

**CITY OF SANTA PAULA  
MEMORANDUM**

To: Honorable Mayor and Members of the City Council

From: Michael K. Rock, City Manager  
Caesar Hernandez, Regulatory Compliance Specialist

Subject: Water Recycling Facility Spill Update and Recommended Mitigation Plan

Date: July 16, 2018

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**RECOMMENDATION:**

Staff recommends that the City Council:

- (1) Receive and file the Waste Water Recycling Facility Spill Update Report,
  - (2) Authorize transfer of \$426,000.00 from the Sewer Fund Balance (Acct. 610-3501) to Sewer Improvements (Acct. 610-5-5063-660),
  - (3) Authorize American Water to solicit bids for the recommended Mitigation Plan work,
  - (4) Take additional, related action that may be desirable.
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**BACKGROUND:****Water Recycling Spill Update Report**

On March 11, 2018 the Santa Paula Water Recycling Facility (WRF) experienced a sewage spill impacting the WRF grounds and adjacent street. This report will service as a memorandum to explain and describe the sequence of events leading up to the spill and the City's wastewater treatment operator American Water's (AW) response.

On March 11 (7:52 p.m.), an apparent power grid failure led to a fault in the WRF instrumentation and control system (I&C). This in turn caused the membrane feed pumps and other equipment, which are controlled by I&C, to shut down. AW staff replaced an I&C component, which allowed the WRF to resume operation. AW personnel restored the WRF to normal operation and observed operation until it was apparent that the pumps were functioning and all alarms were clear. AW staff left the site at about 9:35 PM.

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About an hour later, 10:21 PM, additional alarms were received by AW remote staff. Upon returning to the site, AW staff found an additional I&C failure, possibly caused by another power grid interruption. This failure caused shutdown of the membrane bioreactor (MBR) blowers. Because of interlocks within the MBR programming, when the MBR blowers are not operating all MBR trains go into Safe Mode and permeate production stops. However, the pumps feeding the MBR trains do not stop, and there is no high-level shutdown in the MBR basins to cause them to stop. This led to flooding of the MBR basins, which overflowed into the permeate pump pits, the WRF area and ultimately to Calpipe Road and the adjacent storm drain system. This flooding had already occurred when AW staff arrived around 10:30 PM. Staff immediately shut down the membrane feed pumps to prevent more flooding.

WRF staff requested assistance from AW's Fillmore staff, where AW maintains a vacuum truck. This truck was brought to the WRF and used to drain the permeate pump pits in an attempt to restart the permeate pumps. This attempt was not successful because the pump motors and control wiring had flooded. AW staff were able to replace two permeate pump motors with shelf spares. These were installed by 12:00 PM on March 12, bringing two MBR trains online and allowing export of water from the WRF.

AW staff requested assistance from the City Public Works department. This assistance included providing sand bags to prevent loss of spilled material to the environment. The City's assistance allowed all spilled material to be limited to the adjacent street and storm drain. Approximately 10,000 gallons was spilled from the tank, of which about 800 gallons left the site and was collected from the street and storm drain system adjacent to the WRF. All of the spilled material was recovered and the affected areas were disinfected.

AW called out Patriot Environmental to begin cleanup operations. Patriot was onsite Monday morning with vacuum trucks, pressure washers, and steam cleaners. Patriot extracted all spilled material and cleaned the roadway, the storm drain system and plant surfaces. Cleanup work was completed by close of business March 13<sup>th</sup>.

AW contacted an electrical contractor, Venco Controls, on an emergency basis to repair damage to the permeate pump control panels. Venco was onsite Monday morning March 12<sup>th</sup>. This allowed the two repaired permeate pumps to be placed online as soon as the motors were installed. Venco continued repairing the submerged panels as subsequent pumps were repaired, allowing the plant to return to normal operation on March 13<sup>th</sup>.

AW ordered replacement permeate pump motors on an emergency basis on Monday morning. These were delivered Monday afternoon, and AW began installing them immediately. All permeate pumps were in service by close of business March 13<sup>th</sup>. AW notified the Regional Water Quality Control Board of the spill on March 12<sup>th</sup>, within 24 hours of the spill as required by permit.

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The WRF was back in normal operation by 5:00 PM on March 13. All spilled material had been cleaned and properly disposed at that time.

#### ISSUES/ANALYSIS:

##### **Causes of the Spill and Accompanying Damage**

A number of factors worked in concert to cause the spill. While the precipitating cause was a short failure of power service to the facility, this power failure led to the shutdown of various equipment in the plant. However, the facility should have been able to recover from the power failure without causing a spill. Additional factors include the following:

- The power failure caused process equipment to shut down. Alarms were issued, calling out AW staff to bring them back online. However, some undefined failure in the programmable logic controller (PLC), probably resulting from either the initial or a subsequent power failure, prevented all of the equipment from restarting.
- The membrane feed pumps continued running when the rest of the plant shut down. This is the direct cause of flooding – the pumps were delivering water to the membrane basins with nothing taking the water out. Subsequent evaluations of the PLC program led to the discovery that there is provision in the program to shut down the membrane feed pumps, but the shutdown had been bypassed. It is not known when this bypassing occurred, but it appears to have been before AW took over operation of the WRF. It is likely to have been a response to nuisance alarms resulting from plugging of the level transmitter that provides the shutdown signal.
- The uninterruptible power supply (UPS) for PLC B may have failed to maintain proper operation of the PLC, leading to improper operation of the process equipment. While this cannot be proven, there were other instances in which the PLC seems to have had power issues that should have been prevented by the UPS, so it is considered a likely cause.
- The location of various electrical equipment became an issue when trying to bring the plant back online. The permeate pumps that draw water out of the membrane basins are located below grade in pits adjacent to the membrane basins. Each membrane train also has an electrical control panel located in the pump pits. These pits flooded, damaging the pump motors and the electrical equipment inside the panels. While the WRF had two spare motors in inventory, the remaining four motors had to be purchased on an emergency basis. Thus AW staff was able to get two trains running fairly quickly, but the other four trains had to wait for pump motors and for the control panels to be rebuilt.

##### **Preventive Measures That Have Been Implemented**

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City and American Water staff have taken a number of steps to prevent future spills. These include:

- The bypassed level alarm that was the direct cause of flooding has been enabled, tested, and found to be working properly. AW staff has increased the frequency of cleaning for the level transmitter from monthly to biweekly to prevent nuisance alarms and improve reliability of the alarm.
- AW staff have been directed to actively seek other alarms that might have been bypassed and have been methodically reviewing the alarm systems.
- The uninterruptible power supply (UPS) for PLC B has been replaced with a new industrial grade UPS to protect it from short-term power failures.
- Southern California Edison (SCE) was contacted to determine the extent of power issues leading up to the failure. They did not have record of any problems. AW staff requested that SCE place a recording meter on the incoming power service to monitor for power issues. This has been done (for a period of one week), but a report has not yet been issued by SCE.
- All six of the damaged permeate pump motors have been rebuilt and placed into inventory ready for use.
- City staff directed MKN to perform an evaluation of raising the control panels and permeate pumps out of the pits that flooded. This evaluation has led to a recommendation to provide a full design of moving the panels, for which a proposal has been received.
- MKN has performed an overall evaluation of the WRF control systems and has presented recommendations for improving reliability.

**Additional Work to Improve WRF Reliability and Mitigate Future Occurrences**

A number of additional actions are recommended in addition to the work that has already been performed to prevent a recurrence of the spill.

- Raise the permeate pump control panels out of the pump pits. The City has received a proposal to design this work and has included the cost of this work in the FY 2018/2019 budget.
- Raise the permeate pump motors out of the pits. The cost and feasibility of this work are currently being evaluated.
- Continue observing performance of the level transmitter used to control the membrane feed pumps. If this transmitter continues to foul, consider replacing it with a transmitter using an alternative technology.

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- Continue investigating the WRF control systems to identify bypassed alarms or other areas where the system is not operating as it should. AW staff have been directed to report any such concerns.
- Perform a full audit of the WRF control system to identify potential errors in the PLC code. This will require the services of a control system integrator. This has been included in the WRF Capital Budget for FY 2018/2019
- The Process and Instrumentation Diagrams (P&IDs) prepared when the plant was constructed are not complete. While they seem to provide a good representation of the installed equipment, they do not provide any of the logic used to control the plant. This makes it difficult to trace the cause of plant faults. A control system audit could provide this additional information.
- Replace the existing UPS units serving the PLCs with larger units providing four to eight hours of runtime. These new units should include the capability of communicating with the PLCs to allow monitoring with the WRF control system.
- Replace the existing networked communication system with hardwired control links for certain critical control elements. Hardwired control links are more robust and easier to troubleshoot than networked connections for control elements.

**FISCAL IMPACTS:**

Costs incurred by the City resulting from the spill include both costs of immediate remediation and costs of improving plant facilities to prevent future occurrences. Table 1 presents costs of immediate remediation.

<b>Table 1 Spill Cleanup and Immediate Repair Costs</b>		
<b>Payee</b>	<b>Service</b>	<b>Amount</b>
Harrington Plastics	Provided 4 new electric motors for permeate pumps	\$12,681.49
Patriot Environmental	Clean and dispose spilled fluids	30,655.75
Rain for Rent	Rental pump and tank	5,335.93
Venco Controls	Repair electrical and control panels	18,861.25
West Coast Electric Motors	Rewind damaged pump motors	4,400.00

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<b>Total</b>	<b>\$72,822.34</b>
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Additional costs associated with a recommended mitigation plan to prevent future recurrences have been identified and are presented in Table 2.

<b>Table 2 Estimated Costs of Preventive Actions</b>		
<b>Item</b>	<b>Estimated Cost</b>	<b>Included in FY2018/2019 Budget?</b>
Relocate permeate pump control panels	\$217,000	Yes
Relocate permeate pump motors	\$150,000 (Budget)	No
PLC Program Review	\$50,000	Yes
Replace level transmitter with alternative technology, if required	\$5,000	No
Replace DeviceNet control links with hardwired links.	\$200,000 (Budget – to be confirmed)	No
<b>Subtotal Anticipated Cost</b>	<b>\$622,000</b>	

Staff recommends adding a 20% contingency to the non-budgeted estimated costs adding an additional \$71,000.00 for a **Total Anticipated Cost of \$693,000.00.**

**PERSONNEL IMPACTS:**

None.

**OPTIONS:**

1. Approve Staff recommendations
2. Reject Staff recommendations
3. Make changes to Staff recommendations

**ATTACHMENTS:**