# Memorandum

BURNS McDONNELL

Date: September 20, 2016

To: Andy Ensz, P.E., City of Lawrence

From: Rachel Thompson, P.E., Burns & McDonnell

Subject: Clinton WTP Phase I Process Improvements
Change Order No. 3 – Item 3.3 - Relocation of Carbon Dioxide Tank
UT1209; BMcD Project Number 81696

Change Order No. 3 includes Item 3.3 which consists of work associated with relocation of the carbon dioxide tank. This memo provides a brief summary of the reasons for this change and the alternatives that were evaluated.

**Background**
The 2007 WTP Phase II expansion project included a bid alternate for a carbon dioxide system. The system was not installed at that time, but a portion of the piping was installed to facilitate future installation of the system. This piping consisted of two, below-grade, 2-inch stainless steel lines running from the proposed tank location to the Chemical Feed Building, where space was reserved for the feed equipment.

Upon design of the Clinton WTP Phase I T&O Improvements, the Carbon Dioxide system was designed to utilize the reserved locations and the installed piping. The Contract Documents included requirements for the Contractor to pressure test the existing piping to verify integrity of the pipe prior to connecting the new equipment.

Crossland was proactive in conducting the pressure tests on the stainless steel lines, well in advance of delivery of the Carbon Dioxide equipment. Upon pressure testing, it was discovered that neither of the two lines could hold pressure, indicating an issue with pipe integrity. The lines were inspected via cameras and a few apparent leaks were detected. Localized excavations were conducted to expose the pipe in these areas, but no visible damage to the exterior of the pipe was observed in any of the exposed locations. The stainless steel lines are in close proximity to a number of chemical feed lines and chemical leaks were suspected as a potential cause of the pipe damage; however, no chemical leaks were observed in the excavated areas. Furthermore, performance of the chemical feed systems indicates that no significant chemical leaks are occurring within those systems.

**Alternatives**
The following alternatives were evaluated:

1. Repair the existing stainless steel lines. This option was determined to not be feasible due to absence of identifiable items to repair at the excavated locations. Without exposing the entire line, it is not be possible to determine the locations and number of areas in the pipe that need to be repaired. Exposing the entire line would endanger other

utilities within the plant, disrupt the main drive, and be cost and time intensive. Furthermore, without the ability to clearly identify the cause of pipe degradation, prevention of the same issue in the future will be difficult.

2. Replace stainless steel lines. Due to the location and routing of the existing lines, replacing these lines and using the same routing would endanger other utilities within the plant, disrupt the main drive and be cost and time intensive. Due to the location of the equipment, alternate routes will also have similar challenges. The opinion of probable cost for this item was expected to be in the range of $50,000 to $100,000. Similarly to the repair option, there is concern that future corrosion could impact the integrity of the stainless steel lines.
3. Relocate carbon dioxide tank and/or feed equipment. Relocation of the storage tank and feed equipment was evaluated extensively. Various locations were discussed with consideration as to how these locations would impact access, chemical delivery, maintenance, and cost, as well as what conflicts with existing facilities would occur. The City, Engineer, Contractor and Equipment Supplier participated in these discussions. The opinion of probable cost for this alternative was expected to be in the range of $50,000.

**Solution**

It was determined that relocating the carbon dioxide tank would be the most beneficial and cost-effective option. The feed equipment would remain in the originally proposed location within the chemical building and the storage tank would be placed on the roof of the chemical building. This option utilizes space created by the removal of the existing lime silos and locates the tank in close proximity to the feed equipment, reducing the overall amount of stainless steel piping required. The amount of buried piping is reduced, solving previous problems with utility conflicts and potential for pipe degradation. Delivery access is provided with a remote fill station located at the south end of the building.

The cost associated with this option is detailed in Item 3.3 of Change Order No. 3. The cost of this change is slightly higher than was originally anticipated. All parties have been involved in value-engineering to obtain a solution that is cost effective, durable, reliable, and safe. This solution is believed to be the most cost-effective of the three alternatives and will provide the City with a system that is long-lasting and easily accessible.

RLT/rlt

cc: Philip Ciesielski, City of Lawrence
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