

Wisconsin Department of Veterans Affairs
Office of Policy, Planning & Budget
Madison, WI

HEATING PLANT & BOILER UPGRADES STUDY

WISCONSIN VETERANS HOME
KING, WI

DSF Project No 10L1E-N
September 15, 2012

By;

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Ms. Susan Mattix
Budget & Policy Analyst
STATE OF WISCONSIN
WI Department of Veterans Affairs
Office of Policy, Planning & Budget
201 W. Washington Ave.
Madison, WI 53707

RE: Heating Plant & Boiler Upgrade Study

Dear Ms. Mattix,

We have completed our analysis of the heating plant upgrade for the Wisconsin Department of Veterans Affairs (WDVA). The goal of this study was to evaluate the requirements and provide architectural/engineering resources to assist the Owner in evaluating the requirements and options to remodel the building and services at the Wisconsin Veterans Home in King. The work consists of a study that included a field survey, an analysis of code requirements, sketches of any plan changes, reports recommending the required retrofit work and a proposed construction budget for any corrective measures required to the building, utilities and/or infrastructure.

The consultant for HVAC & Electrical engineering work is Grumman/Butkus Associates.

Specific work shall include the replacement of boiler B-3 with a smaller boiler, replacement of boiler B-1 and B-2 burners, demolition of the high smoke stack, removal of coal bunker equipment, removal of the steam generator, addition of stack economizers at each boiler, emergency portable boiler connections, preheater for makeup water, boiler plant AHU, reconditioning of 15,000 gal fuel oil tank, coal bunker heating, upgrading & installing new generators and repairing/replacing miscellaneous maintenance items.

All costs are based on union labor rates.

We trust the following information is satisfactory and meets your needs. If there is additional information needed, please let us know.

Sincerely,

GO/A Architects, Inc.

Mr. Gary Oien, President
and Principal Point of Contact

Codes & Standards Impacting This Study:

International Mechanical Code (2009 edition).

WI Dept. of Safety and Professional Services (SPS)

SPS 310 Flammable and Combustible Liquids

SPS 314 Fire Prevention

SPS 316 Electrical

SPS 341 Boilers and Pressure Vessels

SPS 362 Building and Structures

SPS 363 Energy Conservation

SPS 364 HVAC

SPS 365 Fuel Gas Appliances

SPS 366 Existing Buildings

NEC 2008.

International Building Code with Wisconsin modifications (IBC, 2009 edition).

Existing Systems

The boiler plant currently consists of three 20,000 lb/hr boilers that were installed in 1951. The boiler's fuel system was converted from coal to a combination of natural gas and fuel oil in 1973. The coal bunker has been abandoned in place since the fuel conversion.

Boiler B-3 was damaged in 1983 and has been experiencing increased maintenance costs since then.

The boilers were originally designed to operate at 100 psi steam, but in 2009 the laundry equipment, located in the Central Service building, was converted from steam to natural gas, which enabled the boilers to be lowered to 60 psi.

The boilers can operate at 60 psi when fired with natural gas but the steam pressure needs to be raised to 100 psi when firing with fuel oil due to the construction of the burners. Also, the oil guns on the burners need to be removed when the boiler is operated on natural gas due to the heat affecting the tips of the oil gun.

The burners have O₂ trim control for energy efficiency; no stack economizers are installed for heat recovery from combustion gases.

Based on information from the agency, the peak winter load is approximately 22,000 lb/hr and the summer load is approximately 8,000 lb/hr, of which an estimated 3,000 to 4,000 lb/hr is due to steam distribution losses based on a 2006 Utilities and System Documentation report. The losses may be lower since the pressure has been reduced to 60 psi. Steam pressure is typically reduced down to 20 psi for domestic hot water and 7 psi for building heat at each cottage.

The water treatment system includes both softeners and reverse osmosis purification. The purified water is not preheated and is introduced directly into the deaerator. The heat exchanger that used to preheat the makeup water was taken out of service due to corrosion from the purified water.

The average daily make-up water ranges from approximately 500 gallons/day in the summer to 3,800 gallons/day in the winter according to the 2006 Utilities and Systems Documentation report.

1. Replacement Of Boiler B-3 With A Smaller Boiler (12,000 LB/HR)

The existing 20,000 lb/hr boiler would be demolished and a new 12,000 lb/hr boiler with at least a 3:1 turndown ratio would be installed to handle the summer and shoulder season heating loads. This work would include all steam, feedwater, blowdown and fuel piping, new breeching, PLC controls, electrical and general work including cat walk for access to valves.

Estimated probable construction cost = \$421,700

2. Replacement of Boiler B-1 and B-2 Burners

The existing boiler burners are 39 years old and have exceeded their life expectancy. Additionally, the oil gun needs to be removed from the burner when firing with natural gas due to the potential damage to the tips of the oil gun from the heat of combustion. This option includes removal of the existing burner and combustion fan and installation of a new high efficiency, combination burner and fan unit for existing boilers B-1 and B-2.

Estimated probable construction cost = \$ 93,500

3. Demolition Of The 150 Ft High Smoke Stack

This would include the demolition of the existing smoke stack and installation of new breeching and chimney for boilers B-1 and B-2. Connecting B-3 breeching into the new breeching under this option was not included, but the additional costs for doing so would simply result in a reduction in the costs under the replacement of boiler B-3 under option 1.

Estimated probable construction costs = \$ 90,800

4. Removal Of Coal Bunker Equipment

This option includes removing abandoned equipment related to the coal bunker.

Estimated probable construction costs = \$ 14,400

5. Removal Of Steam Generator

This option includes removing the abandoned steam generator to clear up floor space for future upgrades on boiler plant and electrical related equipment.

Estimated probable construction costs = \$ 4,500

6. Addition Of Stack Economizers At Each Boiler

This option includes the installation of heat exchangers in the breeching at each boiler to recover some of the heat of combustion for the purpose of heating the boiler feed water or condensate return water.

Estimated probable construction costs = \$ 73,000

7. Emergency Portable Boiler Connections

This option includes providing steam, feed water, natural gas connections at an exterior wall location to allow for a portable gas fired boiler to be connected to and generating steam up to 20,000 lb/hr.

Estimated probable construction costs = \$ 25,000

8. Preheater For Makeup Water

This option includes the installation of a stainless steel construction heat exchanger for preheating the makeup water for the boiler system. The construction of the heat exchanger needs to consider the water condition due to the purification of the makeup water.

Estimated probable construction costs = \$ 13,800

9. Boiler Plant AHU

The plant is currently not equipped with a makeup air unit, and air enters through various openings. This option includes a 12,000 cfm AHU with steam heating coil, filters and automatic dampers for providing combustion air to the boilers under controlled conditions. The work would include steam and condensate piping, ductwork, VFD, electrical and temperature controls.

Estimated probable construction costs = \$ 120,000

10. Reconditioning Of 15,000 Gal Fuel Oil Tank

This option includes the reconditioning of the 15,000 gal fuel oil storage tank located on grade. The work would include sand blasting and repainting the entire tank and reconditioning all pipe connections.

Estimated probable construction costs = \$ 5,000

11. Coal Bunker Heating

This option includes the addition of steam heating to serve new work/storage areas created in the abandoned coal bunkers.

Estimated probable construction costs = \$ 10,000

12. Mezzanine Office Space Heating & A/C

This project would add a ductless split system air conditioning unit and a steam unit heater. This assumes that ventilation would be available from operable windows.

Probable construction cost \$ 9,050

ELECTRICAL REPORT

1. Electrical Work to Support Replacement of Boiler B-3

This project would include electrical work to refeed the new boiler B-3.

Estimated probable construction cost = \$11,000

2. Replacement of Boiler B-1 and B-2 Burners

This project would include electrical work to reconnect the new burners.

Estimated probable construction cost = \$2,500

5. Removal of Steam Generator

This project would include electrical work to disconnect power feeds from the abandoned steam generator.

Estimated probable construction cost = \$500

9. Makeup Air AHU

This project will provide electrical power to the new makeup air handling unit proposed under mechanical project 9.

Estimated probable construction cost = \$3,000

10. Coal Bunker Work/Storage Area Power and Lighting

This project will provide a new electrical panel, power receptacles and lighting to serve the new work/storage area within the abandoned coal bunker.

Estimated probable construction cost = \$8,500

11. Mezzanine Office Space Power and Lighting

New fluorescent lighting would be provided. New power receptacles and one data line would be provided.

Estimated probable construction costs = \$2,500

Generator Upgrade Project

After review of the previous Marden Hall generator study, the DVA has requested the report include this project to reconfigure the existing 350kW generator to feed the advanced food production facility, and install a new 250-300kW generator to serve critical central plant loads. Note that this is similar to the scope of work recommended in Option #3 of the previous Marden Hall generator replacement study.

The advanced food production building is currently fed from a 400KVA, 208/120V transformer on the utility side. The existing 350kW generator can be dedicated to feed the entire food production building by removing the heating and cooling plant load from the 350kW generator.

This would require a new step down transformer to step down 350kW, 480V generator to 208/120V to feed the Food Production building via a new 1600A transfer switch. Existing transfer switches ATS, 2, 4 and 5 with associated transformers, etc. will have to be demolished and re-configured.

Provide a new 250/300kW generator (480/277V) at the heating and cooling plant and connect existing heating plant load (ATS-1) to the generator and run new feeders to Marden Hall and Safety/Security buildings. This project will also provide power to the Macarthur Hall freight elevator.

The new generator size at the heating and cooling plant shall be evaluated to add any additional power plant load to the new generator such as chiller, pumps, etc. as desired by the facility.

Our estimate of probable construction cost is below. Note that this does not include engineering or DFD project management fees.

a. Demolition of existing generator at Marden Hall	\$10,000
b. New 400 KVA transformer, transfer switch, feeders	\$150,000
c. Power to Macarthur Hall Freight Elevator	\$15,000
c. New 250kW generator, transfer switches, feeders	\$150,000
d. Installation of gen pad, generator, etc.	\$50,000
Total Installation Cost	\$375,000

ARCHITECTURAL REPORT

1. Coal Bunker Work/Storage Area

An existing/abandoned coal bunker will be renovated to add approx. 446 sq. ft. of work/storage area to the building. A structural metal/concrete floor will be added. Part of an 18" thick CMU/concrete wall will be removed to add a double interior door to access the new coal bunker space. Part of a 12" & 16" concrete wall will be removed to add 3 double interior doors. Part of a 12" CMU/brick wall will be removed to add a double exterior door.

Estimated probable construction cost = \$44,366

2. Mezzanine Office Space

An existing mezzanine is proposed to be turned into an enclosed office space. The existing metal floor is approx. 392 sq. ft. and adequate for this use. An enclosure consisting of metal studs/joists & gyp. bd. for the walls and 8' high ceiling, sound batts for sound control and a metal interior door/frame shall be added.

Estimated probable construction cost = \$7,457

3. Building Upgrade

Certain maintenance items need to be repaired or replaced. Replace 40 sq. ft. (10 total) broken single pane glass windows. Replace 344 l.f. of glazing. Tuck point & repair 120 sq. ft. of brick/CMU. Repair 286 l.f. of sealant at the base of the brick. Replace a 6' x 7' double exterior door. Replace an 8' x 8' double exterior door.

Estimated probable construction cost = \$13,994