Final Submission

Executive Summary

Twin Cities Army Ammunition Plant

New Brighton, Minnesota

Steam/Power Plant Modernization Program

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

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
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PHONE 215/326-4600. CABLE: SANTOM, TELEX 84-6430.

December 20, 1982

U.S. Army Corps of Engineers
Omaha District
6014 U.S. Post Office and Court House
Omaha, NE 68102

Attention: MROED-MC

Reference: Steam/Power Plant Modernization Study
(Modified Increment E),
Twin Cities Army Ammunition Plant,
New Brighton, Minnesota

Subject: Final Submission

Contract No.: DACA45-80-C-0090

Our Job No.: 05-4660

Gentlemen:

Enclosed is the Final Submission of the Steam/Power Plant Modernization Study at the Twin Cities Army Ammunition Plant.

The Study consists of four volumes: (1) Executive Summary, (2) Report, (3) Appendix I: Calculations, and (4) Appendix II: Computer Output.

The Study presents approaches to meeting TCAAP's demands during peacetime and mobilization periods. The recommended plan represents a technically practical approach to converting the TCAAP steam/power plant to burn coal and satisfies the intent of the Army's energy goals.

This plan represents a combined effort of Sanders & Thomas and various Army departments. We wish to thank all who were involved in the preparation and review of this report.

Thank you for this opportunity to be of continued service.

Very truly yours,

SANDERS & THOMAS, INC.

David M. Jonik, P.E.
Project Manager

DMJ:llr

Final Submission

Executive Summary

Twin Cities Army Ammunition Plant

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PROJECT ABSTRACT

This study is to develop a cost-effective and technically practical modernization program for the steam/power plants at the Twin Cities Army Ammunition Plant (TCAAP) while meeting the intent of the Army energy goals of reduced dependence on oil and natural gas.

The recommended modernization approach is to provide new coal-fired boilers complete with required auxiliary equipment in an addition to Building 515. One existing oil-fired boiler in Building 515 will be converted to burn coal. This approach will satisfy facility steam requirements from peacetime through mobilization demands. Upon completion of construction the remaining boilers in Building 115 and 515 will be abandoned in-place.

Total expenditures required to complete this modernization program are $59 million in FY 1982 dollars or $69 million in actual dollars. Funding allocations are anticipated for FY 1985 through FY 1989.

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EXECUTIVE SUMMARY

Project Requirements and Objectives

The purpose of this study is to develop a cost-effective and technically practical modernization program for the steam/power plants at the Twin Cities Army Ammunition Plant (TCAAP), New Brighton, Minnesota. The objective is to reduce dependence on oil and natural gas.

The program plan presents that method which is consistent with present Army energy goals, is technically feasible, and meets peacetime and mobilization energy requirements.

The plant life-cycle analysis is based on a 25-year life with the period from 1950 to 1975 used as a representative life-cycle for peacetime and mobilization periods. This cycle includes a five-year and seven-year mobilization period.

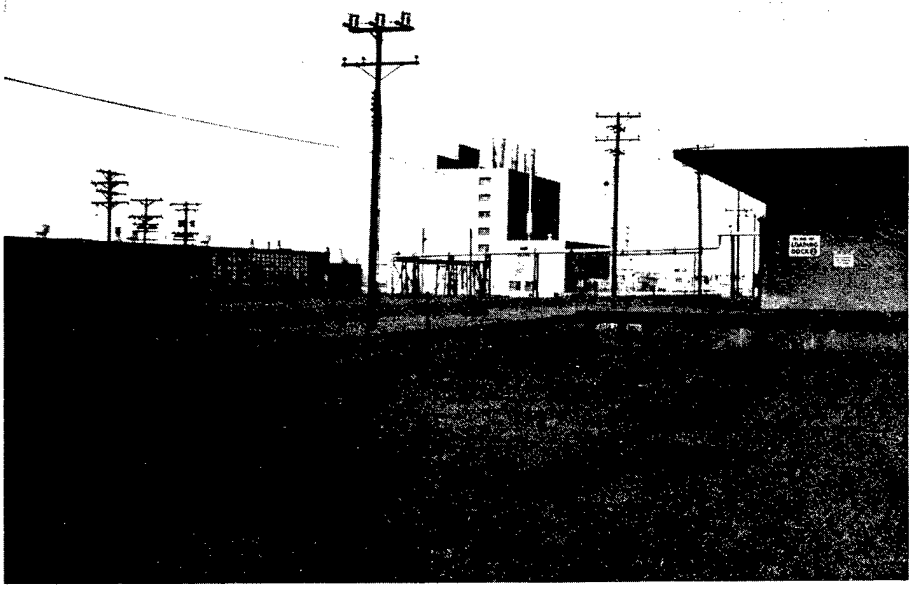
The study considers both technical and economic criteria in developing the final recommended modernization program.

Background

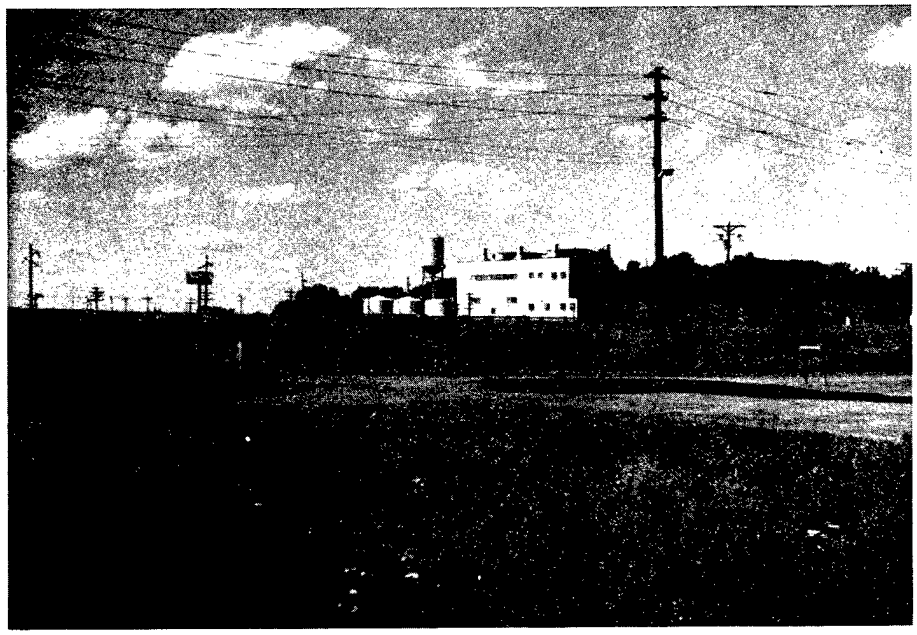
TCAAP is located approximately five miles north of the Twin Cities of Minneapolis and St. Paul. Figure 1: Location Map, shows the plant's location in the Twin Cities Area. The plant is bordered by County Road I to the north, Trunk Highway No. 96 to the south, Lexington Avenue to the east, and Trunk Highway No. 35W and No. 10 to the west.

TCAAP presently has 262 enclosed buildings with a total floor area of about 4.38 million square feet. Most of the buildings were constructed in the early 1940's and were active during World War II, Korea, and Vietnam. Figure 2: Site Map, shows the key features of the plant.

Steam for the entire facility is produced by two interconnected boiler plants in Building 115 and Building 515. The combined capacity of both plants is 555,000 lb/Hr. Each building contains three natural gas and oil-fired boilers installed in 1941 and 1942. The plant is served by an aboveground steam distribution system.



STEAM GENERATING PLANT
BUILDING 115



STEAM GENERATING PLANT
BUILDING 515

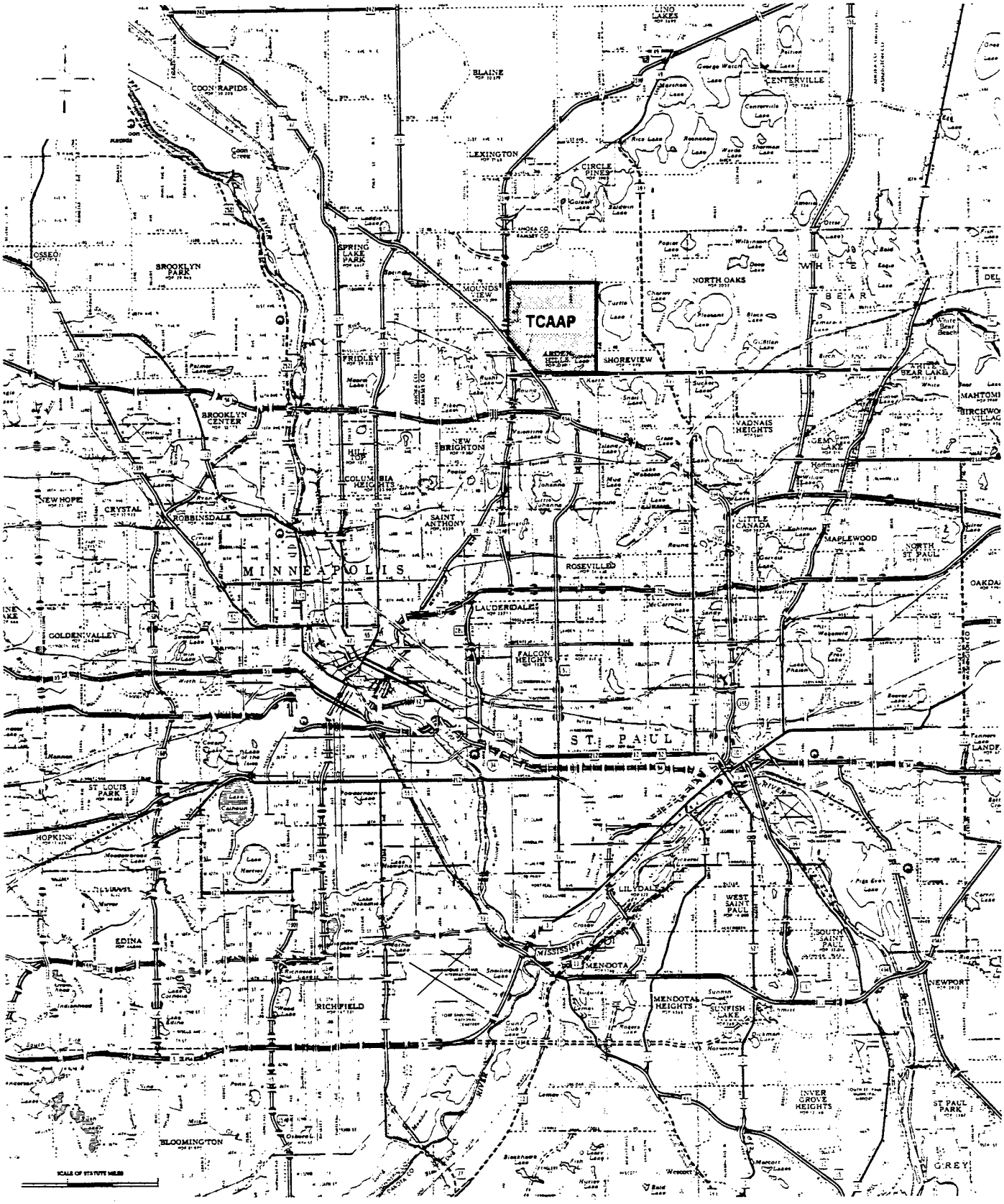


FIGURE 1
TWIN CITIES ARMY AMMUNITION PLANT
LOCATION MAP

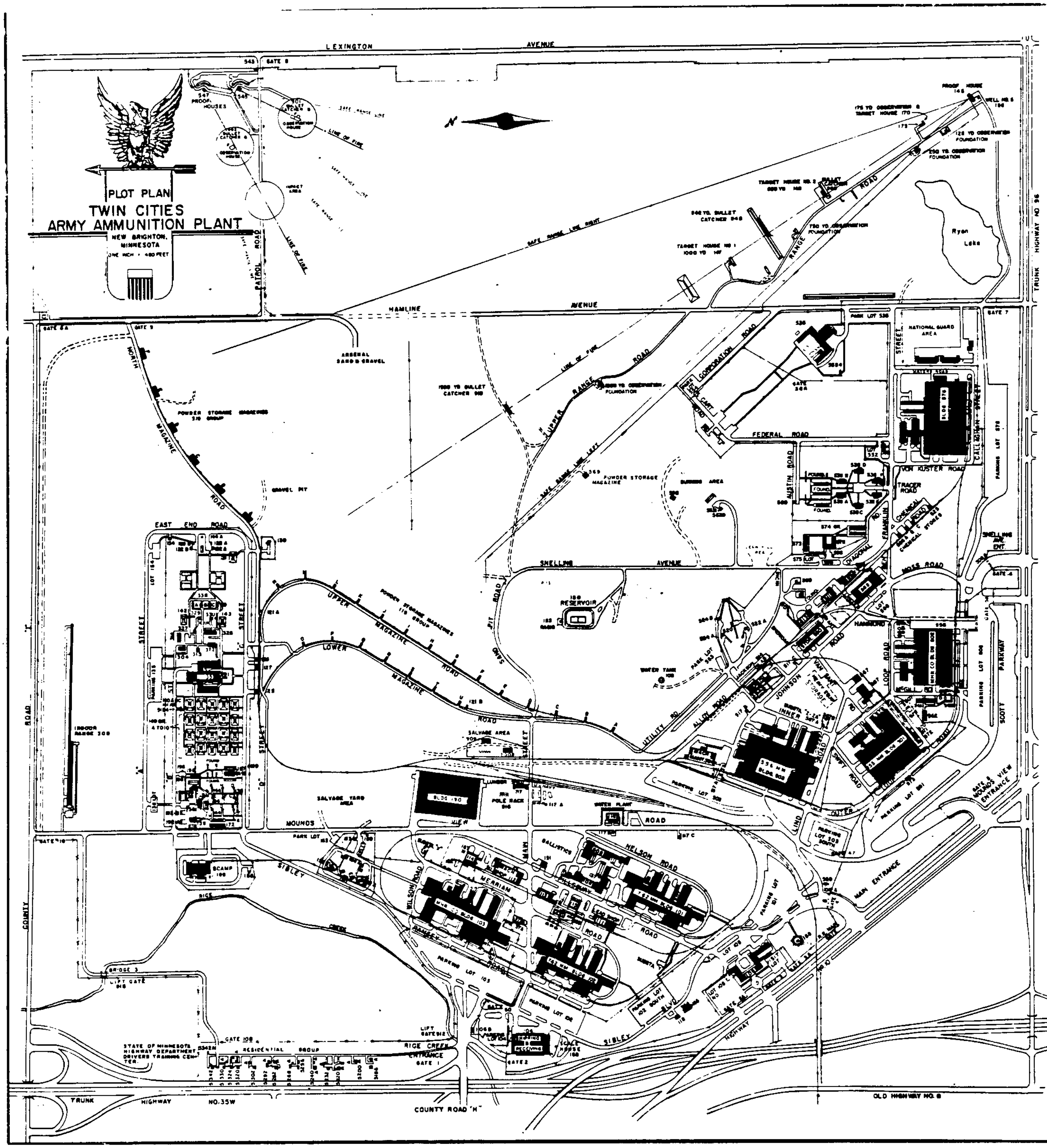


FIGURE 2
TWIN CITIES ARMY AMMUNITION PLANT
SITE MAP

Analysis Method

Planning the TCAAP modernization program involved analyzing plant energy use in both existing and proposed plant configurations. Existing configuration energy use is based on historical fuel consumption records extrapolated to future requirements. Energy use for the plant in its proposed configuration is projected based on historical records, previous technical reports and studies, and operating modes. Energy consumption profiles are then developed to determine the proposed plant configuration and size. Economic factors related to the proposed plant configuration are then used as an input to the Life-Cycle Cost Analysis.

The study involved assembling the data base to develop a load profile for peacetime and mobilization periods. Existing equipment was analyzed and evaluated to detemine the need for physical improvement. Various energy systems were considered with the final selection based on anticipated load centers, effective distribution systems, and site access. Other factors including heat transfer mediums, cogeneration, potential fuels, and combustion techniques were also examined.

A comprehensive life-cycle analysis was performed for the selected methods, which were then ranked in ascending order of capital cost and life-cycle costs. A sensitivity analysis was performed to determine the impact of key parameters on the life-cycle costs.

Regulatory Requirements

All applicable Federal, State, Army and Department of Defense regulations have been complied with in preparing this study and its recommendations.

Energy Requirements/Modes of Operation

Energy requirements in pounds per hour of steam were established for peacetime and mobilization, as detailed in Figures 3 and 4. The study considered the effects of plant activity levels and their relationship to the heat generating facilities, and developed the optimum heating plant arrangement to furnish energy for peacetime and mobilization requirements.

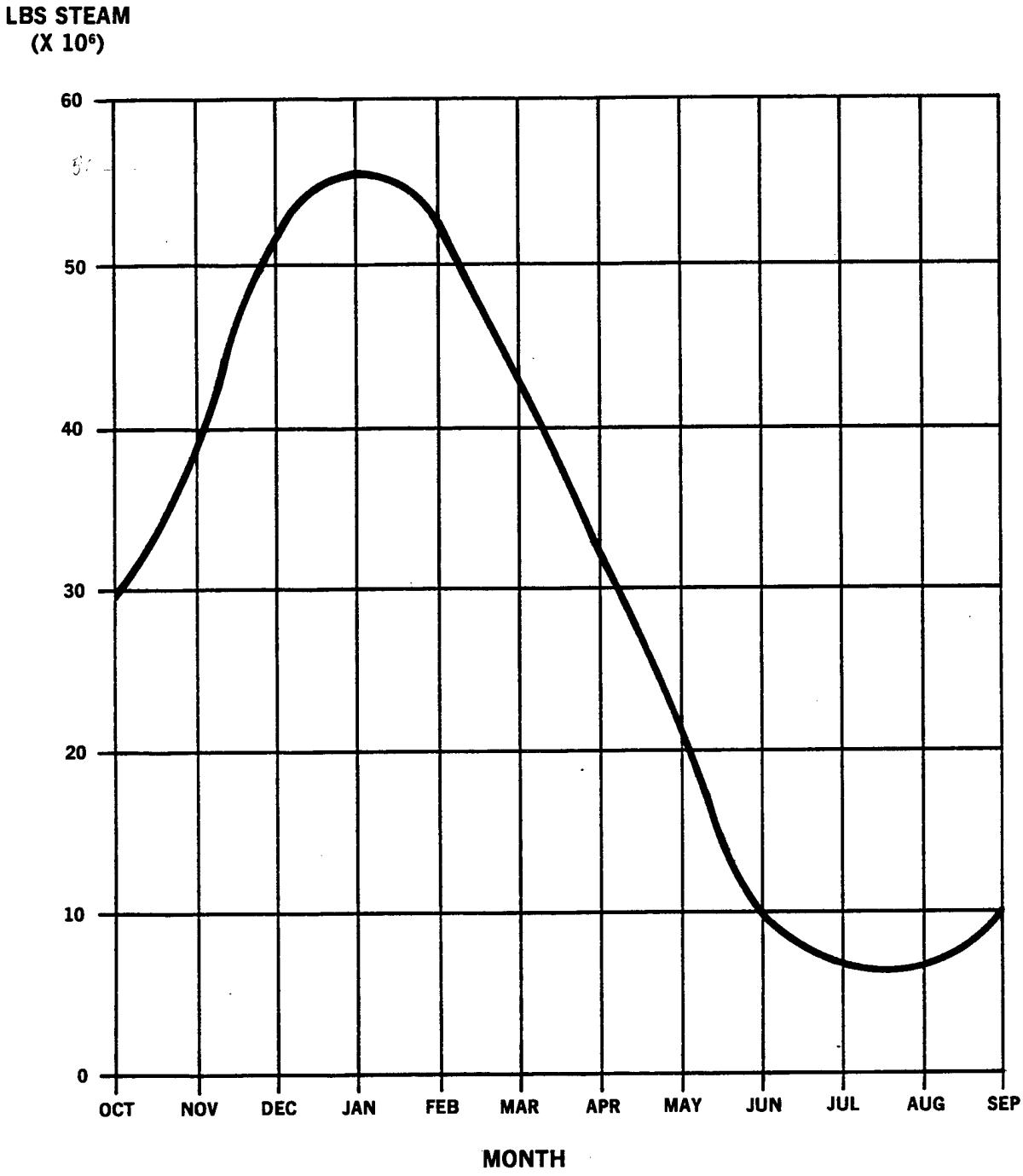


FIGURE 3
ANNUAL PEACETIME STEAM
DEMAND

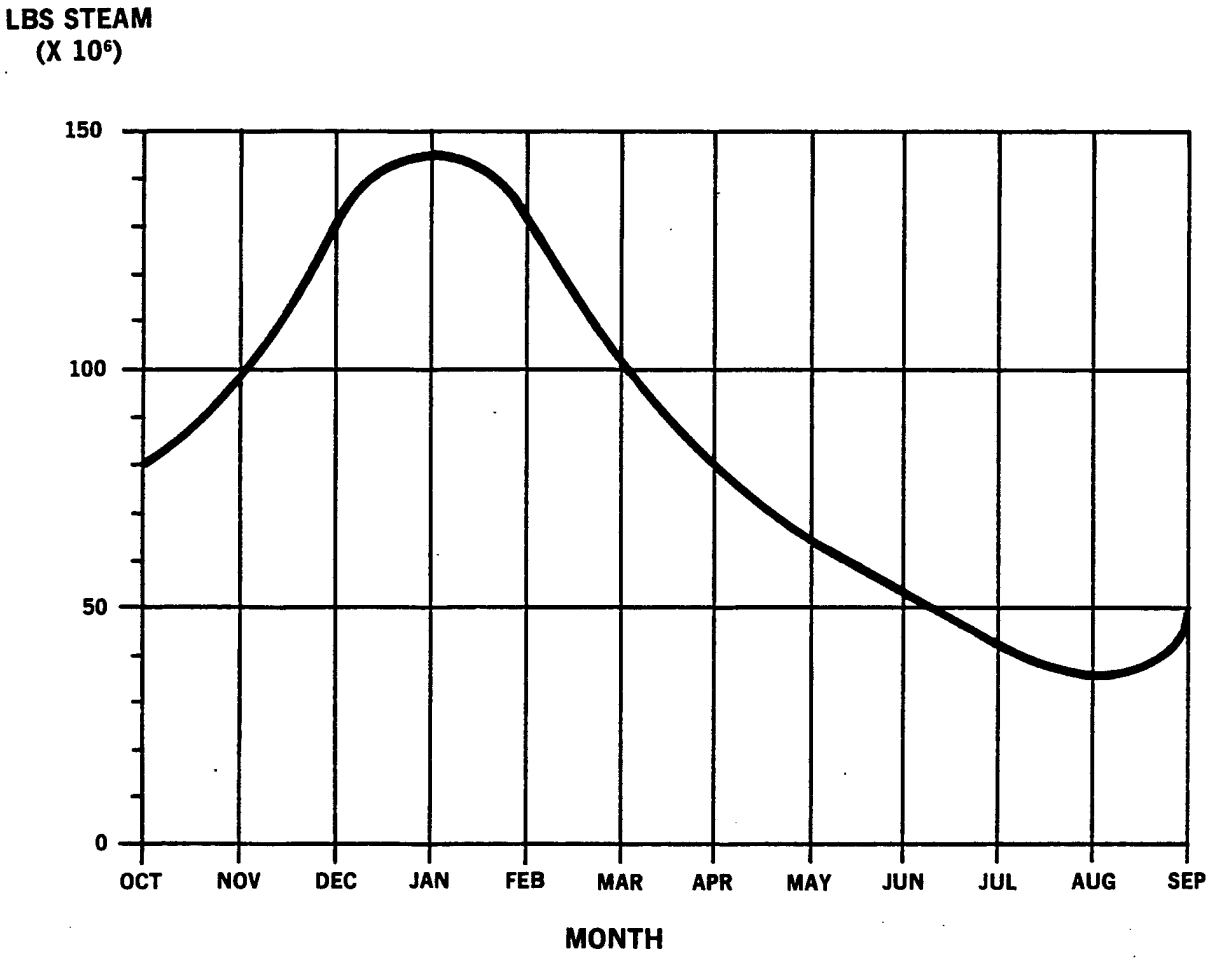


FIGURE 4
ANNUAL MOBILIZATION STEAM
DEMAND

The summary energy requirements are as follows:

Steam Requirement (lbs/Hr)

Status	Peak Hour	Peak Month	Yearly Total
Mobilization	242,000	145,881,000	1,022,100,000
Peacetime	96,000	55,831,000	359,625,000

Emerging Technologies

The study examined the applicability of using emerging technologies to produce steam for process and heating. Coal gasification, fluidized bed combustion, and refuse-derived fuels were considered for applicability. Fluidized bed combustion was recommended for further study.

Fuel Selection

Coal and biomass were evaluated as candidate fuels with Montana coal selected as the preferred solid fuel.

Heat Generation Methods Considered

Five possible heat generation methods were considered: Construct New Coal-Fired Central Steam Plant, Construct New Coal-Fired Central HTW Plant, Install New Coal-Fired Steam Generating Equipment in Boiler Plant 515 Maintaining Fuel Oil-Fired Boilers, Convert Boiler Plant 515 to Fire Coal Expanding Capacity to Meet Mobilization Requirements, and Modernize Existing Equipment and Continue Firing Present Fuel.

The above methods were assessed and four were selected for detailed technical and economic analysis. The New Coal-Fired Central HTW Plant was not selected because of high capital costs which would make this method economically infeasible.

The four methods evaluated are shown below and are ranked in order of ascending life-cycle and initial capital costs.

Rank	Method	Description	Life-Cycle Cost	Initial Capital Cost ($1982)
1	D	Modernize Existing Equipment and Continue Firing Present Fuel	$49,890,000	$ 2,530,000
2	B	Install New Coal-Fired Steam Generating Equipment in Boiler Plant 515 Maintaining Fuel-Oil Fired Boilers	$50,980,000	$38,200,000
3	C	Convert Boiler Plant 515 to Fire Coal Expanding Capacity to Meet Mobilization Requirements	$60,640,000	$50,900,000
4	A	Construct New Coal-Fired Central Steam Plant	$64,500,000	$56,300,000

Of the four methods, Method A is eliminated due to its high initial capital and life-cycle costs. Methods B and D require use of petroleum fuels and natural gas, which is contrary to the intent of present Army energy policies to reduce dependence on these fuels. Method C is therefore selected as the preferred acceptable method.

Recommended Plan

Method C — Convert Boiler Plant 515 to Fire Coal Expanding Capacity to Meet Mobilization Requirements, is the recommended plan. This method is consistent with the intent of present Army energy policy to reduce dependence on petroleum and natural gas. TCAAP's readiness posture can be maintained during construction by continued reliance on the existing steam generating facilities in Building 515 and 115, which have sufficient capacity to meet peacetime and mobilization requirements. The recommended plan is shown on Figure 7: Plan and Section, and Figure 8 : Flow Diagram. Figure 9: Site Plan, shows the location of these improvements.

Cogeneration and Emergency Power

The plant's heating load consumes about 90 percent of the total steam produced during peacetime operation. Therefore co-generation would only be feasible during winter months.

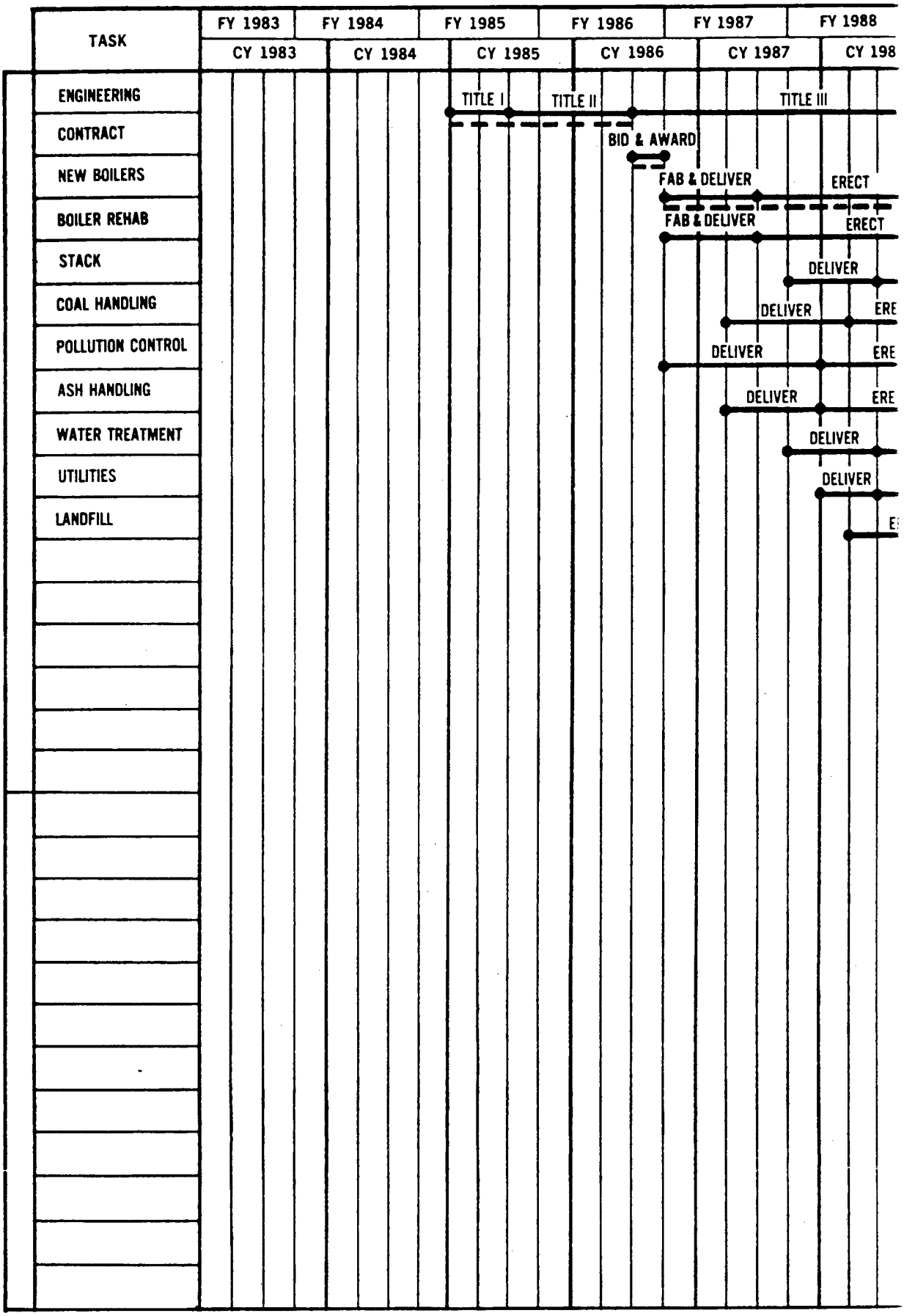
The distributed emergency power generation system is recommended as the preferred system over the central emergency power generation system because of its lower capital cost and greater system flexibility.

Program Plan Implementation

The overall project schedule showing the program plan appears in Figure 5: Program Schedule. This schedule does not reflect any governmental funding constraints for the defined projects. Government procurement regulations have been followed in determining the schedule.

Funding Profile

The funding profile on Figure 6 shows that the total installed cost for the recommended method is about $59 million in 1982 dollars. In actual dollars the total expenditure is $69 million.


TASK
FY 1983
FY 1984
FY 1985
FY 1986
FY 1987
FY 1988
CY 1983
CY 1984
CY 1985
CY 1986
CY 1987
CY 198
ENGINEERING
CONTRACT
NEW BOILERS
BOILER REHAB
STACK
COAL HANDLING
POLLUTION CONTROL
ASH HANDLING
WATER TREATMENT
UTILITIES
LANDFILL
TITLE I
TITLE II
TITLE III
BID & AWARD
FAB & DELIVER
ERECT
FAB & DELIVER
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(1)

FIGURE 5
TWIN CITIES ARMY AMMUNITION PLANT
PROGRAM SCHEDULE

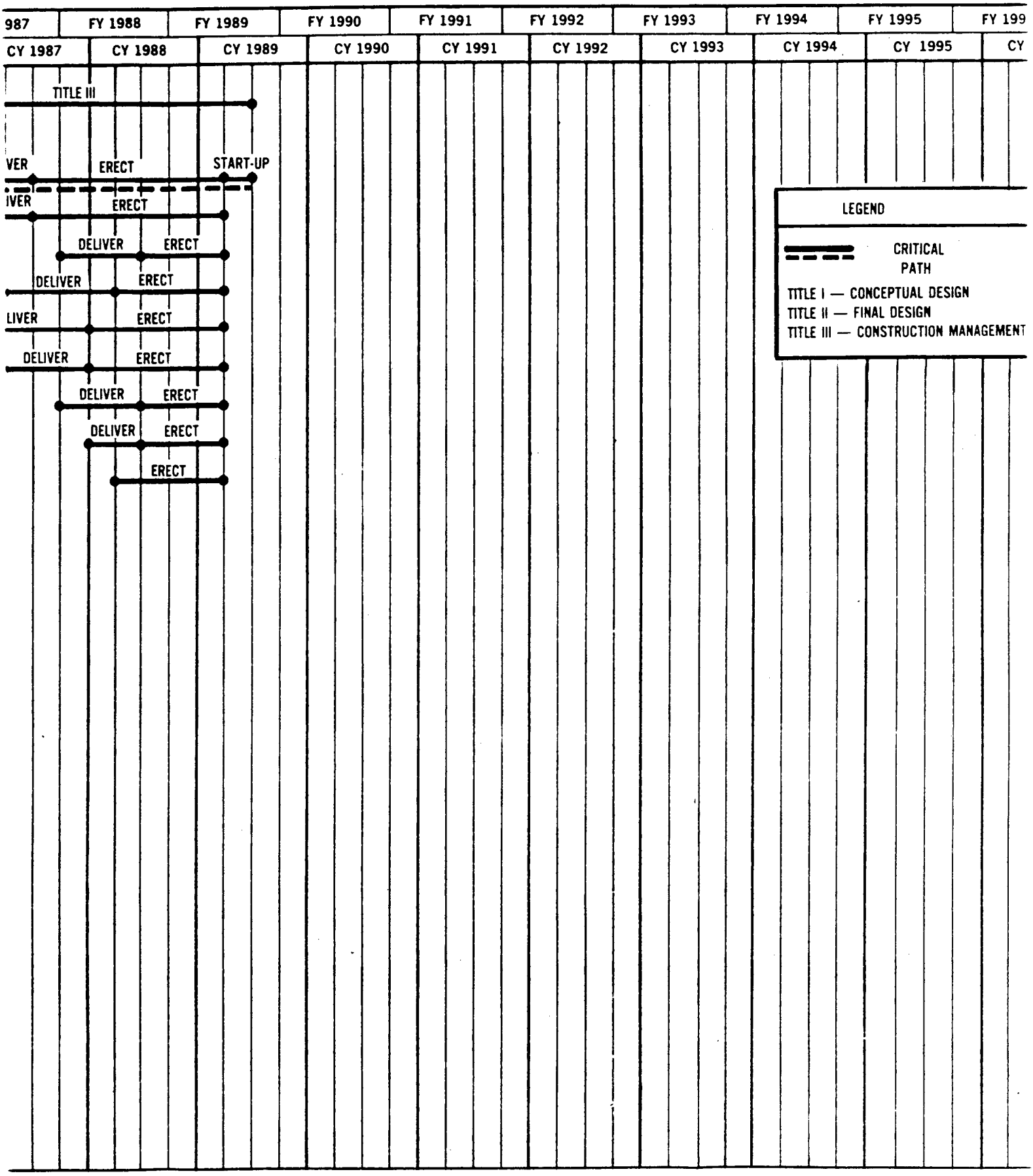
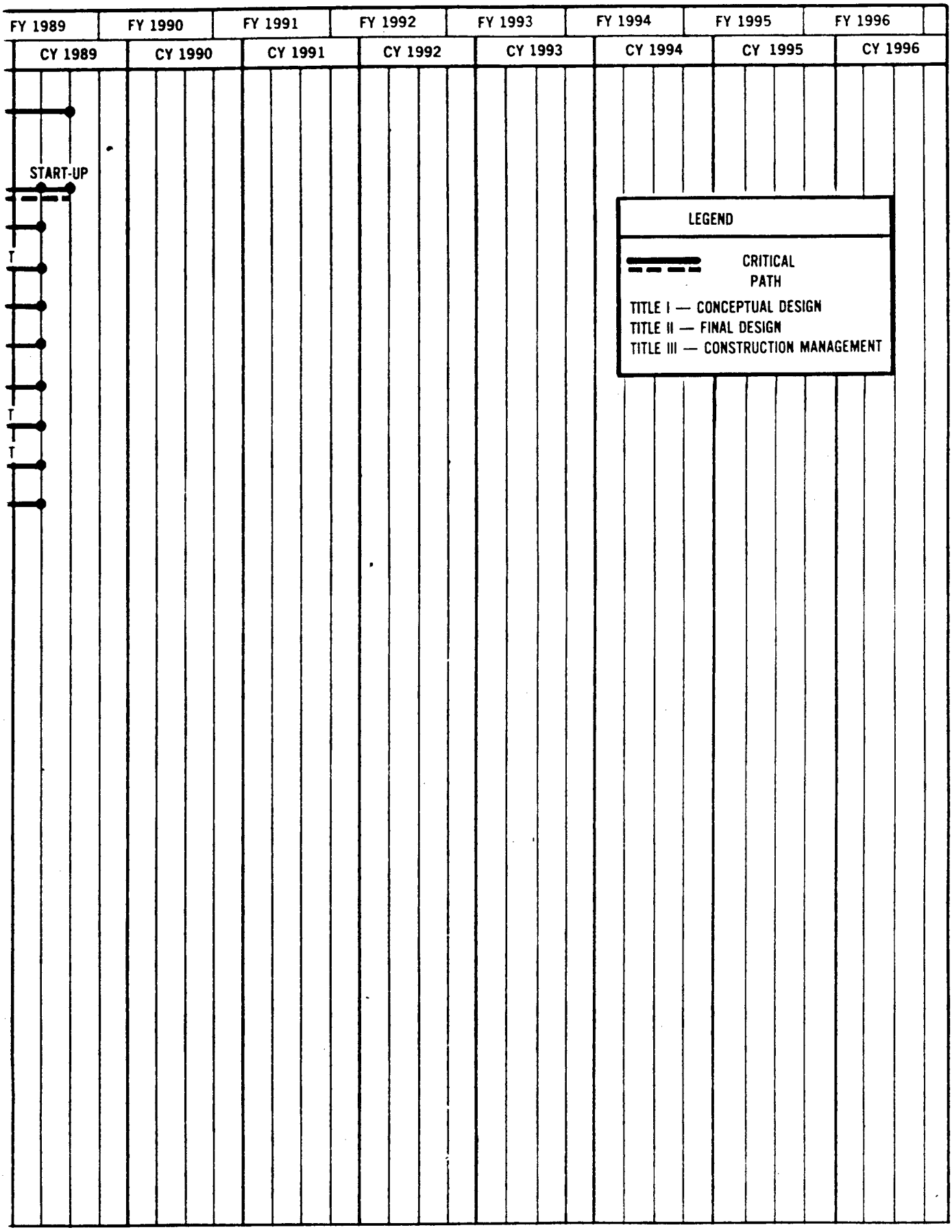


FIGURE 5
ARMY AMMUNITION PLANT
OGRAM SCHEDULE



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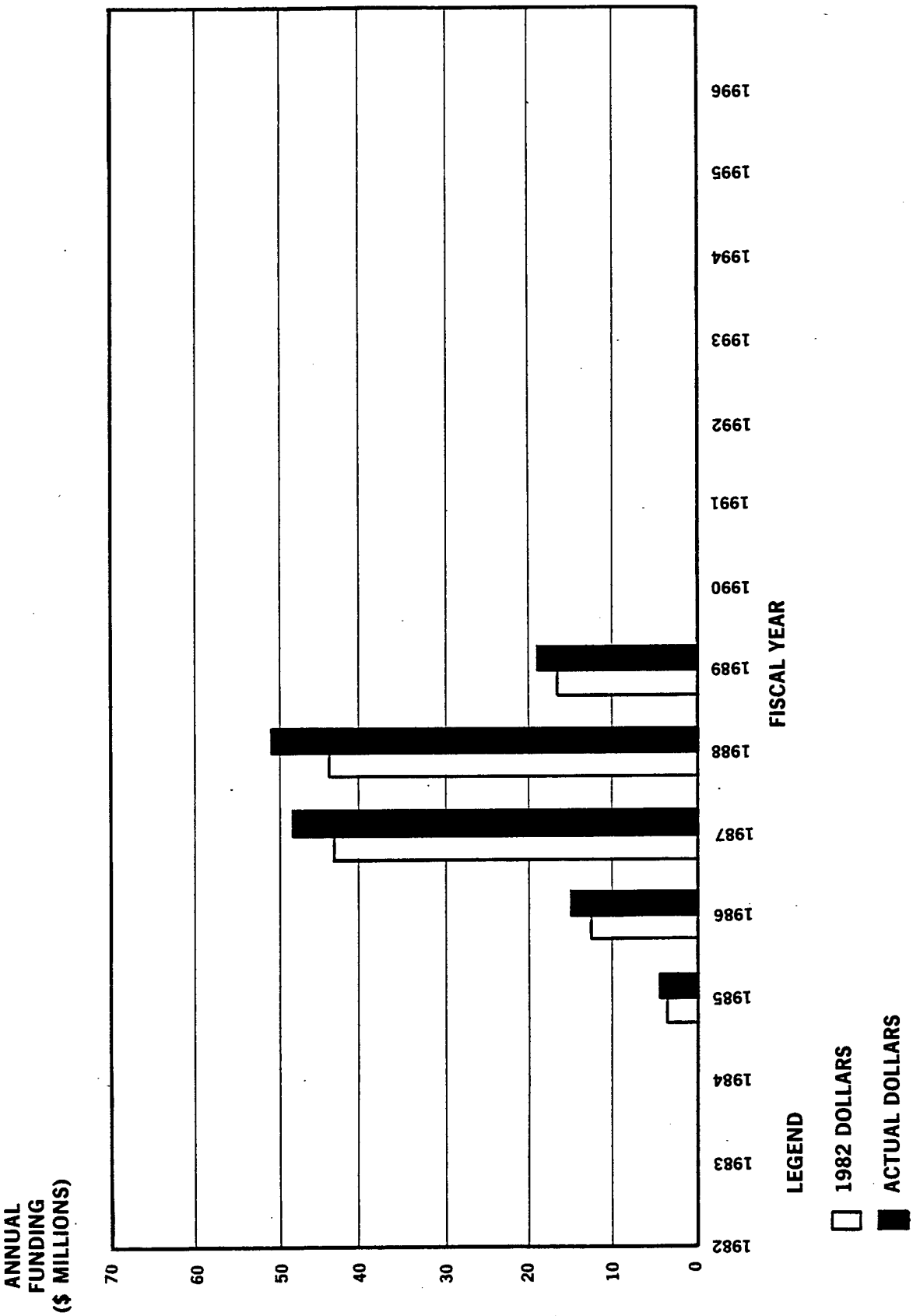
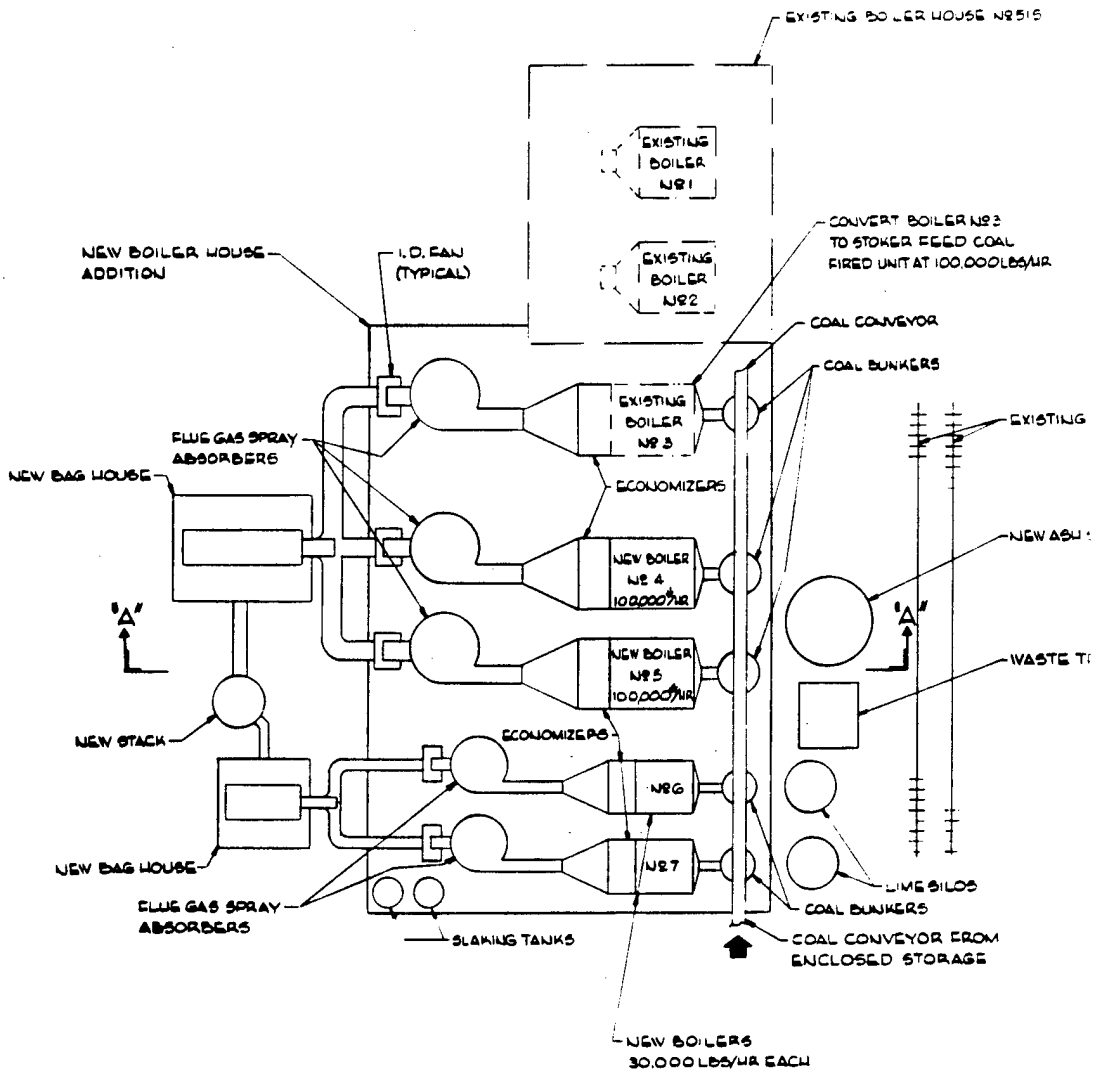


FIGURE 6
FUNDING PROFILE
TWIN CITIES ARMY AMMUNITION PLANT



B-515 ADDITION

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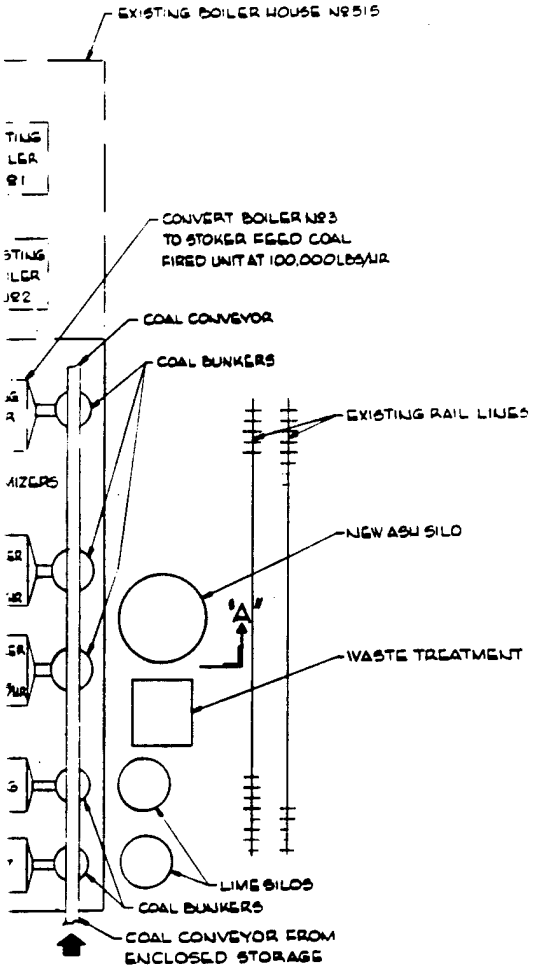
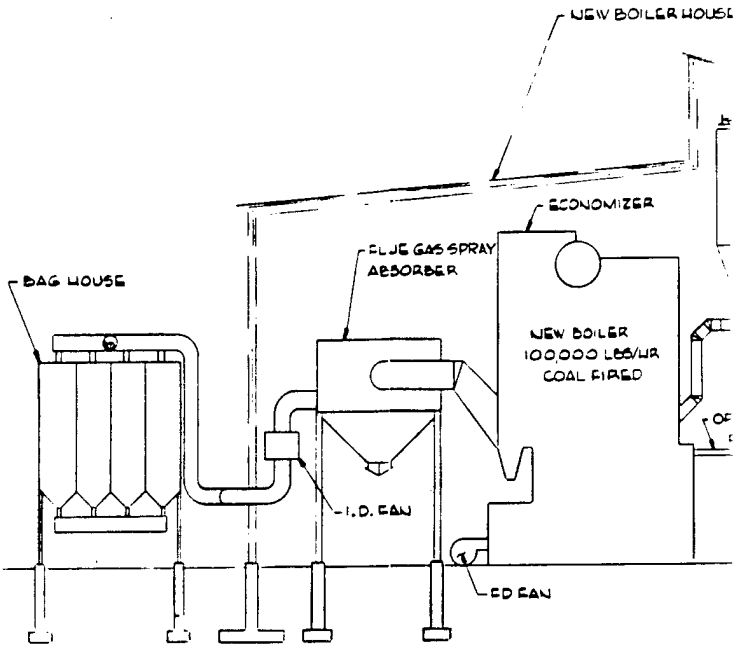


BOILERS
00 LBS/HR EACH



SECTION 'A-A'
SCALE: NONE

METHOD "C"

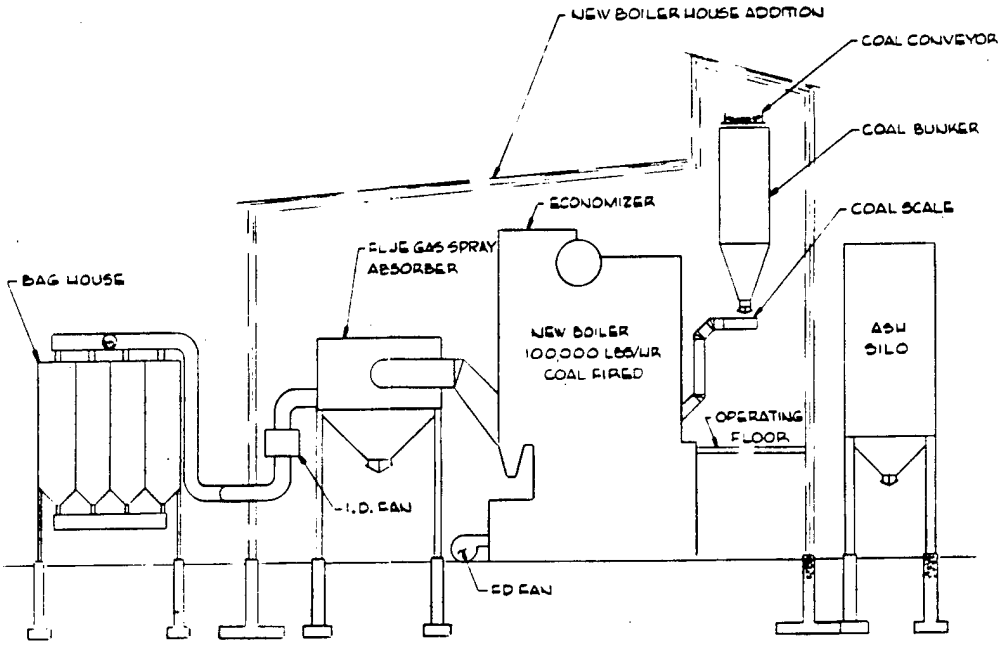
SANDERS & THOMAS, I

DESIGNED BY: EMJ
DRAWN BY:
CHECKED BY: DPC
SUBMITTED BY:
ARCHITECT-ENGINEER
RECOMMENDED:
CHIEF, DESIGN BRANCH
APPROVED:
CHIEF, ENG
APPROVED:
FOR: D. E. DISTRICT ENGINEER

STEAM PO
TWIN CITIES
PLAN
STEA

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO. DACA45
MODIFICATION NO.



SECTION 'A-A'

SCALE: NONE

METHOD "C"

DATE	DESCRIPTION	MADE	APPRD

REVISIONS

SANDERS & THOMAS, INC.
CONSULTING ENGINEERS

U. S. ARMY ENGINEER DISTRICT
OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: E.M.J.
DRAWN BY:
CHECKED BY: D.P.C.
SUBMITTED BY:
ARCHITECT-ENGINEER
RECOMMENDED:
CHIEF, DESIGN BRANCH
APPROVED:
CHIEF, ENGINEERING DIVISION
FOR: U. S. DISTRICT ENGINEER

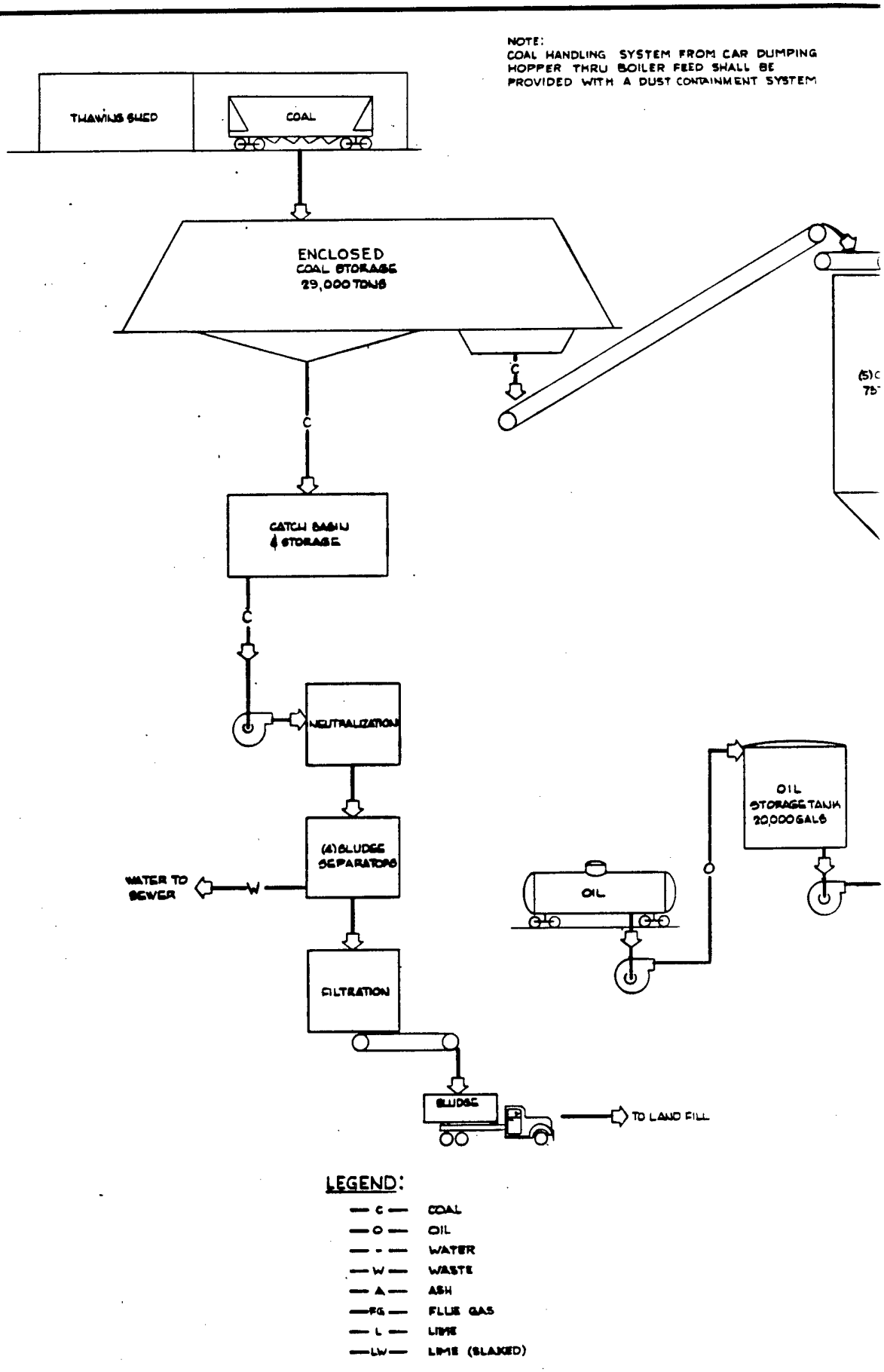
STEAM POWER PLANT MODERNIZATION
TWIN CITIES ARMY AMMUNITION PLANT
PLAN & SECTION NEW COAL FIRED
STEAM PLANT - BUILDING 515

DATE: JULY 14, 1982
SCALE: AS SHOWN
SPEC. NO. DACA45
DRAWING NUMBER
SHEET: FIGURE 7

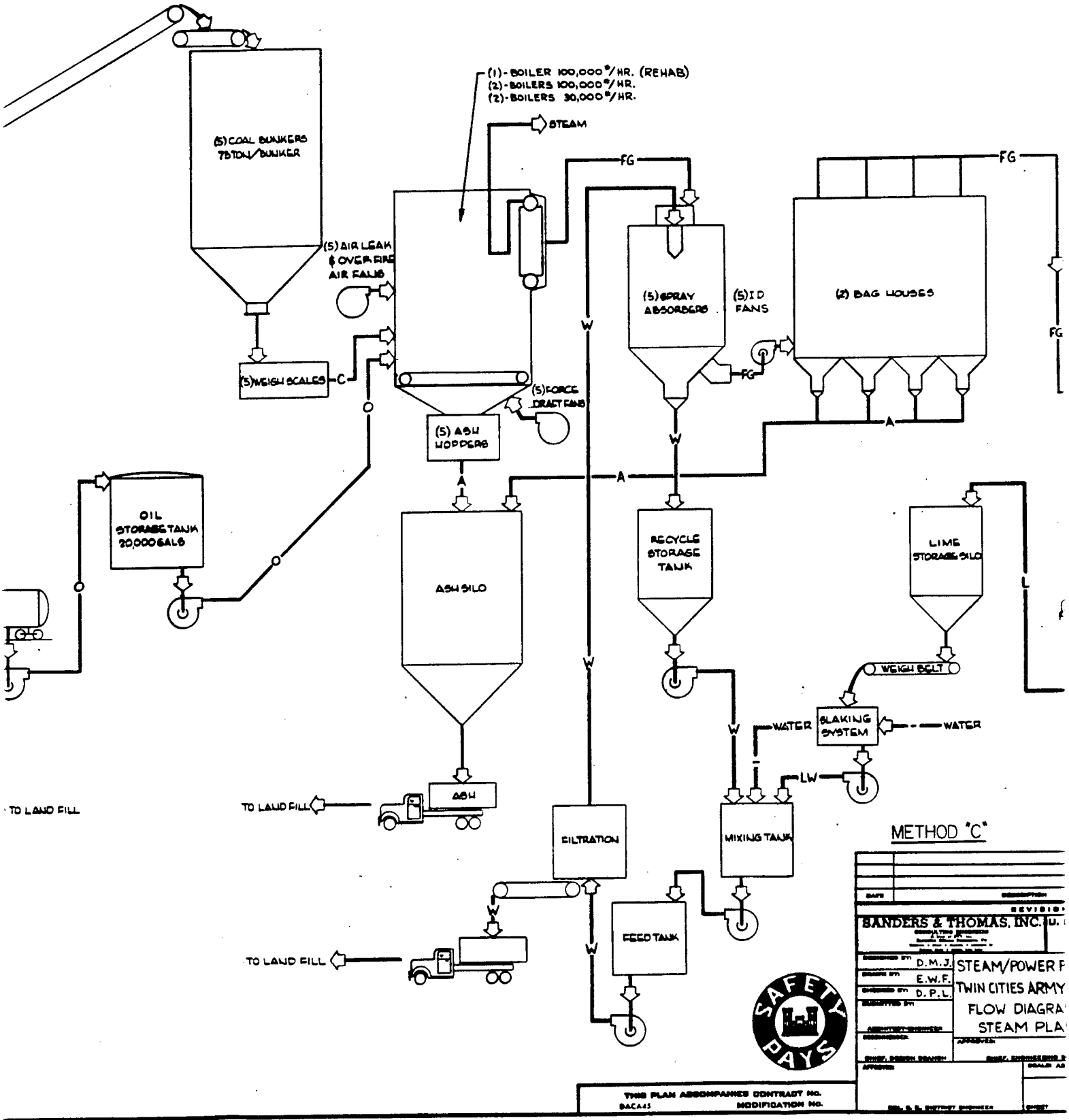
SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO. DACA45
MODIFICATION NO.

3


NOTE:
COAL HANDLING SYSTEM FROM CAR DUMPING HOPPER THRU BOILER FEED SHALL BE PROVIDED WITH A DUST CONTAINMENT SYSTEM
THAWING SHED
COAL
ENCLOSED
COAL STORAGE
29,000 TONS
C
C
CATCH BASIN & STORAGE
C
NEUTRALIZATION
(4) SLUDGE SEPARATORS
WATER TO SEWER
W
FILTRATION
SLUDGE
TO LAND FILL
OIL
STORAGE TANK
20,000 GALS
OIL
LEGEND:
— C — COAL
— O — OIL
— - — WATER
— W — WASTE
— A — ASH
— FG — FLUE GAS
— L — LIME
— LW — LIME (SLAKED)

YSTEM FROM CAR DUMPING
OILER FEED SHALL BE
A DUST CONTAINMENT SYSTEM



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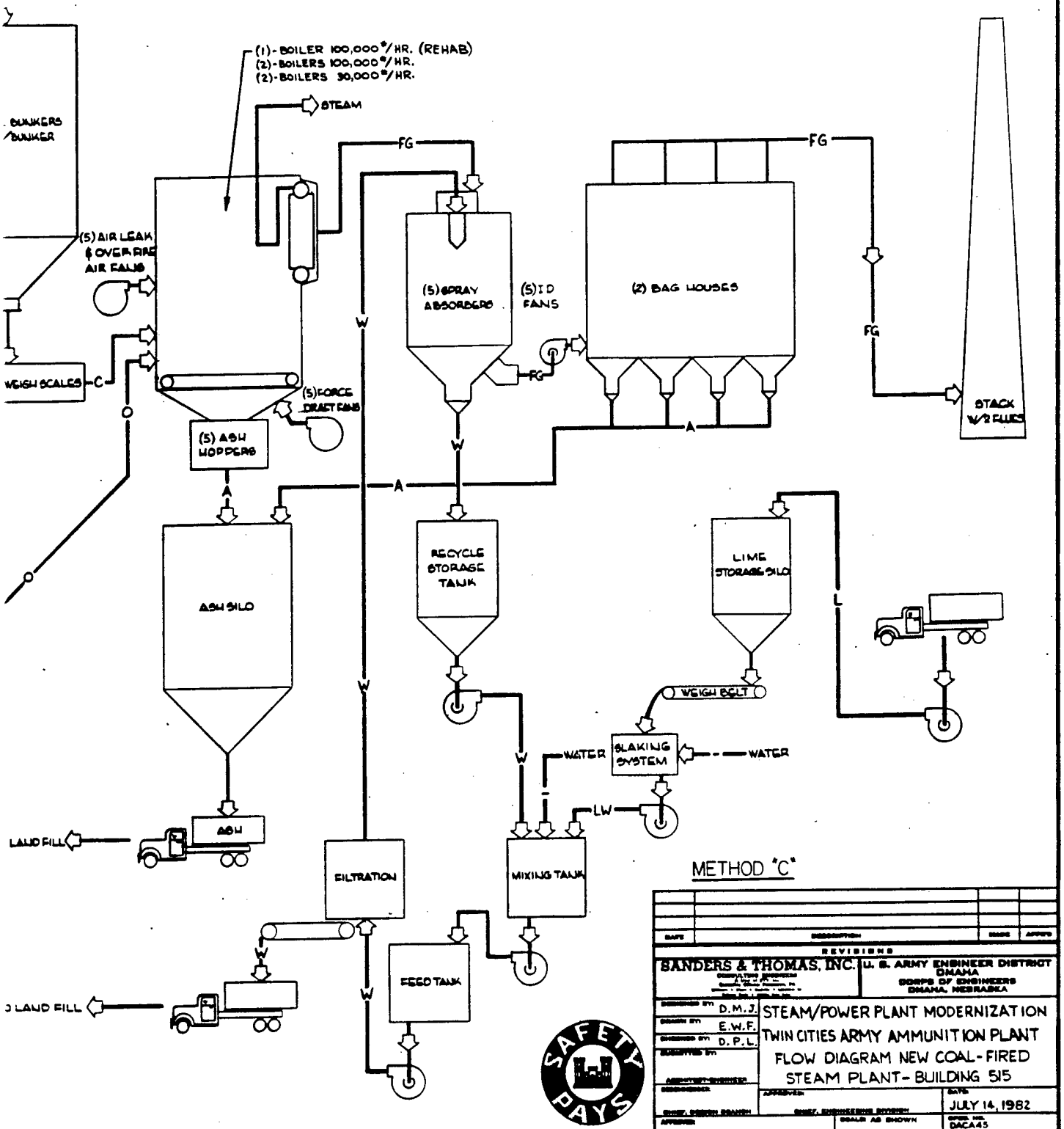
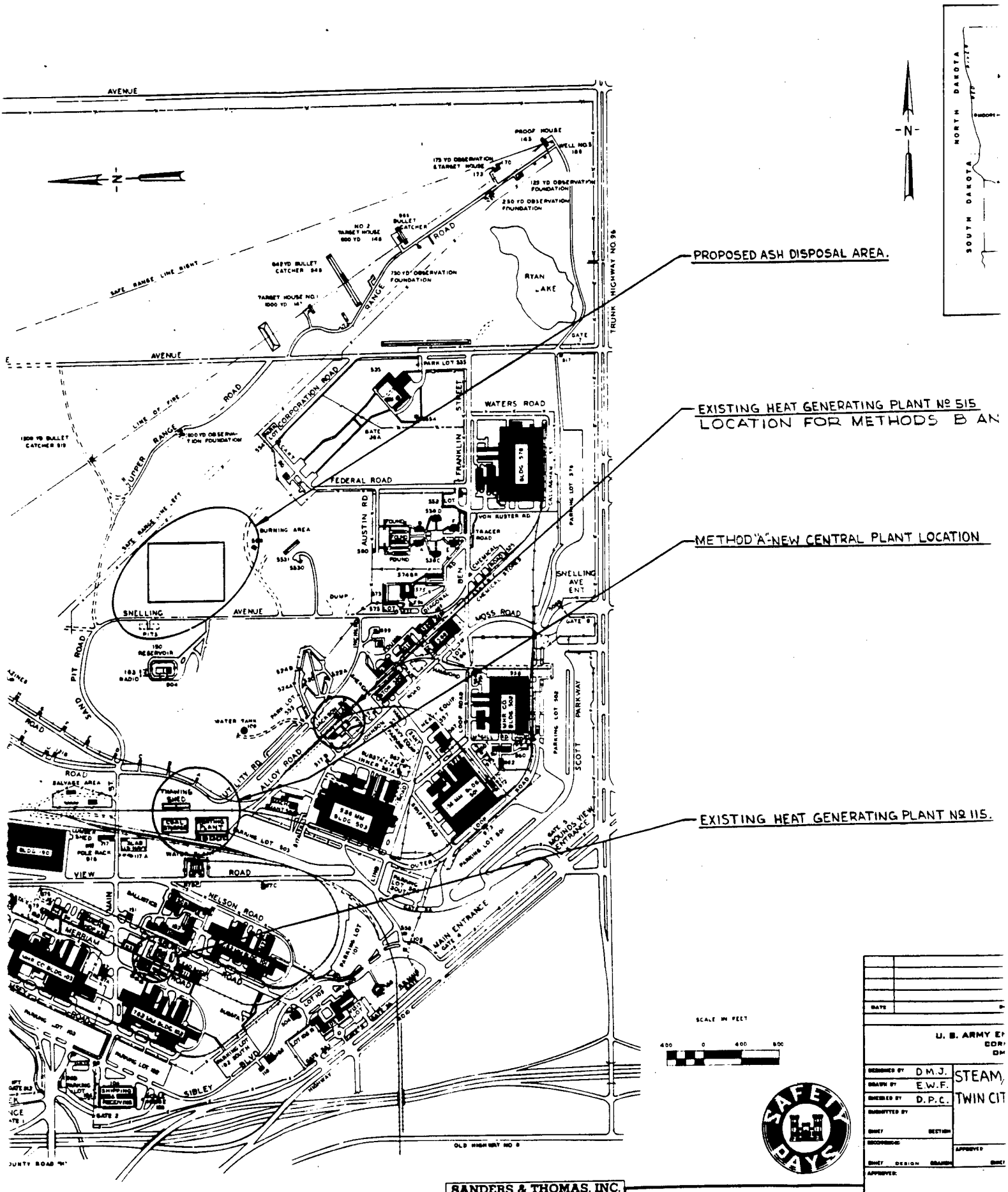
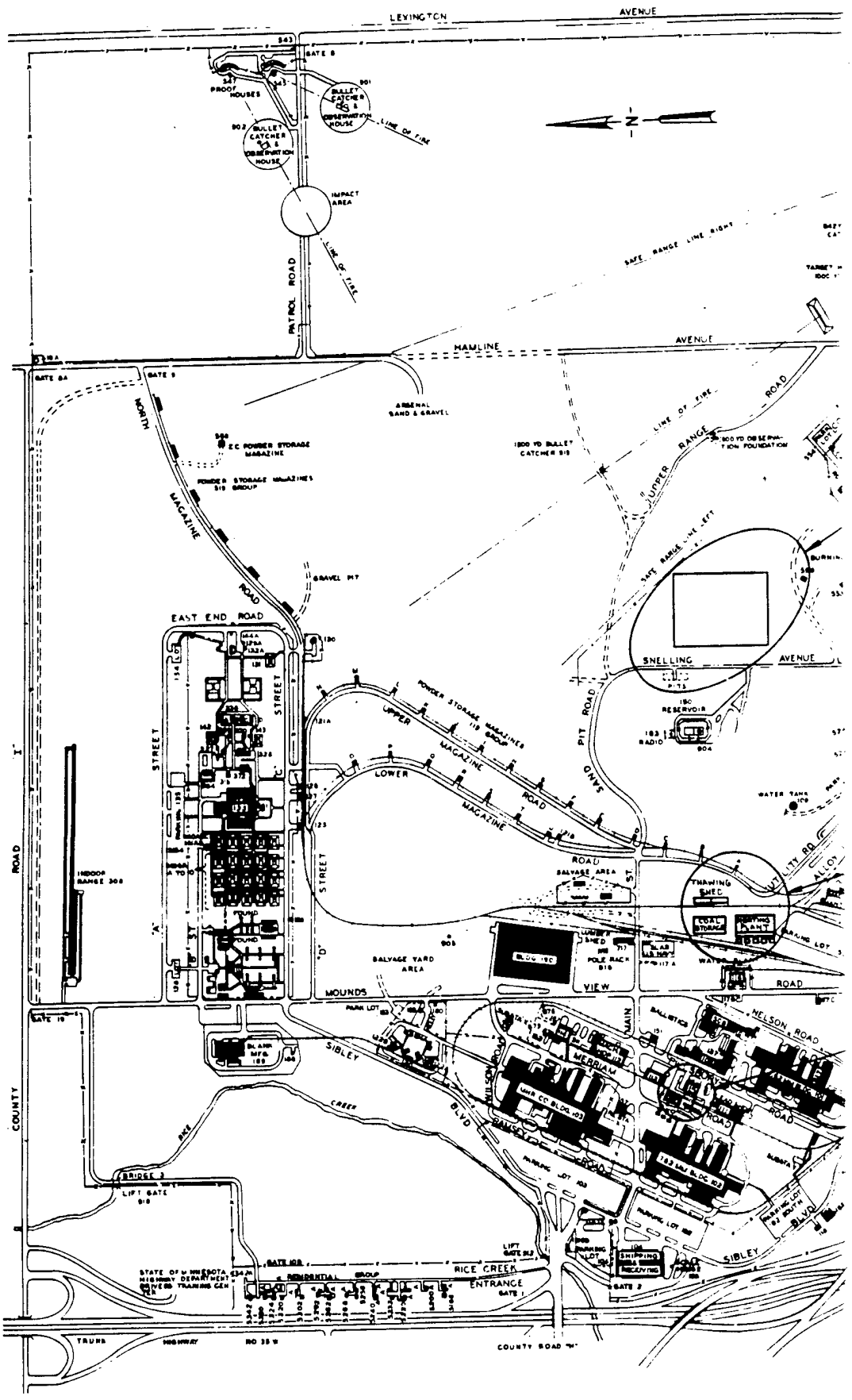
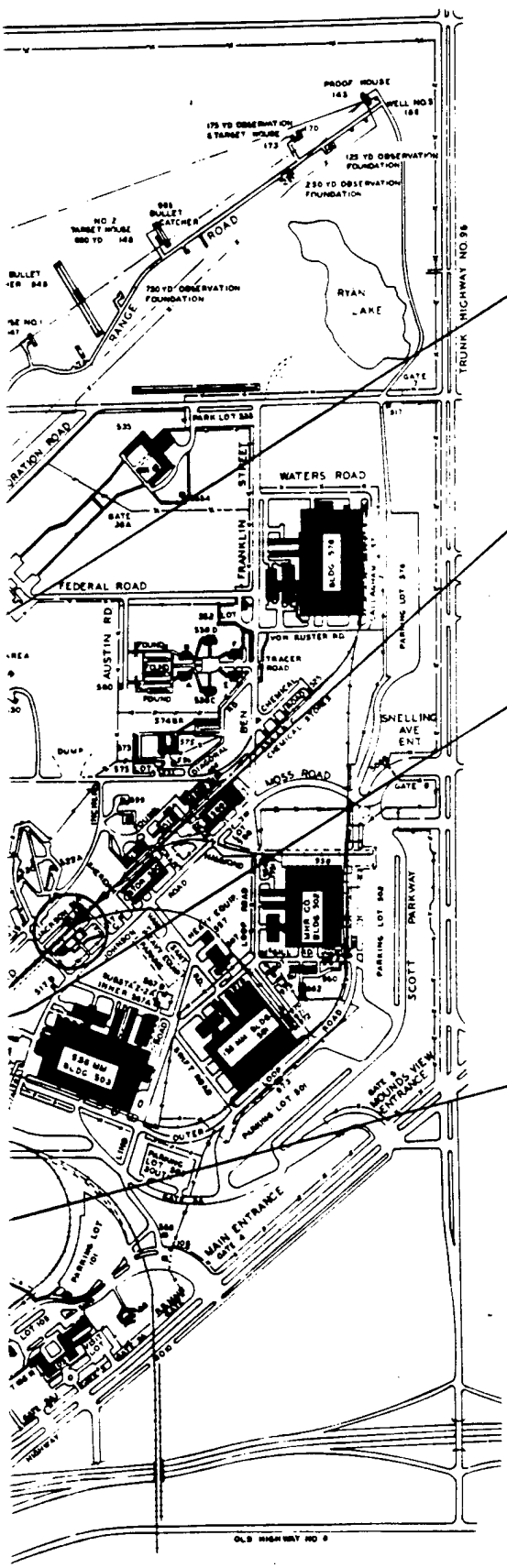

(1)-BOILER 100,000#/HR. (REHAB)
(2)-BOILERS 100,000#/HR.
(2)-BOILERS 30,000#/HR.
STEAM
BUNKERS
BUNKER
(5) AIR LEAK & OVER FIRE AIR FANS
WEIGH SCALES
C
(5) FORCE DRAFT FANS
(5) ASH HOPPERS
(5) SPRAY ABSORBERS
(5) ID FANS
(2) BAG HOUSES
FG
STACK W/2 FLUES
W
A
ASH SILO
RECYCLE STORAGE TANK
LIME STORAGE SILO
L
WEIGH BELT
SLAKING SYSTEM
WATER
LW
ASH
LAND FILL
FILTRATION
MIXING TANK
FEED TANK
METHOD "C"
SAFETY PAYS
SANDERS & THOMAS, INC.
U. S. ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA
D.M.J.
E.W.F.
D. P. L.
STEAM/POWER PLANT MODERNIZATION
TWIN CITIES ARMY AMMUNITION PLANT
FLOW DIAGRAM NEW COAL-FIRED
STEAM PLANT- BUILDING 515
JULY 14, 1982
DACA45
FIGURE 8
THIS PLAN ACCOMPANIES CONTRACT NO. DACA45
MODIFICATION NO.

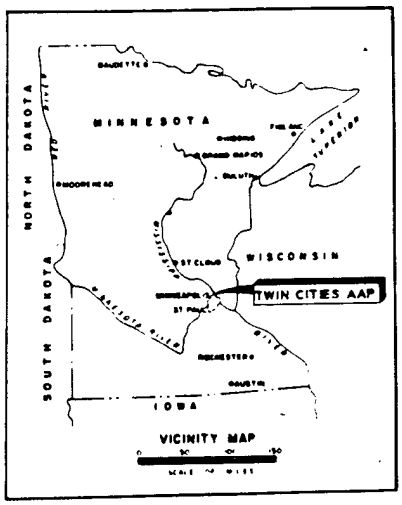
2


PROPOSED ASH DISPOSAL AREA.
EXISTING HEAT GENERATING PLANT Nº 515
LOCATION FOR METHODS B AN
METHOD "A" NEW CENTRAL PLANT LOCATION
EXISTING HEAT GENERATING PLANT Nº 115.
N
NORTH DAKOTA
SOUTH DAKOTA
SCALE IN FEET
400 0 400 800
SAFETY DAYS
SANDERS & THOMAS, INC.
THIS PLAN ACCOMPANIES CONTRACT NO.
DACA 45 7 CO MODIFICATION NO.
U. S. ARMY E
D.M.J.
E.W.F.
D.P.C.
STEAM,
TWIN CIT


LEXINGTON AVENUE
GATE 8
PROOF HOUSES
BULLET CATCHER & OBSERVATION HOUSE
LINE OF FIRE
IMPACT AREA
PATROL ROAD
HAMLINE AVENUE
GATE 8A
GATE 9
NORTH MAGAZINE ROAD
ARSENAL SAND & GRAVEL
EC POWDER STORAGE MAGAZINE
1800 YD BULLET CATCHER 818
SAFE RANGE LINE RIGHT
SAFE RANGE LINE LEFT
UPPER RANGE ROAD
GRAVEL PIT
EAST END ROAD
STREET
POWDER STORAGE MAGAZINES
UPPER MAGAZINE ROAD
LOWER MAGAZINE ROAD
PIT ROAD
SAND
SNELLING AVENUE
180 RESERVOIR
183 RADIO
WATER TANK
ROAD
SALVAGE AREA
TRAINING SHED
COAL STORAGE
HEATING PLANT
BLDG 190
SALVAGE YARD AREA
POLE RACK 819
MOUNDS
PARK LOT
VIEW
MAIN
NELSON ROAD
SIBLEY BLVD
MERRIAM
RAMSEY
BALLISTICS
COUNTY ROAD
CREEK
BRIDGE 3
LIFT GATE 810
LIFT GATE 813
GATE 10
GATE 10A
STATE OF MINNESOTA HIGHWAY DEPARTMENT ARMED TRAINING CEN
RESIDENTIAL GROUP
RICE CREEK
ENTRANCE
GATE 1
GATE 2
SHIPPING & RECEIVING
TRUNK HIGHWAY
COUNTY ROAD

(1)





-N-

SCALE IN FEET
400 0 400 800

SAFETY PAYS

DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY D.M.J.
DRAWN BY E.W.F.
CHECKED BY D.P.C.
SUBMITTED BY:
CHIEF SECTION
RECOMMENDED
CHIEF DESIGN BRANCH
APPROVED
CHIEF ENGINEERING DIVISION

STEAM/POWER PLANT MODERNIZATION
TWIN CITIES ARMY AMMUNITION PLANT
SITE PLAN

DATE DEC 14, 1982
SCALE AS SHOWN
SPEC. NO. DACA 45 7 80
DRAWING NUMBER FIGURE 9
APPROVED:
COL, C. E. DISTRICT ENGINEER

SANDERS & THOMAS, INC.
CONSULTING ENGINEERS

THIS PLAN ACCOMPANIES CONTRACT NO. DACA 45 7 CO MODIFICATION NO.

3