

**COUNCIL ACTION FORM**

**SUBJECT: CHANGE ORDER NO. 5 - 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. 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

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). This causes the tube surfaces to corrode very quickly, especially in the high temperature zones of the superheater.

The existing tubes and insulation and lagging are original to the boiler, built in 1967. 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.

**CHANGE ORDER HISTORY:**

Four change orders were previously issued for this contract. Change Order 1, in the amount of \$233,260, was approved by the City Council on May 14, 2019. This change order was to change subcontractors because of concerns City staff had with the subcontractor Helfrich initially proposed to apply the Inconel cladding. These concerns related to the equipment and the process the subcontractor was going to use to apply the Inconel cladding to the tubes, plus concerns about quality control and the subcontractor's staff's training and experience.

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 that go between 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. This change order was approved by staff.

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 change order was approved by staff.

Change Order 4, in the amount of \$761,733, was approved by City Council on July 16, 2019. This change order was to replace 269 thin tubes found in the generating bank with new tubes, 186 of them were to contain Inconel 625 weld overlay. Helfrich was to replace an additional 2-3' of all tubes on the front and back walls at the bottom of the boiler with new tubes without overlay. Helfrich was also to replace all tube stubs coming from both lower side wall headers with new 8-inch stubs that will have 5 inches of Inconel 625 weld overlay at .070 thickness.

### **THIS ACTION:**

At the time Change Order 4 was presented for City Council approval, the staff report indicated that additional change orders were being evaluated in regard to four areas of concern. These areas were:

- Header and structural support integrity with the additional weight of the Inconel overlay
- Air plenum to direct over-grate air
- Bottom ash hopper and air seal
- Refractory repair

The proposed Change Order 5 presented for City Council consideration addresses the first three of these areas, plus an additional repair that was not previously described to the City Council.

**HEADER AND STRUCTURAL SUPPORT INTEGRITY** – The first item, for a total of **\$65,043**, is responding to the engineering study performed to evaluate the effect of the additional weight of the Inconel overly tubes upon the connections and the effect upon the integrity of headers and the structural supports of the boiler. Although conducting this study was a requirement of the original bid specification, the modifications needed to address the study outcome were not included in the bid specification.

In response to the study, Helfrich will supply and install three (3) additional Front Waterwall hanger lugs, Hanger Rod Assemblies, and modify the existing back to back channels. Pricing includes engineering design of the placement of the hanger lugs and reinforcement of the existing channels, installation of the new hanger lug plates to the front waterwall tubes in the penthouse, and installation of the additional reinforcement plates on the existing channels the hanger rods hang from.

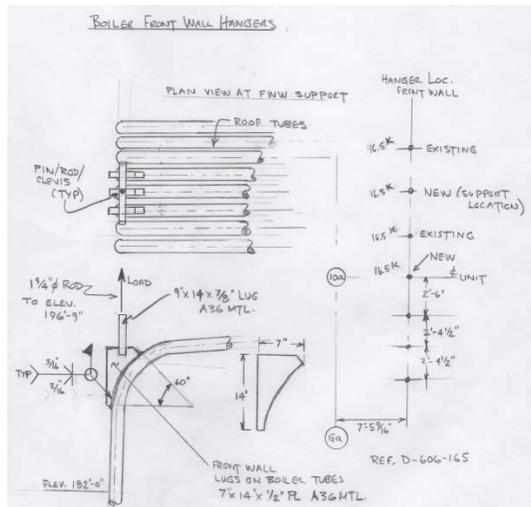


Figure 1: Boiler Front Wall Hangers

**AIR PLENUM TO DIRECT OVER-GRATE AIR** – The second item, for a total of **\$49,950**, is installing an enclosed air chamber at the bottom of the boiler to better direct over grate air. As demolition was being performed in the beginning of the tube replacement project, the existing system showed evidence of significant air leaks.

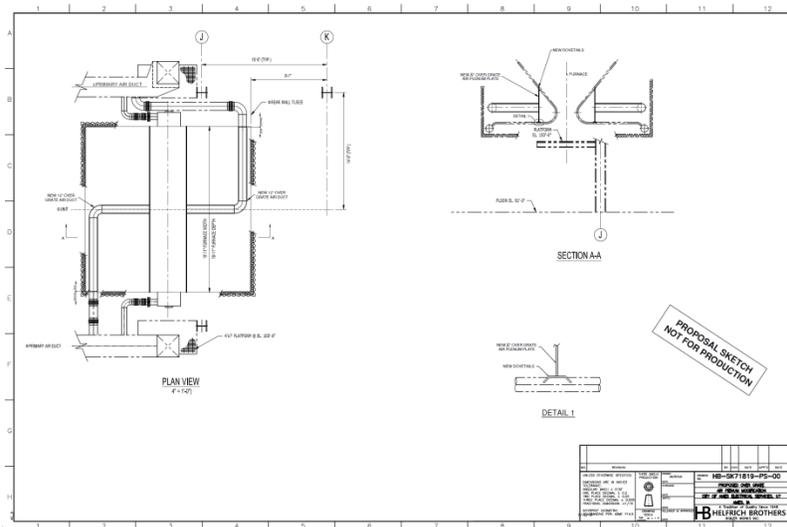


Figure 2: Over Grate Air Plenum Design

Helfrich will supply and install a new Over Grate Air Plenum (enclosed air chamber) that will direct all combustion air to the top surface of the grate. This will help complete combustion of the RDF on the grates and greatly minimize air in leakage.

**BOTTOM ASH HOPPER AND AIR SEAL** – The third item, for a total of **\$228,700**, is to replace the seal trough and air seal around the top of the bottom ash hopper. The condition of the seal trough and air seal was not fully known until performing demolition at the beginning of the project, allowing for staff to thoroughly inspect it.



Helfrich will supply and install a new, 304 stainless steel water seal trough, 316 stainless steel saw tooth wear plate, 309 stainless steel baffle, scallop tube, air seals with gaskets and hardware, and W8 and C11 stiffeners. The replacement will involve removing and replacing a 2-foot band of 9-inch thick refractory around the entire perimeter of the bottom ash hopper.

ADDITIONAL ITEM: SCREEN TUBE REPLACEMENT – The final component of this proposed change order, for a total of **\$84,370**, is to replace 26 screen tubes in the top of the boiler. The screen tubes travel from the back water wall and go into the steam drum, bypassing the mud drum and generating bank.



These tubes are normally shielded to protect them during sootblower cleaning. Upon

inspection, the shielding was found to be in total disrepair or missing all together. Instead of trying to replace the shielding and keep them maintained, the replacement tubes will be overlaid with Inconel 625, providing for adequate protection from future sootblowing.

**Although the July 26<sup>th</sup> Council Action Form indicated that staff anticipated needing a change order to address repairs to worn or missing refractory on the original waterwall tubes left in the boiler, City staff needs to have further discussions with the contractor regarding this item. Aside from this item, City staff is also evaluating additional proposed changes. Staff anticipates further change orders, potentially requiring City Council approval, will be required in the coming weeks.**

**Therefore, the action being requested at this time is to approve Change Order No. 5. This change order will add an additional \$458,027.41, inclusive of \$29,964.41 in sales tax, to the current contract. This will bring the total contract amount to \$7,871,588.31. With the engineer's estimate of \$8,400,000 for this project, the low bid plus the change orders is \$528,411.69 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 Materials/labor superheat and waterwalls	\$8,400,000
<b>TOTAL</b>	<b>\$8,580,946</b>

**ALTERNATIVES:**

1. Approve Change Order No. 5 in the amount of \$458,027.41 (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 #5.

**CITY MANAGER'S RECOMMENDED ACTION:**

This project will go to great lengths to address Unit 7's boiler tube failures. It is crucial that the 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 described above.