

COUNCIL ACTION FORM

SUBJECT: UNIT 7 BOILER SUPERHEAT ATTEMPERATION STUDY

BACKGROUND:

The City's Power Plant operates two natural gas-fired boilers, which generate steam to produce electricity. These are referred to as Unit 7 and Unit 8. The boilers consist of tubes containing water; tubes in the lower part of the boiler are referred to as "waterwall" tubes, and the upper section of the boiler is referred to as the "superheat."

In 2019, the City contracted and commenced work on a project to repair the Unit 7 boiler by replacing the lower waterwalls and the pendant superheater with new boiler tubes clad with a special alloy (Inconel 622), highly resistant to corrosion. The lower waterwall tubes were replaced on all four sides of the boiler from just above the burner level down to the bottom of the boiler, a length of approximately 45 feet. The project also replaced all the tubes in the superheater with new boiler tubes, also clad with Inconel 622.

Under certain operating conditions, it becomes necessary to spray the tubes where the steam exits the superheater. This is called "attemperating," and it reduces the outlet temperature of the steam when that temperature is too high. Following the completion of the boiler repair project, the Power Plant staff noticed that when operating Unit 7, the amount of spray attemperation required to control the outlet temperature of the steam leaving the superheater for the turbine was 200% greater than prior to the repair project.

This excessive attemperation required to control the temperature of the steam exiting the superheater is detrimental in two ways: 1) it is inefficient to overheat the steam and then be forced to cool it before it is sent to the turbine, and 2) long-term it is damaging to the superheater tubes to shock them with a spray of cool water to control the steam exit temperature.

The specification for the boiler repair project required the contractor to ensure the boiler performed the same post-project as it had pre-project. In the bid, and later in an answer to questions posed by the City, the Contractor assured the City there would be no impact on the performance of the boiler due to the repair project.

The City notified the Contractor of the excessive amount of attemperation required to control the steam temperature leaving the boiler, and collectively the Contractor and the City tried to adjust how the boiler was operated to reduce the amount of spray attemperation to historically normal levels without success. **Ultimately, the Contractor's position was that they believed they had performed the boiler repair correctly and in accordance with the contract. The City's position is that the Contractor was responsible for the physical repair of the boiler, but also the operational**

performance of the boiler as specified in the contract, and the boiler post-project failed to operate as it had prior to the start of the project.

To date, the City has withheld retainage from the Contractor while the excessive attemperation problem remains unresolved. The City and the Contractor agreed in principle to a study by a third party to resolve the issue. The City was on the verge of an agreement for a study by a major power boiler manufacturer, but at the “eleventh hour” this boiler manufacturer withdrew, claiming staffing issues due to COVID and resignations, and this along with their core business workload would prevent them from having the staff necessary to complete the study in the timeframe the City desired.

The City then issued an RFP to five entities deemed qualified to study the boiler issues and to make recommendations to resolve the problem. The RFP asked the entities to do three things:

- 1) Determine the reason(s) for why Unit 7 boiler following the boiler repair project requires so much more spray attemperation post-project than it did pre-project.
- 2) Determine if the need for excessive attemperation could have been predicted prior to the start of the Unit 7 Boiler Repair Project work.
- 3) Identify the modification(s) to the boiler, physically and/or operationally, that would return the boiler to pre-project operating conditions.

The City received two proposals as a result of the RFP. The proposals are summarized in the following table:

	Price	Proposal Deliverables
Babcock Power Services	\$69,300	Detailed report of thermal model findings, including reasons for the increase in spray flow, if the increased spray flow was predictable and up to three (3) alternatives for modifying the boiler to lower the amount of spray attemperation to historical levels. Babcock Power Services will also provide a budgetary price if it is necessary to supply materials to modify the boiler.
	\$ TBD	If the physical modifications to the boiler require materials to be fabricated, Babcock Power Services will submit a firm price to produce shop drawings and fabricate the required material. The City then can choose to have the modification(s) to the boiler installed by one of Babcock Power’s subsidiary companies, or by the original Unit 7 Boiler Repair Project contractor.

Sargent & Lundy	\$59,000	Phase 1 – Data collection, testing, and tuning of the boiler.
	\$68,000	Phase 2 – Thermal modeling of the boiler to determine the cause(s) of the increase in attemperator flow and if the increased attemperator flow could have been anticipated by the repair contractor.
	\$ TBD	Phase 3 – Use the model from Phase 2 to evaluate physical and operational modifications to correct the excessive attemperator spray flow.

City staff has evaluated both proposals and have deemed that Babcock Power’s proposal will provide the information the City has requested in the RFP at less cost. Babcock Power Services was also deemed to have the experience and the expertise necessary to perform the study.

The City and the Contractor have agreed to the study that is to be performed by Babcock Power Services, and have agreed to split the cost of the study 50/50. The City’s ultimate goal of the study is to determine the remedy to reduce and return the amount of spray attemperation required to control the superheater outlet temperature to original design and historical normal levels, and then have the Contractor be responsible for implementing that remedy. The Contractor to-date, and most recently expressed in a letter to the City dated July 28, 2022, is unwilling to commit to be responsible for implementing a final remedy prior to the completion of the study. Not knowing the specifics of the contractor’s concern, staff’s guess is the Contractor does not want to agree in advance to be responsible for a remedy of unknown and unlimited cost.

Regardless of the cost of the remedy and who is ultimately responsible for the implementation of the remedy, the study of the Unit 7 boiler’s excessive attemperation problem (following the 2019 project to repair Unit 7 boiler), needs to be performed. Not correcting the excessive attemperation problem is inefficient and will long-term be detrimental to the life of the superheater.

Funds to pay for the study will be obtained from the Steam Electric Plant’s Unit 7 Boiler Maintenance account. \$75,000 has been made available for this study. The City is in receipt of a letter from the Unit 7 Boiler Repair Project contractor, Helfrich Brothers Boiler Works, Inc. of Lawrence, MA, stating their commitment to reimburse the City for one half (1/2) of the cost of the study, or \$34,650.

ALTERNATIVES:

1. Approve a contract with Babcock Power Services of Marlborough, MA, in the amount of \$69,300 to perform the Unit 7 Attemperator Spray Flow Study.
2. Do not approve and direct staff to seek other options to perform the necessary study.

CITY MANAGER'S RECOMMENDED ACTION:

Approving this study will identify the remedy necessary to correct and reduce the excessive attemperation now required to control the temperature of the steam exiting the superheater and headed for the turbine. This reduction in attemperation back to within the design range and to historical normal levels will result in improved boiler efficiency and longer life of the boiler tubes in the superheater.

Once the study is complete, further discussions will need to be held with the contractor to settle the responsibility for the cost of the repairs.

Therefore, it is the recommendation of the City Manager that the City Council adopt Alternative #1 as stated above.