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AYRES ASSOCIATES

October 12, 2009

Mr. David Simon
Wisconsin Department of Transportation-Roadside Facilities
4802 Sheboygan Avenue, Room 501
Madison, WI 53702

Re: Kenosha SWEF Holding Tank

Dear Mr. Simon:

Introduction

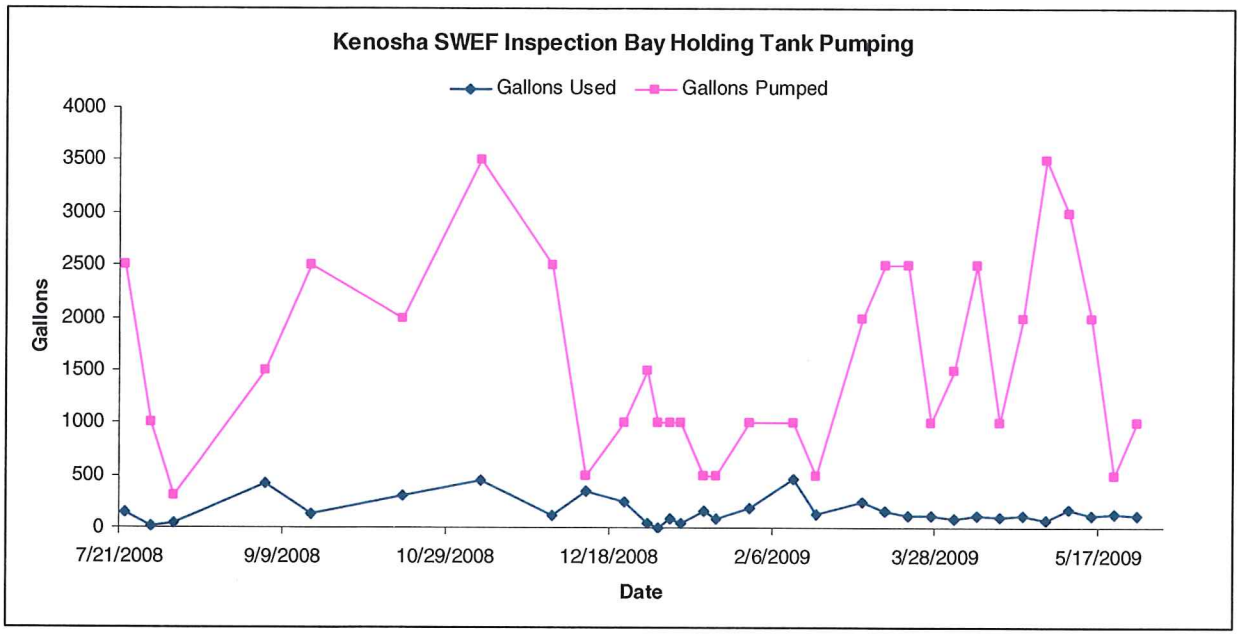
The Kenosha Safety and Weight Enforcement Facility (SWEF) is owned by the Wisconsin Department of Transportation (WisDOT). Rehabilitation for Wisconsin (RFW) provides maintenance service and staff for the facility. Over the past year, RFW staff has noticed that the amount of water pumped from the inspection building holding tank greatly exceeds the metered water usage. Ayres Associates has been retained to investigate the issue.

Background

The Kenosha SWEF is located on west bound Interstate 94 approximately 0.25 mile north of the Illinois border. The facility is operated by the Wisconsin State Patrol. The purpose of the facility is to ensure that commercial carriers operate within statutory or permitted size and weight limitations. The facility has a scale to confirm adherence to weight restrictions and an inspection building that allows officers to view and inspect vehicles.

The Kenosha SWEF has two separate wastewater systems. One system serves the static scale building including sanitary facilities and the other system serves the inspection building. The system of interest in this report is the system serving the inspection building. The system consists of floor drains and trench drains that collect water used during inspections and any liquids that comes off of the inspected vehicles, i.e. rain water, snow melt, fuel, oil, etc. Water use in the building is primarily for hosing down floors of the inspection building. Collected water is conveyed through underground piping to an oil/water separator where oil is retained. Water flows out of the oil/water separator and flows by gravity to a separate 3,000-gallon holding tank located outside of the facility. The holding tank has an alarm which signals that the contents of the tank need to be removed.

The issue at hand is that the amount of water being pumped out of the holding tank is significantly exceeding water use in the inspection building. Some of the excess water can be attributed to snow melt off of the vehicles in the winter, but the trend is seen throughout the year. This can be seen in the graph below. In some instances, the amount of water removed from the holding tank is more than 10 times greater than the amount of water used. It is suspected that ground water is infiltrating into the system causing the excessive volumes of water within the tank.



Objective

The objective of this project was to investigate possible reason(s) for the increased inspection building holding tank pumping and develop an approach for a solution to the issue.

Approach

The approach to this project was a two step process. A resource review was completed with information obtained from WisDOT and RFW. Following the resource review, a plan was developed for a site visit to investigate the issue.

Resource Review

The first step in the investigation was to perform a resource review. Information used in the resource review included as-built drawings for the SWEF from WisDOT, and inspection building water use and holding tank pumping records provided by RFW. The as-built drawings were used to get a sense of the system components, locations, and function. It was determined from the drawings that three trench drains run parallel to the inspection pits in the inspection building. Water from the trench drains, along with several floor drains, flows to area drains located in the inspection pits. The collective flow from the area drains flows to an oil/water separator located directly below the eastern inspection pit. Finally, water flows from the oil/water separator to the holding tank located outside of the building

The inspection building water use and holding tank pumping data from RFW provided water use within the inspection building recorded off of the water meter. It also provided dates the holding tank was pumped and the volume removed from the tank during each pumping event. The data was collected from July 2008 through May 2009. The water use was plotted against the volume

of water wastewater pumped for the months indicated above. The data showed that on average, the monthly volume of water pumped from the inspection building holding tank was 10 or more times higher than the actual volume of water used in the inspection building. Some of the excess water can be attributed to snow melt off of the trucks in the winter months, but the trend continued through the spring and summer months when snowmelt is not a factor. Given the data, it appeared that ground water was infiltrating into the system somewhere from the trench drains through the holding tank.

Site Visit

The next step in the investigation was to perform a site visit at the Kenosha SWEF. A date for the investigation was set and SWEF maintenance staff was contacted to set up pumping of the holding tank prior to Ayres staff arrival. Pumping of the tank was important for two reasons. First, Ayres Associates' staff wanted to see how much water was removed from the tank and secondly, to observe the interior of the tank for active leaks or other indicators, such as faulty construction, damage, or infiltration points. SWEF maintenance staff set up the holding tank pumping for 8:00 am on September 3, 2009.

Ayres Associates' staff arrived on site at 8:00 am. Upon arrival, the septage pumper from Pat's Sanitary Service was just finishing up removal of the contents of the tanks. He stated that he removed approximately 200 gallons from the inspection building holding tank.

Ayres Associates' staff also introduced themselves to the SWEF staff and informed them of what we would be doing onsite. SWEF staff provided the on-site versions of the as-built drawings of the SWEF which yielded very little new information. It was discovered that the inspection building holding tank was not in the location indicated on the drawings, but approximately 200 feet to the south grouped with the other holding tanks serving the scale building.

The evaluation of the holding tank was a multiple step process that used several different methods for examination. The methods are listed below in the order in which they were completed:

1. Tank riser covers and the risers were examined for signs of damage or leakage.
2. A holding tank evaluation for was completed. Data recorded on the form provides an overall status of the tank. A copy of the evaluation form is attached with this letter.
3. The entire tank interior was examined with an underwater video camera. The camera was affixed to a pole which allowed for rotation of the lens. The tank interior was viewed from both risers.
4. The tank interior was also photographed using a still camera. This camera was also affixed to a pole which allowed for rotation. The tank was photographed from both risers.
5. The control panel was examined and the high water alarm was tested for proper function.

Once the holding tank evaluation was completed, the inspection pits inside of the inspection building were examined for any signs of damage or leakage.

Upon completion of site activities, the SWEF staff was notified that the investigation was complete and Ayres staff departed the site.

Findings

The site visit yielded good information that will aide in determining the cause of the increased pumping of the inspection building holding tank at the Kenosha SWEF. The findings from each aspect of the site visit are listed below:

Tank Riser Inspection

The inspection revealed that each section of riser appears to be installed correctly and sealed properly. There was no damage or indications of water inflow or infiltration through either the cover or risers.

Holding Tank Evaluation Form

The holding tank evaluation form allowed Ayres Associates' staff to compile all observable or measurable data along with other known information about the tank into one central format.

Underwater Camera Inspection

During the underwater camera inspection, both the tank bottom and side walls were examined for leakage. The shallow liquid level (~1 inch) on the bottom of the tank was observed to see if there were any indications of active infiltration from a specific location. No liquid was seen coming up through the tank bottom and there was no increase in depth of water in the bottom of the tank during the examination. The side walls were examined to see if there was active seepage or past evidence of water infiltration through a crack or tank seam. The seam between the upper and lower section of the tank was sealed with mastic which was apparent and no evidence of leakage through the seam was visible. There was one area on the side wall that could have been a possible leak indicated by a water mark. It was found in the southwest corner of the tank, along the western wall below the seam. Leakage from this area did not appear to be significant.

Still Camera

The still camera was used to photograph the side walls of the inside of the tank. Photos of the inside of the tank were very clear. The images show many areas of rust that could be caused by one of three methods listed below.

1. The rust could be caused by ground water outside of the tank with a high iron concentration infiltrating through cracks in the tank walls. Once the iron rich water enters the interior of the tank, it oxidizes in the presence of free oxygen and forms the orange iron stains.

   This could be the case because according to the United States Geological Survey (USGS), in many areas of Kenosha County "the water is very hard and contains excessive iron." It could not be directly determined though if the groundwater in the area of the Kenosha SWEF has high iron concentration, but the possibility does exist.

Ayres Associates' staff has observed this condition at a recently completed project. Groundwater was infiltrating into a lift station through an improperly sealed conduit run into the tank. During the spring of 2008 when heavy rains fell, the groundwater table was elevated, and the infiltration into the lift station resulted in excessive wastewater flows to the wastewater treatment plant. Large areas of rust staining were visible within the lift station. Once the conduit run was sealed properly, the excessive flows ceased and there have been no issues since.

2. The rust could be caused by groundwater outside of the tank, not necessarily with a high iron concentration, infiltrating through cracks in the tank walls. The infiltrating water comes in contact with rebar within the tank walls. Iron from the rebar dissolves into solution with the infiltrating water. As the water enters the interior of the tank, it oxidizes in the presence of free oxygen and forms the orange iron stains.

3. The rust could be cause by water and/or other liquids within the tank seeping through internal cracks and making contact with the rebar within the wall of the tank. Iron from the rebar dissolves into solution with the water and/or other liquids. This iron in the liquids then oxidizes as it comes in contact with free oxygen in the tank.

If groundwater is infiltrating into the tank, none of the areas of rust appeared to be a major contributor of ground water seepage, but collectively, the areas of seepage could add up to a significant volume of water depending on the elevation of the water table outside of the tank. Many of the areas were around the seam of the tank, which contradicts the findings of the underwater camera. Also, the photographs indicate that the southwest corner of the tank is not leaking in the location indicated with the underwater camera. The photos on the following pages show examples of the rust colored stains that indicate possible leakage.

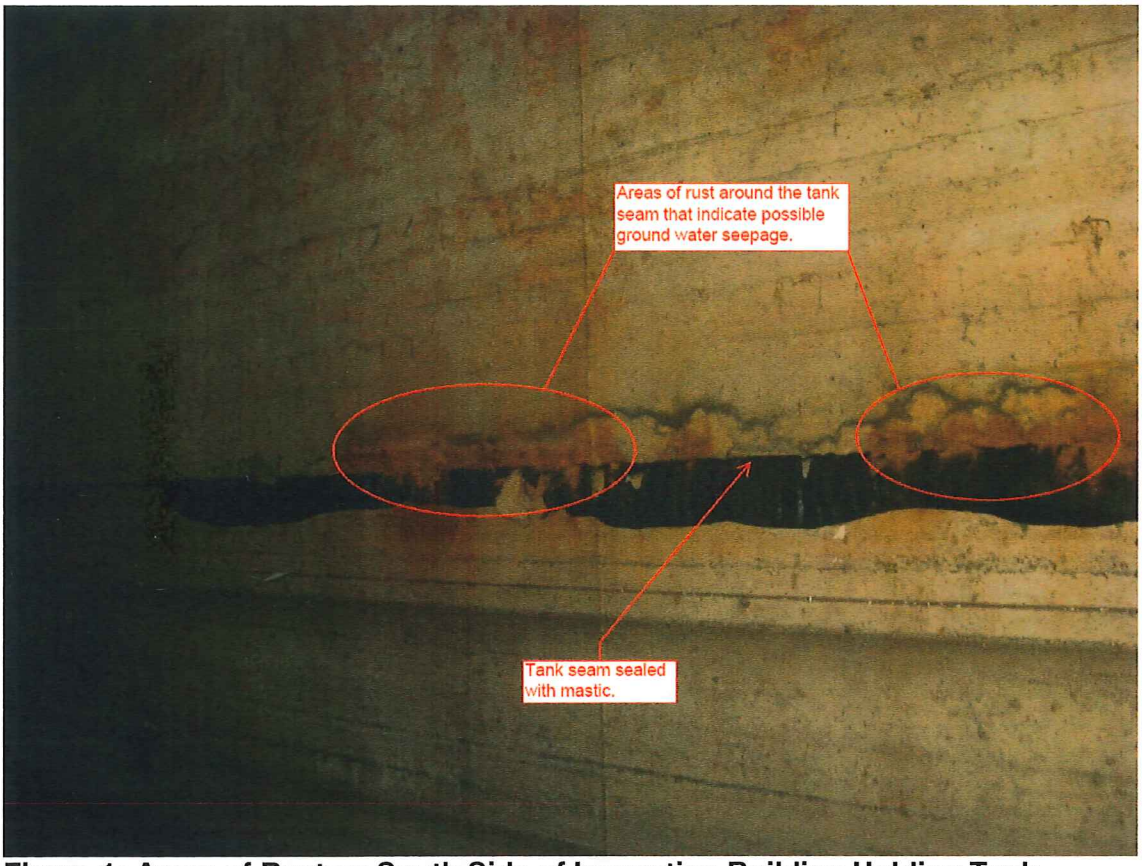


Figure 1: Areas of Rust on South Side of Inspection Building Holding Tank

Figure 2: Areas of Rust on East Side of Inspection Building Holding Tank

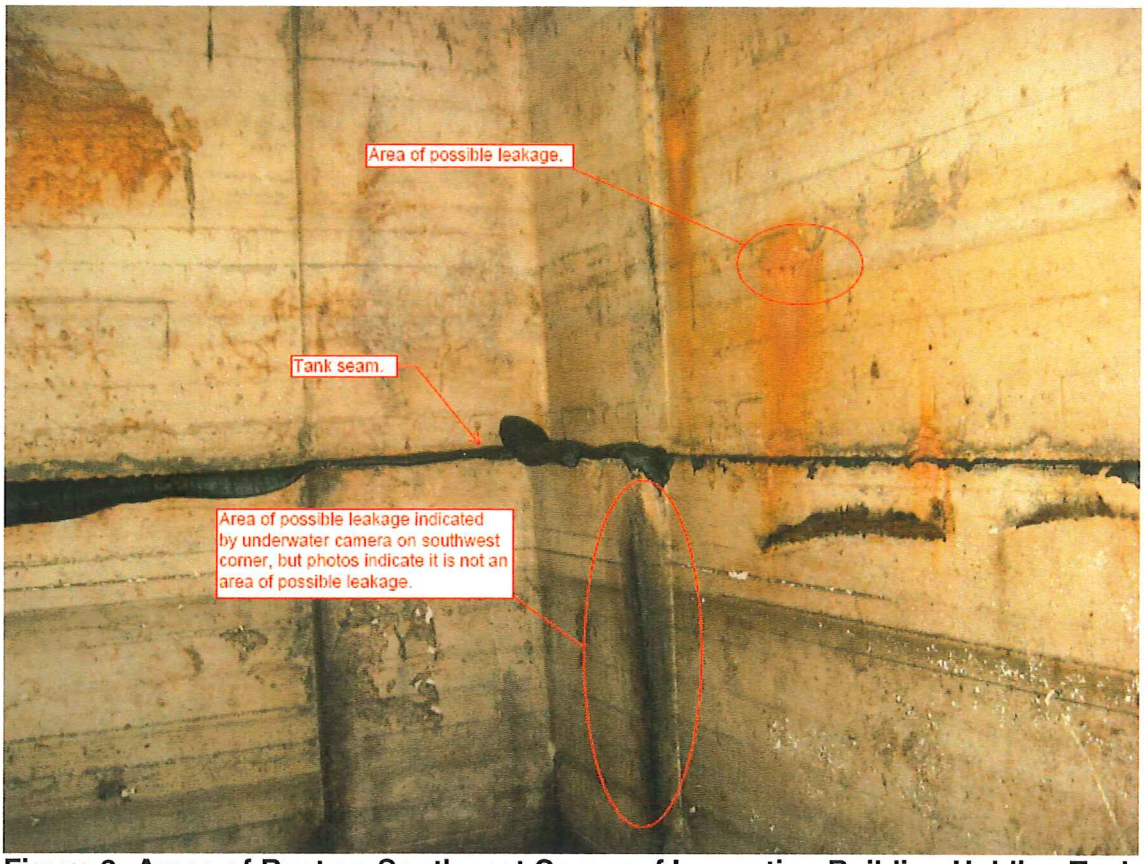


Figure 3: Areas of Rust on Southwest Corner of Inspection Building Holding Tank

Control Panel Inspection

The control panel appeared to be in good working order upon inspection. All components and wiring were intact. There were several insects and wasp nests in the panel, but they did not appear to have done any damage. The high water alarm was tested in the inspection building holding tank, and it was not operational. Several attempts were made to activate the alarm to no avail. The alarm was also tested in the static scale building holding tank, and it functioned properly.

Inspection Pit Examination

Both inspection pits were examined for signs of inflow or infiltration. No evidence of either inflow or infiltration was found.

Discussion

Increased Holding Tank Pumping

Since there was no leaking apparent during the site visit, a definitive cause for the increase in holding tank pumping could not be determined. Low groundwater table is likely the reason for no observable infiltration if indeed such infiltration is occurring. The possibility still exists that

infiltration could be coming from anywhere in the wastewater system including the holding tank, all underground piping, and the oil/water separator.

Holding Tank High Water Alarm

During the investigation, it was determined that the holding tank alarm was not functioning. The alarm is an integral component of the tank that is meant to prevent issues such as overflows and back ups of the system.

Conclusions and Recommendations

A definitive cause to the excessive inspection building holding tank pumping could not be determined as a result of the resource review and site visit. This is because no infiltration into the system was observed during the site investigation. The only portion of the wastewater system viewed was the inspection building holding tank and the inspection pits. These were the only areas accessible by Ayres Associates' staff. Components of the wastewater system that could not be viewed were the oil/water separator and all underground collection piping.

To find a definitive cause to the excessive pumping, it is recommended that a three step investigation should occur during high ground water conditions either this fall or next spring, depending on weather conditions. The investigation should occur during a period of no activity or water use in the inspection building. It should also be completed when there is no snow melt entering the floor drains from trucks being inspected. This effort may require several days to complete so must be coordinated with SWEF operations and the State Patrol staff. The following steps should be taken to accurately determine the point of infiltration.

1. SWEF maintenance staff shall take water level measurements within the tank under the conditions listed above. Measurements should be taken from a fixed point, i.e. the top of the riser. If the water level rises without any input into the tank, the holding tank should be internally inspected by a certified tank inspector with appropriate safety equipment to locate and confirm infiltration.

2. If no infiltration is apparent in the tank, the next step is to use televising equipment to view the underground piping between the oil/water separator and the holding tank. There are companies that specialize in this service that have sophisticated viewing equipment that will find any break, cracks, or separation in the piping.

3. If no infiltration is apparent in the underground piping, then the oil/water separator should be inspected via the same method as the holding tank.

If these steps are followed in sequential order, the point of infiltration should be discovered.

It is also recommended that the alarm be fixed immediately to prevent any back-ups or overflows of the holding tank.

If there are any comments or questions pertaining to any issues discussed in this report, please do not hesitate to contact me at 443.1271 or via email at rehre@ayresassociates.com

Sincerely,

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