)

II OUT-OF-SCOPE PROJECTS

*ECM as presented in the EEA are as follows:

ECM No. 9 — Energy Monitoring and Control system for Ventilation Air Control

ECM No. 10 — Energy Monitoring and Control System for Unoccupied Shutdown Start/Stop Optimization, and Occupied Duty Cycling.

17.0

INCREMENT "E" — CENTRAL BOILER PLANT PROJECTS

Central boiler plant projects were developed for the LAP and Manufacturing Areas. Recommended projects are as follows:

- Lap Area: Coal-Fired, High Temperature Water System - Project Cost = $35,240,000;
- Manufacturing Area: Upgrade South Boiler Plant to burn coal; utilize existing steam distribution system — Project Cost = $29,000,000.

18.0

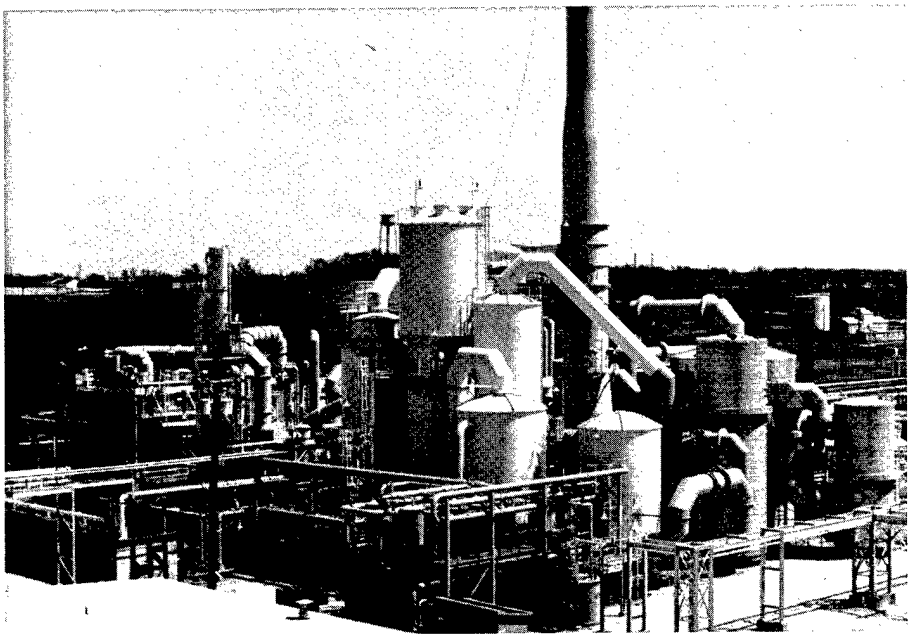
INCREMENT "F" PROJECTS

Increment F projects developed are shown in Table 11: Potential Energy Conservation Projects Developed (Mobilization Status). Projects are listed by descending SIR. If all projects are implemented, total savings will exceed 59,000 MBTU's per year. The total investment will be $724,000 and first year dollar savings will equal approximately $332,000.

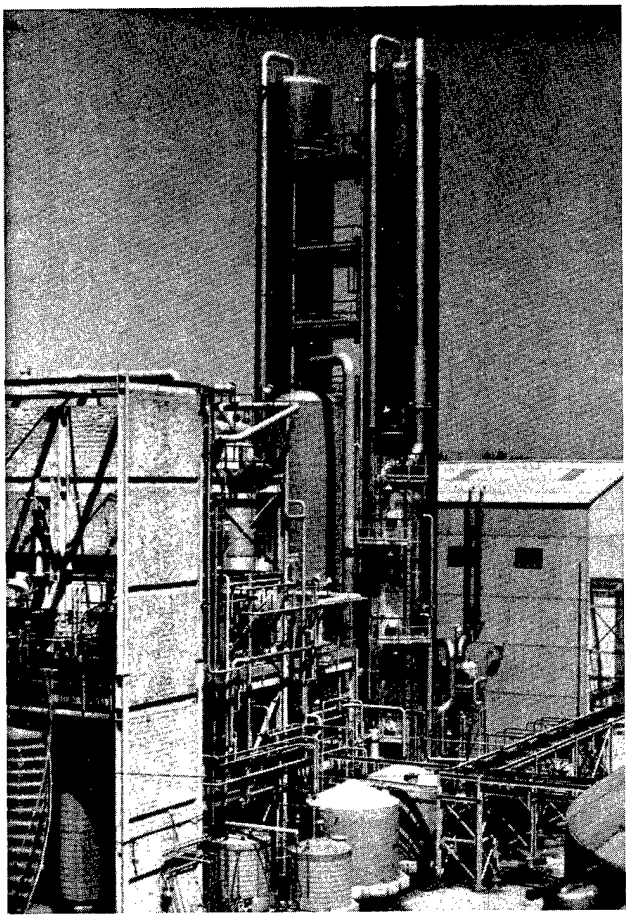
TABLE 11

POTENTIAL ENERGY CONSERVATION PROJECTS DEVELOPED (MOBILIZATION STATUS)

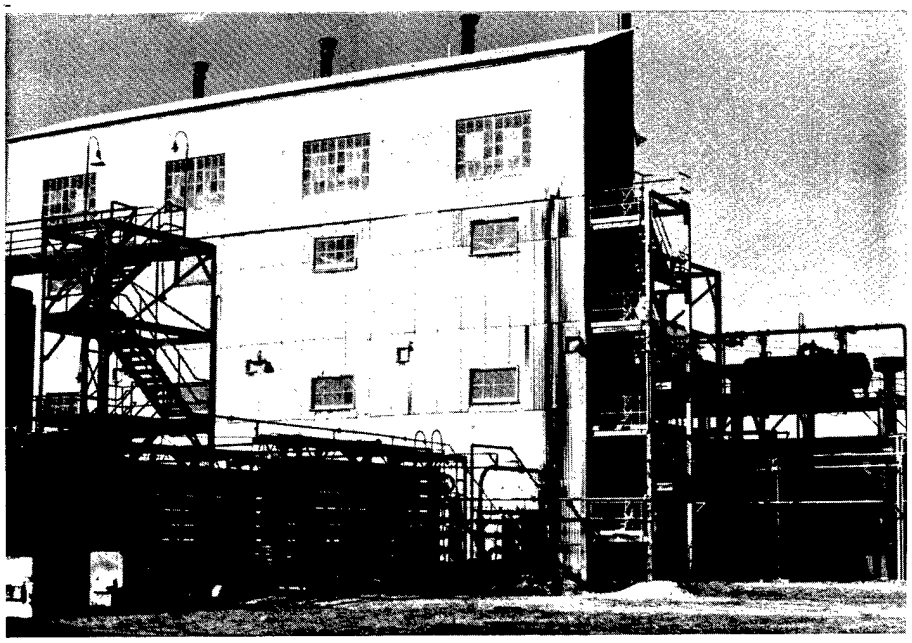
Project No.	Project Title	Annual MBTU Savings	Total Investment ($000)	First Year Dollar Savings ($000)	Total Discounted Savings ($000)	SIR
3-7	Install New Burners	26,140	$106	$152	$1,728	16.29
3-4	Install Heat Destratification Units	2,480	20	15	167	8.51
3-8	Install Strip Doors	1,240	5	7	32	6.33
3-1	Replace Lighting Fixtures and Lamps, Disconnect Fixtures	8,240	83	34	385	4.67
3-3	Insulate Roofs	2,810	45	16	186	4.12
3-2	Insulate Walls and Windows	3,410	74	20	225	3.04
3-6	Install Economizers	13,070	296	76	864	2.92
3-5	Replace Insulation on Steam Distribution	1,670	71	10	110	1.55
3-9	Weatherstrip Doors	400	24	2	26	1.08
	Total	59,460	$724	$332	$3,723	



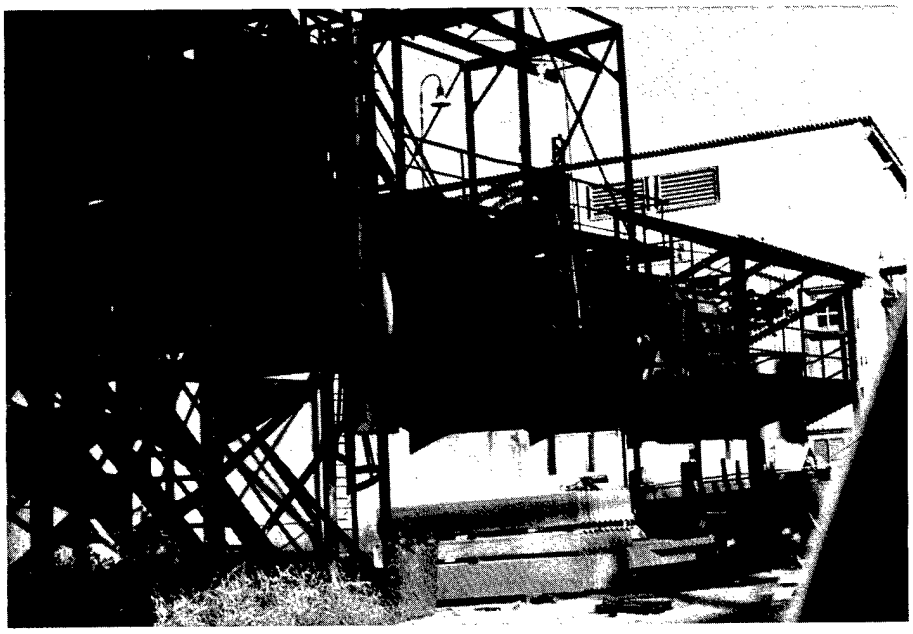
ACID PLANT 4
SULFURIC ACID CONCENTRATOR (SAR)



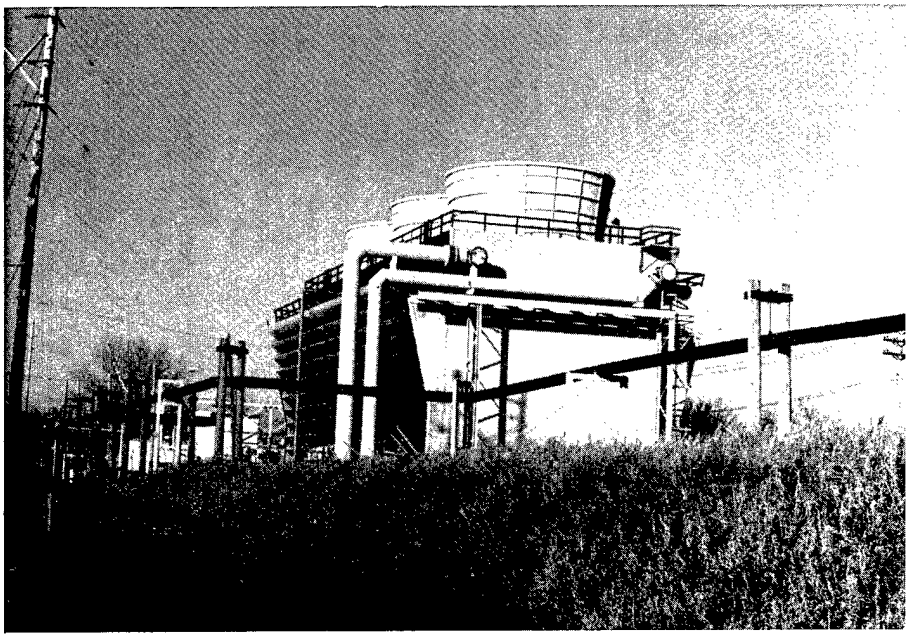
ACID PLANT 4
DIRECT STRONG NITRIC (DSN)



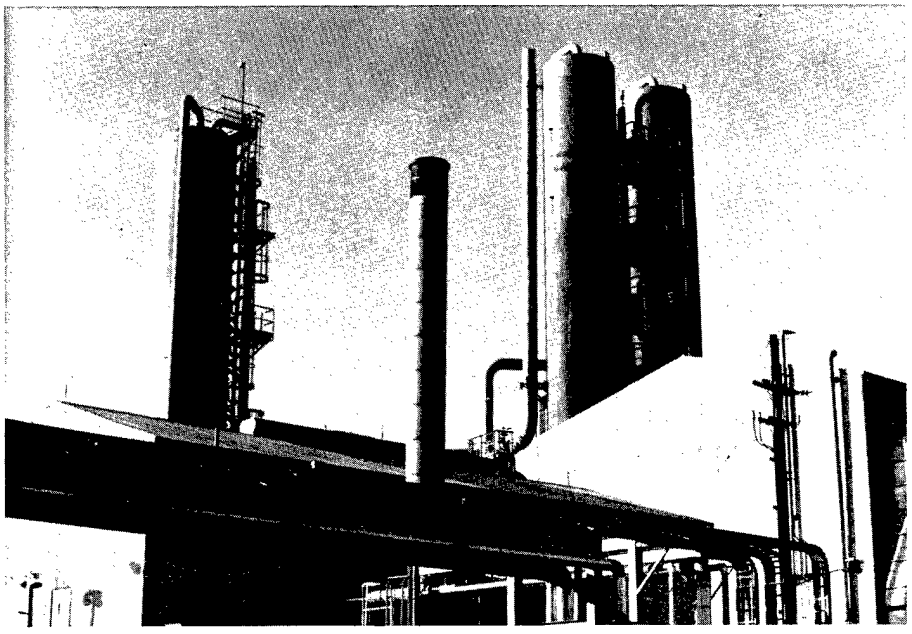
ACID PLANT 1
AMMONIA OXIDATION PLANT (AOP)



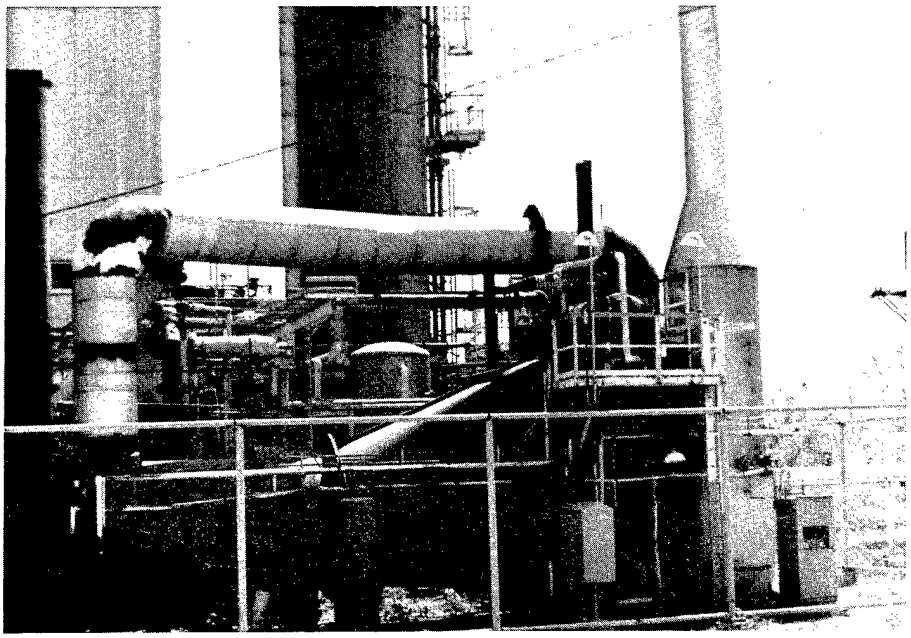
ACID PLANT 3
SULFURIC ACID CONCENTRATOR (SAC)



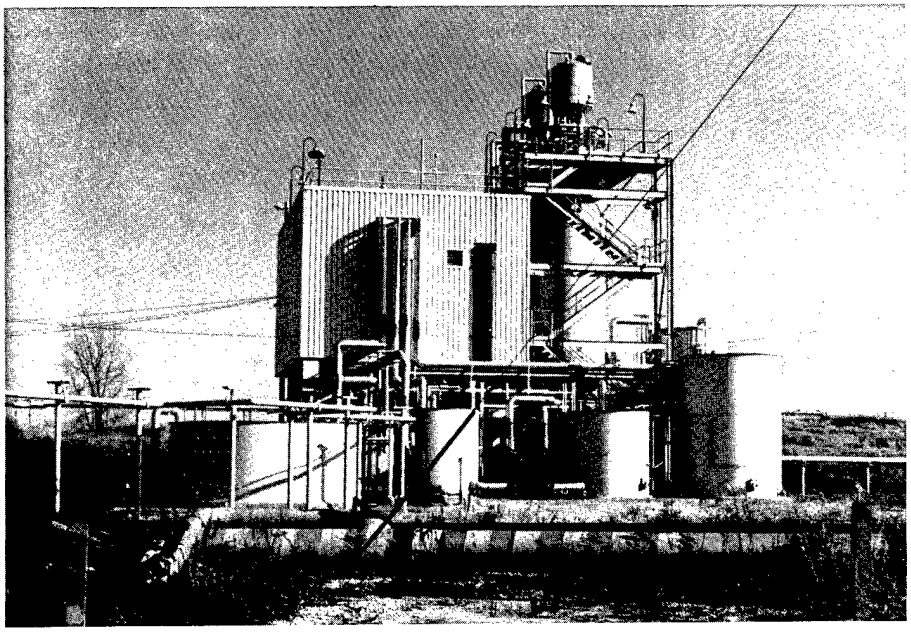
ACID PLANT 4
COOLING TOWER



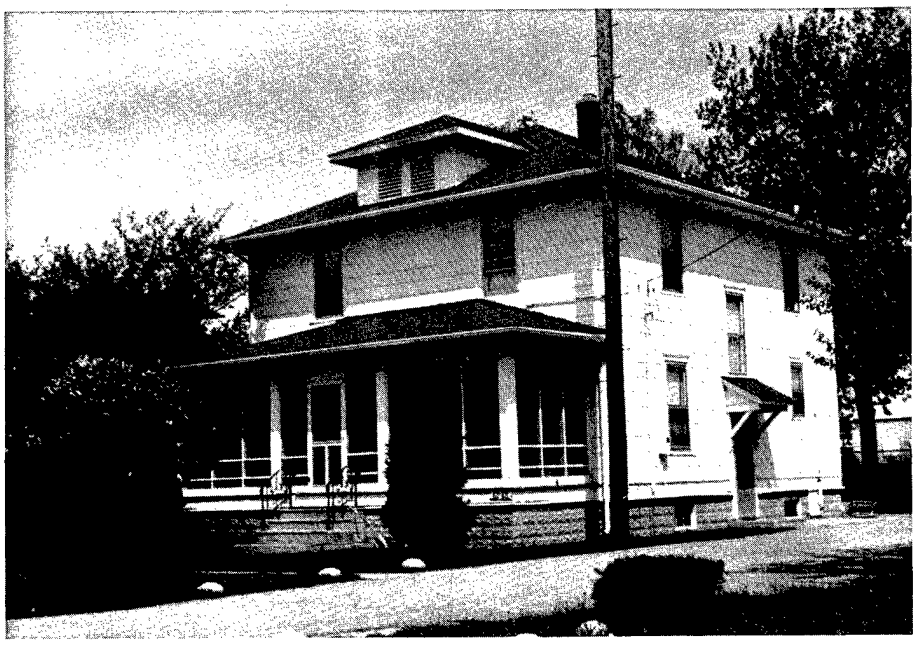
ACID PLANT 4
AMONMONIA OXIDATION PLANT (ADP) LEFT
DIRECT STRONG NITRIC (DSN) RIGHT



NEW TNT LINE
ACID FUME RECOVERY PLANT (AER)



CARBON ADSORPTION UNIT

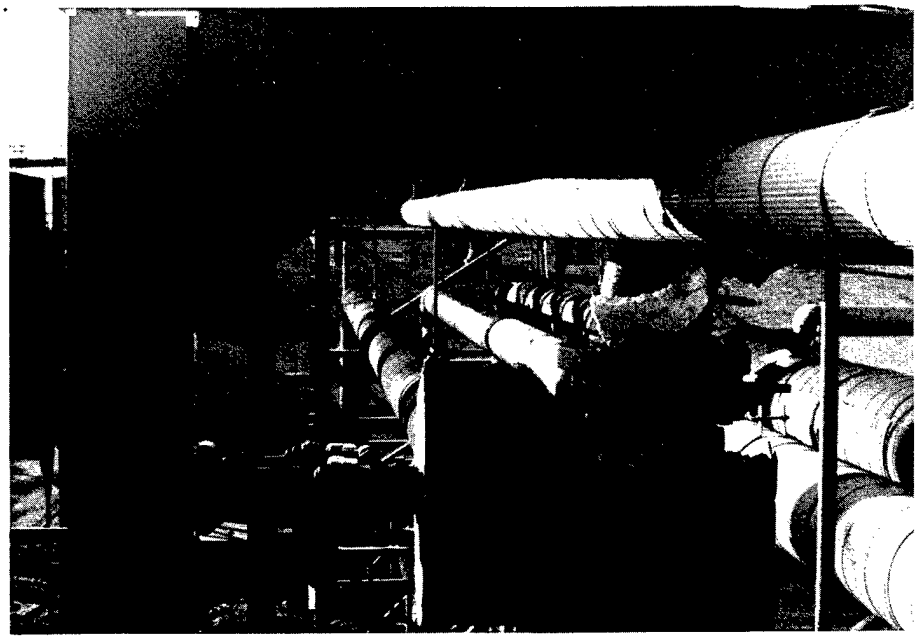


FAMILY HOUSING
WHITE CIRCLE AREA

FAMILY HOUSING
BROWN CIRCLE AREA

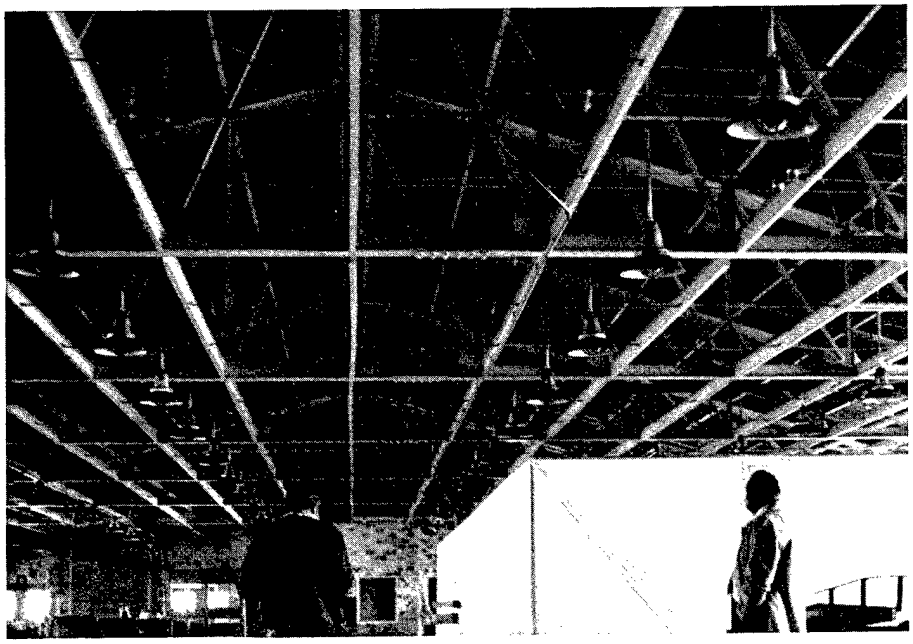
FAMILY HOUSING
WHITE CIRCLE AREA
PREFABRICATED HOUSING

FAMILY HOUSING
WHITE CIRCLE AREA
PREFABRICATED HOUSING

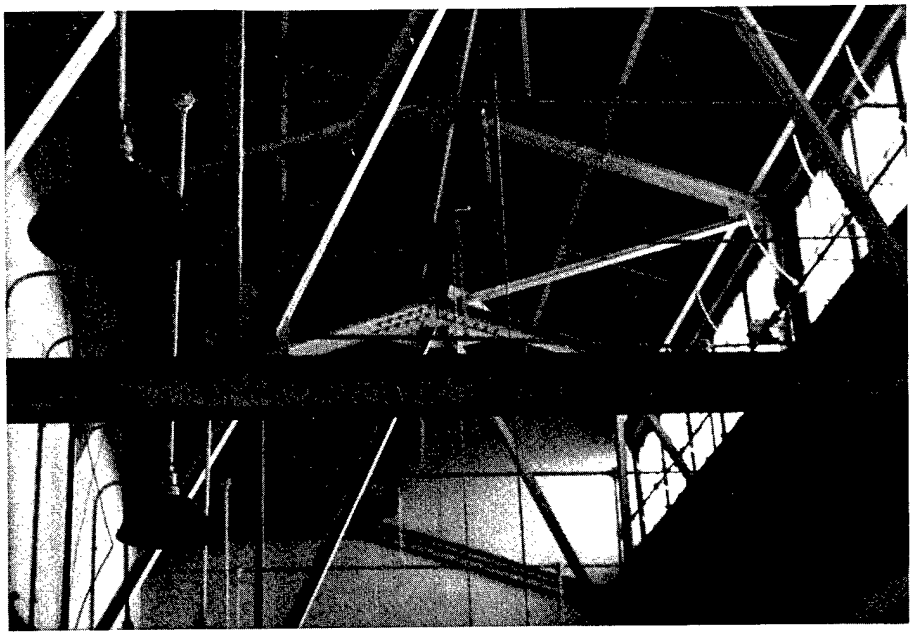


STEAM DISTRIBUTION SYSTEM
DAMAGED INSULATION

STEAM DISTRIBUTION SYSTEM
SUBSTANDARD INSULATION



BUILDING 10-A GROUP 3
LOWER CEILING HEIGHT, INSULATE, AND ADD STRIP DOORS



GROUP 3
OPPORTUNITY FOR HIGH BAY DESTRATIFICATION
AND INSULATION

DEFINITION OF TERMS

Beneficial Occupancy Date (BOD)

The date a facility begins to operate.

Benefit-To-Cost Ratio (BCR)

The dollar savings realized over the life of the project divided by the non-recurring capital investment (including design). BCR is a measure of project payback. A BCR of 1.0, for example, means that the project's initial capital investment will be recovered over its lifetime.

Cost Index

Comparison of Energy Cost Indices for various years giving a chosen base year a value of 100.

Current Working Estimate (CWE)

The project installation cost escalated to the year the project is programmed for implementation. Installation costs are non-recurring and include all labor and material, contractor costs, bond, contingency, SIOH, and escalation. Design costs are not included and must be added to the CWE to develop the total project cost.

Electrical Energy Index

Quantity of electricity per square foot of building area.

Electricity Cost Index

Electricity cost comparison for various years using a base year with an assigned value of 100.

Electricity Index

Comparison of Electrical Energy Indices for various years to a chosen base year.

Energy Conservation and Management (ECAM)

Military funded program for retrofitting existing DOD facilities to make them more energy efficient.

Energy Conservation Measures (ECM)

Programs to conserve energy and/or costs through energy/ manpower reductions.

DEFINITION OF TERMS (CONT'D)

Energy Cost

Cost of Source Energy Consumed (obtained from utility bills).

Energy Cost Index

Energy cost per square foot of building.

Energy Monitoring and Control System (EMCS)

This is a computer-based control system used to achieve energy dollar savings through automatic control of building heating, ventilating and air conditioning (HVAC) systems. This includes implementation of various energy conservation measures, such as programmed equipment shutoff, programmed outside air shutoff, and equipment optimization, to reduce the total energy consumption of individual buildings, reduce energy distribution system losses and improve HVAC system capability.

Energy-To-Cost Ratio (ECR)

The MBTU's per year saved divided by the non-recurring capital investment (excluding design). ECR is a measure of the amount of energy savings related to the required capital investment. Acceptable ECR's should be lower each year since energy costs escalate faster than capital investment costs.

Fuels Energy Index

Ratio of BTU's of fuel consumed to the square footage of the base.

Heating Degree Days

Total number of degree days based on 65°F.

High Temperature Hot Water (HTW)

A hot water heat transfer system generally using water above 350°F.

Laid-Away Status

Inactive buildings or equipment that are maintained in a state of readiness for mobilization.

Medium Temperature Hot Water (MTW)

A hot water heat transfer system generally using water between 230°F and 350°F.

DEFINITION OF TERMS (CONT'D)

Mobilization Status

Period when the plant is operating at full production level.

Savings Investment Ratio (SIR)

The total net discounted savings divided by the total investment, in accordance with ECIP Guidance, dated 6 August 1982.

Simple Amortization Period (SAP)

The project capital investment divided by the yearly savings. This yields the period of time required to recover the initial capital investment.

Source Electricity Energy

Total amount of electricity purchased or total amount produced before line and efficiency losses.

Source Energy Consumed

Sum of fuels consumed and electricity used (includes all fuels such as heating oil, diesel fuel, natural gas, propane, coal, etc.).

Source Energy Index

Ratio of BTU's source energy consumed to square footage of the base.

Source Index

Comparison of the Source Energy Indices for various years giving a chosen base year a value of 100.

Standby Status

Active of laid-away buildings or equipment used to maintain the plant at a reduced production level in readiness for mobilization.

Total Installed Cost (TIC)

The sum of the CWE and the design costs.