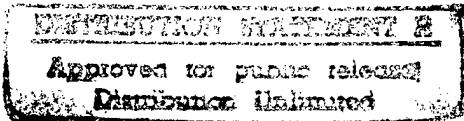


FINAL SUBMITTAL



ENERGY SURVEYS OF
ARMY INDUSTRIAL FACILITIES
ENERGY ENGINEERING ANALYSIS PROGRAM
RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA

VOLUME IV
PROGRAMMING DOCUMENTS

89
CONTRACT NO. DACA65-~~86~~-C-0154

DTIC QUALITY INSPECTED 2

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS
NORFOLK, VIRGINIA

PREPARED BY:

ENERGY AND ENVIRONMENTAL SERVICES DEPARTMENT
REYNOLDS, SMITH AND HILLS, INC.
P.O. BOX 4850
JACKSONVILLE, FLORIDA 32201

MARCH 1991

19971017 274



DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

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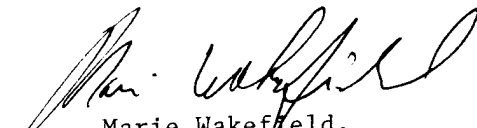

Marie Wakefield,
Librarian Engineering

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QRIP

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- SR-I-1 - Remove Steam Coils in Activated Carbon Area
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- GP-X-4 - Install Turning Vanes in Boiler Ductwork
- NC-X-1 - Modify Boiling Tub Heating Method (one tub only)

OSD PIF

- GP-B-4 - Install Variable Frequency Drives
- GP-N-1 - Replace Incandescents with 35W HPS Screw-Ins
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ECAM

- FN-U-1 - Cover Water Dry Tanks with Insulating Spheres (one tank only)
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QRIP

1 August 1982

C 1, AR 5-4

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS For use of this form, see AR 5-4; the proponent agency is OCA.				1. PROJECT NO.		REQUIREMENT CONTROL SYMBOL DD-M(R) 1561			
2. TO: CDR, AMC (AMCRM-MP) 5001 Eisenhower Avenue Alexandria, VA 22333-0001		3. THRU:		4. FROM: CDR, AMCCOM Attn: AMSMC-MGP-P (R) Rock Island, IL 61299-6000		5. DOD COMP NAME Army		6. DOD COMP CODE A	
9. PROJECT TITLE Reduce Water Flow to Incinerator (ECO GP-X-2)		10. TYPE OF PROJECT (Check one) ☒ ORIP ☐ OSD PIF ☐ PECIP		11. AMORTIZATION YEARS/MONTHS 7,029 + 8,416 X 12 (Project Cost) (Average Annual Savings) (No. Mo) - - - or 10 (months)		7. COMMAND CODE W73QKK		8. DATE	
12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR 024		13. ECONOMIC LIFE 25 yrs.		14. EXPECTED OPERATIONAL DATE					
15. SUBMITTING UNIT(S) Administrative Contracting Office Radford Army Ammunition Pt. Radford, VA 24141		16. UNIT ID CODE WOLLAA		17. PROJECT DESCRIPTION A hydroclone (hydraulic cyclone separator) will be installed at the propellant inlet to one incinerator to reduce the amount of water to be evaporated.					
18. DETAILED JUSTIFICATION Installing a hydroclone will reduce the amount of water to be evaporated by the incinerator and therefore, reduce the amount of fuel oil consumed.									
19. SAVINGS DISPOSITION Savings are used to reduce energy costs.									
20. OTHER REMARKS (Continue on page 5, if more space is needed)									

C I, AR 6-4

218

4. each communication sheet identifying the method and source of data for savings

PRIORITIZATION

(1)	INTERNAL RATE OF RETURN (IRR)	7.00	8.416	0.84	factor.
(1)					

Divide estimated project cost 7,029 by average annual savings 0,410 = 0,01 factor.

$$17.06 \times \frac{8,416}{143,577} = 1.00$$

Multiply annual savings	0.410	X discount factor	
	7,029	20.4	8/1.

(undiscounted)	25	years select discount factor from Table H-4, App H, Ch. 5, AR 5-4.
and an economic life	25	

	Rate of investment per manpower space (RIMS)	NA	how number of manpower space savings	RIMS
1. ...				
2. ...				
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99. ...				
100. ...				

Divide estimated project cost _____ by number _____

(Manpower revaluents cannot be used in this computation.)

1 August 1982

COST FOR PROJECT TO BECOME OPERATIONAL					
EQUIPMENT TYPE ^a	PROPOSED SOURCE OF PROCUREMENT ^b	UNIT PRICE ^c	QUANTITY ^d	TOTAL COST ^e	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT ^f
(1) Hydroclone		7,029	1	7,029	
(2)					
(3)					
(4)					
(5)					
(6) TRANSPORTATION (Equipment delivery)					
(7) EQUIPMENT MODIFICATION ¹					
(8) EQUIPMENT INSTALLATION					
(9) MAINTENANCE CONTRACT ²					
(10) FACILITIES MODIFICATION ³					
(11) TRAINING					
(12) OTHER (Specify):					
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL ⁴				7,029	
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				7,029	
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE ⁵				0	
(16) TOTAL (Sum of (14) + (15) above)				7,029	

¹Not to exceed 10% of equipment cost for QRIP projects.²Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.³Normally not OPA funded.⁴Used to compute amortization in Item 11.⁵Specify source to include certification that funds are available, if financed from the regular budget.

1 August 1982

24. REGULATORY APPROVAL/COORDINATION	
INVESTMENT STATEMENT	
This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints. (Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.) (Functional Coordination at local level, e.g., Pac Eng, Log, Pers, etc.)	
25. OTHER COORDINATION	
26. SUBMITTED BY (Typed name, grade and title of Subordinate Command/Agency or Project Indicator) SIGNATURE DATE (YYMMDD) AUTOVON	
28. APPROVAL RECOMMENDED BY (MACOM/Agency) SIGNATURE DATE (YYMMDD) AUTOVON	
27. APPROVED BY FOR USE BY HQDA ON OSD PIF PROJECTS ONLY SIGNATURE DATE (YYMMDD) AUTOVON	
29. OTHER REMARKS (Cont'd)	



SUBJECT _____

AEP NO _____

DESIGNER G. FALLON

SHEET _____ OF _____

CHECKER P. HUTCHINSDATE 6/14/90DATE 6/14/90

ECO# GP-X-2 REDUCE WATER FLOW INTO INCINERATOR Combustion Program

The Combustion program was adapted to eliminate boiler absorbtions of heat by zeroing the appropriate parameters. Those are shown on the "input" pages of the enclosed runs.

The Incinerator evaporates 2000 LBS/HR of water. The fuel flow necessary to accomplish that while maintaining a 1000°F exit gas temperature was determined by iteration. This relationship was subsequently maintained for the remaining computer runs.

The graph was generated by varying the water flow (and therefore fuel flow) while maintaining the 1000°F exit gas temperature.

ENERGY LOSS AT 2000 LBS/HR H₂O COMPUTER SHEETS

ENERGY LOSS FROM ~~PAGE 2A~~ = 4.45 MBTU/HR

ENERGY LOSS AT 1800 LBS/HR H₂O COMPUTER SHEETS

ENERGY LOSS FROM ~~PAGE 2A~~ = 4.00 MBTU/HR

ANNUAL ENERGY SAVED FROM EACH INCINERATOR

DATA SHOWS 50% INCINERATOR LOAD FACTOR

$$(4.45 - 4.00) \text{ MBTU/HR} \times 3760 \text{ hr} \times .5 = 1971 \text{ MBTU/yr}$$

ENERGY SAVING FOR BOTH INCINERATORS

$$1971 \text{ MBTU/yr} \times 2 = 3942 \text{ MBTU/yr}$$



SUBJECT _____
DESIGNER PFH
CHECKER _____

AEP NO _____
SHEET _____ OF _____
DATE 10/29/90
DATE _____

For QRIP

Current energy use for 1 incinerator

From Table 2-1 annual fuel oil bill is
\$343,763 (Other, #2 fuel oil)

For one incinerator

$$\$343,763 / 2 = \$\underline{171,882} / \text{yr.}$$

Savings for one incinerator hydroclone is

$$3942 / 2 = 1971 \text{ MBtu fuel oil}$$

Value of savings =

$$1971 \times \$4.27 = \$\underline{8416} / \text{yr.}$$

ADIABATIC FLAME TEMPERATURE & COMBUSTION CALCULATIONS

INPUT- INPUT- INPUT- INPUT- INPUT- INPUT-

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP	TIME	12:31 PM

FUEL ULTIMATE ANALYSIS

CONSTITUENT	WT.PCT.	DRY FUEL RECEIVED	DRY & ASH FREE	ADJUSTED FUEL
CARBON	12.48	86.40	86.40	86.40
HYDROGEN	1.83	12.70	12.70	12.70
OXYGEN	0.01	0.10	0.10	0.10
NITROGEN	0.01	0.10	0.10	0.10
SULFUR	0.10	0.70	0.70	0.70
CHLORINE	0.00	0.00	0.00	0.00
WATER	85.56	0.00	0.00	0.00
INERTS	0.00	0.00	0.00	0.00
TOTAL	100.00	100.00	100.00	100.00

FUEL RATE (TONS/DAY)	28
TOTAL AIR ASSIGNED (%)	115
FUEL HIGHER HEATING VALUE (BTU/LB)	1902
HEAT LOSS DUE TO UNBURNED CARBON (%)	0.00
CARBON IN RESIDUE (%)	0.00
EXIT GAS TEMPERATURE (Deg. F)	1000
AMBIENT DRY BULB TEMP (Deg.F)	80
HUMIDITY RATIO (LBS H2O/LB DRY AIR)	0.0132
BAROMETRIC PRESSURE (IN.Hg.)	29.92
RADIATION LOSS (%)	0.00
UNACCOUNTABLE LOSS (%)	0.00
ENTHALPY ADDED IN BOILER (BTU/LB)	0

ADIABATIC FLAME TEMPERATURE &
COMBUSTION CALCULATIONS

O U T P U T - O U T P U T - O U T P U T - O U T P U T - O U T P U T - O U T P U T -

CLIENT	COE	DATE	14-Jun-90
	-----		-----
PLANT	RAAP	TIME	12:31 PM
	-----		-----

HEAT LOSSES	MMBTU/HR	PERCENT
-----	-----	-----
IN DRY FLUE GAS	1.31	29.37
FROM H2O IN AIR	0.02	0.35
FROM H2O IN FUEL--SENSIBLE	0.50	11.21
FROM H2O IN FUEL--LATENT	2.63	59.06
TOTAL IN WET FLUE GAS	4.45	100.00
DUE TO UNBURNED CARBON	0.00	0.00
DUE TO HOT ASH	0.00	0.00
DUE TO RADIATION & UNACCOUNTABLE	0.00	0.00
TOTAL	4.45	100.00

BOILER EFFICIENCY (%)	0.00
STEAM GENERATED (LBS/HR)	ERR
UNBURNED CARBON (LBS/HR)	0
LBS OF WET FLUE GAS PER LB FUEL	3.41
SPEC.VOL.OF WET FLUE GAS (CU.FT./LB)	42.47
AIR TO FUEL RATIO (LB AIR/LB FUEL)	2.38
COMB. AIR SPECIFIC VOL. (CU.FT/LB)	13.712
COMBUSTION AIR FLOW (LBS/HR)	5635

F L U E G A S A N A L Y S I S

	% BY VOLUME		% BY WEIGHT	
	-----		-----	
	WET	DRY	WET	DRY
	---	---	---	---
CO2	7.64	13.39	13.41	19.38
SO2	0.0232	0.0406	0.0592	0.0856
O2	1.65	2.89	2.11	3.04
HCL	0.0000	0.0000	0.0000	0.0000
N2	47.77	83.68	53.61	77.49
H2O	42.91		30.81	

FLUE GAS FLOWS

	WET	DRY
	---	---
MASS (LBS/HR)	7972	5516
VOLUME (ACFM)	5643	3222
(SCFM)(70DEG.F.)	2049	1170
@ 12% CO2	1305	1305
F FACTOR		
(DSCF/MMBTU @12% CO2)		17605

ADIABATIC FLAME TEMPERATURE &
COMBUSTION CALCULATIONS

INPUT- INPUT- INPUT- INPUT- INPUT- INPUT-

CLIENT	COE	DATE	14-Jun-90
	-----		-----
PLANT	RAAP	TIME	06:54 PM
	-----		-----

FUEL ULTIMATE ANALYSIS

CONSTITUENT	WT.PCT.	DRY FUEL RECEIVED	DRY & ASH FREE	ADJUSTED FUEL
CARBON	12.48	86.40	86.40	86.40
HYDROGEN	1.83	12.70	12.70	12.70
OXYGEN	0.01	0.10	0.10	0.10
NITROGEN	0.01	0.10	0.10	0.10
SULFUR	0.10	0.70	0.70	0.70
CHLORINE	0.00	0.00	0.00	0.00
WATER	85.56	0.00	0.00	0.00
INERTS	0.00	0.00	0.00	0.00
TOTAL	100.00	100.00	100.00	100.00

FUEL RATE (TONS/DAY)	25
TOTAL AIR ASSIGNED (%)	115
FUEL HIGHER HEATING VALUE (BTU/LB)	1902
HEAT LOSS DUE TO UNBURNED CARBON (%)	0.00
CARBON IN RESIDUE (%)	0.00
EXIT GAS TEMPERATURE (Deg. F)	1000
AMBIENT DRY BULB TEMP (Deg.F)	80
HUMIDITY RATIO (LBS H2O/LB DRY AIR)	0.0132
BAROMETRIC PRESSURE (IN.Hg.)	29.92
RADIATION LOSS (%)	0.00
UNACCOUNTABLE LOSS (%)	0.00
ENTHALPY ADDED IN BOILER (BTU/LB)	0

ADIABATIC FLAME TEMPERATURE &
COMBUSTION CALCULATIONS

O U T P U T-O U T P U T-O U T P U T-O U T P U T-O U T P U T-O U T P U T-

CLIENT	COE	DATE	14-Jun-90
	-----		-----
PLANT	RAAP	TIME	06:54 PM
	-----		-----

HEAT LOSSES	MMBTU/HR	PERCENT
-----	-----	-----
IN DRY FLUE GAS	1.18	29.37
FROM H2O IN AIR	0.01	0.35
FROM H2O IN FUEL--SENSIBLE	0.45	11.21
FROM H2O IN FUEL--LATENT	2.36	59.07
TOTAL IN WET FLUE GAS	4.00	100.00
DUE TO UNBURNED CARBON	0.00	0.00
DUE TO HOT ASH	0.00	0.00
DUE TO RADIATION & UNACCOUNTABLE	0.00	0.00
TOTAL	4.00	100.00

BOILER EFFICIENCY (%)	0.00
STEAM GENERATED (LBS/HR)	ERR
UNBURNED CARBON (LBS/HR)	0
LBS OF WET FLUE GAS PER LB FUEL	3.41
SPEC.VOL.OF WET FLUE GAS (CU.FT./LB)	42.47
AIR TO FUEL RATIO (LB AIR/LB FUEL)	2.38
COMB. AIR SPECIFIC VOL. (CU.FT/LB)	13.712
COMBUSTION AIR FLOW (LBS/HR)	5071

F L U E G A S A N A L Y S I S

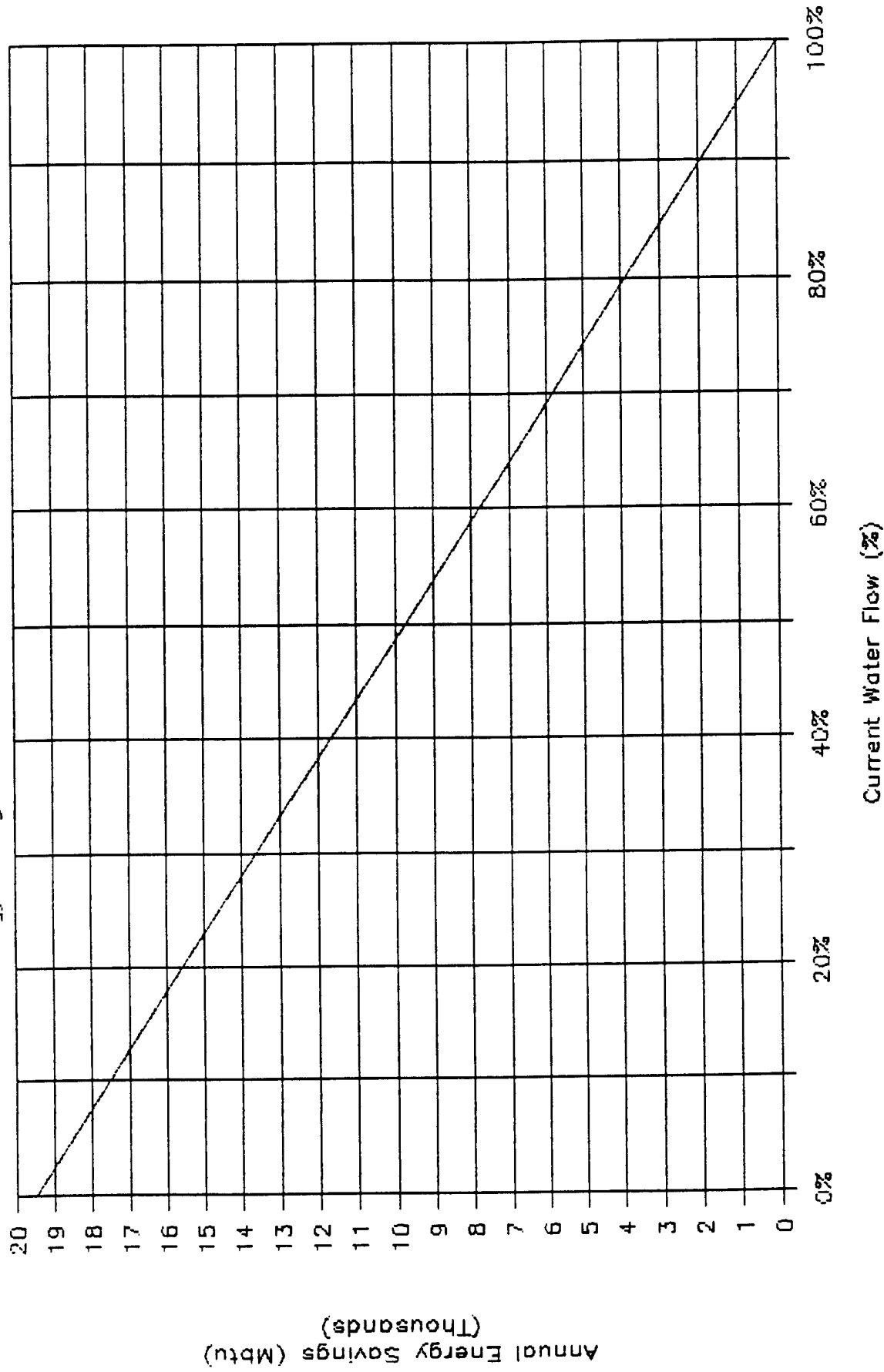
	% BY VOLUME		% BY WEIGHT	
	WET	DRY	WET	DRY
	---	---	---	---
CO2	7.64	13.39	13.41	19.38
SO2	0.0232	0.0406	0.0592	0.0856
O2	1.65	2.89	2.11	3.04
HCL	0.0000	0.0000	0.0000	0.0000
N2	47.77	83.68	53.61	77.49
H2O	42.91		30.81	

FLUE GAS FLOWS

	WET	DRY
MASS (LBS/HR)	7175	4964
VOLUME (ACFM)	5079	2899
(SCFM)(70DEG.F.)	1844	1053
@ 12% CO2	1174	1174
F FACTOR		
(DSCF/MMBTU @12% CO2)		17605

Radford Army Ammunition Plant

Annual Energy Savings vs Percent Current Water Flow (3.9 gpm)



Project No. 290-0379-000

Local _____ L.D. X Placed X Rec'd. _____ Date 5-22-90

_____ Conversed With (404) 394-6200

Of ~~EDDORR~~ OLIVER Regarding HYDROCLONES

1" HYDROCLONE IS CORRECT SIZE PROVIDED PARTICLES
CAN PASS 4mm ORIFICE WILL GET 50/50 SPLIT
DOWN TO 30 μ AT 50 PSIG DP. COST IS \$100.00

Distribution:

1 August 1982

C 1, AR 5-4

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS For use of this form, see AFR 8-4; the proponent agency is OCA.				1. PROJECT NO.		REQUIREMENT CONTROL SYMBOL DD-M(R) 1561			
2. TO: CDR, AMC (AMCRM-MP) 5001 Eisenhower Avenue Alexandria, VA 22333-0001		3. THRU:		4. FROM: CDR, AMCCOM Attn: AMSMC-MGP-P (R) Rock Island, IL 61299-6000		5. DOD COMP NAME Army		6. DOD COMP CODE A	
9. PROJECT TITLE Remove Steam Coils from Activated Carbon Area (ECO SR-I-1)		10. TYPE OF PROJECT (Check one) ☒ ORIP ☐ OSD PIF ☐ PECIP		11. AMORTIZATION YEARS/MONTHS \$ 17,057 + 13,979 X 12 (Project Cost) (Average Annual Savings) (No. Mo) -- or 14.6 (month) (amortization)		7. COMMAND CODE W73QKK		8. DATE	
12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR 024		13. ECONOMIC LIFE		14. EXPECTED OPERATIONAL DATE					
15. SUBMITTING UNIT(S) Administrative Contracting Office Radford Army Ammunition Pt. Radford, VA 24141		16. UNIT ID CODE WOLLAA		17. PROJECT DESCRIPTION Remove disconnected preheat steam coils in the activated carbon solvent recovery area and adjust fan drive to provide design air flow with reduced system air pressure.					
18. DETAILED JUSTIFICATION Steam heating coils previously used to preheat outside air entering the charcoal tanks in the activated carbon solvent recovery process. These coils are no longer used and the steam supply has been disconnected. Removing these coils will reduce the total pressure to be overcome by supply air fans.									
19. SAVINGS DISPOSITION Savings are used to reduce energy costs.									
20. OTHER REMARKS (Continue on page 5, if more space is needed)									

1 August 1982

SUMMARY OF DOLLAR SAVINGS (ROUND OFF TO THE NEAREST DOLLAR)									
Attach computation sheet identifying the method and source of data for savings									
SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS			
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES									
UTILITIES									
MAINTENANCE/ REPAIR									
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY (Identify) Electricity	62,123	48,144	48,144	48,144	48,144	13,979	13,979	13,979	13,979
CONTRACT COSTS									
OTHER (Identify)									
TOTALS	62,123	48,144	48,144	48,144	48,144	13,979	13,979	13,979	13,979

PRIORITIZATION

(1) INTERNAL RATE OF RETURN (IRR)
 Divide estimated project cost 17,057 by average annual savings 13,979 = 1.22 factor.
 Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 138 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (S/I)
 Multiply annual savings 13,979 X discount factor 8.78 = 122,736 and divide by present value of investment
 (undiscounted) 17,057 = 7.2 S/I.
 (Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 6, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE (RIMS) NA
 Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.
 (Manpower requirements cannot be used in this computation.)

1 August 1982

C 1, AR 5-4

COST FOR PROJECT TO BECOME OPERATIONAL					
EQUIPMENT TYPE	PROPOSED SOURCE OF PROCUREMENT	UNIT PRICE	QUANTITY	TOTAL COST	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT
(1)					
(2)					
(3)					
(4)					
(5)					
(6) TRANSPORTATION (Equipment delivery)					
(7) EQUIPMENT MODIFICATION ¹					
(8) EQUIPMENT INSTALLATION					
(9) MAINTENANCE CONTRACT ²					
(10) FACILITIES MODIFICATION ³					
(11) TRAINING					
(12) OTHER (Specify): Remove coils and adjust fan drives				17,057	
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL ⁴				17,057	
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				17,057	
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE ⁵				0	
(16) TOTAL (Sum of (14) + (15) above)				17,057	

¹Not to exceed 10% of equipment cost for QRIP projects.

²Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.

³Normally not OPA funded.

⁴Used to compute amortization in Item 11.

⁵Specify source to include certification that funds are available, if financed from the regular budget.

1 August 1982

C 1, AR 5-4

23. SUMMARY OF SAVINGS (MANPOWER AND DOLLARS)										
ITEMS a	SAVINGS			REAPPLICATION OF SAVINGS						
	NO. MPR OR MHR b	TYPE PERS ⁶ c	DOLLARS d	PROGRAM ELEMENT		TDA PARA AND LINE			FUNCTION CODE	
				e. FROM	f. TO	g. FROM	h. TO	i. FROM	j. TO	
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED										
(2) REQUIREMENTS ONLY ELIMINATED										
(3) BORROWED MILITARY MANPOWER RELEASED										
(4) OVERHIRES OR TEMPORARIES TERMINATED										
(5) HOURS OVERTIME ELIMINATED										
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS ⁷										
(7) OTHER DOLLAR SAVINGS (Excluding Manpower), e.g., CONTRACT COSTS & UTILITIES			13,979							
(8)										
(9)										
(10)										
(11) TOTAL DOLLAR SAVINGS			13,979							
6 (1) US Graded (2) US Wage Board (3) DHFN (4) IHFN (5) Officer (6) WO (7) Enlisted				7 Reflect specific duties being performed with additional manhours available (equivalent manyears)						

⁷ Reflect specific duties being performed with additional manhours available (equivalent manyears)

1 August 1982

REGULATORY APPROVAL/COORDINATION			
INVESTMENT STATEMENT			
This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints. (Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)			
4. OTHER COORDINATION (Functional Coordination at local level, e.g., Pac Eng, Log, Pers, etc.)			
26. SUBMITTED BY (Typed name, grade and title of Subordinate Command/Agency or Project Initiator)	SIGNATURE	DATE (YYMMDD)	AUTOVON
28. APPROVAL RECOMMENDED BY (MACOM/Agency)	SIGNATURE	DATE (YYMMDD)	AUTOVON
FOR USE BY HQDA ON OSD PIF PROJECTS ONLY			
27. APPROVED BY	SIGNATURE	DATE (YYMMDD)	AUTOVON
29. OTHER REMARKS (Cont'd)			

ECO# SR-I-1

REMOVE STEAM COIL FROM A.C.S.R. DUCTWORK

Assumptions:

1. The 450 hp exhaust fan motors are oversized by 20%.
2. The total pressure on the fan is 20 inches of water.
3. The efficiency of the fan and drive assembly is 65 %.
4. The efficiency of the fan motor is 85%.
5. There are three steam coils with 1 row and 14 fins per inch. The pressure drop across each coil is 0.75 inches of water.
6. The exhaust system operates 24 hours per day, 260 days per year (6240 hrs/yr).

Current Energy Consumption:

$$Bhp = \text{Motor hp} \div 1.2 = 450 \text{ hp} \div 1.2 = 375 \text{ Bhp}$$

$$\text{Power} = \frac{Bhp \times 0.746 \frac{\text{Kw}}{\text{hp}}}{\text{Motor Eff.}} = \frac{375 \times 0.746}{0.85} = 329 \text{ Kw}$$

$$\text{Annual energy use} = 329 \text{ Kw} \times 6240 \frac{\text{hrs}}{\text{yr}} = \underline{2,052,960 \text{ Kwh/yr}}$$

$$\text{Annual energy use} = 2,052.96 \frac{\text{Mwh}}{\text{yr}} \times 3.413 \frac{\text{MBtu}}{\text{Mwh}} = \underline{7007 \text{ MBtu/yr}}$$

$$\text{Annual energy cost} = 2,052,960 \frac{\text{Kwh}}{\text{yr}} \times 0.03026 \frac{\$}{\text{Kwh}} = \underline{\$62,123/\text{yr}}$$

Additional Energy Consumption:

There is no additional energy consumption required by this ECO.

Energy Savings:

$$\text{Exhaust CFM} = \frac{\text{Bhp} \times \text{Fan.Eff.} \times 6350}{\text{Total Pressure}}$$

$$\text{CFM} = \frac{375 \text{ hp} \times 0.65 \times 6350}{20 \text{ in H}_2\text{O}} = 77,390 \frac{\text{cu.ft.}}{\text{min}}$$

The reduction in total pressure by removing the steam coils would be:

$$\text{TP}_r = 0.75 \text{ in.H}_2\text{O/coil} \times 3 \text{ coils} = 2.25 \text{ in.H}_2\text{O}$$

The reduction in fan horsepower required is:

$$\text{HP}_r = \frac{\text{CFM} \times \text{TP}_r}{\text{Fan.Eff.} \times 6350} = \frac{77390 \times 2.25}{0.65 \times 6350} = 42 \text{ hp}$$

$$\text{Power} = \frac{\text{hp} \times 0.746}{\text{Motor Eff.}} = \frac{42 \times 0.746}{0.85} = 37 \text{ Kw}$$

$$\text{Energy Savings} = 2 \text{ bldgs} \times 37 \frac{\text{Kw}}{\text{bldg.}} \times 6240 \text{ hr/yr} = 461,760 \text{ Kwh/yr}$$

$$\text{Energy Savings} = 461.76 \frac{\text{Mwh}}{\text{yr}} \times \frac{3.413 \text{ MBtu}}{\text{Mwh}} = 1576 \text{ MBtu/yr}$$

$$\text{Annual cost savings} = 461,760 \frac{\text{Kwh}}{\text{yr}} \times 0.03026 \text{ \$/kwh} = \$13,973/\text{yr}$$

ECO Costs :

Cost for removing steam coils, replacing ductwork
and adjusting fan drive = \$16,997

Refer to Construction Cost Estimate sheet
for detailed itemization of costs.

Simple Payback:

ECO Payback = Cost ÷ Savings

Payback = $\$16,997 \div \$13,973/\text{yr} = \underline{1.2 \text{ years}}$

Project No. 2900379 000

Local (L.D.) Placed Rec'd. 5/17/90
Bill Todd Conversed With Everett Grubb / H. Hill
Of RAAP Maintenance Regarding Activated Carbon Sol. Recovery

Mr. Grubb was not available, so I spoke with an assistant about heat recovery potential.

* Solvent condenser uses filtered water (not chilled water) at 40 lbs pressure.

* Steam coils are not used. The steam valves to these coils have been shut off.

Distribution:

Cost Estimate Backup

Means Mech

Page

12 Coil removal 500 lb each \$395/ton

12 Duct removal 72" wide \$2.70/LF

231 New Duct - S. Steel 72" round

$$\text{mat} = \left(\frac{35 - 31.5}{4} \right) \times 32 + 35 = \$63.00/\text{LF}$$

$$\text{Lab} = \left(\frac{15.4 - 13.45}{4} \right) \times 32 + 15.40 = \$31.00/\text{LF}$$

171 Duct insulation

$$\text{Ztrvl} = 2 \times 3.14 \times 3\text{ft} \times 30\text{ft} = 565 \text{ sq. ft.}$$

229 insulation jacket 74" ϕ

gal. steel

$$\text{mat} = \left(\frac{13.95 - 11.65}{6} \right) \times 38 + 13.95 = \$28.52/\text{LF}$$

$$\text{Lab} = \left(\frac{13.45 - 11.95}{6} \right) \times 38 \times 13.45 = \$22.95/\text{LF}$$

256 Fan adjustment (air balance) \$175 each

COST ESTIMATE BACKUP

Means Mech
Page

12 Coil removal 500 lb each \$395/ton

12 Duct removal 72" wide \$2.70/LF

231 New Duct - S. steel 72" round

$$\text{mat} = \left(\frac{35 - 31.5}{4} \right) \times 32 + 35 = \$63.00 / \text{LF}$$

$$\text{Lab} = \left(\frac{15.4 - 13.45}{4} \right) \times 32 + 15.40 = \$31.00 / \text{LF}$$

171 Duct insulation

$$2\pi r l = 2 \times 3.14 \times 3\text{ft} \times 30\text{ft} = 565 \text{ sq. ft.}$$

129 insulation jacket 74" Ø

gal. steel

$$\text{mat} = \left(\frac{13.95 - 11.65}{6} \right) \times 38 + 13.95 = \$28.52 / \text{LF}$$

$$\text{Lab} = \left(\frac{13.45 - 11.95}{6} \right) \times 38 \times 13.45 = \$22.95 / \text{LF}$$

256 Fan adjustment (air balance) \$175 each

1 August 1982

C 1, AR 5-4

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS For use of this form, see AR 5-4; the proponent agency is OCA.			1. PROJECT NO.	REQUIREMENT CONTROL SYMBOL DD-M(R) 1561		
2. TO: CDR, AMC (AMCRM-MP) 5001 Eisenhower Avenue Alexandria, VA 22333-0001	3. THRU:	4. FROM: AMCCOM: Attn: AMSMC-MGP-P (R) Rock Island, IL 61299-6000		5. DOD COMP NAME Army	6. DOD COMP CODE A	7. COMMAND CODE W73QKK
9. PROJECT TITLE Replace Exterior Incandescent with Fluorescents (ECO GP-N-3)		10. TYPE OF PROJECT (Check one) ☒ QRI ☐ OSD PIF ☐ PECIP		11. AMORTIZATION YEARS/MONTHS \$ 21,485 + 15,770 X 12 (Project Cost) (Average Annual Savings) (No. Mo) - 1.4 or -- (month) (amortization)		
12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR 024		13. ECONOMIC LIFE	14. EXPECTED OPER- ATIONAL DATE			
15. SUBMITTING UNIT(S) Administrative Contracting Office Radford Army Ammunition Pt. Radford, VA 24141		16. UNIT ID CODE WOLLAA		17. PROJECT DESCRIPTION Replace exterior incandescent floodlights with 13 watt compact fluorescent screw-ins.		
18. DETAILED JUSTIFICATION Existing incandescent flood lights have an efficacy of about 15 lumens/watt. Fluorescents offer about 50 lumens/watt. This is recommended in areas where a 25-percent reduction in lighting level is acceptable and the fixtures are non-explosion proof type.						
19. SAVINGS DISPOSITION Savings are used to reduce energy costs.						
20. OTHER REMARKS (Continue on page 5, if more space is needed)						

1 August 1982

SUMMARY OF DOLLAR SAVINGS
(ROUND OFF TO THE NEAREST DOLLAR)

Attach computation sheet identifying the method and source of data for savings

SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS			
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES	6,302	1,765	1,765	1,765	1,765	4,537	4,537	4,537	4,537
UTILITIES									
MAINTENANCE/ REPAIR	2,448	297	297	297	297	6,688	6,688	6,688	6,688
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY (Identify)	10,168	1,085	1,085	1,085	1,085	9,083	9,083	9,083	9,083
CONTRACT COSTS									
OTHER (Identify)									
TOTALS	18,918	3,147	3,147	3,147	3,147	15,770	15,770	15,770	15,770

PRIORITIZATION

(1) INTERNAL RATE OF RETURN (IRR)
Divide estimated project cost 21,485 by average annual savings 15,770 = 1.36 factor.
Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 117 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (S/I)
Multiply annual savings 15,770 X discount factor 8.78 = 138,461 and divide by present value of investment
(undiscounted) 21,485 = 6.4 S/I.
(Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE (RIMS) NA
Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.
(Manpower requirements cannot be used in this computation.)

1 August 1982

C 1, AR 5-4

COST FOR PROJECT TO BECOME OPERATIONAL					
EQUIPMENT TYPE	PROPOSED SOURCE OF PROCUREMENT	UNIT PRICE	QUANTITY	TOTAL COST	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT
(1) 13 Watt PL Compact Fluorescents		59.85	359	21,485	
(2)					
(3)					
(4)					
(5)					
(6) TRANSPORTATION (Equipment delivery)					
(7) EQUIPMENT MODIFICATION ¹					
(8) EQUIPMENT INSTALLATION					
(9) MAINTENANCE CONTRACT ²					
(10) FACILITIES MODIFICATION ³					
(11) TRAINING					
(12) OTHER (Specify):					
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL ⁴				21,485	
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				21,485	
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE ⁵				0	
(16) TOTAL (Sum of (14) + (15) above)				21,485	

¹Not to exceed 10% of equipment cost for QRIP projects.

²Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.

³Normally not OPA funded.

⁴Used to compute amortization in Item 11.

⁵Specify source to include certification that funds are available, if financed from the regular budget.

1 August 1982

C 1, AR 5-4

SUMMARY OF SAVINGS (MANPOWER AND DOLLARS)										
ITEMS a	SAVINGS			REAPPLICATION OF SAVINGS						
	NO. MPR OR MHR b	TYPE PERS ⁶ c	DOLLARS d	PROGRAM ELEMENT		TDA PARA AND LINE		FUNCTION CODE		
				e.	f.	g.	h.	i.	j.	
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED										
(2) REQUIREMENTS ONLY ELIMINATED										
(3) BORROWED MILITARY MANPOWER RELEASED										
(4) OVERHIRE OR TEMPORARIES TERMINATED										
(5) HOURS OVERTIME ELIMINATED										
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS ⁷			2,140							
(7) OTHER DOLLAR SAVINGS (Excluding Manpower), e.g., CONTRACT COSTS & UTILITIES			13,630							
(8)										
(9)										
(10)										
(11) TOTAL DOLLAR SAVINGS			15,770							
⁶ (1) US Graded (2) US Wage Board (3) DHFN (4) IHFN (5) Officer (6) WO (7) Enlisted										

⁷ Reflect specific duties being performed with additional manhours available (equivalent manyears)

1 August 1982

REGULATORY APPROVAL/COORDINATION

INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

A. OTHER COORDINATION (Functional Coordination at local level, e.g., Pac Eng, Log, Pers, etc.)

26. SUBMITTED BY (Typed name, grade and title of Subordinate Command/Agency or Project Initiator)	SIGNATURE	DATE (YYMMDD)
		AUTOVON
28. APPROVAL RECOMMENDED BY (MACOM/Agency)	SIGNATURE	DATE (YYMMDD)
		AUTOVON
FOR USE BY HQDA ON OSD PIF PROJECTS ONLY		
27. APPROVED BY	SIGNATURE	DATE (YYMMDD)
		AUTOVON

29. OTHER REMARKS (Cont'd)

GP-N-3 REPLACE EXTERIOR INCANDESCENTS WITH COMPACT FLUORESCENT FLOODS

Many buildings at RAAP are lit with inefficient incandescent lighting. This ECO analyzes the replacement of exterior incand. floods with 13W PL compact fluorescent flood retrofits which screw into the incandescent sockets. This type of project is suitable for non-explosion proof fixtures in areas where a 20-30% reduction in light level is acceptable. Costs and savings were calculated on a per unit basis as shown on page 2. Only areas operating 3 shifts/day, 5 days/wk were considered. A list of buildings with incandescent lighting was compiled from the building survey data (page 3). It is assumed that 50% of the exterior fixtures on this list are non-explosion proof floods.

$$\text{Number of fixtures} = 0.5 / 717 = 359$$

$$\text{Energy savings} = 836 \frac{\text{kwh}}{\text{yr}} \times 0.003413 \frac{\text{MBtu}}{\text{kwh}} \times 359 = 1024 \frac{\text{MBtu}}{\text{yr}}$$

$$\text{Energy cost savings} = \frac{\$25.30}{\text{yr-fixture}} \times 359 \text{ fixtures} = \$9083/\text{yr}$$

$$\text{Mat'l & Labor cost savings} = \frac{\$18.63}{\text{yr-fixture}} \times 359 = \$6688/\text{yr}$$

$$\text{Total cost savings} = 9083 + 6688 = \$15,771/\text{yr}$$

$$\text{Project cost} = \$66.73/\text{fixture} \times 359 = \$23,956$$

$$(\text{Construction cost} = 23,956 / 1.115 = \$21,485)$$

$$\text{Simple Payback} = \$23,956 / (\$15,771/\text{yr}) = 1.5 \text{ yr}$$

GP-N3 Reduce light levels - limited applications to replace exterior
150 W incandescents with 13 W fluorescent screw-in retrofits

- Assume original light levels can be reduced by 20-30%

- Assume non-explosion proof applications

$$\text{Energy savings} = (150 \text{ W} - 16 \text{ W}) \times \frac{24 \text{ hr}}{\text{day}} \times \frac{260 \text{ days}}{\text{yr}} = 836 \frac{\text{kwh}}{\text{yr}}$$

$$\text{Energy cost savings} = 836 \frac{\text{kwh}}{\text{yr}} \times \frac{\$0.03026}{\text{kwh}} = \$25.30 \text{ yr}$$

$$\text{Labor \& mat'l cost savings} = \left(\frac{\text{Incand. cost}}{750 \text{ hr}} - \frac{\text{Fluor. cost}}{10,000 \text{ hr}} \right) \times 6240 \frac{\text{hr}}{\text{yr}}$$

$$= \left[\frac{(\$2.11 \text{ mat'l} + \$1.20 \text{ labor} \times 0.683)}{750 \text{ hr}} - \frac{(\$7.88 \text{ mat'l} + \$1.95 \text{ labor} \times 0.683)}{10,000 \text{ hr}} \right] \times 6240 \frac{\text{hr}}{\text{yr}}$$

$$= \$18.63 \text{ yr}$$

$$\text{Total cost savings} = \frac{\$25.30}{\text{yr}} + \frac{\$18.63}{\text{yr}} = \$43.93 \text{ yr}$$

Mat'l cost = \$37.32 for fixture price including lamp (1989 vendor info, Reflect-A-Star flood)

Labor cost = \$1.20 x 1.2 x 0.683 (cost of replacing incand. + 20%)

$$\text{Project cost} = [(1.045 \times \$37.32) + (1.2 \times \$0.98)] \times 1.661 = \$66.73$$

$$\text{Simple payback} = \frac{\$66.73}{\$43.93/\text{yr}} = 1.5 \text{ yr} < 10 \text{ yr} \Rightarrow \text{recommended}$$



SUBJECT _____
DESIGNER PFH
CHECKER _____

AEP NO _____
SHEET _____ OF _____
DATE 10/29/90
DATE _____

QRIP Calc's

Current energy costs:

$$\frac{150 \text{ W}}{\text{lamp}} \times \frac{24 \text{ hr}}{\text{da}} \times 260 \text{ da} \div 1000 \times 359 \text{ lamps} \times \$0.3026/\text{kwh} =$$
$$= \underline{\$10,168/\text{yr.}}$$

Current material & labor costs:

$$\frac{\text{cost/lamp}}{750 \text{ hr}} \times 359 \times \frac{6240 \text{ hrs}}{\text{yr}}$$
$$\frac{2.11 + 1.2 \times 0.68}{750 \text{ hr}} \times 359 \times 6240 = \underline{\$8750/\text{yr}}$$

New energy costs:

$$16 \times 24 \times 260 \div 1000 \times 359 \times 0.03026 = \$1085/\text{yr.}$$

New mat'l & labor costs

$$\frac{7.83 + 1.95 \times 1.68}{10,000} \times 359 \times 6240 = \underline{\$2062/\text{yr}}$$

Labor savings

$$\left(\frac{1.2 \times 0.68}{750} - \frac{1.95 \times 0.68}{10,000} \right) \times 359 \times 6240 = \$2140/\text{yr.}$$

For fluorescents, replace ~~both~~ lamp only.



SUBJECT _____

AEP NO _____

DESIGNER JA

SHEET _____ OF _____

CHECKER _____

DATE _____

DATE _____

Current mat'l costs:

$$\frac{2.11}{750} \times 359 \times 6240 = \$6302/\text{yr}$$

New mat'l costs:

$$\frac{7.88}{10,000} \times 359 \times 6240 = \$1765/\text{yr}$$

Current labor:

$$8750 - 6302 = \$2448/\text{yr}$$

New labor:

$$2062 - 1765 = \$297/\text{yr}$$

Radford Army Ammunition Plant
List of Buildings with Incandescent Lighting

Bldg No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
1000 -00	Cotton Linter Warehouse	NC, A&B-Line	1	17	17
1606 -00	Open Tank Air Dry	Sol. Recovery, A-Line	10	20	200
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	27	12	324
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	20	60
4912 -27	SG Curing Hse.- Carpet Rolls	Cast Prop. (Rocket)	10	5	50
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	1	6	6
7106 -04	Dry House #4 (Cure Grain)	1st R P	7	8	56
9334 -15	Blender House	4th Rolled Powder	1	4	4
TOTAL FOR EXTERIOR FIXTURES					717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
2019 -00	Boiling Tub House	NC, B-Line	3	50	150
2022 -00	Beater House	NC, B-Line	3	40	120
2024 -00	Poacher & Blending House	NC, B-Line	3	30	90
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	50	150
4912 -40	Forced Air Dry House	Pilot B	21	10	210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	1	4	4
4915 -00	Small Grain Mold Assembly	Cast Prop. (Rocket)	1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
4951 -02	TOW Launch Saw House	Pilot B	1	8	8
5008 -01	15 Inch Press House	Pilot A	3	2	6
6304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	600
TOTAL FOR INTERIOR FIXTURES					1536

INCANDESCENT LAMPS

GENERAL ELECTRIC LAMPS



A-21



G-16 1/2

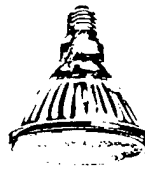


R-40



T-10

INCANDESCENT



PAR-38



G-40



R-30

Bulb	Base	Prod. Code	Lamp Ordering Code	Volts	Std. Pkg. Qty.	Fila-ment Design	MOL (In.)	LCL (In.)	Rated Avg. Life Hours	App. Init. Lum.	DESCRIPTION See Incandescent footnotes pg. 46
100 WATTS (Continued)											
G-40	Medium	39627	100G40/W	120	24	CC-6	6 1/8	--	2500	1280	Pearl (White)--Globe
G-40	Medium	49781	100G40/W	6PK 120	6	CC-6	6 1/8	--	2500	1280	Pearl (White)--Globe. Moonglow
G-40	Medium	13046	100G40/W/L	120	24	CC-6	6 1/8	--	4000	1220	Pearl (White)--Globe
A-23	Medium	18599	100A/B	120	120	CC-6	5 1/8	--	750	--	*Blue
A-23	Medium	18610	100A/G	120	120	CC-6	5 1/8	--	750	--	*Green
A-23	Medium	18594	100A/O	120	120	CC-6	5 1/8	--	750	--	*Orange
A-23	Medium	18632	100A/R	120	120	CC-6	5 1/8	--	750	--	*Red
A-21	Med. (BB)	18363	100A21/TS	120	120	C-9	4 3/8	2 1/8	3000	1280	Clear--Traffic Signal. Rated Watts: 98. BDTH (78)
A-21	Med. (BB)	18365	100A21/TS	130	120	C-9	4 3/8	2 1/8	3000	1280	"
A-21	Med. (BB)	18386	100A21/SP	120	120	C-5	4 3/8	3	200	1340	Clear--Spotlight Light I.F.--Med-
A-21	Med. (BB)	17860	100A21/4SP	120	120	C-5	4 3/8	3	200	--	ical Spotlight
A-23	Medium	18449	100A23	120	120	CC-6	5 1/8	4 1/8	750	--	Inside Frost
A-23	Med. (BB)	18542	100A23/20	120	120	CC-6	5 1/8	4 1/8	1000	--	Clear--Commer-
G-16 1/2	S.C. Bay.	18717	100G16 1/2/29SC	120	60	CC-13	3	1 3/8	200	1660	Clear--Spotlight. BDTH (7.86,99)
G-16 1/2	D.C. Bay.	18721	100G16 1/2/29DC	120	60	CC-13	3	1 3/8	200	1660	"
G-16 1/2	D.C. Bay.	18723	100G16 1/2/29DC	130	60	CC-13	3	1 3/8	200	1660	"
R-40	Medium	18871	**100R/FL	120	24	CC-6	6 3/8	--	2000	1190	Reflector Flood. I.F. (4.35,56)
R-40	Medium	18873	**100R/FL	130	24	CC-6	6 3/8	--	2000	1190	Ref1. Spot--Light I.F. (4.35,56)
R-40	Medium	18876	100R/SP	120	24	CC-6	6 3/8	--	2000	1190	Microscope--ANSI: EDR (22.86,99)
T-8 1/2	Medium	18898	100T8 1/2/9	120	24	CC-13	5 3/8	3	50	1920	††Contour Pro-
T-10	D.C. Med. Ring	18905	100T10/7	6	24	C-6	5 1/2	2 3/8	50	--	jector ANSI: CPS (1.86,99)
T-10	Med. Pref. (HRG)	18907	100T10P	6	24	C-6	5 3/4	2 3/8	50	--	††Contour Pro-
A-23	Medium	18512	100A23	12	120	C-6	5 1/8	4 1/8	1000	--	jector ANSI: CPT (1.86,99)
PAR-38	Med. Side (HRG)	18822	100PAR38/FL	12	12	C-6	4 1/8	--	1000	1400	Inside Frost (53)
PAR-38	Prong (HRG)	18824	100PAR38/2FL	12	12	C-6	5 1/8	--	1000	1400	PAR--Mine Flood (58)
PAR-64	Med. Skir (HRG)	>39394	100PAR64	6	12	C-6	4	--	50	--	PAR--Flood (14.56,96)
PAR-64	Scr. Term (HRG)										Ceillometer--Very Narrow Spot. Filament shielded
R-30	Med. (BB)	>39503	100R30/CL	12	24	C-6	5 3/8	--	2000	1200	Reflector Flood--Clear (4.14,53)
T-8	S.C. Bay.	18881	100T8/1SC	20	24	CC-6	3	2 3/8	50	--	Clear-Contour Map ANSI: BZA (8.31,61.86,94)*
A-21	Medium	18290	100A/RS	30	120	C-9	5 1/4	3 1/8	1000	--	I.F.--Rough Serv.
A-21	Med. (BB)	17845	100A21/3	32	120	C-5	4 3/8	3	500	1610	Clear--Locomotive Headlight (13)
A-23	Medium	17904	100A	34	120	C-9	5 1/8	4 1/8	1000	2160	I.F.--Train
A-23	Med. (BB)	>17906	100A/BB	34	120	C-9	5 1/8	4 1/8	1000	2160	"
PAR-46	Scr. Term (HRG)	34465	100PAR46	60	12	CC-2V	3 3/4	--	800	--	Mine Locomotive Headlight (71)
A-21	Medium	17976	100A	230	120	C-7A	5 1/4	3 1/8	1000	1280	Inside Frost
A-21	Medium	17983	100A	250	120	C-7A	5 1/4	3 1/8	1000	1280	"
A-21	Med. (BB)	18346	100A/99	230-250	120	C-7A	5 1/4	3 1/8	2500	--	I.F.--Ext. Serv.
A-21	Medium	18334	100A/RS	250	120	C-17	5 1/4	3 1/8	1000	960	I.F.--Rough Serv.

> New product listing.

* In "base up" use, heat eventually may deteriorate paper-lined or plastic sockets.

© Source W x H: 4.5 x 3.0mm. Burn base up.

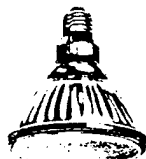
†† Filament offset .100" +/- .030" from base axis.

** PAR ENERGY SAVING in deep down lights consider the 75ER30 lamp shown on page 23. The resulting savings are shown on page 5.



INCANDESCENT LAMPS

GENERAL ELECTRIC LAMPS



PAR-38

INCANDESCENT



R-40

Bulb	Base	Prod. Code	Lamp Ordering Code	Volts	Std. Pkg. Qty.	Fila-ment Desgn	MOL (In.)	LCL (In.)	Rated Avg. Life Hours	App. Init Lum.	DESCRIPTION See Incandescent footnotes pg. 46
150 WATTS (Continued)											
AR-46	Med. Side	41966	150PAR46/3NSP	125	12	CC-13	4	--	2000	1500	Narrow Spot (11,56,58,96)
HRG)	Prong										
AR-46	Med. Side	41968	150PAR46/3MFL	125	12	CC-13	4	--	2000	1500	Medium Flood (11,56,58,96)
HRG)	Prong										
AR-46	Scr. Term	19517	150PAR46	125	12	C-13	3 3/4	--	1000	--	Mine Locomotive Headlight
HRG)	(BB)										
AR-46	3-Prong	>35327	150PAR46/TS	115	12	CC-6	4	--	6000	--	Traffic Signal Stippled Reflector Tapioca lens cover (2)
HRG)											
AR-38	Med. Side	44933	150PAR/3VWFL	125	12	C-13	4 5/8	--	2000	--	† Mine--Wide Flood (56,58,96)
HRG)	Prong										
AR-38	Med. Side	19497	150PAR/4	125	12	C-13	4 5/8	--	2000	--	† Mine--Spot (56,58,96)
HRG)	Prong										
AR-38	Med. Skir	19509	150PAR/5	125	12	C-13	5 5/8	--	2000	--	† Mine--Spot (14,56,96)
HRG)	(BB)										
AR-46	Scr. Term	19518	150PAR46/3	175	12	C-13	3 3/4	--	800	--	Mine Locomotive Headlight (71)
HRG)	(BB)										
-40	Medium	19797	**150R/FL	120	24	CC-6	6 3/8	--	2000	1900	Reflector Flood--ANSI: DWC (4,14,35,56)
-40	Medium	>16445	150R/FL-1	6PK 120	30	CC-6	6 3/8	--	2000	1900	Standard Reflector Flood (4,14,35,56)
-40	Medium	19799	**150R/FL	130	24	CC-6	6 3/8	--	2000	1900	Reflector Flood (4,14,35,56)
-40	Med. (BB)	14715	150R/FL/CVG	130	24	CC-6	6 3/8	--	2000	--	>>Ref. Flood--COV-R-GUARD™ (4,35,56,83)
-40	Medium	19783	150R/SP	120	24	CC-6	6 3/8	--	2000	1900	Ref. Spot--Light I.F. (4,14,35,56)
-40	Medium	>16446	150R/SP-1	6PK 120	30	CC-6	6 3/8	--	2000	1900	Standard Reflector Spot (4,14,35,56)
-40	Medium	19785	150R/SP	130	24	CC-6	6 3/8	--	2000	1900	Reflector Spot--Light I.F. (4,14,35,56)
-40	Medium	19844	150R/A	120	24	CC-6	6 3/8	--	2000	--	Reflector--Amber (14,35,36)
-40	Medium	19823	150R/B	120	24	CC-6	6 3/8	--	2000	--	Reflector--Blue (14,35,36)
-40	Medium	19827	150R/BW	120	24	CC-6	6 3/8	--	2000	--	Reflector--Blue-White (14,35,36)
-40	Medium	19831	150R/G	120	24	CC-6	6 3/8	--	2000	--	Reflector--Green (14,35,36)
-40	Medium	19835	150R/PK	120	24	CC-6	6 3/8	--	2000	--	Reflector--Pink (14,35,36)
-40	Medium	19841	150R/R	120	24	CC-6	6 3/8	--	2000	--	Reflector--Red (14,35,36)
-40	Medium	19851	150R/Y	120	24	CC-6	6 3/8	--	2000	--	Reflector--Yellow (14,35,36)
-40	Med. (BB)	41627	150R40/PL	6PK 120	24	CC-6	6 3/8	--	2000	--	Reflector Plant Light--"Gro and Sho" (4,14,56)
-40	Medium	44674	150R40/TB	120	24	CC-6	6 3/8	--	2000	--	Jewelry Spot Reflector Transpar-ent Daylight Blue (4,14,35,56,76)
-40	Medium	44675	150R40/TB	130	24	CC-6	6 3/8	--	2000	--	Jewelry Spot Reflector Transpar-ent Daylight Blue (4,14,35,56,76)
-25	Med. (BB)	19372	150P25/10	120	60	C-5	4 3/4	3	200	2100	Light I.F.--Spot-light. Hard glass button

• New product listing.

• > Teflon[®] Coated. Teflon is a registered trademark of Dupont.

• Operating position horizontal with locating lug up or down, and with lamp supported by bulb rim.

• * FOR ENERGY SAVING in deep down lights consider the 75ER30 lamp shown on page 23. The resulting savings are shown on page 5.

166 | Lighting

166 100 | Lighting

		CREW	DAILY OUTPUT	MAN-HOURS	UNIT	BARE COSTS				TOTAL
						MAT.	LABOR	EQUIP.	TOTAL	INCL O&P
140	1600 90 watt	1 Elec	.30	26.670	C	5.140	645		5,785	6,600
	1650 135 watt		.20	40		6.905	970		7,875	9,025
	1700 180 watt		.20	40		7.308	970		8,278	9,475
	1750 Quartz line, clear, 500 watt		1.10	7.270		1.872	175		2,047	2,325
	1760 1500 watt		.20	40		3.427	970		4,397	5,200
	1800 Incandescent, interior, A21, 100 watt		1.60	5		173	120		293	370
	1900 A21, 150 watt		1.60	5		211	120		331	410
	2000 A23, 200 watt		1.60	5		227	120		347	430
	2200 PS 30, 300 watt		1.60	5		330	120		450	540
	2210 PS 35, 500 watt		1.60	5		576	120		696	810
	2230 PS 52, 1000 watt		1.30	6.150		1,525	150		1,675	1,900
	2240 PS 52, 1500 watt		1.30	6.150		2,382	150		2,532	2,850
	2300 R30, 75 watt		1.30	6.150		375	150		525	630
	2400 R40, 150 watt		1.30	6.150		408	150		558	670
	2500 Exterior, PAR 38, 75 watt		1.30	6.150		566	150		716	840
	2600 PAR 38, 150 watt		1.30	6.150		525	150		675	795
	2700 PAR 46, 200 watt		1.10	7.270		1,928	175		2,103	2,375
	2800 PAR 56, 300 watt		1.10	7.270		2,193	175		2,368	2,675
	3000 Guards, fluorescent lamp, 4' long		1	8		375	195		570	695
	3200 8' long		.90	8.890		535	215		750	905
145	0010 RESIDENTIAL FIXTURES									
	0400 Fluorescent, interior, surface, circline, 32 watt & 40 watt	1 Elec	20	.400	Ea.	48	9.70		57.70	67
	0500 2' x 2', two U 40 watt		8	1		66	24		90	110
	0700 Shallow under cabinet, two 20 watt		16	.500		45	12.15		57.15	67
	0900 Wall mounted, 4L, one 40 watt, with baffle		10	.800		41	19.40		60.40	74
	2000 Incandescent, exterior lantern, wall mounted, 60 watt		16	.500		36	12.15		48.15	57
	2100 Post light, 150W, with 7' post		4	2		104	49		153	185
	2500 Lamp holder, weatherproof with 150W PAR		16	.500		16	12.15		28.15	35
	2550 With reflector and guard		12	.667		31	16.15		47.15	58
	2600 Interior pendent, globe with shade, 150 watt		20	.400		78	9.70		87.70	100
150	0010 TRACK LIGHTING									
	0080 Track, 1 circuit, 4' section	1 Elec	6.70	1.190	Ea.	33	29		62	79
	0100 8' section		5.30	1.510		48	37		85	105
	0200 12' section		4.40	1.820		81	44		125	155
	0300 3 circuits, 4' section		6.70	1.190		36	29		65	82
	0400 8' section		5.30	1.510		48	37		85	105
	0500 12' section		4.40	1.820		88	44		132	160
	1000 Feed kit, surface mounting		16	.500		12	12.15		24.15	31
	1100 End cover		24	.333		1.98	8.10		10.08	14.05
	1200 Feed kit, stem mounting, 1 circuit		16	.500		16	12.15		28.15	35
	1300 3 circuit		16	.500		16	12.15		28.15	35
	2000 Electrical joiner for continuous runs, 1 circuit		32	.250		6.55	6.05		12.60	16.10
	2100 3 circuit		32	.250		12.10	6.05		18.15	22
	2200 Fixtures, spotlight, 150 PAR		16	.500		47	12.15		59.15	70
	3000 Wall washer, 250 watt tungsten halogen		16	.500		101	12.15		113.15	130
	3100 Low voltage, 2 1/2 watt, 1 circuit		16	.500		102	12.15		114.15	130
	3120 3 circuit		16	.500		109	12.15		121.15	140

166 | Lighting

166 100 Lighting		CREW	DAILY OUTPUT	MAN- HOURS	UNIT	BARE COSTS				TOTAL		
						MAT.	LABOR	EQUIP.	TOTAL	INCL O&P		
135	5100	175 watt metal halide	1 Elec	8	1	Ea.	479	24		503	565	135
	5110	250 watt metal halide		8	1		500	24		524	585	
	5120	150 watt high pressure sodium		8	1		535	24		559	625	
	5130	250 watt high pressure sodium		8	1		556	24		580	645	
	5140	72"H 18" sq., 400 watt metal halide		8	1		525	24		549	615	
	5150	250 watt high pressure sodium		8	1		556	24		580	645	
	5160	400 watt high pressure sodium	↓	8	1	↓	581	24		605	675	
	5190	Portable rectangle, 6" high 13.5" x 20"										
	5200	175 watt metal halide	1 Elec	12	.667	Ea.	293	16.15		308.15	345	
	5210	250 watt metal halide		12	.667		314	16.15		330.15	370	
	5220	150 watt high pressure sodium		12	.667		335	16.15		351.15	390	
	5230	250 watt high pressure sodium		12	.667		360	16.15		376.15	420	
	5240	8" high 18" x 24", 400 watt metal halide		12	.667		365	16.15		381.15	425	
	5250	250 watt high pressure sodium		12	.667		376	16.15		392.15	435	
	5260	400 watt high pressure sodium		12	.667		398	16.15		414.15	460	
	5270	Portable square, 15" high 13.5" sq., 175 watt metal halide		12	.667		324	16.15		340.15	380	
	5280	250 watt metal halide		12	.667		376	16.15		392.15	435	
	5290	150 watt high pressure sodium		12	.667		360	16.15		376.15	420	
	5300	250 watt high pressure sodium		12	.667		386	16.15		402.15	450	
	5400	Pendent 16" round/square, 175 watt metal halide		3.20	2.500		355	61		416	480	
140	5410	250 watt metal halide		2.70	2.960		370	72		442	515	140
	5420	400 watt metal halide		2.40	3.330		398	81		479	555	
	5430	150 watt high pressure sodium		3.20	2.500		398	61		459	525	
	5440	250 watt high pressure sodium		2.70	2.960		428	72		500	575	
	5450	400 watt high pressure sodium	↓	2.40	3.330	↓	454	81		535	620	
	0010	LAMPS										
	0080	Fluorescent, rapid start, cool white, 2' long, 20 watt	1 Elec	1	8	C	348	195		543	670	
	0100	4' long, 40 watt		.90	8.890		198	215		413	535	
	0120	3' long, 30 watt		.90	8.890		442	215		657	805	
	0150	U-40 watt		.80	10		874	245		1,119	1,325	
0170	4' long, 35 watt energy saver		.90	8.890		270	215		485	615		
0200	Slimline, 4' long, 40 watt		.90	8.890		618	215		833	995		
0300	8' long, 75 watt		.80	10		577	245		822	990		
0350	8' long, 60 watt energy saver		.80	10		603	245		848	1,025		
0400	High output, 4' long, 60 watt		.90	8.890		750	215		965	1,150		
0500	8' long, 110 watt		.80	10		775	245		1,020	1,200		
0520	Very high output, 4' long, 110 watt		.90	8.890		1,285	215		1,500	1,725		
0550	8' long, 215 watt		.70	11.430		1,285	275		1,560	1,825		
0600	Mercury vapor, mogul base, deluxe white, 100 watt		.30	26.670		2,142	645		2,787	3,300		
0650	175 watt		.30	26.670		1,663	645		2,308	2,775		
0700	250 watt		.30	26.670		2,968	645		3,613	4,225		
0800	400 watt		.30	26.670		2,340	645		2,985	3,525		
0900	1000 watt		.20	40		5,100	970		6,070	7,025		
1000	Metal halide, mogul base, 175 watt		.30	26.670		3,749	645		4,394	5,075		
1100	250 watt		.30	26.670		4,712	645		5,357	6,125		
1200	400 watt		.30	26.670		4,386	645		5,031	5,775		
1300	1000 watt		.20	40		9,894	970		10,864	12,300		
1320	1000 watt, 125,000 initial lumens		.20	40		9,960	970		10,930	12,400		
1330	1500 watt		.20	40		9,268	970		10,238	11,600		
1350	Sodium high pressure, 70 watt		.30	26.670		4,712	645		5,357	6,125		
1360	100 watt		.30	26.670		4,871	645		5,516	6,300		
1370	150 watt		.30	26.670		5,059	645		5,704	6,525		
1380	250 watt		.30	26.670		5,380	645		6,025	6,875		
1400	400 watt		.30	26.670		5,727	645		6,372	7,250		
1450	1000 watt		.20	40		13,352	970		14,322	16,100		
1500	Low pressure, 35 watt		.30	26.670		3,963	645		4,608	5,300		
1550	55 watt		.30	26.670		4,386	645		5,031	5,775		



LUMATECH

CONTRACTOR PRICE LIST

GP-N-3 p. 9 of 10

CODE

DESCRIPTION

STD. PKG.
PKG. WT. LIST PRICE
QTY. (LBS.) PRICE

REFLECT-A-STAR®—COMPACT FLUORESCENT FLOODLIGHT SERIES

10513T
10514T
10515T



PL5 3.75" Diameter Reflector
PL5 4.50" Diameter Reflector
PL5 5.25" Diameter Reflector

10 11 64.32
10 11 64.32
10 11 64.32

10923
10924
10925

PL9Q 3.75" Diameter Reflector
PL9Q 4.50" Diameter Reflector
PL9Q 5.25" Diameter Reflector

10 11 73.14
10 11 73.14
10 11 73.14

11324
11325

PL13Q 4.50" Diameter Reflector
PL13Q 5.25" Diameter Reflector

10 11 74.64
10 11 74.64

-G

Gold reflector options
available in all units

ADD: 5.25 2.63

10003-P*
10003-W
10003-WF
10003-PF
10003-CF
10003-C



Pink Lens
Warmtone Lens
Warmtone Frost Lens
Pink Frost Lens
Clear Frost Lens
Clear Lens (Standard)

10 1 4.35 2.18
10 1 4.35 2.18
10 1 4.35 2.18
10 1 4.35 2.18
10 1 3.00 1.50
10 1 3.00 1.50

10003-U

Ultraviolet Filter Insert Disk

10 1 4.35 2.18

XT-125



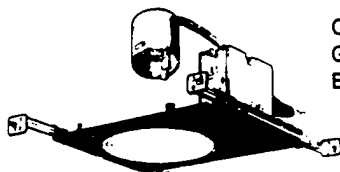
Socket extender—extends unit 1.25"

25 4 4.95 2.48

*IMPORTANT: To order optional lenses or filters, please specify reflector size. The last digit of the product code number for the Reflect-A-Star Series indicates the reflector diameter. "3" indicates 3 3/4", "4" indicates 4 1/2" and "5" indicates 5 1/4".

RECESSED DOWNLIGHT KIT*

5111325
5121325
5131325



Clear Reflector Trim
Gold Reflector Trim
Black Reflector Trim

12 70 176.64 88.32
12 70 176.64 88.32
12 70 176.64 103.32

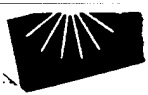


13Quad: 900 lumens as per Bruce Pelton

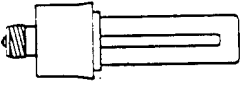
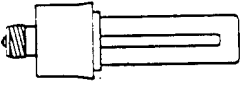
*The recessed downlight kit consists of a frame-in kit, reflector trim in clear, gold or black Alzak® aluminum and a Reflect-A-Star model number 11325 with standard reflector and lens.

*Fixture price includes lamp. "PL" or "PLQ" refers to lamp type only. GE, Osram, Philips or Sylvania lamps will be supplied at the discretion of the distributor.

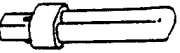
GP-N-3 p. 10 of 10



MicroLamp™ — FLUORESCENT ADAPTOR SERIES

20510		PL5	50	28	28.17	14.09
20710		PL7	50	28	28.17	14.09
20910		PL9	50	28	28.17	14.09
20920		PLQ9	50	28	39.03	19.52
21320		PLQ13	50	30	39.03	19.52

FLUORESCENT REPLACEMENT LAMPS**

40510		5W Fluorescent "PL" lamp	50	4	9.00	4.50
40710		7W Fluorescent "PL" lamp	50	4	9.00	4.50
40910		9W Fluorescent "PL" lamp	50	5	9.00	4.50
41310		13W Fluorescent "PL" lamp	50	6	9.75	4.88
40920		9W Fluorescent "PLQ" lamp	50	7	15.75	7.88
41320		13W Fluorescent "PLQ" lamp	50	8	15.75	7.88

CONDITIONS OF SALE

ORDER ACCEPTANCE

Orders are subject to approval at Lumatech corporate headquarters.

PRICES

Prices are subject to change without notice. Lumatech reserves the right to accept and bill all orders at prices in effect at the time of the shipment.

TERMS

Net 30 days on approved credit only. 1 1/2% per month will be assessed on past due invoices. Any account submitted for collection is subject to reasonable attorney fees and costs.

FREIGHT

Transportation costs will be pre-paid and billed F.O.B. Oakland, California.

RETURNS

No merchandise may be returned without prior written authorization. Authorization may be requested within 30 days from the date of original shipment. All returns will be subject to a minimum handling and factory inspection charge of 25% of invoiced amounts, plus freight, except on products considered by Lumatech to be defective in workmanship and materials.

CLAIMS FOR DAMAGE OR LOSS IN SHIPMENT

It is the responsibility of the consignee to file a claim with the transportation company in the event of lost or damaged merchandise. Immediately upon receipt of the shipment, the consignee should check for loss or damage. In the event such has occurred the consignee should file a claim with the transportation company promptly.

CANCELLATIONS

Orders are not cancelable except on payment for all costs incurred, engineering work performed, any materials purchased or commitments made on the part of Lumatech. Lumatech reserves the right to assess a minimum cancellation charge equal to 25% of the original purchase price of the order placed by the customer.

PRODUCT SPECIFICATIONS

Subject to change without notice.

CATALOG ERRORS

Every effort is made on the part of Lumatech Corporation to provide accurate pricing, dimensional and physical description information, etc. in our literature and price lists. However, as this information is subject to change without notice, we cannot accept the responsibility for any loss or damages due to informational errors in our publications. We invite your inquiry regarding up to date information.

MINIMUM ORDER

Minimum net invoice amount is \$50.00. Any order under \$50.00 is subject to a \$10.00 handling charge.

LIMITED WARRANTY

The REFLECT-A-STAR™ and MicroLamp™ series fixtures are warranted to be free from defects in workmanship and materials, as manufactured, for a period of three years from the date of original invoice. Lamps are warranted for 90 days only.

Our invoice covers only replacement or repair at our factory of the defective part(s), to the original purchaser, and excludes any responsibility for labor or freight expense incurred by the purchaser or others, for servicing such claim during the warranty period. Lumatech reserves the right to issue credit, repair or replace defective merchandise, at our option, upon receipt of written notification by the original purchaser of the alleged defect, within the warranty period. Lumatech further reserves the right to examination of the alleged defective product, or proof satisfactory to Lumatech of the defect. This limited warranty is in lieu of all other responsibility for labor costs in connection with the installation, removal or replacement of warranted products, or for any consequential damages. Lumatech further reserves the right to refuse to honor the above warranty for any product(s) altered, improperly installed, or installed in application for which not intended.

For Authorized Dealer Contact:

1 August 1982

C 1, AR 5-4

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS				1. PROJECT NO.		REQUIREMENT CONTROL SYMBOL DD-M(R) 1691	
For use of this form, see AR 5-4; the proponent agency is OCA.							
2. TO: CDR, AMC (AMCRM-MP) 5001 Eisenhower Avenue Alexandria, VA 22333-0001		3. THRU:		4. FROM: CDR, AMCCOM Attn: AMSMC-MGP-P (R) Rock Island, IL 61299-6000		5. DOD COMP NAME Army	
						6. DOD COMP CODE A	
						7. COMMAND CODE W73QKK	
						8. DATE	
9. PROJECT TITLE Install Turning Vanes in Boiler Ductwork (ECO GP-X-4)				10. TYPE OF PROJECT (Check one)			
				☒ QIP ☐ OSD PIF ☐ PECIP			
				11. AMORTIZATION YEARS/MONTHS			
				\$ 36,630 ÷ 21,998 X 12 (Project Cost) (Average Annual Savings) (No. Mo)			
				- 1.7 or - - (year) (month) (amortization)			
12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR 024				13. ECONOMIC LIFE 25 yrs.			
14. EXPECTED OPERATIONAL DATE				15. PROJECT DESCRIPTION Replace the existing square corner ductwork in Power House 1 exit gas stream with rounded elbows.			
16. SUBMITTING UNIT(S) Administrative Contracting Office Radford Army Ammunition Pt. Radford, VA 24141		16. UNIT ID CODE WOLLAA		17. PROJECT DESCRIPTION Replace the existing square corner ductwork increased energy use for both forced draft and induced draft fans. Replacing the inside corner with rounded elbows will reduce the pressure drop and save energy.			
18. DETAILED JUSTIFICATION							
Existing square corner ductwork increased energy use for both forced draft and induced draft fans. Replacing the inside corner with rounded elbows will reduce the pressure drop and save energy.							
19. SAVINGS DISPOSITION							
Savings are used to reduce energy costs.							
20. OTHER REMARKS (Continue on page 5, if more space is needed)							

1 August 1982

SUMMARY OF DOLLAR SAVINGS
(ROUND OFF TO THE NEAREST DOLLAR)

Attach computation sheet identifying the method and source of data for savings

SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS			
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES									
UTILITIES									
MAINTENANCE/ REPAIR									
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY (Identify) Electricity	33,780	9,792	9,792	9,792	9,792	21,988	21,988	21,988	21,988
CONTRACT COSTS									
OTHER (Identify)									
TOTALS	33,780	9,792	9,792	9,792	9,792	21,988	21,988	21,988	21,988

PRIORITIZATION

(1) INTERNAL RATE OF RETURN (IRR) Divide estimated project cost 36,630 by average annual savings 21,988 = 1.67 factor. Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 35 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (S/I) Multiply annual savings 21,988 X discount factor 11.37 = 250,004 and divide by present value of investment (undiscounted) 36,630 = 6.8 S/I. (Based on economic life 25 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE (RIMS) NA Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS. (Manpower requirements cannot be used in this computation.)

1 August 1982

August 1968

COST FOR PROJECT TO BECOME OPERATIONAL						
EQUIPMENT TYPE	PROPOSED SOURCE OF PROCUREMENT	UNIT PRICE	QUANTITY	TOTAL COST	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT	FY FUNDS REQUIRED
(1) Rounded Elbow Ductwork		3,663	10	36,630		
(2)						
(3)						
(4)						
(5)						
(6) TRANSPORTATION (Equipment delivery)						
(7) EQUIPMENT MODIFICATION ¹						
(8) EQUIPMENT INSTALLATION						
(9) MAINTENANCE CONTRACT ²						
(10) FACILITIES MODIFICATION ³						
(11) TRAINING						
(12) OTHER (Specify):						
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL ⁴				36,630		
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				36,630		
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE ⁵				0		
(16) TOTAL (Sum of (14) + (15) above)				36,630		

¹Not to exceed 10% of equipment cost for QRIP projects.²Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.³Normally not OPA funded.⁴Used to compute amortization in Item 11.⁵Specify source to include certification that funds are available, if financed from the regular budget.

1 August 1982

REGULATORY APPROVAL/COORDINATION

INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

4. OTHER COORDINATION (Functional Coordination at local level, e.g., Pac Eng, Log, Pers, etc.)

25. SUBMITTED BY (Typed name, grade and title of Subordinate Command/Agency or Project Initiator)	SIGNATURE	DATE (YYMMDD)
		AUTOVON
26. APPROVAL RECOMMENDED BY (MACOM/Agency)	SIGNATURE	DATE (YYMMDD)
		AUTOVON
27. APPROVED BY		DATE (YYMMDD)
		AUTOVON

FOR USE BY HQDA ON OSD PIF PROJECTS ONLY

28. OTHER REMARKS (Cont'd)

ECD#GP-X-4. INSTALL TURNING VANES IN BOILER DUCTS
PRESSURE DROP WITH EXISTING SQUARE CORNER

ASSUME: 5280 FT/MIN, 300°F EXIT GAS TEMP.,

ASPECT RATIO (W/D) = 1

FROM FIG 20 (ATTACHED) PRESSURE DROP IS 0.8 IN.W.C.

PRESSURE DROP WITH 24" RADIUS REND IN LIEU OF
SQUARE CORNER ASSUME 6' X 6' DUCT.

$$R/D = \frac{24/12}{6} = .333$$

FROM FIG 20 $\Delta P = 0.28$ IN.W.C.

FAN ENERGY SAVED

$$\text{VOLUME} = 6' \times 6' \times 5280 \text{ FT/MIN} = 190,000 \text{ ACFM}$$

$$\text{ENERGY} = \frac{(190,000)(0.8 - 0.28)}{6356 \times .7} \times 746 = 16.56 \text{ KW}$$

ASSUME 50% LOAD FACTOR ON FAN

$$16.56 \text{ KW} \times 8760 \text{ hr/yr} \times .5 = 72532 \text{ KWH/yr.}$$

$$72532 \text{ KWH/yr} \times 3413 \frac{\text{BTU}}{\text{KWH}} \times 10^{-6} \frac{\text{MBTU}}{\text{BTU}} = 248 \text{ MBTU/yr}$$

Typically 3 boilers operate in winter and 2 in
the summer

Assuming 2.5 boilers and 4 elbows per boiler

$$\text{gives } 2.5 \times 4 \times 248 \text{ MBTU/yr} = 2480 \text{ MBTU/yr}$$



SUBJECT _____
DESIGNER PFH
CHECKER _____

AEP NO _____
SHEET _____ OF _____
DATE _____
DATE _____

QRIP Calc'n

Current energy use =

$$\frac{(190,000)(0.8)}{6356 \times 0.7} \times \frac{7.116}{1000} \times \frac{3760}{2} \times 0.03026 = \$3373/\text{elbow}$$

$$\$3378 \times 10 \text{ elbows} = \underline{\$33,730/\text{yr.}}$$

FRICTION LOSS IN RECTANGULAR DUCTS

All of the losses are figured for unlined steel ducts at 70 F and A/B ratio = 1. Correct for other temperatures and ratios as shown.

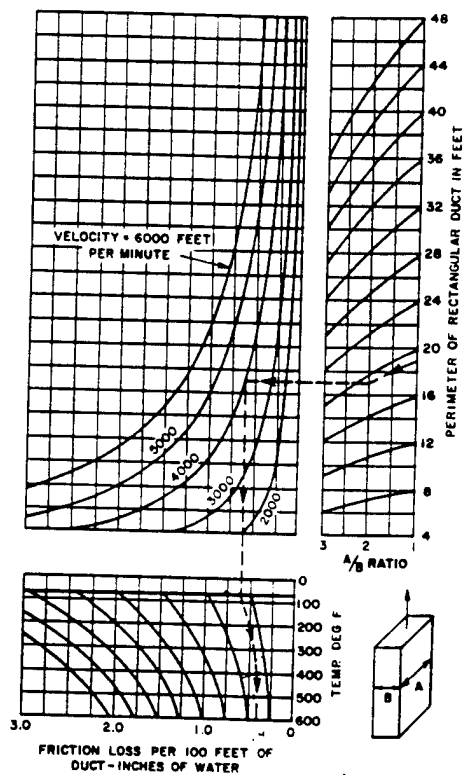


Fig. 19

72

FRICTION LOSS IN PLAIN RECTANGULAR ELBOWS

All of the losses are figured for unlined steel elbows at 70 F and W/D ratio = 1. Correct for other temperatures and ratios as shown.

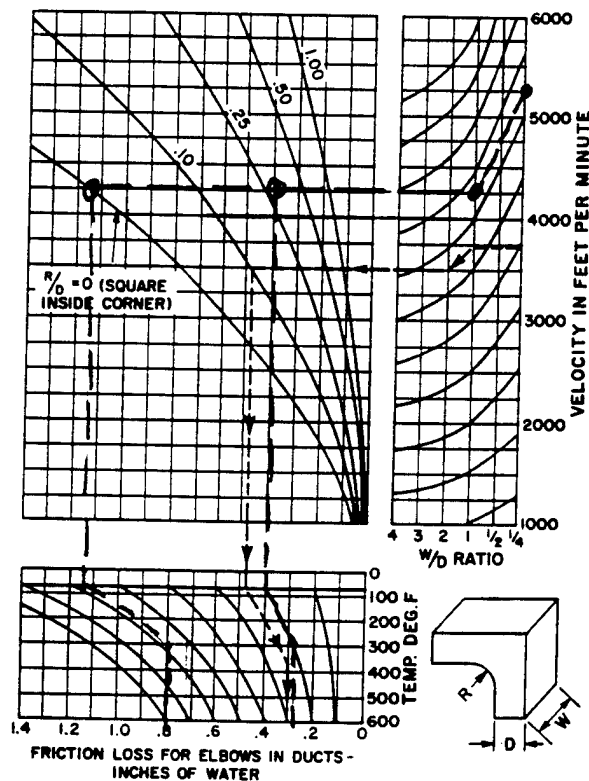


Fig. 20

73

24" RADIUS BEND MAT'L COST

ASSUME: 7 gage PLATE, 6 FT WIDE DUCT, \$2/LB STEEL

AREA

$$24 \text{ IN} \times \frac{1 \text{ FT}}{12 \text{ IN}} \times \frac{2\pi}{4} \times 6 \text{ FT} = 18.85 \text{ FT}^2/\text{bend}$$

Weight

7 gage PLATE weighs 7.5 LBS/FT²

$$18.85 \text{ FT}^2/\text{bend} \times 7.5 \text{ LBS/FT}^2 = 141 \text{ LBS/bend}$$

Cost

STEEL PLATE COSTS ABOUT \$2/LB* FABRICATED

* MEANS. SPECIALTY STEEL

$$141 \text{ LBS/bend} \times \$2/\text{LB} = \$282/\text{bend.}$$

1 August 1982

C 1, AR 5-4

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS For use of this form, see AR 5-4; the proponent agency is OCA.				1. PROJECT NO.		REQUIREMENT CONTROL SYMBOL DD-M(R) 1581	
2. TO: CDR, AMC (AMCRM-MP) 5001 Eisenhower Avenue Alexandria, VA 22333-0001		3. THRU:		4. FROM: CDR, AMCCOM Attn: AMSMC-MGP-p (R) Rock Island, IL 61299-6000		5. DOD COMP NAME Army	6. DOD COMP CODE A
9. PROJECT TITLE Modify Boiling Tub Heating Method (ECO NC-X-1)		10. TYPE OF PROJECT (Check one) ☒ ORIP ☐ OSD PIF ☐ PECIP		11. AMORTIZATION YEARS/MONTHS 8,924 + 8,630 X 12 (Project Cost) (Average Annual Savings) (No. Mo) - 1.03 or 0 (month) (years) (amortization)		7. COMMAND CODE W73QKK	8. DATE
12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR 024		13. ECONOMIC LIFE 25 years		14. EXPECTED OPERATIONAL DATE			
15. SUBMITTING UNIT(S) Administrative Contracting Office Radford Army Ammunition Pt. Radford, VA 24141		16. UNIT ID CODE WOLLAA		17. PROJECT DESCRIPTION A closed heat exchanger will be installed on one boiling tub to replace the steam percolation method currently in use.			
18. DETAILED JUSTIFICATION The steam percolation method now used allows steam to escape from the boiling tub by a "puffing" action. Using a closed heat exchanger to heat the tub contents will greatly reduce this heat loss.							
19. SAVINGS DISPOSITION Savings are used to reduce energy costs.							
20. OTHER REMARKS (Continue on page 6, if more space is needed)							

1 August 1982

C 1, AR 5-4

SUMMARY OF DOLLAR SAVINGS (ROUND OFF TO THE NEAREST DOLLAR)									
Attach computation sheet identifying the method and source of data for savings									
SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS			
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES									
UTILITIES									
MAINTENANCE/ REPAIR									
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY (Identify)									
Coal	23,100	14,470	14,470	14,470	14,470	8,630	8,630	8,630	8,630
CONTRACT COSTS									
OTHER (Identify)									
TOTALS	23,100	14,470	14,470	14,470	14,470	8,630	8,630	8,630	8,630

PRIORITIZATION

(1) INTERNAL RATE OF RETURN (IRR)

Divide estimated project cost 8,954 by average annual savings 8,630 = 1.04 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 185 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (S/I)

Multiply annual savings 8,630 X discount factor 13.34 = 115,124 and divide by present value of investment

(undiscounted) 8,924 = 12.9 S/I.

(Based on economic life 25 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE (RIMS) NA

Divide estimated project cost by number of manpower space savings = RIMS.

(Manpower requirements cannot be used in this computation.)

1 August 1982

C 1, AR 5-4

COST FOR PROJECT TO BECOME OPERATIONAL						
EQUIPMENT TYPE	PROPOSED SOURCE OF PROCUREMENT	UNIT PRICE	QUANTITY	TOTAL COST	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT	FY FUNDS REQUIRED
(1) Closed Heat Exchanger		8,924	1	8,924		
(2)						
(3)						
(4)						
(5)						
(6) TRANSPORTATION (Equipment delivery)						
(7) EQUIPMENT MODIFICATION ¹						
(8) EQUIPMENT INSTALLATION						
(9) MAINTENANCE CONTRACT ²						
(10) FACILITIES MODIFICATION ³						
(11) TRAINING						
(12) OTHER (Specify):						
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL ⁴				8,924		
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				8,924		
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE ⁵				0		
(16) TOTAL (Sum of (14) + (15) above)				8,924		

¹Not to exceed 10% of equipment cost for QRIP projects.²Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.³Normally not OPA funded.⁴Used to compute amortization in Item 11.⁵Specify source to include certification that funds are available, if financed from the regular budget.

1 August 1982

C 1, AR 5-4

SUMMARY OF SAVINGS (MANPOWER AND DOLLARS)										
ITEMS	SAVINGS			REAPPLICATION OF SAVINGS						
	NO. MPR OR MHR	TYPE PERS	DOLLARS	PROGRAM ELEMENT		TDA PARA AND LINE		FUNCTION CODE		
				f.	TO	g.	FROM	h.	FROM	i. TO
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED										
(2) REQUIREMENTS ONLY ELIMINATED										
(3) BORROWED MILITARY MANPOWER RELEASED										
(4) OVERHIRES OR TEMPORARIES TERMINATED										
(5) HOURS OVERTIME ELIMINATED										
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS ⁷										
(7) OTHER DOLLAR SAVINGS (Excluding Manpower), e.g., CONTRACT COSTS & UTILITIES			8,630							
(8)										
(9)										
(10)										
(11) TOTAL DOLLAR SAVINGS			8,630							
⁶ (1) US Graded (2) US Wage Board (3) DHFN (4) IHFN (5) Officer (6) WO (7) Enlisted										
⁷ Reflect specific duties being performed with additional manhours available (equivalent manyears)										

1 August 1982

REGULATORY APPROVAL/COORDINATION

INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

A. OTHER COORDINATION (Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)

26. SUBMITTED BY (Typed name, grade and title of Subordinate Command/Agency or Project Initiator)

SIGNATURE

DATE (YYMMDD)

AUTOVON

28. APPROVAL RECOMMENDED BY (MACOM/Agency)

SIGNATURE

DATE (YYMMDD)

AUTOVON

FOR USE BY HQDA ON OSD PIF PROJECTS ONLY

27. APPROVED BY

SIGNATURE

DATE (YYMMDD)

AUTOVON

20. OTHER REMARKS (Cont'd)



SUBJECT _____
DESIGNER BA
CHECKER BA

AEP NO _____
SHEET 1 OF _____
DATE 9-24-90
DATE _____

ECO # NC -X- 1 INSTALL BOILING TUB HEAT EXCHANGER

Hercules data shows boiling tubs
consume 1408 LBS /HR of 40 PSIA STEAM for
a tub on boil.

HEAT CONSUMPTION

$$\frac{1408 \text{ LBS/HR/TUB} \times 1175 \text{ BTU/LB}}{10^6 \text{ BTU/MBTU}} = 1.654 \text{ MBTU/HR/TUB}$$

OTHER DATA SHOWS A TUB IS ON BOIL FOR
ABOUT 75% OF ITS CYCLE

ANNUAL HEAT CONSUMED

$$1.654 \text{ MBTU/HR/TUB} \times 8760 \times .75 = 10,870 \text{ MBTU/year/tub}$$

PERCENT HEAT SAVED BY CONDENSING STEAM

$$\begin{aligned} \% &= \frac{h_{fg}}{h_f} \times 100 \\ &= \frac{919 \text{ BTU/LB}}{1175 \text{ BTU/LB}} \times 100 = 78.2\% \end{aligned}$$

ANNUAL HEAT SAVED @ TUBS

$$10,870 \text{ MBTU/year/tub} \times .782 = 8501 \text{ MBTU/yr/tub}$$

ANNUAL COAL SAVING

$$\text{Coal savings} = 8501 \times 1.32 = 11,221 \text{ MBTU/tub}$$

3/91



SUBJECT _____

AEP NO _____

SHEET 2 OF _____DESIGNER GF

DATE _____

CHECKER DA

DATE _____

NC-X-1Electricity price differential costs:

$$\$1.11/\text{MBTU 40\#STM.} \times 8501 \text{ MBTU} = \underline{\$9436} \text{ /yr /TUB}$$



SUBJECT _____

AEP NO _____

DESIGNER 87SHEET 3 OF _____CHECKER JADATE 9/25/90

DATE _____

NC-X-1CALCULATE # of tubs ~~to~~ used each year

$$27.9 \times 10^6 \text{ \# NC/yr} \div 30,000 \text{ LBS NC/TUB CYCLE} = 930 \text{ Tub cycles/yr}$$

$$\frac{930 \text{ Tub cy/yr} \times 100 \text{ HR/cy}}{8760 \text{ HR/yr}} = 10.6 \text{ TUBS} \approx 11 \text{ TUBS.}$$

assuming 85% AVAILABILITY

$$\frac{11 \text{ TUBS}}{.85} = 12.9 \approx 13 \text{ TUBS.}$$

RAAP COAL ENERGY SAVINGS

$$11,221 \text{ MBTU/yr/TUB} \times 11 \text{ TUBS} = \underline{123,431 \text{ MBTU COAL/yr}}$$

$$123,431 \text{ \#} \times 1.61 = \$198,724/\text{yr.}$$

Electricity Price Differential Costs:

$$\frac{8501 \text{ MBTU}}{\text{Tub}} \times \$1.11/\text{MBTU} \times 11 \text{ tubs} = \underline{\$103,797}$$

RAAP NET SAVINGS

$$\$198,724 - 103,797 = \underline{\$94,927/\text{yr}}$$



SUBJECT _____
DESIGNER GF
CHECKER QA

AEP NO _____
SHEET 4 OF _____
DATE _____
DATE _____

NC-X-1

TOTAL INSTALLED COST
COST = \$44613 FOR 5 TUBS

$$\frac{\$44613}{5 \text{ TUBS}} \times 13 \text{ TUBS} = \$115,993$$

SIMPLE PAYBACK

$$\frac{\$115,993}{94,921} = \underline{1.2 \text{ yrs}}$$

For QIRIP:

TOTAL COAL USED PER TUB

$$\underline{10,870 \text{ MBtu/yr/tub}} \times \underline{1.32 \frac{\text{MBtu coal}}{\text{MBtu atm}}} = \underline{14,348 \text{ MBtu}}$$

$$\text{FUEL COST} = 14,348 \text{ MBtu} \times \$1.61/\text{MBtu} = \underline{\$23,100}$$

SAVINGS = COAL SAVINGS - ELEC
PRICE DIFF COSTS

$$= (11,221 \text{ MBtu} \times \$1.61) - \$9436 = \underline{\$8630}$$

DIFF
(Proposed METHOD)

$$= \underline{\$14,470}$$

$$\text{COST} = \frac{\$115,993}{5} = \underline{\$8924}$$

CONSTRUCTION COST ESTIMATE				DATE PREPARED		SHEET OF	
PROJECT ENERGY ENGINEERING ANALYSIS				BASIS FOR ESTIMATE ☐ CODE A (No design completed) ☐ CODE B (Preliminary design) ☐ CODE C (Final design) ☐ OTHER (Specify) _____			
LOCATION RADFORD ARMY AMMUNITION PLANT							
ARCHITECT ENGINEER REYNOLDS, SMITH AND HILLS A.E.P., INC.							
DRAWING NO. ECO# ~~GC~~ NC-X-1		ESTIMATOR Gallan		CHECKED BY JH			
PERC. LINE H/X SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
HEAT EXCHANGER							
3" SS 150 LB FLANGE	4	ea	29.00	116	129.15	517	633
SS 150 LB 4X3 REDUCE	2	ea	30.00	60	100.00	200	260
3" SCH 80 316 PIPE	20	FT	8.60	172	57.28	1145	1317
4" SCH 40 316 PIPE	20	FT	9.05	181	35.56	707	888
Pump							
mech	1	ea	88	88	1560	1560	1648
ELEC (means pg 277)	1	ea	430	430	290	290	720
INSULATION							
4" pipe - 2" THK	20	FT	2.99	60	35.57	111	171
SUB TOTAL (ONE TUB)				1107		4530	5637
5 TUBS	5		1107	5535	4530	22650	28185
LOCATION FACTOR			.683	3780	1.002	22695	26475
SALES TAX			1	3780	1.048	23716	27496
FICA INS			1.2	4536	1.00	23716	28252
OVER HEAD 15%							32490
PROFIT 10%							35739
BOND 1%							36096
CONTINGENCY 10%							39706
HERCULES 6%							42088
DESIGN FEE 6%							44613
TOTAL							44613
13 TUBS		13/5					\$115,994
SOURCE: 1989 MEANS							

OSD PIF

1 August 1982

C 1, AR 5-4

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS For use of this form, see AR 5-4; the proponent agency is OCA.			1. PROJECT NO.		REQUIREMENT CONTROL SYMBOL DD-M(R) 1561	
2. TO: HQ. DA (EACA-RMP) Rm 3B719 (Pentagon) Washington, DC 20310-2070		3. THRU: CDR, AMC (AMCRM-MP) 5001 Eisenhower Avenue Alexandria, VA 22333-0001		4. FROM: CDR, AMCCOM Attn: AMSMC-MGP-P (R) Rock Island, IL 61299-6000		5. DOD COMP NAME Army
9. PROJECT TITLE Install Variable Frequency Drives on Plant Water Pumps (ECO GP-B-4)		10. TYPE OF PROJECT (Check one) ☐ ORIP ☒ OSD PIF ☐ PECIP		6. DOD COMP CODE A		7. COMMAND CODE W73QKK
12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR 024		13. ECONOMIC LIFE 15 yrs.		8. DATE		11. AMORTIZATION YEARS/MONTHS \$ 185,735 + 96,994 X 12 (Project Cost) (Average Annual Savings) (No. Mo) - 1.9 or -- (months) (amortization)
15. SUBMITTING UNIT(S) Administrative Contracting Office Radford Army Ammunition Pt. Radford, VA 24141		16. UNIT ID CODE WOLLA		17. PROJECT DESCRIPTION Install variable frequency drives on the water supply pumps so that the water pumped will match the water required.		
18. DETAILED JUSTIFICATION Currently, water is pumped from the New River at a constant rate of about 24,000,000 gallons per day, with a plant usage of about 14,000,000 gallons per day. The remainder is returned to the river. Variable frequency drives would allow the existing pumps to reduce flow to match the demand.						
19. SAVINGS DISPOSITION						
20. OTHER REMARKS (Continue on page 5, if more space is needed)						

1 August 1982

C 1, AR 5-4

SUMMARY OF DOLLAR SAVINGS (ROUND OFF TO THE NEAREST DOLLAR)									
Attach computation sheet identifying the method and source of data for savings									
SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS			
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR
SALARY/LABOR/ OVERTIME									
MATERIAL/ SUPPLIES									
UTILITIES									
MAINTENANCE/ REPAIR									
TRANSPORTATION									
LEASE COSTS									
SALVAGE/ TURN-IN									
ENERGY (Identify)	287,240	190,246	190,246	190,246	190,246	96,994	96,994	96,994	96,994
CONTRACT COSTS									
OTHER (Identify)									
TOTALS	287,240	190,246	190,246	190,246	190,246	96,994	96,994	96,994	96,994

PRIORITIZATION

(1) INTERNAL RATE OF RETURN (IRR) Divide estimated project cost 185,735 by average annual savings 96,994 = 1.91 factor. Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 72 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (S/I) Multiply annual savings 96,994 X discount factor 8.78 = 851,607 and divide by present value of investment (undiscounted) 185,735 = 4.6 S/I. (Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE (RIMS) Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS. (Manpower equivalents cannot be used in this computation.)

1 August 1982

C 1, AR 5-4

COST FOR PROJECT TO BECOME OPERATIONAL						
EQUIPMENT TYPE	PROPOSED SOURCE OF PROCUREMENT	UNIT PRICE	QUANTITY	TOTAL COST	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT	FY FUNDS REQUIRED
(1) 600 hp Variable Freq. Drive		97,590	1	97,590		
(2) 400 hp Variable Freq. Drive		66,109	1	66,109		
(3) 100 hp Variable Freq. Drive		22,036	1	22,036		
(4)						
(5)						
(6) TRANSPORTATION (Equipment delivery)						
(7) EQUIPMENT MODIFICATION ¹						
(8) EQUIPMENT INSTALLATION						
(9) MAINTENANCE CONTRACT ²						
(10) FACILITIES MODIFICATION ³						
(11) TRAINING						
(12) OTHER (Specify):						
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL ⁴				185,735		
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				185,735		
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE ⁵				0		
(16) TOTAL (Sum of (14) + (15) above)				185,735		

¹Not to exceed 10% of equipment cost for QRIP projects.

²Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.

³Normally not OPA funded.

⁴Used to compute amortization in Item 11.

⁵Specify source to include certification that funds are available, if financed from the regular budget.

1 August 1982

C 1, AR 5-4

SUMMARY OF SAVINGS (MANPOWER AND DOLLARS)										
ITEMS a	SAVINGS			REAPPLICATION OF SAVINGS						
	NO. MPR OR MMH b	TYPE PERS ⁶ c	DOLLARS d	PROGRAM ELEMENT		TDA PARA AND LINE		FUNCTION CODE		
				e. FROM	f. TO	g. FROM	h. TO	i. FROM	j. TO	
(1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED										
(2) REQUIREMENTS ONLY ELIMINATED										
(3) BORROWED MILITARY MANPOWER RELEASED										
(4) OVERHIRES OR TEMPORARIES TERMINATED										
(5) HOURS OVERTIME ELIMINATED										
(6) MANHOURS SAVED FROM MULTIPLE POSITIONS ⁷										
(7) OTHER DOLLAR SAVINGS (Excluding Manpower), e.g., CONTRACT COSTS & UTILITIES			96,994							
(8)										
(9)										
(10)										
(11) TOTAL DOLLAR SAVINGS			96,994							
6 (1) US Graded (2) US Wage Board (3) DHFN (4) IHFN (5) Officer (6) WO (7) Enlisted										

⁷ Reflect specific duties being performed with additional manhours available (equivalent manyear)

1 August 1982

C 1, AR 5-4

REGULATORY APPROVAL/COORDINATION			
INVESTMENT STATEMENT			
This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints. (Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)			
A. OTHER COORDINATION (Functional Coordination at local level, e.g., Pac Eng. Log. Pers. etc.)			
26. SUBMITTED BY (Typed name, grade and title of Subordinate Command/Agency or Project Indicator)		SIGNATURE	DATE (YYMMDD) AUTOVON
28. APPROVAL RECOMMENDED BY (MACOM/Agency)		SIGNATURE	DATE (YYMMDD) AUTOVON
FOR USE BY HQDA ON OSD PIF PROJECTS ONLY			
27. APPROVED BY		SIGNATURE	DATE (YYMMDD) AUTOVON
29. OTHER REMARKS (Cont'd)			

ECO # GP-B-4

Install variable frequency drives in main plant water supply pumps

1. Calculate current energy use

Current practice is to operate 1-600 hp turbine pump plus 1-100 hp deep well and 1-400 hp booster pump in combination. The current average flow rate is 24 million gal/day.

Turbine pump:

$$kW_T = \text{volts} \cdot \text{amps} \cdot \sqrt{3} / 1000$$

$$= 2300 \cdot 127 \cdot \sqrt{3} / 1000 = 506 \text{ kW}$$

Deep well pump:

$$kW_D = 2300 \cdot 23 \cdot \sqrt{3} / 1000 = 92 \text{ kW}$$

Booster pump

$$kW_B = 2200 \cdot 130 \cdot \sqrt{3} / 1000 = 495 \text{ kW}$$

$$\text{Total kW} = 506 + 92 + 495 = 1093 \text{ kW}$$

$$\text{Average annual usage} = 1093 \cdot 3760 = \underline{9,574,680 \text{ kWh}}$$

$$\text{Average annual cost} = 9,574,680 \times 0.03 = \underline{\$287,240}$$

$$\text{Annual usage (MBtu)} = 9,574,680 \times 3413 = \underline{32,678 \text{ MBtu}}$$

2. Calculate energy savings

Calculate system head for following current conditions.

$$ehp = 1093 \text{ kW}$$

$$\eta_p = 0.70$$

$$\eta_m = 0.95$$

$$Q = 24,000,000 \text{ gal/da} = 16,667 \text{ gpm}$$

$$ehp = bhp / \eta_m$$

$$kW = 0.75 * ehp$$

$$bhp = whp / \eta_p$$

$$ehp = kW / 0.75$$

$$ehp = whp / \eta_m / \eta_p$$

$$whp = \frac{H \cdot Q}{3960}$$

$$ehp = \frac{H \cdot Q}{3960 \cdot \eta_p \cdot \eta_m} = \frac{kW}{0.75}$$

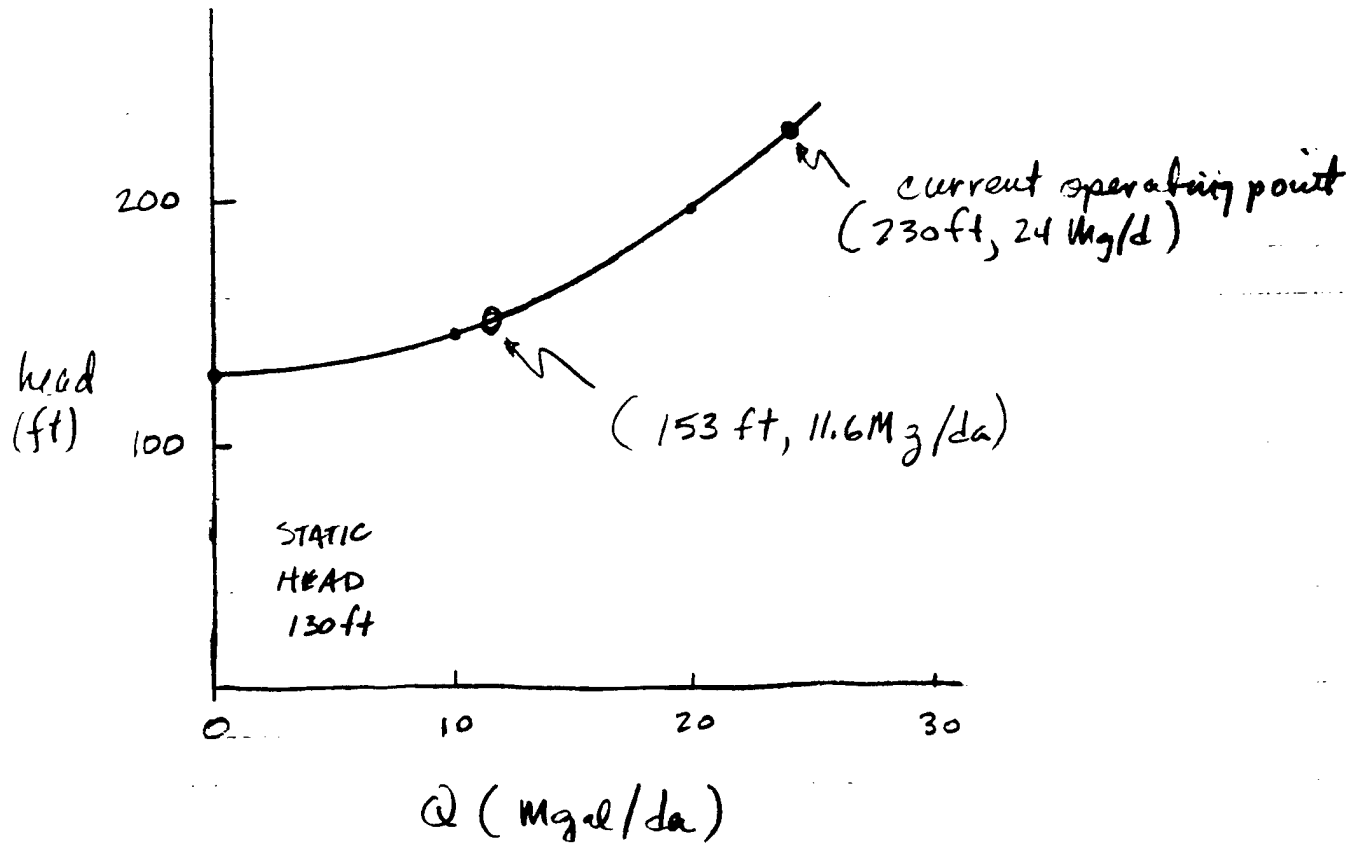
$$H = \frac{kW \cdot 3960 \cdot \eta_p \cdot \eta_m}{Q \cdot 0.75}$$

$$H = \frac{1093 \cdot 3960 \cdot 0.70 \cdot 0.95}{16,667 \cdot 0.75}$$

$$H = 230 \text{ feet}$$

Assume static head is about 150 feet.

Water Plant System Curve



$$\text{savings} = \text{current use} - \text{current} \times \frac{\text{new head}}{\text{old head}}$$

$$= \text{current use} \left(1 - \frac{H_n}{H_o} \right)$$

$$= 32,678 \text{ MBtu} \left(1 - \frac{153}{230} \right) =$$

$$= \underline{\underline{10,940 \text{ MBtu (electricity)}}}$$

Telephone Call Confirmation

Project No. 290-0379-000
(904) 281-0394

reynolds, smith and hills

Local ☒ L.D. _____ Placed ☒ Rec'd _____ Date 5/29/90
P. Hutchins _____ Conversed with Mark Riffle
Of Westinghouse Elec. Corp. Regarding Variable Frequency Drives

MR gave budget estimates for variable speed drives

	labor	materials
600 hp	\$ 2000	\$ 60,000
450 hp	\$ 2000	\$ 40,000
100 hp	\$ 2000	\$ 12,000

Distribution:

CONSTRUCTION COST ESTIMATE

DATE PREPARED

SHEET OF

PROJECT

ENERGY ENGINEERING ANALYSIS

LOCATION

RADFORD ARMY AMMUNITION PLANT

ARCHITECT ENGINEER

REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE

- ☐ CODE A (No design completed).
☐ CODE B (Preliminary design).
☐ CODE C (Final design).
☐ OTHER (Specify) _____

DRAWING NO.

ECO # GP-B-4

ESTIMATOR

P. Hutchins

CHECKED BY

VARIABLE SPEED
DRIVES

SUMMARY

QUANTITY

NO.
UNITSUNIT
MEAS.PER
UNIT

LABOR

TOTAL

PER
UNIT

MATERIAL

TOTAL

TOTAL
COST

1-600 hp VSD

1

ea

2000

60,000

62,000

1-400 hp VSD

1

ea

2000

40,000

42,000

1-100 hp VSD

1

ea

2000

12,000

14,000

Subtotal

6000

112,000

118,000

Sales Tax (4.5%)

5040

5040

FICA/Ins. (20%)

1200

1200

Subtotal

7200

117,040

124,240

Overhead (15%)

18,636

Profit (10%)

14,288

Bond (1%)

1572

Hercules Support (6%)

9524

Contingency (10%)

16826

Construction Cost

\$185,086

Vendor quote Westinghouse

1 August 1982

C 1, AR 5-4

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS For use of this form, see AR 5-4; the proponent agency is OCA.				1. PROJECT NO.		REQUIREMENT CONTROL SYMBOL DD-M(R) 1561	
2. TO:		3. THRU:		4. FROM:		5. DOD COMP NAME	
HQ. DA (EACA-RMP) Rm 3B719 (Pentagon) Washington, DC 20310-2070		CDR, AMC (AMCRM-MP) 5001 Eisenhower Avenue Alexandria, VA 22333-0001		CDR, AMCCOM Attn: AMSMC-MGP-P (R) Rock Island, IL 61299-6000		Army	
9. PROJECT TITLE		10. TYPE OF PROJECT (Check one)		11. AMORTIZATION YEARS/MONTHS		6. DOD COMP CODE	
Replace Incandescents with 35 W HPS Screw-Ins (ECO GP-N-1)		☐ ORIP ☒ OSD PIF ☐ PECIP		\$ 126,001 + 65,833 X 12 (Project Cost) (Average Annual Savings) (No. Mo)		7. COMMAND CODE W730KK	
12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR		13. ECONOMIC LIFE		14. EXPECTED OPERATIONAL DATE		8. DATE	
024							
15. SUBMITTING UNIT(S)		16. UNIT ID CODE		17. PROJECT DESCRIPTION			
Administrative Contracting Office Radford Army Ammunition Pt. Radford, VA 24141		WOLLAA		Replace incandescent lamps in explosion-proof fixtures with 35 watt high pressure sodium screw-in lamps.			
18. DETAILED JUSTIFICATION							
High pressure sodium lamps are much more energy efficient than incandescent lamps. Replacement in areas where color rendition is not critical will save energy.							
19. SAVINGS DISPOSITION							
Savings are used to reduce energy costs.							
20. OTHER REMARKS (Continue on page 5, if more space is needed)							

1 August 1982

C 1, AR 5-4

SUMMARY OF DOLLAR SAVINGS (ROUND OFF TO THE NEAREST DOLLAR)										
Attach computation sheet identifying the method and source of data for savings										
SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS				
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR	
SALARY/LABOR/ OVERTIME										
MATERIAL/ SUPPLIES	32,968	10,857	10,857	10,857	10,857	22,111	22,111	22,111	22,111	
UTILITIES										
MAINTENANCE/ REPAIR	11,813	3,572	3,572	3,572	3,572	8,241	8,241	8,241	8,241	
TRANSPORTATION										
LEASE COSTS										
SALVAGE/ TURN-IN										
ENERGY (Identify) Electricity	49,208	13,799	13,799	13,799	13,799	35,481	35,481	35,481	35,481	
CONTRACT COSTS										
OTHER (Identify)										
TOTALS	94,061	28,228	28,228	28,228	28,228	65,833	65,833	65,833	65,833	

PRIORITIZATION

(1) INTERNAL RATE OF RETURN (IRR)
 Divide estimated project cost 126,001 by average annual savings 65,833 = 1.91 factor.
 Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 72 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (S/I)
 Multiply annual savings 65,833 X discount factor 8.78 = 578,014 and divide by present value of investment
 (undiscounted) 126,001 = 4.6 S/I.
 (Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE (RIMS) NA
 Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.
 (Manpower requirements cannot be used in this computation.)

1 August 1982

COST FOR PROJECT TO BECOME OPERATIONAL						
22.	EQUIPMENT TYPE	PROPOSED SOURCE OF PROCUREMENT	UNIT PRICE	QUANTITY	TOTAL COST	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT
						FY FUNDS REQUIRED
(1)	35 watt HPS Lamps		72.41	1,740	126,001	
(2)						
(3)						
(4)						
(5)						
(6)	TRANSPORTATION (Equipment delivery)					
(7)	EQUIPMENT MODIFICATION ¹					
(8)	EQUIPMENT INSTALLATION					
(9)	MAINTENANCE CONTRACT ²					
(10)	FACILITIES MODIFICATION ³					
(11)	TRAINING					
(12)	OTHER (Specify):				126,001	
(13)	TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL ⁴				126,001	
(14)	TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				--	
(15)	TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE ⁵				126,001	
(16)	TOTAL (Sum of (14) + (15) above)					

¹Not to exceed 10% of equipment cost for QRIP projects.²Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.³Normally not OPA funded.⁴Used to compute amortization in Item 11.⁵Specify source to include certification that funds are available, if financed from the regular budget:

1 August 1982

REGULATORY APPROVAL/COORDINATION

INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

4. OTHER COORDINATION (Functional Coordination at local level, e.g., Pac Eng, Log, Pers, etc.)

25. SUBMITTED BY (Typed name, grade and title of Subordinate Command/Agency or Project Initiator)	SIGNATURE	DATE (YYMMDD)
		AUTOVON
26. APPROVAL RECOMMENDED BY (MACOM/Agency)	SIGNATURE	DATE (YYMMDD)
		AUTOVON
27. APPROVED BY		DATE (YYMMDD)
FOR USE BY HQDA ON OSD PIF PROJECTS ONLY		AUTOVON
SIGNATURE		

28. OTHER REMARKS (Cont'd)

1 August 1982

REGULATORY APPROVAL/COORDINATION

INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

4. OTHER COORDINATION (Functional Coordination at local level, e.g., Pac Eng, Log, Pers, etc.)

25. SUBMITTED BY (Typed name, grade and title of Subordinate Command/Agency or Project Initiator)	SIGNATURE	DATE (YYMMDD)
		AUTOVON
26. APPROVAL RECOMMENDED BY (MACOM/Agency)	SIGNATURE	DATE (YYMMDD)
		AUTOVON
27. APPROVED BY		DATE (YYMMDD)
SIGNATURE		AUTOVON

FOR USE BY HQDA ON OSD PIP PROJECTS ONLY

28. OTHER REMARKS (Cont'd)

GP-N-1 REPLACE INCANDESCENTS WITH 35 W HPS SCREW-INS FOR
EXPLOSION-PROOF FIXTURES

Calculations were made on a per-unit basis for installing

35 W HPS "units" within the existing explosion-proof
incandescent fixtures. These units consist of a HPS lamp and
a ballast with a medium base adapter which screws into the

incandescent socket. The per-unit calculations are on page 2.

From the building survey data, a list was compiled of the

buildings with potential incandescent lighting projects (page 3).
Only areas with lighting operating 3 shifts/day, 5 days/wk were considered.
It is assumed that 90% of the interior and 50% of the exterior

fixtures can be retrofitted in the manner described above for this ECO.

$$\text{Total fixtures} = 0.9(1536) + 0.5(717) = 1740$$

$$\text{Energy savings} = 674 \text{ kWh/yr} \times 0.003413 \text{ MBtu/kWh} \times 1740 \text{ fixtures} = 4003 \text{ MBtu/yr}$$

$$\text{Energy cost savings} = \frac{\$20.39}{\text{yr-fixture}} \times 1740 \text{ fixtures} = \$35,479/\text{yr}$$

$$\text{Labor \& mat'l cost savings} = \frac{\$17.44}{\text{yr-fixture}} \times 1740 = \$30,346/\text{yr}$$

$$\text{Total cost savings} = \$35,479 + \$30,346 = \$65,825/\text{yr}$$

$$\text{Project cost} = \frac{\$80.46}{\text{fixture}} \times 1740 \text{ fixtures} = \$140,000$$

$$(\text{Construction cost} = \$140,000 / 1.115 = \$125,561)$$

$$\text{Simple payback} = \frac{\$140,000}{\$65,825/\text{yr}} = 2.1 \text{ yr}$$

GP-N-1 Replace int/ext 150-200W incandescents with 35 W HPS screw-in retrofits for explosion-proof applications *

$$\text{Energy savings} = (150 \text{ W} - 42 \text{ W}) \times \frac{24 \text{ hr}}{\text{day}} \times \frac{260 \text{ days}}{\text{yr}} = 674 \frac{\text{kwh}}{\text{yr}}$$

$$\text{Energy Cost Savings} = 674 \frac{\text{kwh}}{\text{yr}} \times \frac{\$0.03026}{\text{kwh}} = \$20.39$$

$$\text{Labor \& Mat'l cost savings} = \left(\frac{\text{Incand. cost}}{750 \text{ hr}} - \frac{\text{HPS cost}}{16000 \text{ hr}} \right) \times 6240 \frac{\text{hr}}{\text{yr}}$$

$$= \left[\frac{(\$2.11 \text{ mat'l} + \$1.20 \text{ labor} \times 0.683 \times 1.2 \text{ exp-prt})}{750 \text{ hr}} - \frac{(\$16. \text{ mat'l} + \$6.45 \text{ labor} \times 0.683 \times 1.2)}{16,000 \text{ hr}} \right] \times \frac{6240 \text{ hr}}{\text{yr}} = \$17.44$$

$$\text{Total cost savings} = \frac{\$20.39}{\text{yr}} + \frac{\$17.44}{\text{yr}} = \$37.83$$

Mat'l cost = \$45 for fixture w/ lamp (1990 vendor info.)

$$\text{Labor cost} = \$1.20 \times 1.20 \times 1.20 \text{ exp-prt} \times 0.683 = \$1.18$$

(cost of replacing exp-proof incand. +20%)

$$\text{Project Cost} = [(1.045 \times \$45) + (1.2 \times \$1.18)] \times 1.661 = \$80.46$$

$$\text{Simple payback} = \frac{\$80.46}{\$37.83/\text{yr}} = 2.1 \text{ yr} < 10 \text{ yr}$$

Note: HPS lamps are replaceable in the retrofit ballasts.

*It must be verified that the screw-in retrofits will fit in all fixtures.



SUBJECT _____
DESIGNER _____
CHECKER _____

AEP NO _____
SHEET _____ OF _____
DATE _____
DATE _____

QRIP Calc's

Current energy use for 1740 lamps:

$$\frac{150 \text{ W}}{1000} \times 24 \times 260 \times 0.03026 \times 1740 = \$49,280/\text{yr}$$

Current mat'l & labor costs:

$$\frac{2.11 + 1.2 \times 0.68 \times 1.2}{750} \times 6240 \times 1740 = \$44,731/\text{yr}$$

Current labor costs:

$$\frac{1.2 \times 0.68}{750} \times 6240 \times 1740 = \$11,813/\text{yr}$$

New energy use

$$\frac{42 \text{ W}}{1000} \times 24 \times 260 \times 0.03026 \times 1740 = \$13,799/\text{yr}$$

New mat'l & labor costs:

$$\frac{16 + 6.45 \times 0.68 \times 1.2}{16,000} \times 6240 \times 1740 = \$14,429/\text{yr}$$

New labor costs

$$\frac{6.45 \times 0.68 \times 1.2}{16,000} \times 6240 \times 1740 = \$3572/\text{yr}$$

Radford Army Ammunition Plant
List of Buildings with Incandescent Lighting

Bldg No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
1000 -00	Cotton Linter Warehouse	NC, A&B-Line	1	17	17
1606 -00	Open Tank Air Dry	Sol. Recovery, A-Line	10	20	200
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	27	12	324
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	20	60
4912 -27	SG Curing Hse.- Carpet Rolls	Cast Prop. (Rocket)	10	5	50
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	1	6	6
7106 -04	Dry House #4 (Cure Grain)	1st R P	7	8	56
9334 -15	Blender House	4th Rolled Powder	1	4	4
TOTAL FOR EXTERIOR FIXTURES					717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
2019 -00	Boiling Tub House	NC, B-Line	3	50	150
2022 -00	Beater House	NC, B-Line	3	40	120
2024 -00	Poacher & Blending House	NC, B-Line	3	30	90
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	50	150
4912 -40	Forced Air Dry House	Pilot B	21	10	210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	1	4	4
4915 -00	Small Grain Mold Assembly	Cast Prop. (Rocket)	1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
4951 -02	TOW Launch Saw House	Pilot B	1	8	8
5008 -01	15 Inch Press House	Pilot A	3	2	6
6304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	600
TOTAL FOR INTERIOR FIXTURES					1536

SHEET 4 OF 10

6-90

SHEET 4 OF 10

Basis for Estimate	Date	Estimate	Remarks

☐ OTHER (Specify) _____

REYNOLDS, SMITH AND HILLS A.E.P., INC.

CHECKED BY

GP-N-1

T. Todd

* U. S. GOVERNMENT PRINTING OFFICE : 1959 O-616166

ECP ENERGY CONSERVATION PRODUCTS, 511 CANAL STREET, NYC, NY, 10013—TEL (212)-925-5991

POWER CONSUMPTION AND LUMEN OUTPUT DATA

	WATTS	LINE WATTS	TOTAL LUMEN OUTPUT	LUMENS PER WATT	HOURS OF RATED LIFE	
***** MERCURY VAPOR (DELUXE WHITE)						
*	1000	1075	63000	59	24000	*
*	400	450	23000	56	24000	*
*	250	290	13000	42	24000	*
*	175	205	8500	49	24000	*
*	100	120	4500	42	24000	*
*	75	93	3150	37	16000	*
*	50	61	1680	31	16000	*
***** METAL HALIDE						
*	1500	1600	155000	103	3000	*
*	1000	1100	110000	100	12000	*
*	400	460	34000	85	15000	*
*	175	210	14000	85	7500	*
***** HIGH PRESSURE SODIUM						
*	1000	1080	140000	130	24000	*
*	400	480	50000	104	24000	*
*	250	310	27500	89	24000	*
*	150	200	16000	80	24000	*
*	100	135	9500	70	24000	*
*	70	85	5800	68	24000	*
*	50	70	4000	57	24000	*
*	35	42	2850	67	18000	*
***** FLUORESCENT						
STRAIGHT	40	48	3150	66	20000+	*
CIRCLINE	32	37	1830	50	12000+	*
CIRCLINE	22	25	1050	42	12000+	*
CIRCLINE	20	23	850	37	12000+	*
TWIN TUBE	13	16	900	56	10000+	*
TWIN TUBE	9	12	600	50	10000+	*
STRAIGHT	8	11	400	36	7500+	*
TWIN TUBE	7	10	400	40	10000+	*
STRAIGHT	6	9	300	33	7500+	*
TWIN TUBE	5	8	250	31	10000+	*
***** INCANDESCENT						
*	1000	1000	23740	24	1000	*
*	750	750	17040	23	1000	*
*	500	500	10850	22	1000	*
*	200	200	3710	19	750	*
*	150	150	2880	19	750	*
*	100	100	1750	18	750	*
*	75	75	1190	16	750	*
***** QUARTS—IODINE						
*	1500	1500	35800	24	3000	*
*	1000	1000	23400	23	2000	*
*	500	500	10950	22	2600	*
*	250	250	4850	19	2000	*

LAMP WATTAGE APPX LUMENS AVERAGE LIFE HRS. STANDARD CASE QTY.

RAPID START FLUORESCENT U LAMPS

FB40/U6/CW/EW	34	2,600	12,000	12
FB40/U6/CW	40	2,950	12,000	12

INSTANT START SLIMLINE FLUORESCENT LAMPS

F72T12/CW	55	4,550	12,000	12
F96T12/CW/EW	60	5,600	15,000	15
F96T12/CW	75	6,200	12,000	15

HIGH & VERY HIGH OUTPUT FLUORESCENT LAMPS

F96T12/CW/HO/EW	95	8,300	12,000	15
F96T12/CW/HO	110	9,200	12,000	15
F96T12/CW/VHO/EW	185	14,000	12,000	15
F96T12/CW/VHO	215	15,500	12,000	15

METAL HALIDE UNIVERSAL BURN MEDIUM BASE LAMPS

MH35/U	35	2,300	5,000	12
MH50/U	50	3,400	5,000	12
MH70/U	70	5,500	5,000	12
MH100/U	100	7,200	7,500	12
MH150/U	150	12,000	10,000	12

METAL HALIDE UNIVERSAL BURN MOGAL BASE LAMPS

MH175/U	175	14,000	10,000	12
MH175/C/U	175	14,000	10,000	12
MH250/U	250	20,500	10,000	12
MH250/C/U	250	20,500	10,000	12
MH400/U	400	36,000	20,000	6
MH400/C/U	400	36,000	20,000	6
MH1000/U	1000	110,000	12,000	6
MH1000/C/U	1000	105,000	12,000	6

COMPACT DOUBLE ENDED HQI METAL HALIDE LAMPS

HQI 70	70	5,000	10,000	12
HQI 150	150	11,000	10,000	12
HQI 250	250	19,000	10,000	12
HQI 400	400	25,000	10,000	12

HIGH PRESSURE SODIUM MEDIUM BASE LAMPS

LU35/MED	35	2,250	16,000	12
LU35/D/MED	35	2,150	16,000	12
LU50/MED	50	4,000	24,000	12
LU50/D/MED	50	3,800	24,000	12
LU70/MED	70	6,300	24,000	12
LU70/D/MED	70	5,985	24,000	12
LU100/MED	100	9,500	24,000	12
LU100/D/MED	100	8,800	24,000	12
LU150/MED	150	16,000	24,000	12
LU150/D/MED	150	15,000	24,000	12

COLOR IMPROVED HIGH PRESSURE SODIUM LAMP

NHT50SDX	50	2,500	12,000	12
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HIGH PRESSURE SODIUM ED-23 1/2 MOGAL BASE LAMPS

LU50	50	4,000	24,000	12
LU50/D	50	3,800	24,000	12
LU70	70	6,300	24,000	12
LU70/D	70	5,985	24,000	12
LU100	100	9,500	24,000	12
LU100/D	100	8,800	24,000	12
LU150/55	150	16,000	24,000	12
LU150/55/D	150	15,000	24,000	12

LAMP WATTAGE APPX LUMENS AVERAGE LIFE HRS. STANDARD CASE QTY.

HIGH PRESSURE SODIUM E-18 MOGUL BASE LAMPS

LU200	200	22,000	24,000	12
LU250	250	29,000	24,000	12
LU250/D	250	26,000	24,000	12
LU310	310	37,000	24,000	12
LU400	400	50,000	24,000	12

LOW PRESSURE SODIUM LAMPS

SOX10	10	1,000	9,000	20
SOX18	18	1,800	14,000	20
SOX35	35	4,800	18,000	12
SOX55	55	8,000	18,000	9
SOX90	90	13,500	18,000	9
SOX135	135	22,500	18,000	9
SOX180	180	33,000	18,000	9

MR16 LOW VOLTAGE 12V TUNGSTEN HALOGEN LAMPS

ESX (N)	20	3,300	2,000	20
BAB (W)	20	460	2,000	20
EYR (N)	42	7,300	2,000	20
EYS (M)	42	2,500	2,000	20
EYP (W)	42	1,200	2,000	20
EXT (N)	50	9,150	3,000	20
EXZ (M)	50	3,000	3,000	20
EXN (W)	50	1,500	3,000	20
EYF (N)	75	11,500	3,500	20
EYJ (M)	75	4,500	3,500	20
EYC (W)	75	2,000	3,500	20

MR16 LINE VOLTAGE 120V MEDIUM BASE TUNGSTEN HALOGEN LAMPS

M/JDR75W/N	75	6,300	2,000	12
M/JDR75W/M	75	3,500	2,000	12
M/JDR75W/W	75	2,100	2,000	12
M/JDR100/N	100	8,500	2,000	12
M/JDR100/M	100	4,500	2,000	12
M/JDR100/W	100	3,000	2,000	12

MR16 LINE VOLTAGE 120V INTERMEDIATE BASE TUNGSTEN HALOGEN LAMPS

I/JDR75W/N	75	6,300	2,000	12
I/JDR75W/M	75	3,500	2,000	12
I/JDR75W/W	75	2,100	2,000	12
I/JDR100/N	100	8,500	2,000	12
I/JDR100/M	100	4,500	2,000	12
I/JDR100/W	100	3,000	2,000	12

TUNGSTEN HALOGEN LINE VOLTAGE MEDIUM BASE TUBULAR LAMPS

64484/CL	75	1,200	2,000	15
64484/FR	75	1,140	2,000	15
64486/CL	100	1,600	2,000	15
64486/FR	100	1,520	2,000	15
64488/CL	150	2,760	2,000	15
64488/FR	150	2,622	2,000	15

TUNGSTEN HALOGEN LINE VOLTAGE DOUBLE ENDED LAMPS

Q100T3/CL	100	1,600	200	12
Q150T3/CL	150	2,800	200	12
Q200T3/CL	200	3,600	200	12
Q300T3/CL	300	6,000	200	12
Q500T3/CL	500	11,000	200	12
Q1500T3/CL	1500	33,000	200	12

166 | Lighting

166 100 | Lighting

166 100 Lighting			CREW	DAILY OUTPUT	MAN- HOURS	UNIT	BARE COSTS				TOTAL	
							MAT.	LABOR	EQUIP.	TOTAL	INCL O&P	
140	1600	90 watt	1 Elec	.30	26.670	C	5,140	645		5,785	6,600	140
	1650	135 watt		.20	40		6,905	970		7,875	9,025	
	1700	180 watt		.20	40		7,308	970		8,278	9,475	
	1750	Quartz line, clear, 500 watt		1.10	7.270		1,872	175		2,047	2,325	
	1760	1500 watt		.20	40		3,427	970		4,397	5,200	
	1800	Incandescent, interior, A21, 100 watt		1.60	5		173	120		293	370	
	1900	A21, 150 watt		1.60	5		211	120		331	410	
	2000	A23, 200 watt		1.60	5		227	120		347	430	
	2200	PS 30, 300 watt		1.60	5		330	120		450	540	
	2210	PS 35, 500 watt		1.60	5		576	120		696	810	
	2230	PS 52, 1000 watt		1.30	6.150		1,525	150		1,675	1,900	
	2240	PS 52, 1500 watt		1.30	6.150		2,382	150		2,532	2,850	
	2300	R30, 75 watt		1.30	6.150		375	150		525	630	
	2400	R40, 150 watt		1.30	6.150		408	150		558	670	
	2500	Exterior, PAR 38, 75 watt		1.30	6.150		566	150		716	840	
	2600	PAR 38, 150 watt		1.30	6.150		525	150		675	795	
	2700	PAR 46, 200 watt		1.10	7.270		1,928	175		2,103	2,375	
	2800	PAR 56, 300 watt		1.10	7.270		2,193	175		2,368	2,675	
	3000	Guards, fluorescent lamp, 4' long		1	8		375	195		570	695	
	3200	8' long		.90	8.890		535	215		750	905	
145	0010	RESIDENTIAL FIXTURES										145
	0400	Fluorescent, interior, surface, circine, 32 watt & 40 watt	1 Elec	20	.400	Ea.	48	9.70		57.70	67	
	0500	2' x 2', two U 40 watt		8	1		66	24		90	110	
	0700	Shallow under cabinet, two 20 watt		16	.500		45	12.15		57.15	67	
	0900	Wall mounted, 4'L., one 40 watt, with baffle		10	.800		41	19.40		60.40	74	
	2000	Incandescent, exterior lantern, wall mounted, 60 watt		16	.500		36	12.15		48.15	57	
	2100	Post light, 150W, with 7' post		4	2		104	49		153	185	
	2500	Lamp holder, weatherproof with 150W PAR		16	.500		16	12.15		28.15	35	
	2550	With reflector and guard		12	.667		31	16.15		47.15	58	
	2600	Interior pendent, globe with shade, 150 watt		20	.400		78	9.70		87.70	100	
150	0010	TRACK LIGHTING										150
	0080	Track, 1 circuit, 4' section	1 Elec	6.70	1.190	Ea.	33	29		62	79	
	0100	8' section		5.30	1.510		48	37		85	105	
	0200	12' section		4.40	1.820		81	44		125	155	
	0300	3 circuits, 4' section		6.70	1.190		36	29		65	82	
	0400	8' section		5.30	1.510		48	37		85	105	
	0500	12' section		4.40	1.820		88	44		132	160	
	1000	Feed kit, surface mounting		16	.500		12	12.15		24.15	31	
	1100	End cover		24	.333		1.98	8.10		10.08	14.05	
	1200	Feed kit, stem mounting, 1 circuit		16	.500		16	12.15		28.15	35	
	1300	3 circuit		16	.500		16	12.15		28.15	35	
	2000	Electrical joiner for continuous runs, 1 circuit		32	.250		6.55	6.05		12.60	16.10	
	2100	3 circuit		32	.250		12.10	6.05		18.15	22	
	2200	Fixtures, spotlight, 150 PAR		16	.500		47	12.15		59.15	70	
	3000	Wall washer, 250 watt tungsten halogen		16	.500		101	12.15		113.15	130	
	3100	Low voltage, 2 1/2 watt, 1 circuit		16	.500		102	12.15		114.15	130	
	3120	3 circuit		16	.500		109	12.15		121.15	140	

66 | Lighting

66 100 Lighting		CREW	DAILY OUTPUT	MAN- HOURS	UNIT	BARE COSTS				TOTAL INCL O&P
						MAT.	LABOR	EQUIP.	TOTAL	
135	5100	1 Elec	8	1	Ea.	479	24		503	565
	5110		8	1		500	24		524	585
	5120		8	1		535	24		559	625
	5130		8	1		556	24		580	645
	5140		8	1		525	24		549	615
	5150		8	1		556	24		580	645
	5160		8	1		581	24		605	675
	5190									
	5200	1 Elec	12	.667	Ea.	293	16.15		309.15	345
	5210		12	.667		314	16.15		330.15	370
	5220		12	.667		335	16.15		351.15	390
	5230		12	.667		360	16.15		376.15	420
	5240		12	.667		365	16.15		381.15	425
	5250		12	.667		376	16.15		392.15	435
	5260		12	.667		398	16.15		414.15	460
	5270		12	.667		324	16.15		340.15	380
	5280		12	.667		376	16.15		392.15	435
	5290		12	.667		360	16.15		376.15	420
	5300		12	.667		386	16.15		402.15	450
	5400		3.20	2.500		355	61		416	480
	5410		2.70	2.960		370	72		442	515
	5420		2.40	3.330		398	81		479	555
	5430		3.20	2.500		398	61		459	525
	5440		2.70	2.960		428	72		500	575
	5450		2.40	3.330		454	81		535	620
140	0010	LAMPS								
	0080	1 Elec	1	8	C	348	195		543	670
	0100		.90	8.890		198	215		413	535
	0120		.90	8.890		442	215		657	805
	0150		.80	10		874	245		1,119	1,325
	0170		.90	8.890		270	215		485	615
	0200		.90	8.890		618	215		833	995
	0300		.80	10		577	245		822	990
	0350		.80	10		603	245		848	1,025
	0400		.90	8.890		750	215		965	1,150
	0500		.80	10		775	245		1,020	1,200
	0520		.90	8.890		1,285	215		1,500	1,725
	0550		.70	11.430		1,285	275		1,560	1,825
	0600		.30	26.670		2,142	645		2,787	3,300
	0650		.30	26.670		1,663	645		2,308	2,775
	0700		.30	26.670		2,968	645		3,613	4,225
	0800		.30	26.670		2,340	645		2,985	3,525
	0900		.20	40		5,100	970		6,070	7,025
	1000		.30	26.670		3,749	645		4,394	5,075
	1100		.30	26.670		4,712	645		5,357	6,125
	1200		.30	26.670		4,386	645		5,031	5,775
	1300		.20	40		9,894	970		10,864	12,300
	1320		.20	40		9,960	970		10,930	12,400
	1330		.20	40		9,268	970		10,238	11,600
	1350		.30	26.670		4,712	645		5,357	6,125
1360		.30	26.670		4,871	645		5,516	6,300	
1370		.30	26.670		5,059	645		5,704	6,525	
1380		.30	26.670		5,380	645		6,025	6,875	
1400		.30	26.670		5,727	645		6,372	7,250	
1450		.20	40		13,352	970		14,322	16,100	
1500		.30	26.670		3,963	645		4,608	5,300	
1550		.30	26.670		4,386	645		5,031	5,775	



Project No. 290 0379 000Local (718) L.D. 851-4577 Placed ✓ Rec'd. ✓ Date 6-7-90T. Todd Conversed With Mr. Singer
Of American Scientific Lighting Co. Regarding HPS retrofits

For retrofits of incandescent fixtures, the "Bulb Lumenight" and "Colorlight" products are recommended. The lamps are replaceable in both, and the "Colorlight" is more whitish. Contractors costs (including lamp) for quantities of 100+ are as follows:

Bulb Lumenight	35 W	— \$45	(lamps only)
	50 W	— \$45	\$16 - \$20

(also come in 70 W, 100 W, 150 W)

Colorlight	50 W	— \$67	(lamps only)
			\$30

They will send a copy of their catalog for dimensions.



FLUOR-A-LAMP™ SERIES: COMPACT FLUORESCENT LAMPS

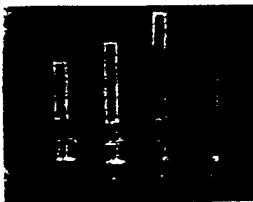


GLOBE LAMP/LUMA LAMP

- **LAMP:** Compact disposable fluorescent globe or tubular lamp/standard or tapered base
- **WATTAGE:** Fifteen
- **LUMENS:** 720
- **COLOR:** Warm white/2800k
- **USE:** Indoor only
- **BURNING POSITION:** Any
- **LAMP LIFE:** 9,000 hours
- **INSTALLATION:** Screws into any 120V medium base socket
- **PACKAGING:** Ten lamps per master carton

CATALOG NUMBER	LAMP	DIMENSIONS
FGL S/15	BFG15 LE/A	Lamp Diameter 3 3/4" Overall Length 6 1/4"
FGL T/15	BFG15 LE/T	Lamp Diameter 3 3/4" Overall Length 6 3/4"
FLL S/15	BFT15 LE/A	Lamp Diameter 3 1/2" Overall Length 6 3/4"
FLL T/15	BFT15 LE/T	Lamp Diameter 3 1/2" Overall Length 7"

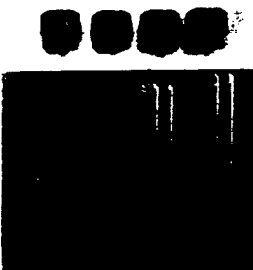
CONVERT-A-LITE™ SERIES: SCREW-IN FLUORESCENT ADAPTER CONVERSIONS



ECONOMY CUP CONVERSION

- **ADAPTER:** Molded Norel® thermal plastic/Sealed and potted to protect internal components
- **FINISH:** White
- **LAMP:** Centered on top of adapter/Not dimmable
- **INSTALLATION:** Adapter screws into any standard 120V medium based socket/No additional wiring or modified circuitry required
- **PACKAGING:** Bulk packed/Lamp included

CATALOG NUMBER	LAMP	DIMENSIONS
CC/5/E	PL5	Adapter Diameter 2 1/2" Overall Length 6 3/4"
CC/7/E	PL7	Overall Length 7 1/2"
CC/9/E	PL9	Overall Length 8 3/4"
CC/13/E	PL13	Overall Length 9 1/4"
CC/Q9/E	Quad 9	Overall Length 6 3/4"
CC/Q13/E	Quad 13	Overall Length 7"



PREMIUM CUP CONVERSION

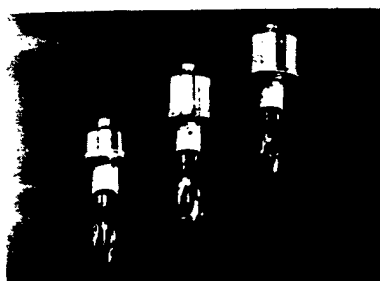
- **ADAPTER:** Molded Norel® thermal plastic/Sealed to protect internal components
- **FINISH:** Black
- **LAMP:** Centered/Recessed inside of adapter/Not dimmable
- **INSTALLATION:** Adapter screws into any standard 120V medium base porcelain socket/No additional wiring or modified circuitry required/Ratched screw base prevents over tightening
- **PACKAGING:** Bulk packed/Lamp included

CATALOG NUMBER	LAMP	DIMENSIONS
CC/5/P	PL5	Adapter Diameter 2 3/4" Overall Length 5 1/2"
CC/7/P	PL7	Overall Length 6 1/4"
CC/9/P	PL9	Overall Length 8"
CC/13/P	PL13	Overall Length 8 1/4"
CC/Q9/P	QUAD 9	Overall Length 5 1/2"
CC/Q13/P	QUAD 13	Overall Length 6 1/4"
CC/Q22/P	QUAD 22	Overall Length 8 3/4"
CC/Q28/P	QUAD 28	Overall Length 9 1/4"

PREMIUM OPTIONS:

DWC Direct Wire—Center SWS Direct Wire—Side

CONVERT-A-LITE™ SERIES: SCREW-IN HPS ADAPTER CONVERSIONS



BULB LUMENIGHT™

- **ADAPTER:** Heavy gauge spun aluminum
- **FINISH:** Caustic etching
- **INSTALLATION:** Adapter screws into a standard 120V medium base porcelain socket/No additional wiring or modified circuitry required/Safety weight ground wire
- **PACKAGING:** Four per carton/Lamp included

CATALOG NUMBER	LAMP	DIMENSIONS
BL/35	LU35	Diameter 3 1/4"
BL/50	LU50	Overall Length 9 3/4"
BL/70	LU70	Diameter 3 1/4" Overall Length 10 1/16"
BL/100	LU100	Diameter 4"
BL/150	LU150	Overall Length 10 1/8"

OPTIONS:

HBR High Bay Reflector DW Direct Wire
LBR Low Bay Reflector

1 August 1982

C 1, AR 5-4

DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS For use of this form, see AR 5-4; the proponent agency is OCA.				1. PROJECT NO.		REQUIREMENT CONTROL SYMBOL DD-M(R) 1561			
2. TO: HQ. DA (EACA-RMP) Rm 3B719 (Pentagon) Washington, DC 20310-2070		3. THRU: CDR, AMC (AMCRM-MP) 5001 Eisenhower Avenue Alexandria, VA 22333-0001		4. FROM: CDR, AMCCOM Attn: AMSMC-MGP-P (R) Rock Island, IL 61299-6000		5. DOD COMP NAME Army		6. DOD COMP CODE A	
9. PROJECT TITLE Change Incinerator Fuel to Natural Gas (ECO GP-X-6)		10. TYPE OF PROJECT (Check one) ☐ ORIP ☒ OSD PIF ☐ PECIP		11. AMORTIZATION YEARS/MONTHS \$ 250,875 + 78 457 X 12 (Project Cost) (Average Annual Savings) (No. Mo) - 3.2 or -- (month) (amortization)		7. COMMAND CODE W730KK		8. DATE	
12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR 024		13. ECONOMIC LIFE		14. EXPECTED OPERATIONAL DATE					
15. SUBMITTING UNIT(S) Administrative Contracting Office Radford Army Ammunition Pt Radford, VA 24141		16. UNIT ID CODE WOLLAA		17. PROJECT DESCRIPTION Install a natural gas line to the waste propellant incinerators to replace #2 fuel oil as combustion fuel.					
18. DETAILED JUSTIFICATION Currently #2 fuel oil is used to incinerate the waste propellant generated at Radford AAP. Extending the existing natural gas line to the incinerator is more economic due to the lower cost of natural gas on a Btu basis.									
19. SAVINGS DISPOSITION Cost savings will reduce utility bills.									
20. OTHER REMARKS (Continue on page 6, if more space is needed)									

1 August 1982

C 1. AR 5-1

SUMMARY OF DOLLAR SAVINGS (ROUND OFF TO THE NEAREST DOLLAR)										
Attach computation sheet identifying the method and source of data for savings										
SAVINGS BREAKOUT	PRESENT METHOD	PROPOSED METHOD				DIFFERENCE/SAVINGS				
		1ST YR	2D YR	3D YR	4TH YR	1ST YR	2D YR	3D YR	4TH YR	
SALARY/LABOR/ OVERTIME										
MATERIAL/ SUPPLIES										
UTILITIES										
MAINTENANCE/ REPAIR										
TRANSPORTATION										
LEASE COSTS										
SALVAGE/ TURN-IN										
ENERGY (Identify)										
Fuel Oil	368,146	289,689	289,689	289,689	289,689	78,457	78,457	78,457	78,457	78,457
CONTRACT COSTS										
OTHER (Identify)										
TOTALS	368,146	289,689	289,689	289,689	289,689	78,457	78,457	78,457	78,457	78,457

PRIORITIZATION

(1) INTERNAL RATE OF RETURN (IRR)
 Divide estimated project cost 250,875 by average annual savings 78,457 = 3.2 factor.
 Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 37 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (S/I)
 Multiply annual savings 78,457 X discount factor 15.36 = 1,205,227 and divide by present value of investment (undiscounted) 250,875 = 4.8 S/I.
 (Based on economic life 25 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.)

(3) RATE OF INVESTMENT PER MANPOWER SPACE (RIMS)
 Divide estimated project cost by number of manpower space savings = RIMS.
 (Manpower requirements cannot be used in this computation.)

1 August 1982

COST FOR PROJECT TO BECOME OPERATIONAL					
EQUIPMENT TYPE	PROPOSED SOURCE OF PROCUREMENT	UNIT PRICE	QUANTITY	TOTAL COST	APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT
(1) Natural Gas Line		250,875	1	250,875	
(2)					
(3)					
(4)					
(5)					
(6) TRANSPORTATION (Equipment delivery)					
(7) EQUIPMENT MODIFICATION ¹					
(8) EQUIPMENT INSTALLATION					
(9) MAINTENANCE CONTRACT ²					
(10) FACILITIES MODIFICATION ³					
(11) TRAINING					
(12) OTHER (Specify):					
(13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL ⁴				250,875	
(14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL				250,875	
(15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE ⁵				--	
(16) TOTAL (Sum of (14) + (15) above)				250,875	

¹Not to exceed 10% of equipment cost for QRIP projects.²Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.³Normally not OPA funded.⁴Used to compute amortization in Item 11.⁵Specify source to include certification that funds are available, if financed from the regular budget.

1 August 1982

REGULATORY APPROVAL/COORDINATION

INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)

A. OTHER COORDINATION (Functional Coordination at local level, e.g., Pac Eng, Log, Pers, etc.)

26. SUBMITTED BY (Typed name, grade and title of Subordinate Command/Agency or Project Initiator)

SIGNATURE

DATE (YYMMDD)

AUTOVON

28. APPROVAL RECOMMENDED BY (MACOM/Agency)

SIGNATURE

DATE (YYMMDD)

AUTOVON

FOR USE BY HQDA ON OSD PIF PROJECTS ONLY

27. APPROVED BY

SIGNATURE

DATE (YYMMDD)

AUTOVON

20. OTHER REMARKS (Con't'd)



SUBJECT _____

AEP NO _____

DESIGNER G. FALLON

SHEET _____ OF _____

CHECKER P. HUTCHINGDATE 6/14/90DATE 6/14/90

ECO # GP-X-6 CHANGE INCINERATOR FUEL TO NAT. GAS
INCINERATOR FUEL COST SAVINGS

FUEL OIL SAVINGS = 86,217 MBTU/yr

NAT GAS INCREASE = 86,217 MBTU/yr

Current energy ^{costs} ~~costs~~ :
 $86,217 \times 4.27 = \$368,146 / \text{yr.}$

New energy costs :
 $86,217 \times 3.36 = \$289,689 / \text{yr.}$

Savings = \$78,458 / yr.

Project No. 290-0379-000Local _____ L.D. X Placed X Rec'd. _____ Date 5-31-90G. F. _____ Conversed With Pat ZEEKOf Radford (us. Gov't) Regarding Gas line for incineratorIncinerator Gas line - Past study citation.Date of Study - ~~87~~ '86Scope of work - ie: Incinerator Burner new? NO!Total installed cost - \$142,960 +Any Energy Savings? - (NO.)How much - ?"Put or Pay" contract with gas company
is under negotiation and proceeding
slowly.Original \$87-130,000/yr. savings.200-250K ~~instl~~ installed cost.Because of fuel oil and natural gas price
fluctuations Radford projects a 25-30%
cost saving to switch to natural gas.

Distribution:

ECAM

ECO Number: FN-U-1

COVER THE WATER DRY TANKS WITH HOLLOW PLASTIC SPHERES

Description

The water dry process is used to remove residual ether and alcohol left in the propellant after the solvent recovery process. Open tanks filled with water heated to 149°F are used to purge the solvents from the propellant. These tanks are about nine feet high and have a diameter of 16 feet. Approximately 730 MBtu per year of heat is lost from the surface of each water dry tank. Over 86 percent of these losses is due to evaporation and the remainder is conduction.

The surface heat loss can be significantly reduced by adding a layer of two-inch hollow plastic spheres. These spheres would reduce the exposed surface area (the driving force for evaporation) by 85 percent and also improve the U-value of the surface by a factor of two.

Recommendations

Based on the Life Cycle Cost Analysis, it is recommended that two-inch hollow plastic spheres be used on the surface of the water dry tanks.

Construction Cost	=	\$49,899
Annual Energy Savings (coal)	=	14,421 MBtu
Annual Energy Cost Savings	=	\$23,218
Additional Purchased Electricity	=	\$ 9,143
Reduced Power House O&M	=	\$9,379
Net Cost Savings	=	\$23,454
SIR	=	4.68
Simple Payback	=	2.14 years

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: BALLS

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.035

INSTALLATION & LOCATION: RADFORD AAP REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: FN-U-1 COVER WATER DRY TANK WITH PLASTIC BALLS

FISCAL YEAR 1990 DISCRETE PORTION NAME: WATER DRY TANKS

ANALYSIS DATE: 10-02-90 ECONOMIC LIFE 15 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	\$	49899.
B. SIOH	\$	2745.
C. DESIGN COST	\$	2994.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	50074.
E. SALVAGE VALUE COST	-\$	0.
F. TOTAL INVESTMENT (1D-1E)	\$	50074.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 8.87	0.	\$ 0.	8.78	0.
B. DIST	\$ 4.27	0.	\$ 0.	12.34	0.
C. RESID	\$.00	0.	\$ 0.	12.05	0.
D. NAT G	\$.00	0.	\$ 0.	12.48	0.
E. COAL	\$ 1.61	14421.	\$ 23218.	10.01	232410.
F. TOTAL		14421.	\$ 23218.		\$ 232410.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)	\$	236.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)	\$	2150.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4)	\$	2150.
D. PROJECT NON ENERGY QUALIFICATION TEST		
(1) 25% MAX NON ENERGY CALC (2F5 X .33)	\$	76695.
A IF 3D1 IS = OR > 3C GO TO ITEM 4		
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= _____		
C IF 3D1B IS = > 1 GO TO ITEM 4		
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY		

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 23454.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 234560.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 4.68
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 2.14

ECO# FN-U-1

COVER WATER DRY TANK SURFACE WITH SPHERES

Assumptions:

1. Heat losses due to radiation from the tank are neglected due to the low temperature difference and being indoors.
2. Heat losses due to convection from the tank are neglected due to the still air conditions in the building.
3. The average room conditions are 70°F db, 60% RH, 56°F dew point.
4. The tank temperature is 149°F. Waterland & Viar, Industrial Steam System Analysis for RAAP.
5. The tank diameter is 16 Feet. RAAP building inventory printout.

6. The evaporation rate is given by the following equation:

$$\dot{m}_{\text{evap}} \left(\frac{\text{lb}}{\text{hr}} \right) = \frac{A (95 + 0.425 V)}{Y} (p_w - p_a)$$

ASHRAE HVAC Systems Handbook, 1987, page 20.8.

Calculations:

$$\text{Area of surface} = \pi r^2 = \pi \times (8 \text{ ft})^2 = 201 \text{ ft}^2$$

$$Q_{\text{conduction}} = UA \Delta T$$

$$Q_{\text{evaporation}} = \dot{m} (c_{\text{vap}} + c_p \Delta T)$$

Plastic Spheres (continued):

$$U_{Top} = 1/R_{Air} = 1/0.68 = 1.47 \text{ Btu/hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}$$

$$\Delta T = 149^\circ\text{F} - 70^\circ\text{F} = 79^\circ\text{F}$$

$$Y = h_{fg} = \text{heat of vaporization @ } 149^\circ\text{F} = 1008.3 \text{ Btu/lb} \quad \text{ASHRAE Fund. Table 4, p. 6.15}$$

$$C_p = 1 \text{ Btu/lb} \cdot ^\circ\text{F}$$

$$V = \text{air velocity} = 1 \text{ ft/min}$$

$$p_w = \text{Sat. Vapor Press. @ } 149^\circ\text{F} \approx p_s = 7.394 \text{ in.Hg.}$$

ASHRAE Fund. Table 2, p. 6.8

$$p_a = \text{Sat. Vapor Press. @ } 56^\circ\text{F (d.pt.)} = 0.452 \text{ in.Hg.}$$

ASHRAE Fund. Table 2, p. 6.6

$$\dot{m}_{\text{evap}} = \frac{201 (95 + 0.425 \times 1)}{1008} (7.394 - 0.452) = (\text{lb/hr})$$

$$\dot{m}_{\text{evap}} = 132 \text{ lb/hr}$$

$$\text{FY 89 WD cycles} = \frac{181 \text{ FY 88 WD cycles}}{12 \times 10^6 \text{ \#NC}} \times 25 \times 10^6 \text{ \#NC} = 377$$

$$377 \text{ WD cycles} \div 15 \text{ Active bldgs} \div 2 \text{ tanks/bldg} = 12.6 \frac{\text{cycles}}{\text{tank}}$$

$$\text{FY 88 cycles/tank} = 181 \text{ WD cycles} \div 8 \text{ bldgs} \div 2 \text{ tanks ea} = 11.3$$

Use ~ 12 WD cycles/tank per year

$$\text{Average cycle time} = \frac{65000 \text{ hours}}{181 \text{ cycles}} \times \frac{1 \text{ day}}{24 \text{ hrs}} = 15 \frac{\text{days}}{\text{cycle}} = 360 \frac{\text{hrs}}{\text{cycle}}$$

$$12 \text{ cyc/yr} \times 360 \text{ hr/cycle} = 4320 \text{ hours/yr}$$

Plastic Spheres (Continued) :

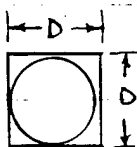
$$Q_{\text{Cond}} = 1.47 \frac{\text{Btu}}{\text{hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}} \times 201 \text{ ft}^2 \times 79^\circ\text{F} \times 4320 \frac{\text{hrs}}{\text{yr}} = \underline{100.8 \text{ MBtu/yr}}$$

$$Q_{\text{Evap}} = 132 \frac{\text{lb}}{\text{hr}} \times 4320 \frac{\text{hr}}{\text{yr}} \times \left[1008.3 \frac{\text{Btu}}{\text{lb}} + 1 \frac{\text{Btu}}{\text{lb} \cdot ^\circ\text{F}} \times (149 - 53)^\circ\text{F} \right]$$

$$Q_{\text{Evap}} = 570,240 \frac{\text{lb}}{\text{yr}} \times \left(1008.3 \frac{\text{Btu}}{\text{lb}} + 96 \frac{\text{Btu}}{\text{lb}} \right) = \underline{629.7 \text{ MBtu/yr}}$$

Exposed Surface Area Reduction By Addition of Plastic Spheres:

minimum:



$$\frac{\text{area of circle}}{\text{area of square}} = \frac{\pi D^2/4}{D \times D} = \pi/4 = 0.785$$

Maximum = 0.884 (See attached calculations)

Use 0.85

Assume 2" plastic spheres with a 1.5" air space

Neglect R-Value of plastic

$$\text{Minimum } R_{\text{Air space}} = 0.77 \frac{\text{ft}^2 \cdot \text{hr} \cdot ^\circ\text{F}}{\text{Btu}}$$

1981 ASHRAE Fund.
Page 23.13, Table 2

$$U_{\text{spheres}} = 1/R_T = \frac{1}{R_{\text{air}} + R_{\text{film}}} = \frac{1}{.77 + .68} = 0.69 \text{ Btu/hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}$$

$$U_{\text{surface}} = 0.85 \times 0.69 \frac{\text{Btu}}{\text{hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}} + 0.15 \times 1.47 \frac{\text{Btu}}{\text{hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}} = 0.81 \text{ Btu/hr} \cdot \text{ft}^2 \cdot ^\circ\text{F}$$

Plastic Spheres (Continued):

$$Q_{\text{cond-new}} = UA\Delta T = 0.81 \frac{\text{Btu}}{\text{hr-ft}^2\text{°F}} \times 201 \text{ft}^2 \times 79\text{°F} \times 4320 \text{hr/yr}$$

$$= 55.6 \text{ MBtu/yr}$$

$$Q_{\text{Evap-new}} = Q_{\text{Evap}} \times (1 - 0.85) = 629.7 \frac{\text{MBtu}}{\text{hr}} \times 0.15$$

$$= 94.5 \text{ MBtu/yr}$$

Steam Savings:

$$\text{Savings} = (Q_{\text{old}} - Q_{\text{new}}) \times \text{No. Tanks}$$

$$= \left[(100.8 + 629.7) \frac{\text{MBtu}}{\text{yr}} - (55.6 + 94.5) \frac{\text{MBtu}}{\text{yr}} \right] \times 2 \frac{\text{Tanks}}{\text{bldg}} \times 8 \text{ bldg}$$

$$\text{Savings} = 9286.4 \text{ MBtu/yr}$$

Coal Savings:

$$\text{Savings} = \text{Steam Savings} \times \frac{\text{steam savings factor}}{\text{Dist. losses}}$$

$$\text{Energy} = 9286.4 \frac{\text{MBtu}}{\text{yr}} \times 1.32 \div 0.85 = 14,421.2 \frac{\text{MBtu}}{\text{yr}}$$

$$\text{Cost} = 14,421.2 \frac{\text{MBtu}}{\text{yr}} \times 1.61 \frac{\$/\text{MBtu}}{\text{yr}} = \underline{\underline{\$23,218/\text{yr}}}$$

Electric Purchase Effect:

Cost Increase = $9286.4 \frac{\text{MBtus}}{\text{yr}} \times 0.111 \frac{\text{MBtus}}{\text{MBtus}} \times \$8.87/\text{MBtus} = \underline{\underline{\$9143/\text{yr}}}$

Non-Energy Costs:

$$\underline{\underline{\$1.01}} \times 9286.4 = \underline{\underline{\$9379/\text{yr}}}$$

Plastic Spheres (Continued):

$$\text{Non-Energy Savings} = \$9379 - 9143 = \underline{\$236 / \text{yr.}}$$

Cost Savings:

$$\begin{aligned} \text{Savings} &= \text{Coal \$ Savings} - \text{Elec \$ increase} + \text{Non energy \$} \\ &= (23,218 - 9143 + 9379) \$ / \text{yr} = \underline{\$23,454 / \text{yr}} \end{aligned}$$

Construction Cost:

$$\text{Project Cost} = \$49,899$$

See Construction Cost Estimate Sheet.

2" polypropylene or HDPE hollow spheres

$$500 \frac{\text{balls}}{\text{case}} \times \frac{\pi D^2}{4} \times \frac{1 \text{ ft}^2}{144 \text{ in}^2} = 500 \times \frac{\pi}{144} \text{ ft}^2 / \text{case} = 10.9 \text{ ft}^2 / \text{case}$$

$$10.9 \text{ ft}^2 / \text{case} \div 0.85 (\% \text{ cover}) = 12.8 \text{ ft}^2 \text{ coverage per case}$$

$$201 \text{ ft}^2 \div 12.8 \text{ ft}^2 / \text{case} = 15.7 \Rightarrow 16 \text{ cases / tank}$$

Simple Payback

$$\text{Payback} = \text{Cost} \div \text{Savings}$$

$$= \$49,899 \div \$23,454 / \text{yr} = \underline{2.1 \text{ years}}$$

$$\text{Non energy savings} = 9286.4 \frac{\text{mBtu}}{\text{yr}} \times 1.01 \$ / \text{mBtu} = \$9379$$

Cover Water Dry Tanks

$$A_s = \text{Surface Area} = 6D \times 8D$$

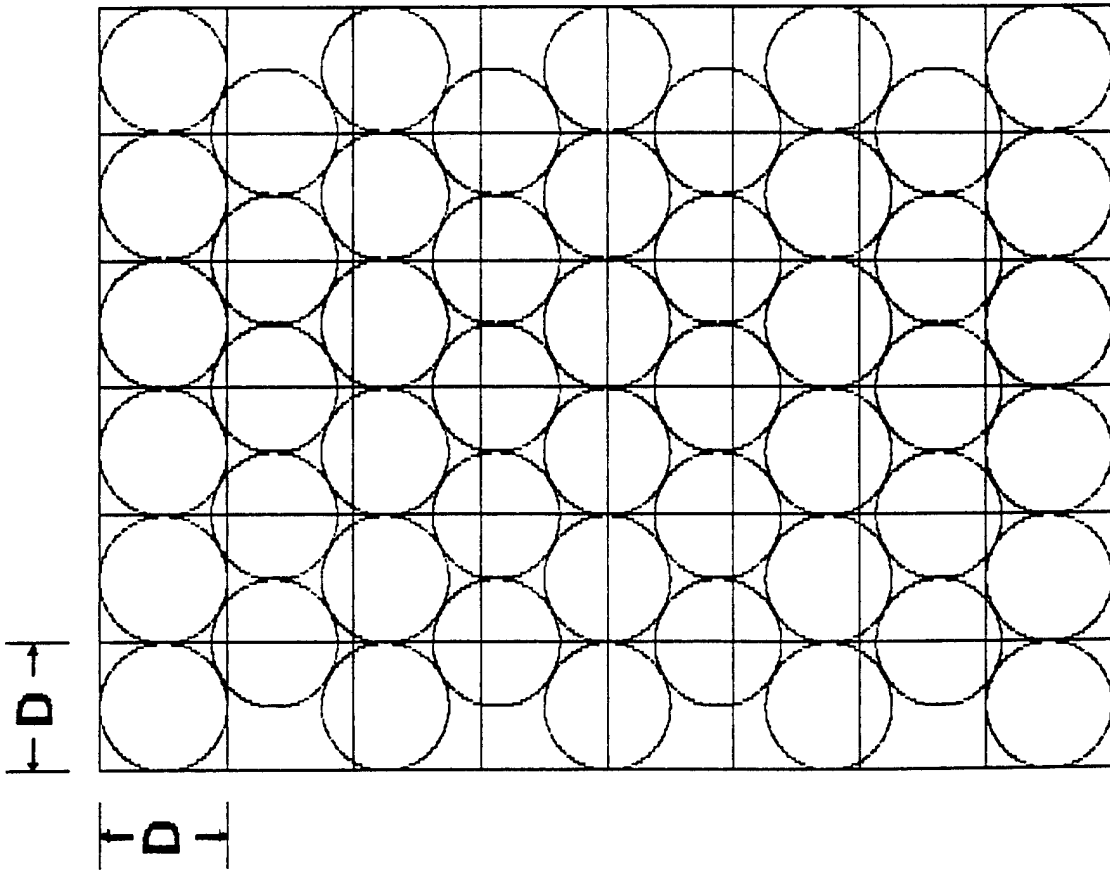
$$A_c = \text{Circle Areas} = 6 \times 9 \times \frac{\pi D^2}{4}$$

$$C = \% \text{ Coverage} = \frac{A_c}{A_s} \times 100$$

$$C = \frac{6 \times 9 \times \frac{\pi D^2}{4}}{6D \times 8D} \times 100$$

$$C = \frac{9 \times \pi}{4 \times 8} \times 100 = \frac{9\pi}{32} \times 100$$

$$C = \underline{88.4\%}$$



R S H 38 (3-63)

Water Dry House

PSYCHROMETRIC CHART

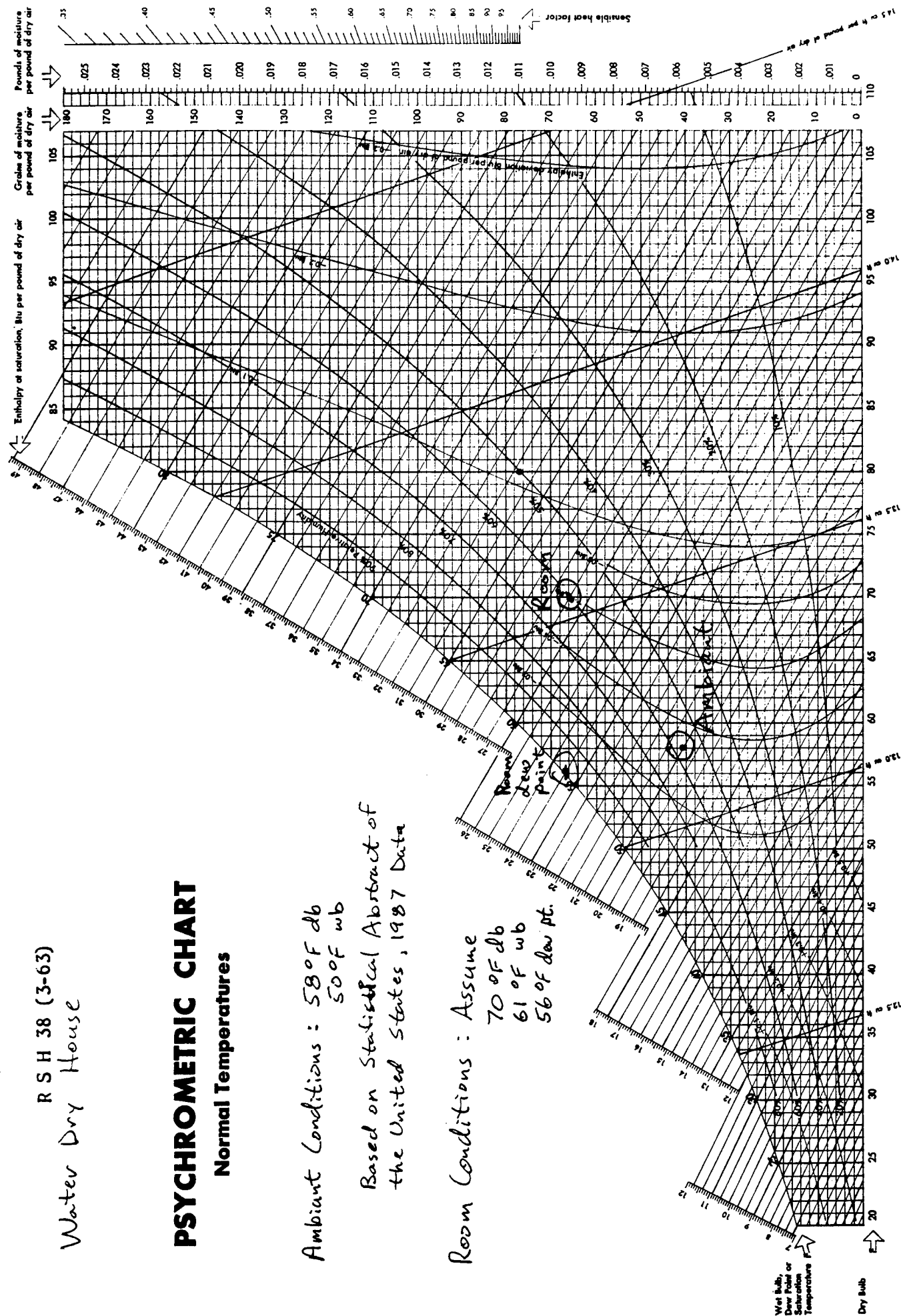
Normal Temperatures

Ambiant Conditions : 58°F db
50°F wb

Based on Statistical Abstract of
the United States, 1987 Data

Room Conditions : Assume
70°F db
61°F wb
56°F dew pt.

Cover Water Dry Tanks



800-468-1501
 Project No. 2900379-000
 Local B. Todd L.D. Placed Rec'd. 6/4/90
 Date 6/4/90
 Of Mid-America Plastics Conversed With Gary Lyons
 Regarding Hollow Plastic Spheres

Dia = 3/4"	1000	\$39.40 /case + shipping
1 1/2"	1000	\$143.50
2"	500	\$123.00
4"	100	\$203.00

Polypropylene or HDPE

90 fumes reduction
 88.3 Evap. reduction
 69.5 % Fuel savings

water with other (small amounts) and alcohol

Gary will fax product info to me today.

Distribution:

MID-AMERICA PLASTICS, INC.

Plastic Specialists / Fabrication & Distribution
700 Industrial Circle So.
Shakopee, Minnesota 55379
612/445-7667 / FAX# 612/445-2974
800/468-1501

DATE: 4-6-90
TO: [initials]
ATTN: BILL TODD X2653

Number of pages (Including this cover page): 2

REGARDING:

INFO ON PLASTIC BALLS

SIGNATURE Gary Lyon
Mid-America Plastics, Inc.

MAP FAX # (612) 445-2974

6124452974

JUN- 4-98 MON 9:21 MID AMERICA PLSTCS

P. 02

THE ENERGY SAVERS AND POLLUTION STOPPERS



**CUT HEAT LOSSES !
SAVE FACTORY MAINTENANCE !
IMPROVE SAFETY !
REMOVE FUMES AND ODORS !**

**PROVEN to Reduce Fuel Costs 19.5%
Reduces Fumes 90%
Reduces Evaporation 88.3%
ALL PLASTIC FLOATING SPHERES**

Spheres float on surface of liquid in open tank and thereby greatly reduce the exposed liquid surface area — up to 90%. Dramatically diminishes objectionable fumes and odors. Blanket of spheres also insulates heated liquid reducing evaporation and heat requirements.

Ideal for plating tanks and similar open tank installations where the liquid surface can be covered with a blanket of spheres without impeding access to the tank for process purposes.

Spheres are hollow and will float on any liquid. Fully round. No welt or rim on which chemicals can deposit and being smooth they ensure a much tighter surface cover.

Polypropylene: non-toxic and able to withstand continuous working temperatures of 110°C (230°F) polypropylene is suitable for use in most known chemicals.

High Density Polyethylene generally suitable as above but with a continuous working temperature limitation of 80°C (176°F) softening point about 110°C (230°F). High density polyethylene has better chemical resistance to certain compounds like oil, and other hydrocarbons. Also less stress cracking at low temperatures than polypropylene. Color white translucent except 100 MMA, black for outside use.

APPLICATIONS

METAL WORKING — In Pickling and Chromating Tanks.

PLATING: Manual Chromium Line Reduces Spray Splashing.

PETROLEUM: Air Pollution, Noxious Odors, Waste Collection Pits.

FOOD: Reduces Vapor, Smoke in Bacon Manufacturing.

POWER STATION: Surge Tank Reservoir of Hot Boiler — No Steam.

SWIMMING POOLS: Reduces Heat Loss.



POLYPROPYLENE		HIGH DENSITY POLYETHYLENE		DIMENSIONS			
Stock No.	Price Per Case	Stock No.	Price Per Case	Diameter (mm)	Approx. Size	No. Required Per Sq Ft.	No. in Case

macip

MID-AMERICA PLASTICS, INC.

Plastic Specialists / Fabrication & Distribution

700 Industrial Circle S. • Shakopee, Minnesota 55379

Phone 612 445-7861



ECO Number: GP-N-8

REPLACE INCANDESCENTS WITH COLOR-CORRECTED HPS SCREW-INS FOR EXPLOSION-PROOF
FIXTURES

Discussion

Many buildings at RAAP are lit by inefficient incandescent lighting for interior areas. This ECO evaluates replacement of the incandescent lamps in explosion-proof fixtures with 50 watt color-corrected HPS units, which consist of HPS lamps and ballasts with a medium base adapter which screws into the incandescent socket. These lamps have been color-corrected to produce a whitish light rather than a yellowish light usually associated with HPS. At the present time, these lamps are only produced in this wattage (50 W). Light levels will be decreased 33 percent when 200 W incandescents (3,710 lumens) are replaced by 50 W color-corrected HPS (2,500 lumens). When 150 W incandescents are replaced by 50 W color-corrected HPS, light levels will decrease 13 percent, from 2,880 lumens to 2,500 lumens.

Recommendations

Based on the Life Cycle Cost Analysis, it is recommended that 50 W HPS screw-in retrofits be installed in the interior incandescent explosion-proof fixtures.

Construction Cost	=	\$147,062
Energy Savings (electricity)	=	2,354 MBtu/yr
Cost Savings	=	\$31,081/yr
SIR	=	1.87
Simple Payback	=	4.8 years

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: GPN8

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.035

INSTALLATION & LOCATION: RADFORD AAP REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: GP-N-8 REPLACE INCAND. W/ COLOR-CORRECT HPS

FISCAL YEAR 1990 DISCRETE PORTION NAME: TOTAL

ANALYSIS DATE: 10-05-90 ECONOMIC LIFE 15 YEARS PREPARED BY: T. TODD

1. INVESTMENT

A. CONSTRUCTION COST	\$	147062.
B. SIOH	\$	8089.
C. DESIGN COST	\$	8824.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	147578.
E. SALVAGE VALUE COST	-\$	0.
F. TOTAL INVESTMENT (1D-1E)	\$	147578.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 8.87	2354.	\$ 20868.	8.78	183218.
B. DIST	\$.00	0.	\$ 0.	12.34	0.
C. RESID	\$.00	0.	\$ 0.	12.05	0.
D. NAT G	\$.00	0.	\$ 0.	12.48	0.
E. COAL	\$.00	0.	\$ 0.	10.01	0.
F. TOTAL		2354.	\$ 20868.		\$ 183218.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)	\$	10213.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)	\$	93040.
C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4)	\$	93040.
D. PROJECT NON ENERGY QUALIFICATION TEST		
(1) 25% MAX NON ENERGY CALC (2F5 X .33)	\$	60462.
A IF 3D1 IS = OR > 3C GO TO ITEM 4		
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=	1.65	
C IF 3D1B IS = > 1 GO TO ITEM 4		
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY		

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 31081.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 276258.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.87
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 4.75

GP-N-8 REPLACE INCANDESCENTS WITH COLOR-CORRECTED HPS
SCREW-INS FOR EXPLOSION PROOF FIXTURES

Calculations were made on a per-unit basis for installing 50 W
HPS color-corrected units within the existing explosion-proof
incandescent fixtures. The per-unit calculations are on page 2.
Only areas operating 3 shifts/day, 5 days/wk were considered.
From the building survey data, a list of the buildings with potential
incandescent lighting projects was compiled (page 3). It is
assumed for this ECO that 90% of the interior fixtures are
explosion proof and can be retrofitted in this manner. Exact dimensions
of fixtures and screw-in retrofits should be verified.

$$\text{Total fixtures} = 0.9(1536) = 1382$$

$$\text{Energy Savings} = 499 \frac{\text{kwh}}{\text{yr}} \times 0.003413 \frac{\text{MBtu}}{\text{kwh}} \times 1382 \text{ fixtures} = 2354 \frac{\text{MBtu}}{\text{yr}}$$

$$\text{Energy cost savings} = \frac{\$15.11}{\text{yr-fixture}} \times 1382 = \$20,882/\text{yr}$$

$$\text{Mtl & Labor Cost Savings} = \frac{\$7.39}{\text{yr-fixture}} \times 1382 = \$10,213/\text{yr}$$

$$\text{Total cost savings} = 20,882 + 10,213 = \$31,095/\text{yr}$$

$$\text{Project cost} = \frac{\$118.65}{\text{fixture}} \times 1382 = \$163,974$$

$$(\text{Construction cost} = \$163,974 / 1.115 = \$147,062)$$

$$\text{Simple payback} = \frac{\$163,974}{\$31,095/\text{yr}} = 5.3 \text{ yr}$$

GP-N-8 Replace interior 150-200 W incandescents with 50 W HPS
screw-in retrofits for explosion-proof applications

- Assume color rendition is important in this area, so the 50 W HPS (color-corrected) is chosen even though lumens exceed requirements.

$$\text{Energy savings} = (150 \text{ W} - 70 \text{ W}) \times 24 \frac{\text{hr}}{\text{day}} \times 260 \frac{\text{days}}{\text{yr}} = 499 \frac{\text{kwh}}{\text{yr}}$$

$$\text{Energy cost savings} = 499 \frac{\text{kwh}}{\text{yr}} \times \frac{\$0.03026}{\text{kwh}} = \$15.11 \frac{\text{yr}}{\text{yr}}$$

$$\text{Labor \& Mat'l cost savings} = \left(\frac{\text{Incand cost}}{750 \text{ hr}} - \frac{\text{HPS cost}}{12,000 \text{ hr}} \right) \times 6240 \frac{\text{hr}}{\text{yr}}$$

$$= \left[\frac{(\$2.11 \text{ mat'l} + \$1.20 \text{ labor} \times 0.683 \times 1.2)}{750 \text{ hr}} - \frac{(\$30.00 \text{ mat'l} + \$6.45 \text{ labor} \times 0.683 \times 1.2)}{12,000 \text{ hr}} \right] \times 6240 \frac{\text{hr}}{\text{yr}} = \$7.39 \frac{\text{yr}}{\text{yr}}$$

$$\text{Total cost savings} = \$15.11 \frac{\text{yr}}{\text{yr}} + \$7.39 \frac{\text{yr}}{\text{yr}} = \$22.50 \frac{\text{yr}}{\text{yr}}$$

$$\text{Mat'l cost} = \$67.00 \text{ for fixture w/lamp} \quad (1390 \text{ vendor info})$$

$$\text{Labor cost} = \$1.20 \times 1.20 \text{ retrofit} \times 1.2 \text{ explosion} \times 0.683 = \$1.18$$

$$\text{Project Cost} = [(1.045 \times \$67.00) + (1.2 \times \$1.18)] \times 1.661 = \$118.65$$

$$\text{Simple payback} = \frac{\$118.65}{\$22.50/\text{yr}} = 5.3 \text{ yr} < 10 \text{ yr}$$

Note: HPS lamps are replaceable in the retrofit ballasts.

Radford Army Ammunition Plant
List of Buildings with Incandescent Lighting

Bldg No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
1000 -00	Cotton Linter Warehouse	NC, A&B-Line	1	17	17
1606 -00	Open Tank Air Dry	Sol. Recovery, A-Line	10	20	200
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	27	12	324
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	20	60
4912 -27	SG Curing Hse.- Carpet Rolls	Cast Prop. (Rocket)	10	5	50
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	1	6	6
7106 -04	Dry House #4 (Cure Grain)	1st R P	7	8	56
9334 -15	Blender House	4th Rolled Powder	1	4	4
TOTAL FOR EXTERIOR FIXTURES					717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
2019 -00	Boiling Tub House	NC, B-Line	3	50	150
2022 -00	Beater House	NC, B-Line	3	40	120
2024 -00	Poacher & Blending House	NC, B-Line	3	30	90
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	50	150
4912 -40	Forced Air Dry House	Pilot B	21	10	210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	1	4	4
4915 -00	Small Grain Mold Assembly	Cast Prop. (Rocket)	1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
4951 -02	TOW Launch Saw House	Pilot B	1	8	8
5008 -01	15 Inch Press House	Pilot A	3	2	6
6304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	600
TOTAL FOR INTERIOR FIXTURES					1536

SCP ENERGY CONSERVATION PRODUCTS, 511 CANAL STREET, NYC, NY, 10013—TEL (212)-925-5991

POWER CONSUMPTION AND LUMEN OUTPUT DATA

	WATTS	LINE WATTS	TOTAL LUMEN OUTPUT	LUMENS PER WATT	HOURS OF RATED LIFE	
***** MERCURY VAPOR (DELUXE WHITE)						
*	1000	1075	63000	59	24000	*
*	400	450	23000	56	24000	*
*	250	290	13000	42	24000	*
*	175	205	8500	49	24000	*
*	100	120	4500	42	24000	*
*	75	93	3150	37	16000	*
*	50	61	1680	31	16000	*
***** METAL HALIDE						
*	1500	1600	155000	103	3000	*
*	1000	1100	110000	100	12000	*
*	400	460	34000	85	15000	*
*	175	210	14000	85	7500	*
***** HIGH PRESSURE SODIUM						
*	1000	1080	140000	130	24000	*
*	400	480	50000	104	24000	*
*	250	310	27500	89	24000	*
*	150	200	16000	80	24000	*
*	100	135	9500	70	24000	*
*	70	85	5800	68	24000	*
*	50	70	4000	57	24000	*
*	35	42	2850	67	18000	*
***** FLUORESCENT						
STRAIGHT	40	48	3150	66	20000+	*
CIRCLINE	32	37	1830	50	12000+	*
CIRCLINE	22	25	1050	42	12000+	*
CIRCLINE	20	23	850	37	12000+	*
TWIN TUBE	13	16	900	56	10000+	*
TWIN TUBE	9	12	600	50	10000+	*
STRAIGHT	8	11	400	36	7500+	*
TWIN TUBE	7	10	400	40	10000+	*
STRAIGHT	6	9	300	33	7500+	*
TWIN TUBE	5	8	250	31	10000+	*
***** INCANDESCENT						
*	1000	1000	23740	24	1000	*
*	750	750	17040	23	1000	*
*	500	500	10850	22	1000	*
*	200	200	3710	19	750	*
*	150	150	2880	19	750	*
*	100	100	1750	18	750	*
*	75	75	1190	16	750	*
***** QUARTS—IODINE						
*	1500	1500	35800	24	3000	*
*	1000	1000	23400	23	2000	*
*	500	500	10950	22	2600	*
*	250	250	4850	19	2000	*

LAMP WATTAGE APPX LUMENS AVERAGE LIFE HRS. STANDARD CASE QTY.

RAPID START FLUORESCENT U LAMPS

FB40/U6/CW/EW	34	2,600	12,000	12
FB40/U6/CW	40	2,950	12,000	12

INSTANT START SLIMLINE FLUORESCENT LAMPS

F72T12/CW	55	4,550	12,000	12
F96T12/CW/EW	60	5,600	15,000	15
F96T12/CW	75	6,200	12,000	15

HIGH & VERY HIGH OUTPUT FLUORESCENT LAMPS

F96T12/CW/HO/EW	95	8,300	12,000	15
F96T12/CW/HO	110	9,200	12,000	15
F96T12/CW/VHO/EW	185	14,000	12,000	15
F96T12/CW/VHO	215	15,500	12,000	15

METAL HALIDE UNIVERSAL BURN MEDIUM BASE LAMPS

MH35/U	35	2,300	5,000	12
MH50/U	50	3,400	5,000	12
MH70/U	70	5,500	5,000	12
MH100/U	100	7,200	7,500	12
MH150/U	150	12,000	10,000	12

METAL HALIDE UNIVERSAL BURN MOGAL BASE LAMPS

MH175/U	175	14,000	10,000	12
MH175/C/U	175	14,000	10,000	12
MH250/U	250	20,500	10,000	12
MH250/C/U	250	20,500	10,000	12
MH400/U	400	36,000	20,000	6
MH400/C/U	400	36,000	20,000	6
MH1000/U	1000	110,000	12,000	6
MH1000/C/U	1000	105,000	12,000	6

COMPACT DOUBLE ENDED HQI METAL HALIDE LAMPS

HQI 70	70	5,000	10,000	12
HQI 150	150	11,000	10,000	12
HQI 250	250	19,000	10,000	12
HQI 400	400	25,000	10,000	12

HIGH PRESSURE SODIUM MEDIUM BASE LAMPS

LU35/MED	35	2,250	16,000	12
LU35/D/MED	35	2,150	16,000	12
LU50/MED	50	4,000	24,000	12
LU50/D/MED	50	3,800	24,000	12
LU70/MED	70	6,300	24,000	12
LU70/D/MED	70	5,985	24,000	12
LU100/MED	100	9,500	24,000	12
LU100/D/MED	100	8,800	24,000	12
LU150/MED	150	16,000	24,000	12
LU150/D/MED	150	15,000	24,000	12

COLOR IMPROVED HIGH PRESSURE SODIUM LAMP

CHT50SDX	50	2,500	12,000	12
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HIGH PRESSURE SODIUM ED-23½ MOGUL BASE LAMPS

LU50	50	4,000	24,000	12
LU50/D	50	3,800	24,000	12
LU70	70	6,300	24,000	12
LU70/D	70	5,985	24,000	12
LU100	100	9,500	24,000	12
LU100/D	100	8,800	24,000	12
LU150/55	150	16,000	24,000	12
LU150/55/D	150	15,000	24,000	12

LAMP WATTAGE APPX LUMENS AVERAGE LIFE HRS. STANDARD CASE QTY.

HIGH PRESSURE SODIUM E-18 MOGUL BASE LAMPS

LU200	200	22,000	24,000	12
LU250	250	29,000	24,000	12
LU250/D	250	26,000	24,000	12
LU310	310	37,000	24,000	12
LU400	400	50,000	24,000	12

LOW PRESSURE SODIUM LAMPS

SOX10	10	1,000	9,000	20
SOX18	18	1,800	14,000	20
SOX35	35	4,800	18,000	12
SOX55	55	8,000	18,000	9
SOX90	90	13,500	18,000	9
SOX135	135	22,500	18,000	9
SOX180	180	33,000	18,000	9

MR16 LOW VOLTAGE 12V TUNGSTEN HALOGEN LAMPS

ESX (N)	20	3,300	2,000	20
BAB (W)	20	460	2,000	20
EYR (N)	42	7,300	2,000	20
EYS (M)	42	2,500	2,000	20
EYP (W)	42	1,200	2,000	20
EXT (N)	50	9,150	3,000	20
EXZ (M)	50	3,000	3,000	20
EXN (W)	50	1,500	3,000	20
EYF (N)	75	11,500	3,500	20
EYJ (M)	75	4,500	3,500	20
EYC (W)	75	2,000	3,500	20

MR16 LINE VOLTAGE 120V MEDIUM BASE TUNGSTEN HALOGEN LAMPS

M/JDR75W/N	75	6,300	2,000	12
M/JDR75W/M	75	3,500	2,000	12
M/JDR75W/W	75	2,100	2,000	12
M/JDR100/N	100	8,500	2,000	12
M/JDR100/M	100	4,500	2,000	12
M/JDR100/W	100	3,000	2,000	12

MR16 LINE VOLTAGE 120V INTERMEDIATE BASE TUNGSTEN HALOGEN LAMPS

M/JDR75W/N	75	6,300	2,000	12
M/JDR75W/M	75	3,500	2,000	12
M/JDR75W/W	75	2,100	2,000	12
M/JDR100/N	100	8,500	2,000	12
M/JDR100/M	100	4,500	2,000	12
M/JDR100/W	100	3,000	2,000	12

TUNGSTEN HALOGEN LINE VOLTAGE MEDIUM BASE TUBULAR LAMPS

64484/CL	75	1,200	2,000	15
64484/FR	75	1,140	2,000	15
64486/CL	100	1,600	2,000	15
64486/FR	100	1,520	2,000	15
64488/CL	150	2,750	2,000	15
64488/FR	150	2,622	2,000	15

TUNGSTEN HALOGEN LINE VOLTAGE DOUBLE ENDED LAMPS

Q100T3/CL	100	1,600	200	12
Q150T3/CL	150	2,800	200	12
Q200T3/CL	200	3,600	200	12
Q300T3/CL	300	6,000	200	12
Q500T3/CL	500	11,000	200	12
Q1500T3/CL	1500	33,000	200	12

166 | Lighting**166 100 | Lighting**

			CREW	DAILY OUTPUT	MAN- HOURS	UNIT	BARE COSTS				TOTAL INCL. O&P	
							MAT.	LABOR	EQUIP.	TOTAL		
140	1600	90 watt	1 Elec	.30	26.670	C	5.140	645		5.785	6.600	140
	1650	135 watt		.20	40		6.905	970		7.875	9.025	
	1700	180 watt		.20	40		7.308	970		8.278	9.475	
	1750	Quartz line, clear, 500 watt		1.10	7.270		1.872	175		2.047	2.325	
	1760	1500 watt		.20	40		3.427	970		4.397	5.200	
	1800	Incandescent, interior, A21, 100 watt		1.60	5		173	120		293	370	
	1900	A21, 150 watt		1.60	5		211	120		331	410	
	2000	A23, 200 watt		1.60	5		227	120		347	430	
	2200	PS 30, 300 watt		1.60	5		330	120		450	540	
	2210	PS 35, 500 watt		1.60	5		576	120		696	810	
	2230	PS 52, 1000 watt		1.30	6.150		1,525	150		1,675	1,900	
	2240	PS 52, 1500 watt		1.30	6.150		2,382	150		2,532	2,850	
	2300	R30, 75 watt		1.30	6.150		375	150		525	630	
	2400	R40, 150 watt		1.30	6.150		408	150		558	670	
	2500	Exterior, PAR 38, 75 watt		1.30	6.150		566	150		716	840	
	2600	PAR 38, 150 watt		1.30	6.150		525	150		675	795	
	2700	PAR 46, 200 watt		1.10	7.270		1,928	175		2,103	2,375	
	2800	PAR 56, 300 watt		1.10	7.270		2,193	175		2,368	2,675	
	3000	Guards, fluorescent lamp, 4' long		1	8		375	195		570	695	
	3200	8' long		.90	8.890		535	215		750	905	
145	0010	RESIDENTIAL FIXTURES										145
	0400	Fluorescent, interior, surface, circine, 32 watt & 40 watt	1 Elec	20	.400	Ea.	48	9.70		57.70	67	
	0500	2' x 2', two U 40 watt		8	1		66	24		90	110	
	0700	Shallow under cabinet, two 20 watt		16	.500		45	12.15		57.15	67	
	1000	Wall mounted, 4'L, one 40 watt, with baffle		10	.800		41	19.40		60.40	74	
	2000	Incandescent, exterior lantern, wall mounted, 60 watt		16	.500		36	12.15		48.15	57	
	2100	Post light, 150W, with 7' post		4	2		104	49		153	185	
	2500	Lamp holder, weatherproof with 150W PAR		16	.500		16	12.15		28.15	35	
	2550	With reflector and guard		12	.667		31	16.15		47.15	58	
	2600	Interior pendant, globe with shade, 150 watt		20	.400		78	9.70		87.70	100	
150	0010	TRACK LIGHTING										150
	0080	Track, 1 circuit, 4' section	1 Elec	6.70	1.190	Ea.	33	29		62	79	
	0100	8' section		5.30	1.510		48	37		85	105	
	0200	12' section		4.40	1.820		81	44		125	155	
	0300	3 circuits, 4' section		6.70	1.190		36	29		65	82	
	0400	8' section		5.30	1.510		48	37		85	105	
	0500	12' section		4.40	1.820		88	44		132	160	
	1000	Feed kit, surface mounting		16	.500		12	12.15		24.15	31	
	1100	End cover		24	.333		1.98	8.10		10.08	14.05	
	1200	Feed kit, stem mounting, 1 circuit		16	.500		16	12.15		28.15	35	
	1300	3 circuit		16	.500		16	12.15		28.15	35	
	2000	Electrical joiner for continuous runs, 1 circuit		32	.250		6.55	6.05		12.60	16.10	
	2100	3 circuit		32	.250		12.10	6.05		18.15	22	
	2200	Fixtures, spotlight, 150 PAR		16	.500		47	12.15		59.15	70	
	3000	Wall washer, 250 watt tungsten halogen		16	.500		101	12.15		113.15	130	
	3100	Low voltage, 2 1/2 watt, 1 circuit		16	.500		102	12.15		114.15	130	
	3120	3 circuit		16	.500		109	12.15		121.15	140	

166 | Lighting

166 100 | Lighting

CREW	DAILY OUTPUT	MAN-HOURS	UNIT	BARE COSTS				TOTAL INCL O&P
				MAT.	LABOR	EQUIP.	TOTAL	
1 Elec	8	1	Ea.	479	24		503	565
	8	1		500	24		524	585
	8	1		535	24		559	625
	8	1		556	24		580	645
	8	1		525	24		549	615
	8	1		556	24		580	645
↓	8	1	↓	581	24		605	675
1 Elec	12	.667	Ea.	293	16.15		309.15	345
	12	.667		314	16.15		330.15	370
	12	.667		335	16.15		351.15	390
	12	.667		360	16.15		376.15	420
	12	.667		365	16.15		381.15	425
	12	.667		376	16.15		392.15	435
	12	.667		398	16.15		414.15	460
	12	.667		324	16.15		340.15	380
	12	.667		376	16.15		392.15	435
	12	.667		360	16.15		376.15	420
	12	.667		386	16.15		402.15	450
	3.20	2.500		355	61		416	480
	2.70	2.960		370	72		442	515
	2.40	3.330		398	81		479	555
	3.20	2.500		398	61		459	525
	2.70	2.960		428	72		500	575
↓	2.40	3.330	↓	454	81		535	620

140	0010	LAMPS	1 Elec	1	8	C	348	195		543	670
	0080	Fluorescent, rapid start, cool white, 2' long, 20 watt					198	215		413	535
	0100	4' long, 40 watt			.90	8.890	442	215		657	805
	0120	3' long, 30 watt			.90	8.890					
	0150	U-40 watt			.80	10	874	245		1,119	1,325
	0170	4' long, 35 watt energy saver			.90	8.890	270	215		485	615
	0200	Slimline, 4' long, 40 watt			.90	8.890	618	215		833	995
	0300	3' long, 75 watt			.80	10	577	245		822	990
	0350	3' long, 60 watt energy saver			.80	10	603	245		848	1,025
	0400	High output, 4' long, 60 watt			.90	8.890	750	215		965	1,150
	0500	8' long, 110 watt			.80	10	775	245		1,020	1,200
	0520	Very high output, 4' long, 110 watt			.90	8.890	1,285	215		1,500	1,725
	0550	8' long, 215 watt			.70	11.430	1,285	275		1,560	1,825
	0600	Mercury vapor, mogul base, deluxe white, 100 watt			.30	26.670	2,142	645		2,787	3,300
	0650	175 watt			.30	26.670	1,663	645		2,308	2,775
	0700	250 watt			.30	26.670	2,968	645		3,613	4,225
	0800	400 watt			.30	26.670	2,340	645		2,985	3,525
	0900	1000 watt			.20	40	5,100	970		6,070	7,025
	1000	Metal halide, mogul base, 175 watt			.30	26.670	3,749	645		4,394	5,075
	1100	250 watt			.30	26.670	4,712	645		5,357	6,125
	1200	400 watt			.30	26.670	4,386	645		5,031	5,775
	1300	1000 watt			.20	40	9,894	970		10,864	12,300
	1320	1000 watt, 125,000 initial lumens			.20	40	9,960	970		10,930	12,400
	1330	1500 watt			.20	40	9,268	970		10,238	11,600
	1350	Sodium high pressure, 70 watt			.30	26.670	4,712	645		5,357	6,125
	1360	100 watt			.30	26.670	4,871	645		5,516	6,300
	1370	150 watt			.30	26.670	5,059	645		5,704	6,525
	1380	250 watt			.30	26.670	5,380	645		6,025	6,875
	1400	400 watt			.30	26.670	5,727	645		6,372	7,250
	1450	1000 watt			.20	40	13,352	970		14,322	16,100
	1500	Low pressure, 35 watt			.30	26.670	3,963	645		4,608	5,300
	1550	55 watt			.30	26.670	4,386	645		5,031	5,775



Telephone Call Confirmation

Project No. 290 0379 000Local _____ L.D. (718) 851-577 Placed ✓ Rec'd. ✓ Date 6-7-90_____
T. Todd Conversed With Mr. Singer
Of American Scientific Lighting Co. Regarding HPS retrofits

For retrofits of incandescent fixtures, the "Bulb Lumenight" and "Colorlight" products are recommended. The lamps are replaceable in both, and the "Colorlight" is more whitish. Contractors costs (including lamp) for quantities of 100+ are as follows:

Bulb Lumenight	35 W	—	\$45	(lamps only)
	50 W	—	\$45	(\$16 - \$20)
(also come in 70 W, 100 W, 150 W)				

Colorlight	50 W	—	\$67	(lamps only)
				\$30)

They will send a copy of their catalog for dimensions.



DOWNLITE™ CONVERSION SERIES: COMPACT FLUORESCENT REFLECTOR LAMPS

GLOBE FLECTOR™ LUMA FLECTOR™

- **LAMP:** Compact disposable fluorescent globe or tubular lamp/Standard or tapered base
- **REFLECTOR:** Highly polished aluminum
- **WATTAGE:** Fifteen
- **LUMENS:** 1350
- **COLOR:** Warm white/2800k
- **USE:** Indoor only
- **BURNING POSITION:** Any
- **LAMP LIFE:** 9,000 hours
- **INSTALLATION:** Screws into any 120V medium base socket
- **PACKAGING:** Ten conversions per carton

CATALOG NUMBER	LAMP	DIMENSIONS
DGF S/15	BFG15 LE/A	Reflector Diameter 5 1/8" Overall Length 6 1/4"
DGF T/15	BFG15 LE/T	Reflector Diameter 5 1/8" Overall Length 6 3/4"
DLF S/15	BFT15 LE/A	Reflector Diameter 5 1/8" Overall Length 6 3/4"
DLF T/15	BFT15 LE/T	Reflector Diameter 5 1/8" Overall Length 7"

LINE VOLTAGE/LOW VOLTAGE MR16 HALOGEN CONVERSIONS

HALOGENLITE™ 120V

- **LAMP:** MR16 Dichro-Cool tungsten halogen/Medium base or intermediate with medium adapter base and clip on lens/Line voltage/Cool crisp white light 3000k/Dimmable up to twenty five percent/Medium beam spread.
- **LAMP LIFE:** 2,000 hours/High lumen maintenance
- **INSTALLATION:** Screws directly into any ventilated 120V medium base porcelain socket rated above 100 watt/Minimum front diameter opening 4 3/4"
- **PACKAGING:** Ten lamps per carton

CATALOG NUMBER	LAMP	DIMENSIONS
MEDIUM		
DH 120 M/75	JDR75	Lamp Diameter 2"
DH 120 M/100	JDR100	Overall Length 2 5/16"
INTERMEDIATE		
DH 120 I/75	JDR75	Lens Diameter 2 1/8"
DH 120 I/100	JDR100	Overall Length 5 1/4"
OPTIONS:		M Medium Beam Spread 18°
R Reflector		N Narrow Beam Spread 10°
		W Wide Beam Spread 28°

HALOGENLITE™ 12V

- **ADAPTER:** Molded Valox® plastic/Vented to cool internal components
- **FINISH:** Black
- **LAMP:** MR16 Dichro-Cool tungsten halogen/Low voltage/Stepdown transformer/Dimmable/Cool crisp white light 3000k/Natural sunlight appearance
- **LIFE:** 2000 hours — 20 watt/3000 hours — 50 watt
- **INSTALLATION:** DH 12/20 screws into any medium base porcelain socket rated for 75 watts/DH 12/50 into socket rated for 150 watts
- **PACKAGING:** Four conversions per carton/Lamp included

CATALOG NUMBER	LAMP	DIMENSIONS
DH 12/20	JR/20	Adapter Diameter 3 1/4"
DH 12/50	JR50	Overall Length 6"
DH 12/20/R40	JR/20	Adapter Diameter 3 1/4"
DH 12/50/R40	JR/50	Overall Length 7 3/4"
OPTIONS:		EXT Narrow Spot/50w
BAB Flood/20w		EXZ Narrow Flood/50w
ESX Narrow Spot/20w		EXN Flood/50w

COLOR IMPROVED HPS HIGH HAT CONVERSION

COLORLITE 50™

- **ADAPTER:** Heavy gauge spun aluminum
- **FINISH:** Caustic etching
- **REFLECTOR:** Highly polished aluminum/Vented slots for cool operation
- **LAMP COLOR:** 2500K • **LAMP LIFE:** 12000 Hours
- **INSTALLATION:** Adapter screws into a standard 120V high hat fixture/Medium base porcelain socket required/Fixture rated for a minimum of 150 watts/Minimum front diameter opening 5"
- **PACKAGING:** Four conversions per carton/Lamp included

CATALOG NUMBER	LAMP	DIMENSIONS
DC/50	NHT50 SDX	Adapter Diameter 3 1/8" Reflector Diameter 5 1/4" Overall Height 8 1/2"

ECO Number: GP-N-2

REPLACE INCANDESCENTS WITH CIRCLINE FLUORESCENTS

Discussion

Many buildings at RAAP are lit with inefficient incandescent lighting. This ECO analyzes the replacement of interior incandescent lamps with 32 W circline fluorescent screw-in retrofit fixtures. This type of project is suitable for nonexplosion-proof interior fixtures. Replacing 100 W incandescents with 32 W circlines would increase the lumen output by five percent, from 1,750 lumens to 1,830 lumens. Replacing 150 W incandescents with 32 W circlines would decrease the lumen output 57 percent, from 2,880 lumens to 1,830 lumens.

Recommendations

Based on the Life Cycle Cost Analysis, it is recommended that incandescent lamps be replaced with fluorescent circline fixtures.

Construction Cost	=	\$13,048
Annual Energy Savings (electricity)	=	371 MBtu/yr
Annual Cost Savings	=	\$6,416/yr
SIR	=	4.38
Simple Payback	=	2.0 years

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: GPN2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.035

INSTALLATION & LOCATION: RADFORD AAP REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: GP-N-2 REPLACE INCAND. W/ CIRCLINE FLUOR.

FISCAL YEAR 1990 DISCRETE PORTION NAME: TOTAL

ANALYSIS DATE: 10-05-90 ECONOMIC LIFE 15 YEARS PREPARED BY: T. TODD

1. INVESTMENT

A. CONSTRUCTION COST	\$	13048.
B. SIOH	\$	718.
C. DESIGN COST	\$	783.
D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	13094.
E. SALVAGE VALUE COST	-\$	0.
F. TOTAL INVESTMENT (1D-1E)	\$	13094.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 8.87	371.	\$ 3285.	8.78	28845.
B. DIST	\$.00	0.	\$ 0.	12.34	0.
C. RESID	\$.00	0.	\$ 0.	12.05	0.
D. NAT G	\$.00	0.	\$ 0.	12.48	0.
E. COAL	\$.00	0.	\$ 0.	10.01	0.
F. TOTAL		371.	\$ 3285.		\$ 28845.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)	\$	3131.
(1) DISCOUNT FACTOR (TABLE A)		9.11
(2) DISCOUNTED SAVING/COST (3A X 3A1)	\$	28523.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4) \$ 28523.

D. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 9519.

A IF 3D1 IS = OR > 3C GO TO ITEM 4

B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= 2.93

C IF 3D1B IS = > 1 GO TO ITEM 4

D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 6416.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 57368.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 4.38
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 2.04

GP-N-2 REPLACE INCANDESCENTS WITH CIRCLINE FLUORESCENTS

Calculations were made on a per-unit basis for installing 32 W circline fluorescent fixtures in place of incandescents for interior non-explosion proof applications. The per-unit calculations are on page 2. From the building survey data, a list of the buildings with potential incandescent lighting projects was compiled (page 3). It is assumed for this ECD that 10% of the interior fixtures are non-explosion proof and can be retrofitted in this manner. Only areas operating 3 shifts/day, 5 days/wk were considered.

$$\text{Total fixtures} = 0.1 \times 1536 = 154$$

$$\text{Energy savings} = 70.5 \frac{\text{kwh}}{\text{yr}} \times 0.003413 \frac{\text{MBtu}}{\text{kwh}} \times 154 = 371 \text{ MBtu/yr}$$

$$\text{Energy cost savings} = \frac{\$21.34}{\text{yr-fixture}} \times 154 \text{ fixtures} = \$3286/\text{yr}$$

$$\text{Matl & labor cost savings} = \frac{\$20.33}{\text{yr-fixture}} \times 154 = \$3131/\text{yr}$$

$$\text{Total cost savings} = 3286 + 3131 = \$6417/\text{yr}$$

$$\text{Project cost} = \frac{\$24.47}{\text{fixture}} \times 154 = \$14,548$$

$$(\text{Construction cost} = 14,548 / 1.115 = \$13,048)$$

$$\text{Simple payback} = \frac{\$14,548}{\$6417/\text{yr}} = 2.3 \text{ yr}$$

GP-N-2 Replace interior 100-150W incandescents with 32 W screw-in fluorescent fixtures for non-explosion proof applications

- Assume original light levels should not be reduced significantly.

(32 W fluor. provides lumen output between 100W and 150W incand.)

$$\text{Energy savings} = (150 \text{ W} - 32 \text{ W}) \times \frac{24 \text{ hr}}{\text{day}} \times \frac{260 \text{ days}}{\text{yr}} = 705 \frac{\text{kwh}}{\text{yr}}$$

$$\text{Energy cost savings} = 705 \frac{\text{kwh}}{\text{yr}} \times \$0.03026 \frac{\text{\$/kwh}}{\text{kwh}} = \$21.34 \frac{\text{\$}}{\text{yr}}$$

$$\text{Labor \& mat'l cost savings} = \left(\frac{\text{Incand. cost}}{750 \text{ hr}} - \frac{\text{Fluor. cost}}{12,000 \text{ hr}} \right) \times 6240 \frac{\text{hr}}{\text{yr}}$$

$$= \left[\frac{(\$2.11 \text{ mat'l} + \$1.20 \text{ labor} \times 0.683)}{750 \text{ hr}} - \frac{(\$5.55 \text{ mat'l} + \$2.45 \text{ labor} \times 0.683)}{12,000 \text{ hr}} \right] \times 6240 \frac{\text{hr}}{\text{yr}} = \$20.33 \frac{\text{\$}}{\text{yr}}$$

$$\text{Total cost savings} = \frac{\$21.34}{\text{yr}} + \frac{\$20.33}{\text{yr}} = \frac{\$41.67}{\text{yr}}$$

$$\text{Mat'l cost} = \$42.90 \text{ for fixture} \times 1.10 \text{ inflation (1984 vendor literature)} \\ + \$5.55 \text{ for lamp} \times 1.10 \text{ infl.} = \$53.30$$

$$\text{Labor cost} = \$1.20 \times 1.20 \times 0.683 \text{ (cost of replacing incand. bulb + 20\%)}$$

$$\text{Project cost} = [(1.045 \times \$53.30) + (1.2 \times \$0.98)] \times 1.661 = \$94.47$$

$$\text{Simple payback} = \frac{\$94.47}{\$41.67/\text{yr}} = 2.3 \text{ yr} < 10 \text{ yr.}$$

Radford Army Ammunition Plant
List of Buildings with Incandescent Lighting

Bldg No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
1000 -00	Cotton Linter Warehouse	NC, A&B-Line	1	17	17
1606 -00	Open Tank Air Dry	Sol. Recovery, A-Line	10	20	200
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	27	12	324
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	20	60
4912 -27	SG Curing Hse.- Carpet Rolls	Cast Prop. (Rocket)	10	5	50
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	1	6	6
7106 -04	Dry House #4 (Cure Grain)	1st R P	7	8	56
9334 -15	Blender House	4th Rolled Powder	1	4	4
TOTAL FOR EXTERIOR FIXTURES					717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
2019 -00	Boiling Tub House	NC, B-Line	3	50	150
2022 -00	Beater House	NC, B-Line	3	40	120
2024 -00	Poacher & Blending House	NC, B-Line	3	30	90
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	50	150
4912 -40	Forced Air Dry House	Pilot B	21	10	210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	1	4	4
4915 -00	Small Grain Mold Assembly	Cast Prop. (Rocket)	1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
4951 -02	TOW Launch Saw House	Pilot B	1	8	8
5008 -01	15 Inch Press House	Pilot A	3	2	6
6304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	600
TOTAL FOR INTERIOR FIXTURES					1536

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POWER CONSUMPTION AND LUMEN OUTPUT DATA

* WATTS	* LINE WATTS	* TOTAL LUMEN OUTPUT	* LUMENS PER WATT	* HOURS OF RATED LIFE	* *
***** MERCURY VAPOR (DELUXE WHITE)					
* 1000	1075	63000	59	24000	*
* 400	450	23000	56	24000	*
* 250	290	13000	42	24000	*
* 175	205	8500	49	24000	*
* 100	120	4500	42	24000	*
* 75	93	3150	37	16000	*
* 50	61	1680	31	16000	*
***** METAL HALIDE					
* 1500	1600	155000	103	3000	*
* 1000	1100	110000	100	12000	*
* 400	460	34000	85	15000	*
* 175	210	14000	85	7500	*
***** HIGH PRESSURE SODIUM					
* 1000	1080	140000	130	24000	*
* 400	480	50000	104	24000	*
* 250	310	27500	89	24000	*
* 150	200	16000	80	24000	*
* 100	135	9500	70	24000	*
* 70	85	5800	68	24000	*
* 50	70	4000	57	24000	*
* 35	42	2850	67	18000	*
***** FLUORESCENT					
STRAIGHT 40	48	3150	66	20000+	*
CIRCLINE (32)	(37)	(1830)	50	(12000+)	*
CIRCLINE 22	25	1050	42	12000+	*
CIRCLINE 20	23	850	37	12000+	*
TWIN TUBE 13	16	900	56	10000+	*
TWIN TUBE 9	12	600	50	10000+	*
STRAIGHT 8	11	400	36	7500+	*
TWIN TUBE 7	10	400	40	10000+	*
STRAIGHT 6	9	300	33	7500+	*
TWIN TUBE 5	8	250	31	10000+	*
***** INCANDESCENT					
* 1000	1000	23740	24	1000	*
* 750	750	17040	23	1000	*
* 500	500	10850	22	1000	*
* 200	200	3710	19	750	*
* (150)	150	(2880)	19	(750)	*
* 100	100	(1750)	18	750	*
* 75	75	1190	16	750	*
***** QUARTS—IODINE					
* 1500	1500	35800	24	3000	*
* 1000	1000	23400	23	2000	*
* 500	500	10950	22	2600	*
* 250	250	4850	19	2000	*

166 | Lighting

166 100 Lighting		CREW	DAILY OUTPUT	MAN- HOURS	UNIT	BARE COSTS				TOTAL		
						MAT.	LABOR	EQUIP.	TOTAL	INCL O&P		
140	1600	90 watt	1 Elec	.30	26.670	C	5,140	645		5,785	6,600	140
	1650	135 watt		.20	40		6,905	970		7,875	9,025	
	1700	180 watt		.20	40		7,308	970		8,278	9,475	
	1750	Quartz line, clear, 500 watt		1.10	7.270		1,872	175		2,047	2,325	
	1760	1500 watt		.20	40		3,427	970		4,397	5,200	
	1800	Incandescent, interior, A21, 100 watt		1.60	5		173	120		293	370	
	1900	A21, 150 watt		1.60	5		211	120		331	410	
	2000	A23, 200 watt		1.60	5		227	120		347	430	
	2200	PS 30, 300 watt		1.60	5		330	120		450	540	
	2210	PS 35, 500 watt		1.60	5		576	120		696	810	
	2230	PS 52, 1000 watt		1.30	6.150		1,525	150		1,675	1,900	
	2240	PS 52, 1500 watt		1.30	6.150		2,382	150		2,532	2,850	
	2300	R30, 75 watt		1.30	6.150		375	150		525	630	
	2400	R40, 150 watt		1.30	6.150		408	150		558	670	
	2500	Exterior, PAR 38, 75 watt		1.30	6.150		566	150		716	840	
	2600	PAR 38, 150 watt		1.30	6.150		525	150		675	795	
2700	PAR 46, 200 watt		1.10	7.270		1,928	175		2,103	2,375		
2800	PAR 56, 300 watt		1.10	7.270		2,193	175		2,368	2,675		
3000	Guards, fluorescent lamp, 4' long		1	8		375	195		570	695		
3200	8' long		.90	8.890		535	215		750	905		
145	0010	RESIDENTIAL FIXTURES										145
	0400	Fluorescent, interior, surface, circine, 32 watt & 40 watt	1 Elec	20	.400	Ea.	48	9.70		57.70	67	
	0500	2' x 2', two U 40 watt		8	1		66	24		90	110	
	0700	Shallow under cabinet, two 20 watt		16	.500		45	12.15		57.15	67	
	0900	Wall mounted, 4'L, one 40 watt, with baffle		10	.800		41	19.40		60.40	74	
	2000	Incandescent, exterior lantern, wall mounted, 60 watt		16	.500		36	12.15		48.15	57	
	2100	Post light, 150W, with 7' post		4	2		104	49		153	185	
	2500	Lamp holder, weatherproof with 150W PAR		16	.500		16	12.15		28.15	35	
	2550	With reflector and guard		12	.667		31	16.15		47.15	58	
	2600	Interior pendant, globe with shade, 150 watt		20	.400		78	9.70		87.70	100	
150	0010	TRACK LIGHTING										150
	0080	Track, 1 circuit, 4' section	1 Elec	6.70	1.190	Ea.	33	29		62	79	
	0100	8' section		5.30	1.510		48	37		85	105	
	0200	12' section		4.40	1.820		81	44		125	155	
	0300	3 circuits, 4' section		6.70	1.190		36	29		65	82	
	0400	8' section		5.30	1.510		48	37		85	105	
	0500	12' section		4.40	1.820		88	44		132	160	
	1000	Feed kit, surface mounting		16	.500		12	12.15		24.15	31	
	1100	End cover		24	.333		1.98	8.10		10.08	14.05	
	1200	Feed kit, stem mounting, 1 circuit		16	.500		16	12.15		28.15	35	
	1300	3 circuit		16	.500		16	12.15		28.15	35	
	2000	Electrical joiner for continuous runs, 1 circuit		32	.250		6.55	6.05		12.60	16.10	
	2100	3 circuit		32	.250		12.10	6.05		18.15	22	
	2200	Fixtures, spotlight, 150 PAR		16	.500		47	12.15		59.15	70	
	3000	Wall washer, 250 watt tungsten halogen		16	.500		101	12.15		113.15	130	
	3100	Low voltage, 2 1/2 watt, 1 circuit		16	.500		102	12.15		114.15	130	
	3120	3 circuit		16	.500		109	12.15		121.15	140	

66 | Lighting

166 100 Lighting		CREW	DAILY OUTPUT	MAN- HOURS	UNIT	BARE COSTS				TOTAL INCL O&P	
						MAT.	LABOR	EQUIP.	TOTAL		
135	5100	1 Elec	8	1	Ea.	479	24		503	565	
	5110		8	1		500	24		524	585	
	5120		8	1		535	24		559	625	
	5130		8	1		556	24		580	645	
	5140		8	1		525	24		549	615	
	5150		8	1		556	24		580	645	
	5160	↓	8	1	↓	581	24		605	675	
	5190										
	5200	1 Elec	12	.667	Ea.	293	16.15		309.15	345	
	5210		12	.667		314	16.15		330.15	370	
	5220		12	.667		335	16.15		351.15	390	
	5230		12	.667		360	16.15		376.15	420	
	5240		12	.667		365	16.15		381.15	425	
	5250		12	.667		376	16.15		392.15	435	
	5260		12	.667		398	16.15		414.15	460	
5270		12	.667		324	16.15		340.15	380		
5280		12	.667		376	16.15		392.15	435		
5290		12	.667		360	16.15		376.15	420		
5300		12	.667		386	16.15		402.15	450		
5400		3.20	2.500		355	61		416	480		
5410			2.70	2.960		370	72		442	515	
5420			2.40	3.330		398	81		479	555	
5430			3.20	2.500		398	61		459	525	
5440			2.70	2.960		428	72		500	575	
5450		↓	2.40	3.330	↓	454	81		535	620	
140	0010	LAMPS									
	0080	Fluorescent, rapid start, cool white, 2' long, 20 watt	1 Elec	1	8	C	348	195		543	670
	0100	4' long, 40 watt		.90	8.890		198	215		413	535
	0120	3' long, 30 watt		.90	8.890		442	215		657	805
	0150	U-40 watt		.80	10		874	245		1,119	1,325
	0170	4' long, 35 watt energy saver		.90	8.890		270	215		485	615
	0200	Slimline, 4' long, 40 watt		.90	8.890		618	215		833	995
	0300	3' long, 75 watt		.80	10		577	245		822	990
	0350	8' long, 60 watt energy saver		.80	10		603	245		848	1,025
	0400	High output, 4' long, 60 watt		.90	8.890		750	215		965	1,150
	0500	8' long, 110 watt		.80	10		775	245		1,020	1,200
	0520	Very high output, 4' long, 110 watt		.90	8.890		1,285	215		1,500	1,725
	0550	8' long, 215 watt		.70	11.430		1,285	275		1,560	1,825
	0600	Mercury vapor, mogul base, deluxe white, 100 watt		.30	26.670		2,142	645		2,787	3,300
	0650	175 watt		.30	26.670		1,663	645		2,308	2,775
	0700	250 watt		.30	26.670		2,968	645		3,613	4,225
	0800	400 watt		.30	26.670		2,340	645		2,985	3,525
	0900	1000 watt		.20	40		5,100	970		6,070	7,025
	1000	Metal halide, mogul base, 175 watt		.30	26.670		3,749	645		4,394	5,075
	1100	250 watt		.30	26.670		4,712	645		5,357	6,125
	1200	400 watt		.30	26.670		4,386	645		5,031	5,775
	1300	1000 watt		.20	40		9,894	970		10,864	12,300
	1320	1000 watt, 125,000 initial lumens		.20	40		9,960	970		10,930	12,400
	1330	1500 watt		.20	40		9,268	970		10,238	11,600
	1350	Sodium high pressure, 70 watt		.30	26.670		4,712	645		5,357	6,125
	1360	100 watt		.30	26.670		4,871	645		5,516	6,300
	1370	150 watt		.30	26.670		5,059	645		5,704	6,525
	1380	250 watt		.30	26.670		5,380	645		6,025	6,875
	1400	400 watt		.30	26.670		5,727	645		6,372	7,250
	1450	1000 watt		.20	40		13,352	970		14,322	16,100
	1500	Low pressure, 35 watt		.30	26.670		3,963	645		4,608	5,300
	1550	55 watt		.30	26.670		4,386	645		5,031	5,775



100



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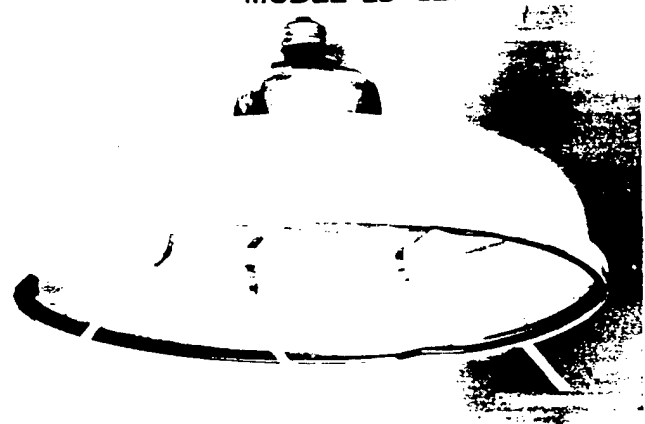
LAMP PRICES					
ORDERING CODE	TYPE	WATTAGE	LIST	CONT.	MIN QTY
F4T5/CW	FLUORESCENT	4	6.37	3.19	12
F4T5/WW	FLUORESCENT	4	7.17	3.59	12
F6T5/CW	FLUORESCENT	6	6.37	3.20	12
F6T5/WW	FLUORESCENT	6	8.79	4.40	12
F8T5/CW	FLUORESCENT	8	6.03	3.02	12
F8T5/WW	FLUORESCENT	8	7.15	3.58	12
FC6T9/CW	FLUORESCENT	20	10.00	5.00	12
FC6T9/WW	FLUORESCENT	20	11.35	5.68	12
FC8T9/CW	FLUORESCENT	22	10.00	5.00	12
FC8T9/WW	FLUORESCENT	22	11.35	5.68	12
FC12T9/CW	FLUORESCENT	32	11.10	5.55	12
FC12T9/WW	FLUORESCENT	32	12.50	6.25	12
FC16T9/CW	FLUORESCENT	40	13.00	6.50	12
FC16T9/WW	FLUORESCENT	40	14.75	7.38	12
PL-7	FLUORESCENT	7	13.00	6.50	10
PL-9	FLUORESCENT	9	13.00	6.50	10
PL-13	FLUORESCENT	13	14.00	7.00	10
LU-35	H.P.S.	35	70.00	35.00	6
LU-50	H.P.S.	50	70.00	35.00	6
LU-70	H.P.S.	70	70.00	35.00	6
LU-100	H.P.S.	100	80.00	40.00	6
LU-150	H.P.S.	150	80.00	40.00	6
ESX (NARROW)	QUARTZ HALOGEN	20	20.00	10.00	4
BAB (WIDE)	QUARTZ HALOGEN	20	20.00	10.00	4
EXT (NARROW)	QUARTZ HALOGEN	50	21.00	10.50	4
EXN (WIDE)	QUARTZ HALOGEN	50	21.00	10.50	4
EYF (NARROW)	QUARTZ HALOGEN	75	22.00	11.00	4
EYC (WIDE)	QUARTZ HALOGEN	75	22.00	11.00	4

ORDERS UNDER MINIMUM ADD 10%

**SAVE
OVER \$62.00**
PER FIXTURE,
PER YEAR



MODEL 23-32



with 32 watt screw-in fluorescent fixture...
replaces 150 watt bulb

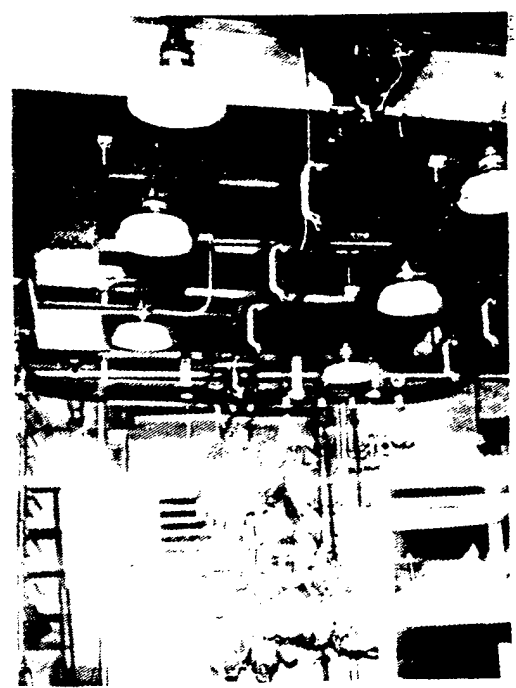
(available in 54 watts)

Advantages

1. Immediate savings (no rewiring)
2. Long life (12,000 hrs)
3. Unbreakable (poly carbonate) lens
4. Reduced heat load (saves on refrigeration costs)
5. Easy cleaning
6. Equal illumination



Before



After

COMPARE COSTS*

150 watt RS/TF incandescent bulb vs.
32 watt fluorescent screw-in

				savings
Energy Cost	\$46.80	vs	\$11.54 (including ballast)	\$32.56
Lamp & maintenance cost	\$21.31	vs	\$ 1.82	\$19.49
By reducing the heat load caused by the incandescent bulb, you can achieve additional savings on refrigeration costs				\$10.85
Total Savings				\$62.90

*Based on 12 hour burn, 5 days per week

DISTRIBUTED BY:



GP-11-2 p. 10 & 11

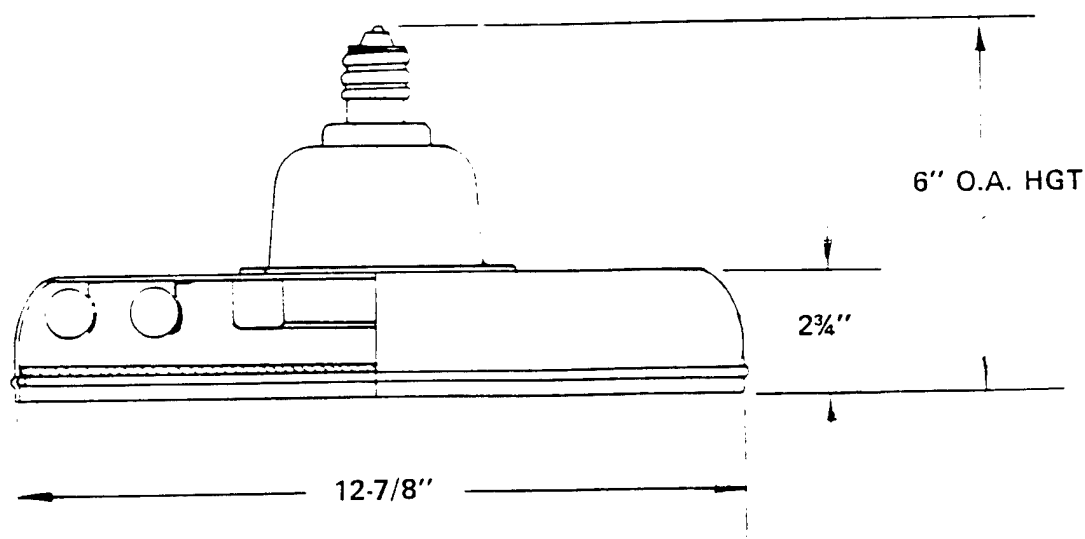
TWIST OF THE WRIST[®] BRAND ENERGY SAVING LIGHTING FIXTURES

MODEL 23 32 WATT OR 54 WATT

SOCKET: Standard Medium Base HOUSING: Aluminum DIFFUSER: Clear Polycarbonate

BALLAST: Robertson R32AP-WS (32 watt)
Robertson R2232P-WS (54 watt)

MODEL	LAMP	WATTAGE	TEMPERATURE RANGE
23-32	FC12T10	32	Down to 32° F
23-54	FC12T10	32	Down to 32° F
	FC8T9	22	
23-32-0'	FC12T10	32	Down to 0° F
23-54-0'	FC12T10	32	Down to 0° F



ECP ENERGY CONSERVATION PRODUCTS
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EFFECTIVE 3/1/84

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PRICING - MODEL # 23 SCREW-IN FLUORESCENT CONVERSIONS

FIXTURE PRICES DO NOT INCLUDE LAMPS.

MODEL	DESCRIPTION	LIST	CONT.	MIN QTY
23-32 =====	32 WATT SCREW IN FLUORESCENT FIXTURE (WHITE FINISH) WITH LEXAN DIFFUSER.	85.80	42.90	3
23-54 =====	54 WATT SCREW IN FLUORESCENT FIXTURE (WHITE FINISH) WITH LEXAN DIFFUSER.	99.30	49.65	3
OPTIONS -----				
DIFFUSER	N - WITHOUT LEXAN DIFFUSER DEDUCT	9.90	4.95	-
BALLAST	V - 277 VOLT BALLAST	12.00	6.00	
	O - ZERO DEGREE BALLAST(DOWN TO 0 F)			
	32WATT	16.00	8.00	-
	54WATT	16.00	8.00	-

STANDARD MODEL BALLAST WILL LIGHT DOWN TO 32 F. ORDERS BELOW MINIMUM ADD 10%

PRICING - MODEL #25 RECESSED CEILING FIXTURE RETRO-FIT

FIXTURE PRICES DO NOT INCLUDE LAMP.

MODEL	DESCRIPTION	LIST	CONT.	MIN QTY
25-20-DW =====	20 WATT RECESSED FLUORESCENT CONVERSION FIXTURE WITH SCREW IN ADAPTOR AND WHITE ACRYLIC DIFFUSER (WHITE FINISH)	91.80	45.90	5
25-22-DW =====	22 WATT - SAME AS ABOVE	104.00	52.00	100
OPTIONS -----				
DIFFUSER	PQ - PARASQUARE	13.40	6.70	-
	PA - PARAHEX	14.90	7.45	-
BODY TYPE	A - ADJUSTABLE STEM	CONSULT FACTORY...		
BALLAST	C - COLD WEATHER BALLAST	14.00	7.00	-

ORDERS BELOW MINIMUM ADD 10%