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TO: Michael C. Van Milligen, City Manager

FROM: Deron Muehring, Water & Resource Recovery Center Director

SUBJECT: Water & Resource Recovery Center Odor Abatement Efforts Update

DATE: December 14, 2023

INTRODUCTION

The purpose of this memo is to provide an update on odor abatement efforts at the Water & Resource Recovery Center.

BACKGROUND

The Water & Resource Recovery Center (WRRC) uses physical, biological, and chemical processes to remove up to 98% of incoming organic pollutants. This process does result in the creation of gases and compounds that can create unpleasant odors. The nature of the odors is a function of the chemical characteristics of the influent wastewater received at the WRRC. The wastewater generated in Dubuque has higher concentrations of pollutants than typical domestic waste. Therefore, it has a higher propensity to produce odors.

As wastewater with high organic content undergoes decomposition, it releases gases such as hydrogen sulfide (H2S) and mercaptans. H2S is also called “sewer” gas known for its pungent “rotten egg” odor even at low concentrations. Mercaptans are known for their pungent “smelly sock” odor. These gases can be produced and released at multiple locations within the treatment system. In fact, these gases can be present to some degree in the wastewater when it first reaches the WRRC.

The most likely sources for the odors at the WRRC, listed from highest contributor to lowest, are the primary clarification process, raw influent from forcemain/pressurized sewers, blended sludge storage, waste activated sludge storage, and anaerobic digestion. Even though odor producing compounds will always be present at the WRRC, there are steps that can be taken to minimize the release of the gases and odors into the atmosphere.

In June of 2023, the City hired US Peroxide, LLC (USP) to assist WRRC staff with performing an odor control evaluation at the WRRC. USP is a leading provider of peroxygen-based technologies and full-service chemical treatment programs for municipal and industrial water and wastewater treatment applications. They have extensive experience in liquid phase treatment for odor control. USP provides temporary chemical feeds equipment to dose the system and monitoring equipment to measure the effectiveness of the chemical dosing. The odor control evaluation began with discussing treatment objectives, suspected locations of odor release, treatment facility design and wastewater characteristics. The initial consultation was followed by bench testing of

wastewater from several process locations to determine the extent of possible sulfide removal at varying reaction times and dose rates. Bench testing was conducted, with multiple chemicals, to identify which chemicals would likely provide the most efficient and cost-effective odor reduction. In August of 2023, the WRRC began dosing hydrogen peroxide between where the wastewater reaches the WRRC (the headworks) and the primary clarifiers where the highest levels of hydrogen sulfide (H2S) can be expected.

DISCUSSION

While progress is being made to identify the location/source, and reduce the presence of, odor producing gases and compounds at the WRRC, those improvements are now masked by odors created because of temporary operational changes – changes necessary to continue to receive and treat the city's wastewater in accordance with the federal Clean Water Act. The operational changes were necessary due to an unfortunate error by a private contractor hired to assist with the annual inspection of equipment that helps ensure that the WRRC effectively treats the wastewater generated in the Dubuque community.

As the manufacturer of the equipment, they were hired because they would possess unparalleled insight into the intricacies of the equipment. Utilizing the manufacturer for servicing minimizes the learning curve often associated with third-party service providers. Their familiarity with the WRRC system should translate to streamlined processes and quicker responses when issues arise. By choosing them, the City was entrusting the equipment to a contractor with years of experience in designing, manufacturing, and servicing similar equipment. Their expertise should have ensured that the WRRC equipment would be kept in peak operational condition. Unfortunately, that was not the reality.

Inspection of the equipment required the contractor to remove the electrical service and controls to allow access to the interior of the equipment. Following inspection, the contractor re-wired the unit to put it back into service. After finishing up unrelated maintenance of the unit, they went to start the equipment and it failed to function correctly. The contractor returned to try and help troubleshoot the equipment but left without having resolved the issue, believing that it wasn't related to the equipment but had something to do with the WRRC computer system that controls the equipment. That left WRRC staff and a second contractor, a computer program logic controller (PLC) contractor, to try and troubleshoot the issue. They tried a variety of things to rule out various elements of the controller system. Finally, a week later the WRRC team, along with the PLC contractor discovered that the service contractor had re-wired the equipment incorrectly. Once corrected, the unit started up.

The WRRC employs an anaerobic digestor system to break down organic material in system solids. This process involves microorganisms that thrive in anaerobic (oxygen-free) conditions. The breakdown of volatile organic material in an anaerobic digester occurs through a series of microbial activities, primarily carried out by bacteria and other microorganisms. The equipment that was inoperable for a week helps to maintain the delicate balance and relative population of the microorganisms in the anerobic digesters. As a result of the inoperable equipment, two of the four digester units became dormant. They could no longer accept and treat the waste stream. The other two remained active. However, to ensure they would remain so, to ensure that the discharge from the WRRC remains within permit discharge limitations, WRRC staff had to limit the waste stream sent to the two functional digesters. To accommodate this, waste is being temporarily stored in tanks where they normally are not. As a result, the odor producing gases can readily escape into the atmosphere. And this has resulted in what might be unprecedented odors coming from the WRRC.

WRRC staff have been doing what they can to bring the dormant systems back to life. That has

included collecting digester seed sludge from Iowa City's wastewater treatment facility and introducing it into the dormant digester units to try and jump start the regrowth of the microorganism ecosystem.

The effectiveness of the steps taken to date will be assessed during the week of December 18. If the system shows clear signs of recovery, then more of the solids waste stream will be sent to the digesters for treatment. This will be done gradually to ensure that the system can handle the waste. If the system reacts well to the additional waste, the WRRC might be able to return to normal operations by early January. Unfortunately, that will not eliminate the odors as it will take some time to reintroduce the waste that is being temporarily stored in the tanks exposed to the air. Again, that material will have to be slowly reintroduced, metered back into the treatment process. But if the system comes back as described, the temporary tanks would be emptied and cleaned in February.

Recognizing the failure of the contractor and the City's costs that have resulted, not to mention the intangible effect the odors have on citizens in the community, discussions are underway with the Legal Department to explore possible legal remedies due to the contractor's error.

As stated previously, progress has been made to identify the location/source and reduce the presence of odor producing gases and compounds at the WRRC as measured by the reduction in hydrogen sulfide. It has been determined that a 50% reduction in H2S can be achieved if between 50 and 60 gallons of peroxide per day is added into the waste stream between the headworks and the primary clarifiers. That would cost between $130,000 and $150,000 per year based on current chemical pricing. Based on these results, an improvement package will be included as part of the Fiscal Year 2025 budget to increase the WRRC operating budget to fund this odor reduction effort. The odor reduction evaluation doesn't end there.

The next step for the odor reduction evaluation to start in early January is to evaluate the odor reduction benefits of adding a combination of peroxide and ferric salts (iron salts) to the waste stream at other strategic locations. In addition to binding up sulfur and reducing the production of H2S, iron salts can minimize the production of struvite within the system. Struvite is a mineral composed of magnesium, ammonium, and phosphate. It often forms as a crystalline precipitate in anaerobic digesters and pipes causing scaling and clogging of pipes. Therefore, dosing the waste stream before the it enters the anerobic digesters will be evaluated. It may take anywhere from eight to fourteen weeks to determine the optimum dosing rates, but odor reduction benefits could be realized right away. The evaluation will also include determining the effective dosing rate and combination of adding peroxide and iron salts in the waste stream before it enters the centrifuge. Determining the effective dosing rate at this location should only take about four weeks once dosing is initiated.

Periodic updates on the progress towards addressing both the short-term odor issue and the comprehensive odor reduction evaluation will be posted on the City of Dubuque website at www.cityofdubuque.org/odorcontrol.

ACTION REQUIRED
This memorandum is intended for informational purposes.

Cc: Crenna Brumwell, City Attorney
William O'Brien, W&RRC Manager