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OIG ADVISORY ON MAY 2021 ROSELAND PUMPING STATION FAILURE

CITY OF CHICAGO
OFFICE OF INSPECTOR GENERAL



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I. EXECUTIVE SUMMARY

On May 6, 2021, an equipment failure at the Roseland Pumping Station (RPS) caused pressure in the water main to drop, requiring the Department of Water Management (DWM) to issue a 24-hour water-boil order for much of the 19th Ward in the RPS service area—spanning from Albany Avenue to the west, 119th Street to the south, and west of Interstate 57 to southwest Beverly Avenue. The resulting boil order affected residents of the Beverly and Morgan Park neighborhoods.¹

On May 25, 2021, failure of the same type of equipment caused a second power outage at the facility which did not result in a boil order but exacerbated concerns about the facility, resulting in media reports and a formal aldermanic request that the Office of Inspector General (OIG) investigate what had become a matter of ongoing public concern.

OIG examined the issues at RPS, which included interviewing a City vendor and City and ComEd officials, as well as reviewing emails and records. On the basis of the information provided, OIG has concluded that the root of the May 6, 2021 and May 25, 2021 issues was a City equipment failure inside the station—namely, a rented uninterruptible power supply (UPS) unit installed in 2018 and a temporary replacement installed after the May 6th event.

II. THE ROSELAND PUMPING STATION

The 110-year-old RPS, located at 347 West 104th Street, provides water to a portion of the Southwest Side. It is one of 12 pumping stations strategically located throughout Chicago that provide water pressure to City businesses, residents, and fire systems.² In 1998 the City began converting the station from steam to electric power.³ Next to RPS is a ComEd vault, a substation that feeds power to the DWM facility.

III. THE UNINTERRUPTIBLE POWER SUPPLY (UPS)

A UPS was installed when the pumping station was converted to electric power. A UPS is an electrical component that sits between incoming utility power and certain critical equipment such as servers and data rooms, that supports the downstream equipment by keeping it appropriately energized. The main function of a UPS is to clean up power imbalances, either voltage sags or spikes, to send the proper voltage downstream.⁴ The secondary purpose of a UPS is to maintain power to critical components in the event of an electrical disruption. In those instances, the UPS typically works in conjunction with diesel generators to keep critical operations engaged through the provision of power from an alternative internal backup source.

¹ <https://news.wttw.com/2021/05/06/2-south-side-neighborhoods-under-boil-order-why-and-what-does-mean>.

² <https://www.chicago.gov/city/en/depts/water/provdrs/supply.html>.

³ <https://www.chicagotribune.com/news/ct-xpm-1998-10-01-9810010159-story.html>.

⁴ This information was provided by a City electrical contractor.

In the case of the Roseland Pumping Station, the UPS, which is battery charged, should maintain power long enough in the event of an outage to engage the generators and keep the pumps operational. That did not happen on May 6, 2021.

The UPS installed had nickel cadmium (NICAD) batteries. The UPS had a roughly 20-year lifespan and began failing in 2018.⁵ Consequently, in 2018, a City electrical vendor removed the old UPS unit, installed a rental unit with a lead-acid battery, and began working with DWM on a replacement for the original unit after it was determined that repairing the original unit was not feasible due to its age and the availability of replacement parts.

Initially, the City wanted the replacement to have NICAD batteries, which presented certain difficulties. The batteries were now manufactured overseas in China, which meant delays. More significantly, NICAD batteries require regular maintenance and emit gases, and therefore must be housed in a separate room with a specific ventilation system to change out the air, which would involve making changes to the facility's ductwork. Notably, the room that housed RPS's original NICAD batteries did not have the required ventilation system.

Given those issues, the City elected to pursue a UPS with lead-acid batteries and began work on procuring such a unit in 2019. That course of action revealed a different set of issues. Lead-acid batteries last only three to five years and should not be stored in high temperature areas, as would be the case at RPS. A DWM electrical contractor looked into designing a cabinet system with a cooling mechanism to house the lead-acid batteries as a possible solution, which caused even further delays.

Eventually, the lead-acid battery system was abandoned in favor of a UPS with lithium-ion batteries, whose capabilities have improved significantly in the previous couple of years. Lithium-ion batteries require less maintenance than lead-acid batteries and have more than double the lifespan. In addition, the batteries do not emit gases like NICAD batteries, they can be stored with the UPS as opposed to in a separate room, and they are functional in temperatures below 104 degrees. A City contractor said a UPS with lithium-ion batteries is currently in the proposal stage.

For several reasons, replacing the original UPS took longer than it should have. The initial design issues presented a significant challenge. Following initial delays, the Covid-19 pandemic caused additional supply and production problems. In the interim, the rental UPS was understood to be adequately functioning, which may have eased the urgency to procure a permanent replacement. Finally, while the City experienced delays in identifying and effecting a permanent solution, the lead-acid batteries for the rental unit—which have a comparatively short life cycle—had likely degraded, possibly hastened due to high temperatures where they were housed in the facility, according to City contractor familiar with the UPS equipment. All of those issues, coupled with bad luck related to the timing of scheduled maintenance on the rental UPS, gave way to the May 6, 2021 system failure and resulting boil order.

⁵ This information was provided by a City electrical contractor.

IV. POWER OUTAGES ON MAY 6TH AND MAY 25TH

Shortly after 8 a.m. on May 6, 2021, RPS experienced a power outage. The facility's pumps shut down and the generators, which usually engage during power loss, did not do so. The circuit breakers popped. An electrician at the facility managed to reset the breakers, but when he started the generators, the breakers failed again. The electrician noticed that the UPS had failed and had to bypass it to get the facility controls back on, reset the breakers, and start the generators. The outage caused a pressure drop for a duration of time that required the City to issue a boil order for those in the affected areas, primarily the Beverly and Morgan Park neighborhoods.

That morning, ComEd was in its RPS vault performing what ComEd officials said was a routine switching operation. City officials said that all four lines into RPS experienced a voltage sag around the time of the outage and suggested it may have been the result of work being performed by ComEd or a loss of power from ComEd to RPS.

ComEd denied that was the case. Officials with the utility said they had no knowledge of the City-owned electrical equipment system in the station, but there was no voltage loss from any of the utility's four feeder lines into RPS. Moreover, ComEd received no complaints from other customers serviced by the four feeder lines into RPS and, while ComEd personnel were in the vault prior to the outage, they did not begin work on the scheduled maintenance until after the outage occurred.

On May 7, 2021, after the May 6th event, a second rental unit was installed at RPS. According to City officials, the replacement UPS failed on May 25, 2021, when the facility experienced voltage sags. On that day, DWM personnel bypassed the UPS and activated the generators. Bypassing the UPS prevented the need for a boil order.

On May 26, 2021, the second rental UPS was subsequently replaced with a third rental unit. As of the date of this report this unit is still operating at the RPS.

V. CONCLUSION

Indications from ComEd are that on May 6th and May 25th, RPS received an appropriate and steady flow of electricity from ComEd, with any sags or spikes within industry accepted (and historical) ranges. City officials dispute that was the case. Regardless of the disagreement between ComEd and DWM over whether there were voltage sags and, if so, from whose equipment those issues originated, it is clear that the primary reason that the May 6, 2021 incident resulted in a boil order was due to the failure of DWM's rental UPS that had been in place since 2018 and, incidentally, was scheduled for maintenance the following month. The UPS is City property and not the responsibility of ComEd.

In short, the City's rental UPS failed at RPS causing the pumps to go offline which resulted in the pressure in the water main to drop and subsequent boil order. If the UPS was fully operational at

the time of the incident, the UPS would have been triggered to provide a temporary supply of power until the backup power source—the facility’s own diesel generators—kicked in. Had that occurred, the station pumps may not have gone down at all, and if they had they likely would have been back online much sooner than occurred on May 6th, with a boil order likely not needed. Armed with the knowledge of the UPS’s problems, DWM was able to avoid a similar fate on May 25th, when no boil order was needed even though the second replacement UPS also temporarily failed.

Now that the electrical vendor has identified a suitable replacement UPS which uses lithium-ion batteries, DWM should be in a position to procure the unit and not continue to rely on rentals units which caused the May 6, 2021 boil order and the May 25, 2021 power failure.

OIG invites DWM to respond in writing by October 12, 2021. Any such response will be made public together with this OIG Report.

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