H.R. LABOUNTY SAFETY AWARD PROGRAM

TEHACHAPI-CUMMINGS COUNTY WATER DISTRICT APPLICATION

IMPROVED HEAT EXCHANGER INLET SCREEN

MARCH 2016

OPS-MS

NOMINATED EMPLOYEES

Jim Schneider	Pump Plant Superintendent
Chris Vigil	Controls/Emissions Specialist
Rod Michael	Lead Mechanic
Wes Fowlkes	Heavy Duty Mechanic
Doug Hertz	Heavy Duty Mechanic
Greg Carpenter	Heavy Duty Mechanic

PROBLEM

The adage in California is that, "water flows uphill to money". TCCWD is a prime example of this. We receive State Water Project water from the California Aqueduct at the base of the Grapevine near Laval, CA and pump it uphill almost 3,500 vertical feet to serve both agricultural and M&I customers in the Tehachapi area.

The raw water taken from the aqueduct is subject to both natural and man-made contamination. Moss, algae, rags, plastics, wood and too many other objects to name are routinely encountered and need to be screened from the flow prior to entering our pumps. We utilize a rotating screen immediately adjacent to the aqueduct turnout that removes the bulk of this debris; however, a significant quantity bypasses the rotating screen and makes its way through seven miles of pipeline to our first pumping plant (it takes a series of four pumping plants to lift the flow the total elevation amount of 3,500 feet).

Once the flow arrives at the pumping plant, it is put to use to cool our 1,200 HP, natural gas fired engines before continuing on its journey up the mountain. The engines are cooled using heat exchangers that contain an array of small diameter (1 ½") tubes (See Figures 1 and 2). The cool, aqueduct water flows through the tubes. The heated coolant from the engines is pumped through the vessel surrounding the tubes. The coolant temperature is reduced to acceptable levels via contact with the cooled tubes and returned to the engines in a continuous, circulating system.

The flow needs to be screened prior to entrance to the heat exchangers to ensure that it won't plug the small diameter, cooling tubes and also to safeguard against damage to the multi-stage, centrifugal pumps used to lift the water to the next station. To provide this function, an inlet screen is installed at the entrance to the heat exchangers. The screen is circular, fixed and accessed via two, four inch diameter hand holes (See Figure 3). These hand holes are very difficult to access. They are located (looking at the end section of the heat exchanger) at 12

o'clock and either 5 o'clock or 7 o'clock, depending on the location). The heat exchangers are mounted below floor level in the pump stations and are accessed by removing floor grates and then requiring the mechanics to crawl down into a very constricted space. The plugs in the hand holes are removed with a pipe wrench and then the mechanics are required to insert their arms as far as possible into the holes and scrape as much debris off the screens as possible, utilizing their fingers (See Figures 4 & 5).

This process invloves several, potential safety concerns.

- The hand holes are below the grates and climbing in and out of the wells is restricted by equipment and piping.
- The locations of the lower hand holes are very difficult to access and the plugs are difficult to remove and replace (See Figure 6).
- The process of cleaning the screens by hand is very problematic. It can only performed with very thin gloves. It requires the mechanic to insert their arm as far as it will fit into a 4" hole. Cuts and abrasions are common. It is almost impossible to remove all of the debris from the screen using this method.

SOLUTION

We recently embarked on a project to replace our four engines at Pump Plant 1. This plant is the first one in line and receives the vast majority of the debris from the aqueduct. During a standard, bi-weekly Safety Meeting, the pump plant department staff asked me if they could present an idea for improvement. I enthusiastically asked them to proceed! They suggested replacing the existing inlet screen (with the two hand holes) with a filter box arrangement. As the heat exchangers were being replaced in conjunction with the engine replacements, it was a perfect opportunity to reconsider this design. Their proposal would allow top access and include a removable screen to allow easier and more complete cleaning. I presented their idea to our vendor who was fabricating the new heat exchangers, Support Product Services. Ted Hill and James Myers took the idea and created some CAD schematic drawings. Our Pump Plant Department staff reviewed the schematics and made several critical revisions that led to a better finished product. Once the design was agreed upon, SPS provided shop drawings (See Figure 7) and fabricated a prototype. The prototype was reviewed by our staff and pressure tested by SPS. After passing these tests, the units went into production. The resultant product (See Figure 8) is far superior to the previous approach. The new filter boxes provide much easier access, much better cleaning and a much safer approach to this very frequent and redundant task.

BENEFITS

The new filter boxes are an exponential improvement over the old design. The mechanics can access the screens from the top rather than the bottom. This results in much less bending, stretching and laying on cold, wet concrete. Removing the lids is accomplished with an impact wrench from above rather than a pipe wrench from below. The screens are now removable and

stainless steel. They can be pressure or air washed and replaced with little effort. During certain periods of the year and depending on weather conditions, the debris from the aqueduct has different characteristics. If the screen perforations at a given time prove to be too large or too small, the screens can easily be replaced with a more appropriate mesh gradation.

CONCLUSION

I am proud to nominate our entire Pump Plant Department for the H.R. LaBounty Safety Award for their redesign of our heat exchanger screens. Their pro-active approach to solving a significant safety issue is a tangible benefit to our district. As we get older, wider and less flexible; more ergonomic work procedures will result in less risk of workplace injuries. The reduction in the numbers of scrapes and abrasions from cleaning the screens will be a benefit and morale booster. As a manager, I am very pleased that our staff recognized a problem, presented a timely, cost-effective solution and saw their idea through to completion and into service. Additionally, we are very pleased to have worked with Ted Hill and James Myers at Support Product Services on this project. They turned our idea into a finished product. They incorporated this revision into a very tight production and delivery schedule and were true professionals throughout the process.

Thank you for this opportunity to nominate these worthy and dedicated employees and to describe this exciting improvement!

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FIGURES

FIGURE 1 – HEAT EXCHANGER (NEW UNIT FOR ALTERNATE LOCATION)

FIGURE 2 – HEAT EXCHANGER TUBES

FIGURE 3 – HANDHOLES AT 12:00 AND 7:00 ORIENTATION

FIGURE 4 – MECHANIC REMOVING HAND HOLE PLUG (IN WELL BELOW FLOOR)

FIGURE 5 – MECHANIC REMOVING PLUG AT LOWER HAND HOLE

FIGURE 6 – MECHANIC ACCESSING LOWER HAND HOLE

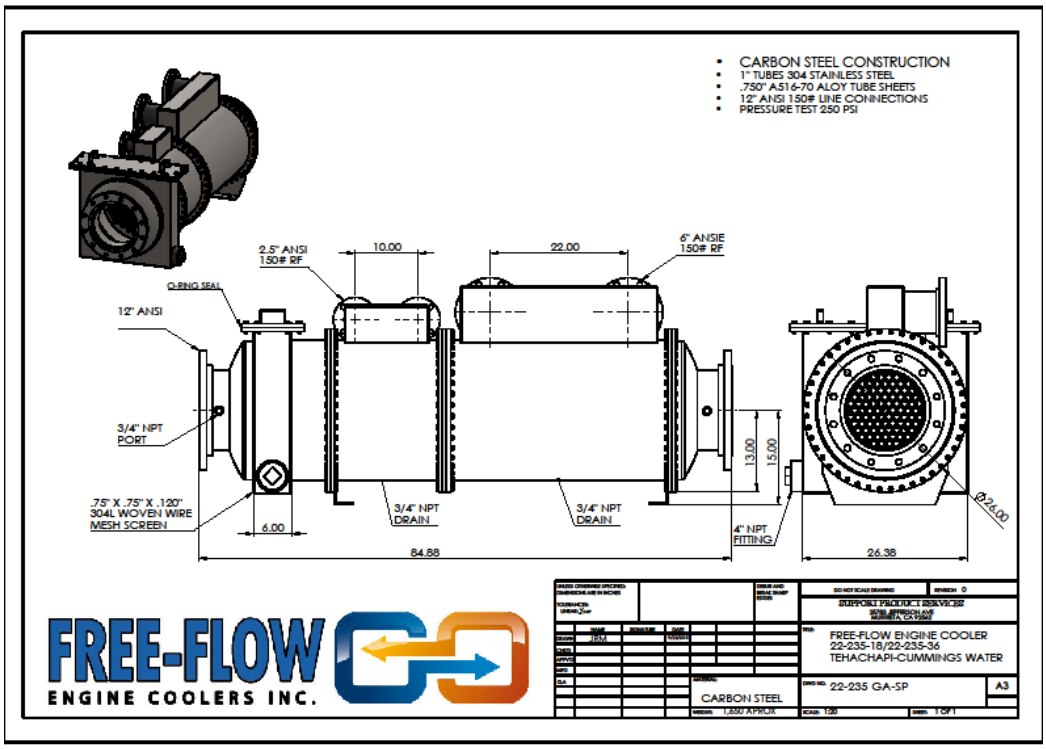

FIGURE 7 – HEAT EXCHANGER WITH FILTER BOX FABRICATION DRAWING

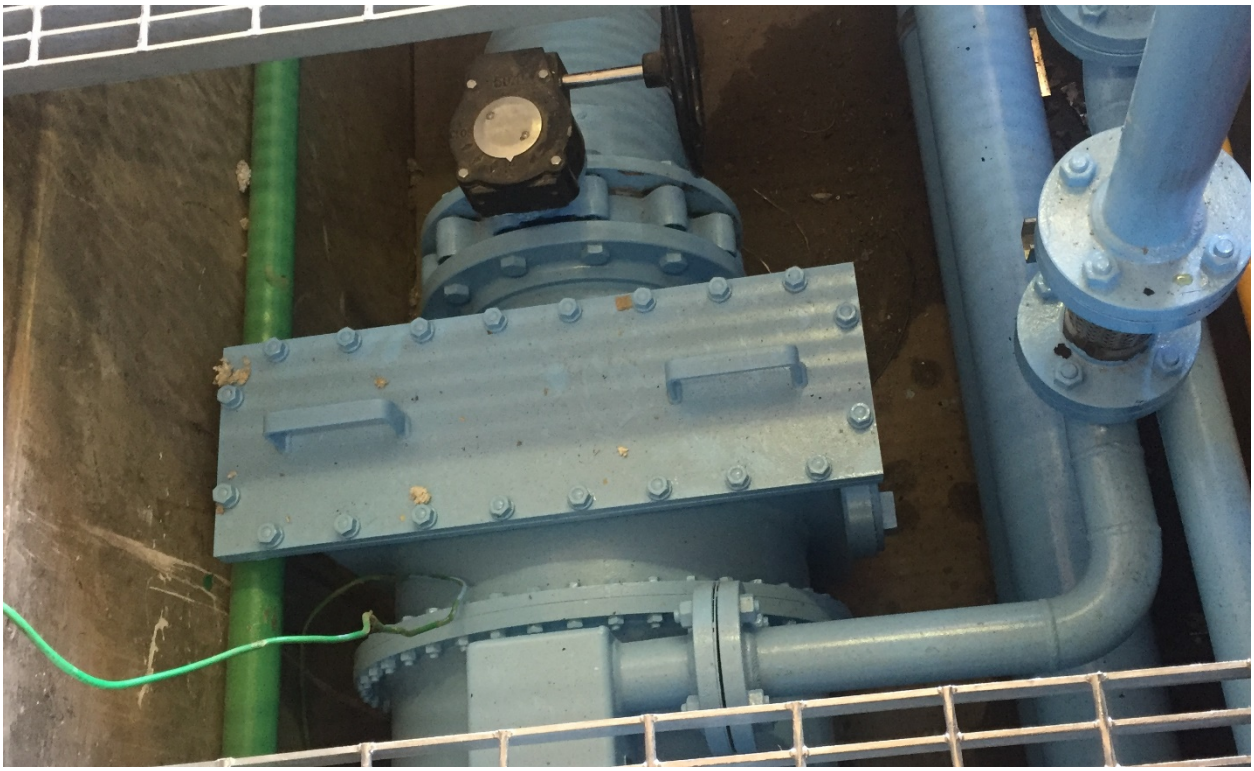

FIGURE 8 – NEW FILTER BOX SCREEN ASSEMBLY (IN PLACE)