

COUNCIL ACTION FORM

SUBJECT: CHANGE ORDER NO. 4 - UNIT 7 BOILER REPAIR PROJECT

BACKGROUND:

On March 26, 2019, the City Council approved the award of a contract to Helfrich Brothers Boiler Works, Inc. of Lawrence, MA, in the amount of \$6,376,685 for the Unit 7 Boiler Repair Project. The existing boiler tubes and insulation and lagging are original to the boiler, built in 1967.

After switching from coal to natural gas two years ago, staff found that the boiler tubes, especially the superheater tubes, were deteriorating at an accelerated rate. The water vapor created during the combustion of natural gas combines with the chlorides and acid gases from combusting refuse-derived fuel (RDF), causing the tube surfaces to corrode very quickly, especially in the high temperature zones of the superheater.

The replacement tubes will be coated with Inconel, an alloy that is resistant to the kind of corrosion created from combusting RDF and natural gas. This project is to repair the boiler through the following actions:

- Replacing the boiler tubes in the lower water wall section of the boiler. This includes the bottom 50' of tubes on all four sides of the boiler.
- Replacing all the pendant tubes in the superheat section
- Reinsulating the steam and mud drums
- Replacing the insulation and lagging (the aluminum skin) that covers the entire boiler

CHANGE ORDER HISTORY:

Three change orders were previously issued for this contract. Change Order 1, in the amount of \$233,260, was to change subcontractors because of concerns City staff had with the initial proposed subcontractor Helfrich intended to use to apply the Inconel cladding.

Change Order 2, in the amount of \$22,951.50, was to perform nondestructive testing on the generating bank tubes to determine their condition. The generating bank is composed of 1,426 tubes connecting the steam drum and mud drum, located at the top of the boiler. The current Unit 7 capital project allowed for opportunity to examine these generating bank tubes, which was not part of the base contract.

Change Order 3, in the amount of \$18,931.40, was to install additional scaffolding in the upper furnace section to accommodate ultrasonic testing and to also remove the lower air seals at the bottom of the boiler.

THIS ACTION

This change order request involves repairing three different areas of the boiler that were examined during the demolition portion of the project.

The first area is in the generating bank.



Figure 1 Unit 7 Front Side of Generating Bank tubes

After performing a special testing process called Internal Rotary Inspection System (IRIS), plant staff found that a majority of the tubes are in good condition. However, there are 269 tubes that have thinned over the number of years of operation due to steam source soot blowing. These thin tubes will be removed and replaced with new tubes that have a cladding on the outside surface to help them stand up to the soot blowing in the future.

The second area is located at the bottom of the boiler on the front and rear walls.



Figure 2 Bottom Tubes on Rear Wall



Figure 3 Bottom Tubes on Rear Wall

After performing demolition of the lower water wall tubes per the original specification, it was realized an additional two to three feet of existing tube on the north and south walls needed to be replaced. These tubes are pitted on the bottom side and are much thinner in the pitted areas than anticipated. These areas were not accessible for testing before the demolition process.

The third area is also located at the bottom of the boiler on both side walls.



Figure 4 Unit 7 Lower Wall North Side Header



Figure 5 Lower Wall North Side Header

The original scope required the contractor to replace the water wall tubes from the side bottom headers up 50 feet. The contractor was to leave a six-inch tube stub, for each water wall tube, sticking out from the header. After demolition of the water wall tubes, the tube stubs coming from the headers were inspected and found to be very thin and needing replacement. The scope of this change order will be for the contractor to remove each tube stub on both side wall lower headers and replace with new tube stubs that have a cladding on the outside surface, allowing them to stand up to the corrosion that led to the thinning of the original tubes.

The action being requested is to approve Change Order No. 4 to allow for Helfrich to repair the thin tubes found in the generating bank, replace an additional two to three feet of all the tubes on the front and back walls at the bottom of the boiler, and replace all of the tube stubs coming from the lower left and right side walls, going into the lower headers. This change order will add an additional \$761,733 to the current contract. This will bring the total contract amount to \$7,413,560.90. With the engineer's estimate of \$8,400,000 for this project, the low bid plus the four change orders is \$986,439.10 less than the engineer's estimate.

The FY 2019/20 Capital Improvements Plan (CIP) includes the following funding for the Unit No. 7 Boiler Repair Project:

2015/16 Engineering	\$5,150
2016/17 Engineering	\$125,796
2017/18 Engineering	\$50,000
2019/20 <i>Materials/labor superheat and waterwalls</i>	<i>\$8,400,000</i>
TOTAL	\$8,580,946

It should be noted that Power Plant staff anticipates additional change orders in the future for this project. While this additional work is still being reviewed to determine scope and pricing, it is estimated the cost to complete all of these future change orders will be well within the remaining funding for the overall project.

These additional change orders include the following:

- Responding to an Engineering study performed to evaluate the effect of the weight of the Inconel overly tubes upon the connections and the effect upon the integrity of headers and the structural supports of the boiler
- Installing an air plenum at the bottom of the boiler to better direct over-grate air. The existing system shows evidence of significant air leaks
- Repairing worn or missing refractory on the original water wall tubes left in the top of the boiler
- Repairing the bottom ash hopper and installing a new air seal

ALTERNATIVES:

1. Approve Change Order No. 4 in the amount of \$761,733 (inclusive of sales tax) to Helfrich Brothers Boiler Works, Inc., of Lawrence, MA, for the Unit 7 Boiler Repair Project.
2. Do not approve Change Order No. 4

CITY MANAGER'S RECOMMENDED ACTION:

This project is a substantial overhaul of the Unit 7 boiler. The proposed change order will repair components that, if left unaddressed, are likely to fail in the future. The current project is the best opportunity to repair these components, since the boiler has been opened up for this work and the contractor is in place to fix them. Additionally, it is crucial that the repair project proceed as soon as possible in order to minimize downtime for this boiler and to increase the Power Plant's availability and reliability.

Therefore, it is the recommendation of the City Manager that the City Council adopt Alternative No. 1 as stated above.