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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: January 9, 2024

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.

USP determined that a 50% reduction in H2S (most prominent odor producing compound) can be achieved by adding between 50 and 60 gallons of peroxide per day 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.

An error committed by a private company hired to assist with a required equipment inspection resulted in equipment failure necessitated temporary operational changes – changes necessary to continue to receive and treat the city's wastewater in accordance with the federal Clean Water Act. As the manufacturer of the equipment, the company was hired because they should 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 WRRC personnel finished up additional, unrelated maintenance of the unit, the unit was restarted by the contractor who then left the premises. Approximately five (5) hours later, a power interruption caused the unit to shutdown and WRRC personnel were unable to restart the unit. The contractor returned later in the week to try and get the equipment to operate but left after several hours without any success. Believing that it wasn't related to the equipment but had something to do with the WRRC computer system that controls the equipment, WRRC staff and a second contractor, a computer program logic controller (PLC) contractor, were left to try and troubleshoot the issue. They systematically worked through the process of ruling out potential causes of the failure. 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 two weeks 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 and could no longer accept and treat the waste stream. The other two remained active. To try

and remain compliant with 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.

DISCUSSION

The first step to address the short term, unprecedented odor issue, is to bring the anaerobic digesters back within normal operational parameters. WRRC personnel have been working towards that goal. Roughly 90,000 gallons of anaerobic seed sludge has been trucked from Iowa City and emptied into the system to try and fortify the necessary biological population. Staff also added almost 12,000 pounds of sodium bicarbonate, increasing the alkalinity to help improve the ecosystem for biological activity.

Since the report last month, two of the digesters have been brought to within normal operating parameters. The other two are trending in the right direction such that the process of slowly reintroducing solids waste loads into the digesters has started. It must be done gradually to ensure that the system can handle the waste, that the amount of the waste doesn't upset the biological activity in the digesters. We are optimistic that we will be able to return to normal operations in the next few weeks.

Elimination of the odors will require treatment/disposal of the waste that is being temporarily stored in the excess flow tanks, tanks exposed to the air. Again, that material will have to be slowly reintroduced, metered back into the treatment process. In late December, we started pumping the waste that was temporarily stored in the north excess flow tank back into the treatment system. Only a small portion remains such that the tank will be able to be cleaned when temperatures permit. It will take more time to deal with the waste in the south excess tank. Slowly reintroducing it back into the system will take several weeks and could be hindered by cold temperatures. We continue to explore ways to expedite that process. The goal remains to have the tanks empty and cleaned in time for spring rains.

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.

The investigation into reducing long-term odor emissions at the WRRC continues. Since reporting last month, the City's consultant has identified two additional locations to dose the waste stream to further reduce H2S emissions from the WRRC. They are working on a scope of services to dose the system with ferric chloride (iron salt). In addition to binding up sulfur and reducing the production of H2S, iron salts can bind with orthophosphates and 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. Dosing with iron salts will both reduce H2S emissions and improve the efficiency and effectiveness of the treatment process. The dosing of the waste stream between the digesters and the centrifuge is expected to begin in January. Dosing of the waste stream at the aeration tank overflow will follow. The anticipated dosing rate will be calculated prior to the initial dosing such that the benefits will be immediate. But it will take some time to adjust the dosing rate to where it achieves the desired H2S and struvite mitigation without negatively impacting the treatment

process. Once the optimal dosing rate for irons salts is determined, dosing with additional hydrogen peroxide will be evaluated to further reduce H2S emissions.

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