**ITEM # 1**
**DATE: 04-16-13**

# COUNCIL ACTION FORM

**SUBJECT: POWER PLANT STEAM TURBINE NO. 8 OVERHAUL – CHANGE ORDER #2**

## BACKGROUND:

This project is required to replace worn parts discovered after the opening and inspection of the Power Plant's Unit No. 8 turbine and generator for repairs that may be needed to avoid more serious damage. Repairs and replacement of worn parts are completed as the inspection progresses and work is defined. **It is important to understand that large change orders are a normal and expected part of a major turbine-generator overhaul, due to the fact that many repair needs are unknown until the unit is opened and inspected.**

On January 22, 2013, City Council awarded a contract to NAES Corporation, Houston, TX, for Steam Turbine No. 8 Overhaul in the amount of $807,800. This original amount included the following elements:

- $443,800 for the lump sum base bid contract portion.
- $91,500 for the time and material based "not to exceed" contract portion.
- $272,500 for the estimated time and material based contract portion.

On April 9, 2013, City Council approved Change Order #1 in an amount of $171,482 for additional work on the steam turbine section.

Council authorization for a second change order containing the following five elements is now needed.

## Item 1

**Description:** When the steam path diaphragms were removed for shipment to the Century Turbine shop for cleaning, inspection and repair, the diaphragm to shell fit which was hidden from view was found to be severely eroded. The shell metal was cut by leaking steam bypassing the steam path. Failure to repair now will result in accelerated erosion and ultimate loosening of the diaphragm and turbine failure and shutdown.

**Cost:** The not-to-exceed cost for Item 1 is $16,500.

**Item 2**

**Description:** The hydrogen seal housing and seals were discovered to be damaged upon disassembly. No cause was determined, but repair is necessary before operation resumes to prevent hydrogen from escaping and potentially creating an explosive environment.

**Cost:** The not-to-exceed cost to repair is $34,841.95

**Item 3**

**Description:** General Electric recommends a new type of sealing system for the generator end shields. Modifications are required for the new system. Approval of this work will potentially reduce hydrogen leakage and assist with the acceptance of the pre-start air leakage test.

**Cost:** The not-to-exceed cost to modify and seal the shields is $6,665.

**Item 4**

**Description:** Inspection of control valve number 4 identified a seat crack. This crack must be replaced, since if it breaks the metal will flow through the turbine and wreck steam path components as it goes. The City will procure the part, and under this change order NAES will provide the labor to remove the damaged seat, install the new control valve seat and lap it.

**Cost:** The not-to-exceed cost is $11,550.

**Item 5**

**Description:** Upon disassembly of the valve rack shaft, damage was found that needs to be repaired to allow smooth valve operation. If this is not repaired, operation can be jerky which leads to unstable turbine operation. It is recommended that this item be authorized so that NAES can complete the necessary work before the rotor returns to Ames from the repair shop for reinstallation.

**Cost:** The not-to-exceed cost to return to spec is $5,720.

**The total cost of all five items in Change Order No. 2 is $75,276.95.**

**PROJECT COST HISTORY**

As was noted above, one change order has already been approved for this contract. Change Order No. 1, for $171,482, increased funds to cover costs associated with turbine repairs that were more extensive then what was included in the base bid.

**This change order will increase this portion of the Steam Turbine No. 8 Overhaul project cost by an additional $75,276.95. As a result, this would bring costs for this portion of the project to $1,054,558.95. Overall, the <u>total</u> project dollar amount committed to date (inclusive of Change Order No. 2) is $1,837,515.85.**

**The engineer's estimate to perform the overhaul work with the original work scope and a reasonable amount of repair was $1,830,000.** The approved FY 2012/13 Budget and Capital Improvements Plan includes $3,500,000 for the turbine generator overhaul. That amount includes parts, professional technical assistance, and contractor services.

To date, the project budget has the following items encumbered:

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|---|---|---|
| 1. | $526,086.90* | Actual cost for Unit #8 Steam Turbine Parts (This total did not include freight) |
| 2. | $807,800.00 | Actual cost of Base Bid, plus cost-not-to-exceed Options for Steam Turbine No. 8 Overhaul |
| 3. | $171,482.00 | Contract Change Order No. 1 to Steam Turbine No. 8 Overhaul (Approved by City Council on April 9, 2013) |
| **4.** | **$ 75,276.95** | **Contract Change Order No. 2 to Steam Turbine No. 8 Overhaul (this item)** |
| 5. | $256,870.00 | Cost-not-to-exceed time and materials for GE representative to provide technical direction for this overhaul |
| | **$1,837,515.85** | **Total committed to date** |

**<u>ALTERNATIVES</u>:**

1. Approve contract Change Order No. 2, including Items 1 through 5 above, to NAES Corporation of Houston, TX, in the amount of $75,276.95 for the Steam Turbine No. 8 Overhaul.

2. Reject contract Change Order No. 2.

**<u>MANAGER'S RECOMMENDED ACTION</u>:**

The Unit No. 8 Turbine-Generator is currently down for a major overhaul. These overhauls are typically performed in the industry about every five years to restore unit efficiency and to maintain good unit life and reliability. We are now into our 8$^{th}$ year since the last overhaul, which has contributed to the number and cost of repairs identified after the turbine and generator are disassembled. This change order, along with others that will be identified in coming weeks, is necessary to restore the steam turbine back to good working order and allow the unit to run until the next major

overhaul in 5+ years.

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

**It is important to note that another major change order may be needed in short order.** Inspection of the turbine's stator has determined that wedges used to hold the coils "firm" have been working loose. The wedges can be replaced during this outage, but that could cause a delay in the project completion date by 2-3 weeks. An alternative may be to reassemble the generator and plan the stator repair for this fall or next spring. The risk of problems developing in the interim is small, but additional cost will be incurred for re-opening the turbine, pulling the rotor and reassembly. **If staff ultimately determines that this work should be performed now, a special City Council meeting will probably be requested in order to keep the outage duration to a minimum.**