

**Investigative Summary Report**  
**Rapidan Service Authority Objectionable Odor Event**  
**August 21 – August 27, 2024**



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## Acronyms & Definitions

BCEE	Bis-2 chloroethyl ether
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CFR	Code of Federal Regulations
DBP	Disinfection by-products
DCLS	Division of Consolidated Laboratory Services
DEQ	Department of Environmental Quality
EPA	U.S. Environmental Protection Agency

GC	General Contractor
hp	Horsepower
MCL	Maximum contaminant level
mg/l	Milligrams per liter (which are equivalent to parts per million)
MGD	Million Gallons Per Day
NAICS	North American Industry Classification System
NOAV	Notice of Alleged Violation
NSF	National Sanitation Foundation
NTU	Nephelometric Turbidity Unit (measure of turbidity/suspended particles in water)
NPDWR	National Primary Drinking Water Regulations, 40 C.F.R. Part 141
ODW	Office of Drinking Water
PMCL	Primary maximum contaminant level
ppb	Parts per billion (which are equivalent to micrograms per liter)
ppm	Parts per million (which are equivalent to milligrams per liter)
PWSL	Public Water Supplies Law, Code of Virginia §§ 32.1-167 through 32.1-176
RRHD	Rappahannock-Rapidan Health District
RSA	Rapidan Service Authority
SDS	Safety Data Sheet
SDWA	Safe Drinking Water Act, 42 U.S.C. § 300f et seq.
SCC	State Corporation Commission
T&O	Taste and Odor
TPH DRO	Total Petroleum Hydrocarbon, Diesel Range Organics
TPH ORO	Total Petroleum Hydrocarbon, Oil Range Organics
TMF	Technical, managerial and financial capacity and capability
UC	Unified Command
µg/l	Micrograms per liter (which are equivalent to parts per billion)
VAC	Virginia Administrative Code
VDEM	Virginia Department of Emergency Management
VPDES	Virginia Pollution Discharge Elimination System
VDH	Virginia Department of Health
WQM&A	DEQ's Water Quality Monitoring & Assessment Program
WTP	Wilderness Water Treatment Plant

“Contaminant” means any objectionable or hazardous physical, chemical, biological, or radiological substance or matter in water.

“Consumer” or “Customer” means any person who drinks or uses water from a waterworks for human consumption.

“Distribution system” means a network of pipelines and appurtenances by which a waterworks delivers drinking water to its consumers.

“Finished water” means water that is introduced into the distribution system of a waterworks and is intended for consumption without further treatment.

“Health hazard” means any condition, device, or practice in a waterworks or its operation that creates, or may create, a danger to the health and well-being of the water consumer.

“Maximum contaminant level” or “MCL” means the maximum permissible level of a contaminant in pure water that is delivered to any user of a waterworks. MCLs are set as close to

EPA’s maximum contaminant level goals as feasible using the best available treatment technology. MCLs may be either “primary” (PMCL), meaning based on health considerations, or “secondary” (SMCL) meaning based on aesthetic considerations.

“Operator” means any individual with the requisite skills, employed or appointed by any owner, who is designated by the owner to be the person having full responsibility for the waterworks operations and any subordinate operating staff.

“Owner” means the entity that owns a waterworks, which in the context of this report represents the Rapidan Service Authority (RSA).

“Service connection” means the point of delivery of water to a consumer through the distribution system.

“Synthetic organic chemical” or “SOC” means a man-made organic compound, generally utilized for agriculture or industrial purposes. [Table 340.2](#) of the Waterworks Regulations (12VAC5-590) lists SOCs regulated as contaminants.

“Volatile organic chemical” or “VOC” means an organic compound generally characterized by its low molecular weight and its tendency to vaporize rapidly at relatively low temperatures and pressures. [Table 340.2](#) of the Waterworks Regulations (12VAC5-590) lists VOCs regulated as contaminants.

“Waterworks” means a system that serves piped water for human consumption to at least 15 service connections or 25 or more individuals for at least 60 days out of the year and includes all structures, equipment, and appurtenances used in the storage, collection, purification, treatment, and distribution of pure water except the piping and fixtures inside the building where such water is delivered.

## Executive Summary

On August 21, 2024, in conjunction with the Virginia Department of Health (VDH), Rapidan Service Authority (RSA), the owner of the Wilderness water treatment plant (WTP), issued a Do Not Use Water Advisory after receiving complaints of an odor associated with the drinking water. Customers were asked to only use the water for toilet flushing. Customers described the objectionable odor in various ways, including “WD-40,” “diesel,” “gasoline,” or a “mechanics shop.” RSA confirmed the objectionable odor was also evident at the WTP. VDH, the Virginia Department of Environmental Quality (DEQ), and the Virginia Department of Emergency Management (VDEM) began investigating the odor and collecting initial samples on August 21.

On August 24, 2024, RSA, with VDH support, changed the Do Not Use Water Advisory to a Do Not Drink Advisory, meaning that water could be used for all purposes other than consumption. At that time, all water sampling results showed that the drinking water complied with federal and state standards. No epidemiological impacts were observed from those with direct contact with the drinking water. VDH toxicology reviews did not indicate concern with skin contact based on the lab sampling results. While the objectionable odor lingered, there was no identified

regulatory violation necessitating that the Do Not Use Water Advisory remain in place at that time.

On August 27, RSA lifted the Do Not Drink Advisory with VDH support, which allowed customers to use the drinking water for all purposes. RSA lifted the advisory for three primary reasons. First, laboratory sampling data over multiple days demonstrated that the drinking water fully complied with federal and state drinking water standards. Second, VDH's daily inspections of the Wilderness WTP and distribution system confirmed that the objectionable odor in the drinking water was no longer present at the WTP and had sufficiently dissipated in the distribution system to no longer be a concern. Finally, VDH substantially completed its epidemiological investigation and found no evidence of any negative impact from exposure to the drinking water. Review by VDH's Office of Drinking Water's (ODW) subject matter experts, toxicologists, and U.S. EPA Region 3 did not find any reason to continue the advisory. RSA and VDH asked customers to flush water until the objectionable odor was no longer noticed.

The cause and source of the objectionable odor was not known when RSA lifted the advisory on August 27. At the direction of the Honorable Governor Glenn Youngkin and Secretary of Health and Human Resources Janet Kelly, VDH and DEQ continued their detailed investigation to find the cause and source of the odor. Agency staff investigated and considered several possibilities, including upstream and upslope pollution reports, nearby road paving activities, pesticide applications at a nearby golf course, construction at the WTP's intake, algal blooms, bacteria, stormwater, bad actor scenarios, and equipment failures. The state agencies held a crowdsourcing meeting with national and state experts and engaged with taste and odor experts in academia to make sure all possible causes and tests were considered and investigated.

DEQ performed a detailed source area investigation and source water sampling. Initial source area investigation included a review of reports of spills and releases, sanitary sewer overflow reports, paving activities in the adjacent neighborhoods, turf management at the golf course, and an erroneous delivery of fuel at a regional fueling station. DEQ obtained safety data sheets (SDSs) associated with several of these activities and compared the SDS chemicals to the analytical results received. None of these lines of inquiry led to any potential source from the Rapidan River. DEQ reviewed a list of the VPDES individual permits, hazardous waste generators, and Tier II reporting facilities that fall within the Rapidan River watershed above the water intake. DEQ reviewed NAICS codes, hazardous waste codes, and materials stored on site. DEQ never identified any potential source from the Rapidan River that required additional investigation. All potential sources were a significant distance upstream of the WTP's water intake.

DEQ and VDH collected water quality field data and surface water samples, and made visual and olfactory observations at the WTP, on the river immediately after the odor appeared in the WTP, and at the water distribution system. Neither DEQ nor VDH found evidence of a release from the Rapidan River. DEQ collected multiple rounds of source water area samples and there was no visual or olfactory evidence of a release from the Rapidan River into the WTP. DEQ staff stated that if the source of the odor were an illicit discharge to the river, the size or volume of the

discharge would have been significant - significant enough to travel down river and still be present in high enough concentration to impact the WTP and the distribution system. DEQ field teams never observed any evidence of such a discharge or release to the Rapidan River. Surface water sampling did not find any evidence of a release. DEQ determined that the source of the odor had to be much smaller and closer to, or within, the WTP to have the impact observed because there was no detectable cause in the source water.

From the investigation's start on August 21, 2024, state agencies had 98 total samples analyzed for over 2,357 individual analyte results. Analyses included 21 published analytical methods by certified laboratories and six research or pending publication methods. The state agencies informally coordinated or contracted with laboratories specializing in unknown contaminant identifications and taste and odor analysis. Two methods that were utilized are revisions to published methods or are pending publication. The agencies evaluated some samples with very sensitive tests, including high resolution scans, mass spectrometry, and chromatography tests.

Three chemicals not associated with disinfection by-products were found – isovanillin, Bis(2-chloroethyl) ether (BCEE) and benzaldehyde. The routine practice of the drinking water program is to confirm whether a contaminant is present by collecting confirmation samples and finding repeat detections. Two chemicals found in the drinking water, BCEE and benzaldehyde, were not confirmed through additional sampling. Only a single sampling event detected BCEE and this chemical would not have been associated with the odor. Benzaldehyde is used in the food industry and would not have been associated with the objectional odor. Isovanillin, an isomer of vanillin (which is used in the food industry) was a likely cause of the objectionable odor and found in multiple sampling events. Other unidentified hydrocarbons associated with the food grade mineral oil, which was either scorched, burned, or heated during the catastrophic pump failure on August 20, may have also contributed to the objectionable odor.

BCEE was found in finished water collected on August 21 during the Do Not Use Water Advisory. BCEE is a colorless, nonflammable liquid that is used as a solvent for some lacquers and oils, and as a chemical synthesis intermediate. The concentration found in water was very low, 13.7 µg/L, just above the detection limit of 10 µg/L. Someone who drank water containing this chemical at this concentration over a period of years could have an increased risk of cancer. However, this chemical is not regularly found in drinking water. Drinking water with this amount of BCEE over a period of days would not have harmed people's health. If people were exposed to BCEE at this concentration, it was likely for a very short time because this sample was taken the day the Do Not Use Water Advisory was issued and not observed again. The BCEE detection could have resulted from non-food grade mineral oil materials, such as wire coatings or metals, being scorched, heated, or burned when the intake pump catastrophically failed on August 20.

After extensive investigation and sampling, on September 13, 2024, VDH determined that a catastrophic failure of a raw water pump at the intake from the Rapidan River caused the objectionable odor. The catastrophic pump failure occurred on August 20, the day before customers noticed the objectionable odor. About two to three gallons of food grade mineral oil was released. The food grade mineral oil was likely thermally altered, burned, or scorched from

the catastrophic pump failure. A taste and odor (T&O) expert in Texas recreated the “WD-40” odor by heating a sample of the food grade mineral oil used in the submersible pumps at the WTP. The T&O expert followed the new *Standard Method* 2150D Attribute Rating Test to determine that the food grade mineral oil in the failed pumps matched the odor from water samples that VDH collected in the distribution system during the objectional odor event. The food grade mineral oil did not pose a threat to public health based on toxicology reviews, epidemiological monitoring, and sampling results.

## Background & Applicable Regulations and Law

The National Primary Drinking Water Regulations (40 CFR Part 141), the Public Water Supplies Law (Va. Code § 32.1-167), and the Waterworks Regulations (12VAC5-590) establish standards for drinking water quality, drinking water infrastructure, and oversight of the drinking water program. Problems with RSA’s drinking water infrastructure or oversight of the waterworks could result in an increased risk of contamination of drinking water with lead, copper, and other substances, organisms, or contaminants. Contamination of drinking water could have serious negative effects on health and well-being.

The Waterworks Regulations at [12VAC5-590-360](#) require RSA to “provide and maintain conditions throughout the” waterworks that will ensure “a high degree of capability and reliability to comply with Part II<sup>1</sup> ([12VAC5-590-340 et seq.](#)) of the Waterworks Regulations. RSA’s duty to ensure a high degree of capability and reliability extends to source water, transmission, treatment, storage, and distribution system facilities, and the operation of those facilities. Additionally, [12VAC5-590-360](#) requires RSA to:

- Identify and evaluate factors that could impair the quality of the water delivered to the consumers.
- Promptly implement preventative control measures to protect public health and prevent health hazards.
- Exercise control of the waterworks from the source water to the service connections. RSA must also exercise control of all buildings, structures, and equipment up to the point of the service connection to the waterworks. This requirement does not limit or modify ownership of or maintenance for the service line, that may be specified by local agreements and conditions.

The Waterworks Regulations at [12VAC5-590-480](#) state that water analyses and tests “at waterworks are conducted for four main purposes: (i) to ensure compliance; (ii) to control water treatment plant operation; (iii) to record water treatment plant performance; and (iv) to provide information for improving water treatment plant performance....” The finished product must be clean, free from objectionable taste and odor, and free from undesirable chemical characteristics, and is safe for human consumption.

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<sup>1</sup> Part II of the Waterworks Regulations regulates, among other things, compliance standards and bacteriological, chemical, and radiological monitoring and treatment requirements.

The Waterworks Regulations at [12VAC5-590-1040](#) require all electrical work to conform to the requirements of the state building code.

The Waterworks Regulations at [12VAC5-590-1050](#) require all pumps to be lubricated with water of equal or better quality than the water being pumped or with food grade oil. The Waterworks Regulations, at that same section, also require that water seals not be supplied with water of a lesser sanitary quality than that of the water being pumped.

RSA operates the WTP, a packaged surface water treatment plant<sup>2</sup> that draws water from the Rapidan River. RSA provides drinking water to a population of about 13,000 and has over 5,200 service connections. The WTP operates 14 to 18 hours per day, treating and delivering about 1.2 million gallons per day (MGD) to subdivisions, restaurants, businesses, medical facilities, and other industries. The WTP has several chemical feeds for treatment, including poly-aluminum chloride and sodium permanganate (pre-filter), caustic soda, chlorine, and fluoride (post-filtration).<sup>3</sup> The source water from the Rapidan River has a typical pH of 7.0 to 7.5; iron (Fe) of 0.40 to 0.60 mg/l; manganese (Mn) of 0.03 to 0.098 mg/l; alkalinity of 22 to 25 mg/l; hardness of 16 to 20 mg/l, and a routine turbidity of less than 10 nephelometric turbidity unit (NTU).<sup>4</sup>

## Oversight, Roles and Responsibilities

The Public Water Supplies law (PWSL) authorizes the Board of Health to supervise and control all water supplies and waterworks in the Commonwealth insofar as the bacteriological, chemical, radiological, and physical quality of waters furnished for human consumption may affect public health and welfare.<sup>5</sup> Enacted in 1950, the PWSL is broader than the Safe Drinking Water Act (SDWA) in that it authorizes VDH to regulate not just drinking water standards and treatment practices, but also waterworks construction, operation, and maintenance, permitting, enforcement, and receivership.

In addition to setting drinking water standards and treatment techniques, the SDWA also allows EPA to award states with primacy (i.e., primary responsibility for implementing the federal program). To maintain primacy, Virginia promulgated the Waterworks Regulations, which cannot be less stringent than the federal requirements. Through primacy, VDH oversees monitoring and reporting requirements, routine operations, plans for construction and modification, sanitary surveys, training and technical assistance, and enforcement of drinking water standards. VDH has been the primacy agency for the federal law and regulations since 1977.

If a waterworks violates a water quality standard or other requirement, then VDH's priority is to work with the waterworks to address the issue and return the waterworks to compliance. VDH

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<sup>2</sup> The water treatment plant contains pre-assembled, and factory tested, package systems for treatment processes.

<sup>3</sup> The chemicals used to treat the water are commonly used throughout the drinking water industry and are safe for human consumption.

<sup>4</sup> NTU is a unit of measure for turbidity and the presence of suspended solids in the water. Values less than 10 NTU are considered as having low turbidity.

<sup>5</sup> See Code of Virginia § 32.1-167, et seq.



issues notices of alleged violation to inform the waterworks of a regulatory requirement not met and what the waterworks must do to return to compliance. If the waterworks is either unwilling or unable to address the violation in a timely and appropriate manner, then enforcement may be necessary. Enforcement can include informal letters and meetings, or formal administrative orders requiring compliance actions. ODW's enforcement staff also works with ODW's Financial and Construction Assistance Program (FCAP) and Capacity Development to identify resources and provide technical, managerial and financial (TMF) capacity assistance to waterworks. ODW reports violations of federal regulatory standards to EPA. In turn, EPA's Enforcement Targeting Tool assists ODW in assessing the severity of ongoing regulatory violations based on the potential for harm to human health and the length of noncompliance.

In most cases, emergency responses are left up to the waterworks' owners and operators that are most familiar with the waterworks' design and operation, condition of infrastructure, system capabilities, and governing resources. VDH typically provides a supporting role by providing technical assistance, information to various entities and waterworks, and other compliance assistance as needed. Most emergency incidents involve water main breaks, equipment failures, pressure loss, or boil water advisories.

## Purpose of Investigation

At the direction of the Honorable Governor Glenn Youngkin and Secretary of Health and Human Resources Janet Kelly, VDH and DEQ were tasked to thoroughly examine all possible causes of the odor event that occurred with RSA's Wilderness WTP and to determine the cause and source of the objectionable odor.

## Detailed Summary of Investigatory Actions

VDH, in concert with other entities as described below, performed the following investigatory actions. During the incident response and investigation, staff from different agencies, and staff from different work specialties (e.g., epidemiology, toxicology, environmental sciences, engineering, operations, mechanical, emergency response, etc.) were communicating on varying topics of interest with different RSA staff, RSA contractors, and other customers and stakeholders. RSA had many separate communications and interactions with stakeholders, its customers, and its contractors. These multiple and varied conversations and interactions were happening every day. The different personnel and staff communicating on different days, or the same day, about similar topics or different subjects, creates an opportunity for delayed or unclear understanding at particular points in time by various persons involved with investigating this event. The detailed summary described herein is VDH's best understanding of events as VDH staff could discern through its investigation and questioning of various persons involved throughout the event. While every effort has been made to accurately and completely disclose what understanding was formed, and when that understanding became generally known among all parties, it is possible that certain persons at VDH, RSA, DEQ, or other stakeholders had a better or different understanding before or after the events and summary described in this report.

### Wednesday, August 21

- Around 2:30 p.m., officials from RSA contacted VDH ODW to alert them of a system shutdown due to multiple customer complaints of odor in the water. RSA confirmed the presence of an odor that has been described as having a petroleum or “WD-40” smell. RSA stopped distribution of the water and notified VDH of the issue.
- A multi-agency meeting was held at 5:00 p.m. to discuss how to start identification of the source of the smell as well as issuing a Do Not Use Water Advisory from RSA.
- Decision-makers agreed that the community needed fire protection and toilet flushing for sanitation, which resulted in RSA restarting the WTP to maintain water pressure in the distribution system.
- ODW contacted water facilities downstream of Wilderness WTP on the Rapidan and Rappahannock Rivers to inform them of the situation for observation and switching to alternate water sources.
- Noticeable odor was detected at the raw water intake wet well and the area located beside the raw water intake wet well.
- DEQ contacted Apex Companies, LLC, which is one of contractors on the State-Lead Contract, to support the odor investigation. Under the State Lead Program, DEQ retains one or more contractors through contract procurement procedures to perform emergency response activities as well as release investigation and corrective action at petroleum release sites. DEQ staff oversee work performed by State Lead contractors.
- At 8:00 p.m., personnel from ODW, DEQ, VDEM, and Apex were onsite to evaluate the smell and collect an initial round of samples.
- VDEM collected samples at two locations (the plant site wet well and pre-sedimentation basin) to perform a qualitative screening analysis to help with potential target analytes. The screening analysis returned a result of a possible hydrocarbon detection (benzene, phenol, and toluene).
- At the same time, Apex collected water samples from the plant site wet well, water treatment plant influent, and the finished water and submitted them to a VELAP-certified laboratory for volatile organic compounds (VOCs) (EPA Method 8260) and semi-volatile organic compounds (SVOCs) (Method 8270) analyses. The results were non-detect for all constituents, except for one constituent [bis (2-chloroethyl) ether at 13.7 µg/L] and for typical chlorination by-products, which were detected in the finished water sample entering the distribution system.
- At 8:24 p.m., the State Corporation Commission (SCC) deputy director of Pipeline Safety & Damage Prevention reported the following findings from an investigation of the Colonial Pipeline which crosses the Rapidan River five to seven miles upstream of the Wilderness intake.
  - As of 8:06 p.m., Colonial Pipeline Company has not found any leak indications.
  - Colonial Pipeline Company also found no indications of any contaminants consistent with refined petroleum product inside the water plant’s holding tank (per their environmental technicians).
  - Both pipelines are up and running at regular operating pressure.
  - No leak indications observed at operating pressure.
  - Colonial Pipeline demobilized from the site.

**Thursday, August 22**

- A 9:30 a.m. meeting between responding agencies, RSA, and Orange County officials was held and a sampling/data collection team was formed to set sampling priorities and locations.
- An 11:00 a.m. sampling/data collection team meeting was held, and sample collection and observation priorities were established – samples to be collected from the raw water, the entry point to the distribution system, and in the distribution system for VOC and SVOC analyses. A protocol of utilizing non-potable water analysis methods for all water collections below the finished water tap at the plant site was set. Samples from the distribution system entry point and in the distribution system would be run using certified drinking water analysis methods.
- RSA collected samples in the distribution system for VOC and SVOC analyses using drinking water methods and they were sent to a certified laboratory. These sample results were received on August 23 at 5:26 p.m. and showed VOCs consistent with disinfection by-products, which are expected in finished drinking water using chlorine disinfection. No contaminants that would cause the odor issue were identified.
- A map of the RSA service area was produced for tracking odor complaints and system flushing activities.
- DEQ's water quality monitoring staff visited three established monitoring stations located at bridges over the Rapidan River, including the Route 522 and Route 3 bridges, which are upstream of the RSA water intake, and the Route 610 bridge, which is downstream of the water intake. DEQ personnel collected field parameter data and made visual and olfactory observations. All observations and measurements were consistent with historical data, and no evidence of an oil or hazardous substance release was observed.
- DEQ spoke with the watershed manager for the City of Fredericksburg's police department. Police department officers floated and walked segments of the watershed from the City of Fredericksburg to above the RSA water intake. The officers did not observe any evidence of an oil or hazardous substance release.
- A 3:00 p.m. meeting was held where an Incident Management Team (IMT) was formed, and the sampling data/collection team was folded into the Unified Operation Section.
- Stafford County Utilities collected water samples around the area of their intakes (river and reservoir) on the Rappahannock River, within the Lake Mooney Reservoir, an outfall from the transfer station as well as the intake station.
- The Rappahannock-Rapidan Health District (RRHD) epidemiologist reviewed its routine monitoring system and found no issues that would be related to the objectionable odor event. The epidemiology team reached out to local hospitals for awareness and reporting of any potential symptomatic patients, but nothing was reported.
- DEQ began a source investigation, which included the following activities: investigating pollution reports in Orange County; reviewing historical Sanitary Sewer Overflow (SSO) reports; and inspecting nearby sites and activities, such as the golf course, the paving activities, and the on-site construction activities at the WTP intake. DEQ collected SDSs for products used in these nearby activities and compared chemical compounds to analyte lists. All lines of inquiries were explored, and no potential sources were identified.

### **Friday, August 23**

- At 8:30 a.m., the Operations Branch of the Unified Command (UC) met to discuss findings and set sampling objectives and observation activities for the day.
- ODW personnel visited the Wilderness WTP early in the morning for updates and assessment of the situation.
- Out of an abundance of caution and with the potential contaminant still unidentified, RRHD issued a swimming advisory for a portion of the Rapidan River.
- RSA observed that the odor was dissipating in the pre-sedimentation basin, but strong odor was still observed in the finished water. The flushing program continued, and filter backwash timelines were shortened.
- RSA personnel collected three additional samples, one at the distribution entry point and two in the distribution system. Samples were sent to the Department of General Services' Division of Consolidated Laboratory Services (DCLS) for analysis during weekend hours when the contract laboratory was closed. The testing of these samples was expedited, and results were reported by 10:30 p.m. The reported results continued to show only VOCs consistent with disinfection by-products from chlorination treatment.
- Apex collected three additional samples for VOC, SVOC, and Diesel Range Organics (DRO) analyses and sent them to the same laboratory. The samples were collected at the following locations: one sample in the Rapidan River upgradient of the water intake, one downgradient from the water intake at the intake for the Hunting Run Reservoir, and one in Wet Well #1 near the RSA intake at the Rapidan River. During sampling activities, Apex personnel made visual and olfactory observations of the river and noted no evidence of an oil or hazardous substance release. All results were received by 5:00 p.m. on August 27 and the results were not detected for all constituents at all three locations.
- DEQ interviewed the general contractor (GC) overseeing work being performed near the water intake. During the interview, the GC stated that recent on-site work was limited to the upgrade of the electrical service. Specifically, new electrical wiring was being run from a new building at the top of the hill, next to the wastewater treatment plant, to electrical boxes at the intake wet wells. The new electrical service was being run within PVC piping that was buried in a trench. DEQ requested SDSs for all products being used in the project, and the GC provided SDSs for the piping glue, fuel and hydraulic oil additives used in the heavy equipment. At no time did the GC indicate any unusual circumstances or events had occurred at the intake wet wells; the GC especially did not mention the pump failure on August 20.
- DEQ received SDSs for the pesticides used at the commercial golf course situated upstream of the WTP intake.
- Stafford County reported that sample results from initial VOC sampling came back with no detections.
- VDH epidemiologist interviewed five different families regarding concerns of illness and was working with four of the families to test urine for contaminants of concern.
- VDH environmental health staff visited all permitted facilities, including restaurants, and left notifications asking them to cease operations and answered any questions.
- DCLS provided test kits to RSA officials to be collected by VDH Epidemiology personnel as needed, while samples were delivered by RSA to the laboratory in Richmond, VA.

- A 5:00 p.m. Operations Branch meeting was held to discuss findings and establish activities for the weekend. Email coordination of the Operations Branch was decided upon while Operations leads would be communicating in the UC meetings.
- When initial SVOC results were received at 5:30 p.m., a VDH toxicologist was assigned to complete a toxicological review for the disinfection by-product VOCs and the Bis (2-chloroethyl) ether to determine the potential for these products to cause the odor and the potential health effects of consuming the product at that concentration.

### **Saturday, August 24**

- ODW staff reviewed SDSs for construction materials, pesticides, and herbicides used on the Wilderness WTP site and upstream businesses and recreational areas. ODW did not identify compounds used in sufficient quantities of concern but consulted with DCLS on a test plan to rule out these sources. DCLS planned to ship test kits on Monday, August 26, for these analyses.
- The VDH toxicologist supplied a report on the chemicals, which indicated no concerns for acute health risks.
- At 11:00 a.m., ODW and RSA staff, along with Orange County officials, reviewed operational reports and test reports, and received a verbal report of plant site conditions and operations. RSA reported a lessening of the odor in the treatment plant and only a slight odor in the water leaving the plant.
- ODW consulted with DCLS on utilizing a laboratory department that has equipment and expertise to identify unknowns in a variety of matrices. A test plan was discussed, and sample collection was scheduled during an ODW inspection on Sunday, August 25.
- RSA reported an increase in community water usage based on wastewater volume and difficulty in filling tanks sufficiently overnight.
- In the absence of a contaminant of concern and with no volatile compounds detected in any of the treatment process or distribution system and a continued dissipation of the odor in the treatment process, ODW supported RSA's request to replace the Do Not Use Water Advisory with a Do Not Drink Water Advisory.
- Later that day, after RSA planned to change the Do Not Use advisory to a Do Not Drink advisory, RSA reported to VDH that two raw water intake wet well pumps had failed. RSA stated that RSA would need to delay a change in the advisory to ensure adequate water flow to meet customer water demand. RSA would have a contractor bring and put online a new emergency pump directly to the Rapidan River. RSA also told VDH that a contractor would pull the failed pumps for repair.
- At 10:00 p.m., with a temporary raw water intake pump solution implemented, RSA, with support from VDH, changed from a Do Not Use Water Advisory to a Do Not Drink Water Advisory, and an inspection was scheduled by VDH staff for 10:00 a.m. the next day.
- RSA's contractor pulled Pumps #2 and #3 for repairs. The contractor did not report the presence of any mineral oil.

### **Sunday, August 25**

- Multiple ODW personnel performed an inspection of the plant facility and distribution system to assess odor. ODW reviewed operations records and collected samples for High Resolution Mass Spectral Analysis using gas and liquid chromatography from the DCLS laboratory.
- ODW staff noted continued but lessened detection of the odor in the water treatment facility as well as the distribution system.
- ODW staff performed taste assessments by swishing the water in their mouths and spitting it out. ODW personnel detected a taste in the water at all locations of the distribution system where the test was performed.
- ODW provided some operational recommendations to RSA to try and rectify the lingering odor (see Attachment 1). Water demand would dictate the ability to fully execute those recommendations.
- ODW held a meeting at 2:45 p.m. with RSA staff to review the inspection. ODW indicated it would not recommend a change in the advisory status at that time and scheduled an additional inspection for the next day.
- ODW personnel delivered water samples that night to DCLS in Richmond to begin analyses first thing the next morning.
- RRHD lifted the swimming advisory for portions of the Rapidan River.

### **Monday, August 26**

- DEQ reached out to subject matter experts in the water and wastewater treatment field and requested assistance with investigating the potential sources of odor in source water and/or in the treatment plant process, including researchers at Virginia universities and their partners. DEQ received and shared the recommendations with RSA, VDH, and DCLS for follow up, including recommendations on potential sources of the odor such as bacterial and other odor-causing chemical compounds.
- An Operations Branch meeting was held at 1:00 p.m. with a UC meeting held at 2:30 p.m. Updates from operations members included:
  - RSA – no detection of odors on the plant site; ODW to visit today.
  - RSA – collecting information on customer complaints to investigate.
  - Spotsylvania County – collected VOCs (8260) and SVOCs (8270) at their Rappahannock River intake and delivered samples to the lab. Expect results on Wednesday, August 28.
  - RRHD – recreational water advisory lifted; posted signs removed yesterday.
  - RRHD – preparing to visit permitted facilities when advisory is lifted.
  - VDH epidemiologist – working with a handful of parents to get children tested; most likely existing conditions and not water-related due to symptoms or onset.
  - VDH epidemiologist – some reports of rashes to be investigated.
- Multiple ODW personnel performed another inspection of the facility and distribution system. The odor in the water leaving the facility had reduced in intensity and was barely noticeable. The water in the distribution system continued to have a detectable taste and odor although it had reduced in intensity from Sunday.
- A meeting was held with ODW, RSA, and Orange County staff to discuss findings and recommendations. VDH did not recommend lifting the Do Not Drink Water Advisory. RSA was in a position from a water production standpoint to implement some

recommendations to help remove odor and implemented those procedures, such as continued distribution flushing and meeting with customers to help remove odor reports.

- An inspection was scheduled for the next day at 8:00 a.m. to assess the plant and distribution system again.
- VOC results from two locations at the Rapidan and Wilderness intakes collected on August 23 came back with no detections. SVOC and DRO results were expected the next day.
- In response to DEQ's outreach, Virginia Tech connected DEQ, and subsequently VDH, to a water utility director in Wichita Falls, Texas, who is a nationally recognized researcher in taste and odor compounds. The researcher offered to provide support in the way of analysis of samples from the source water area and the WTP.
- RSA pulled Pump #2 for repairs.

### **Tuesday, August 27**

- Verbal results from DCLS on the high-resolution mass spectrometry analysis returned no contaminants of concern identified.
- Multiple ODW personnel inspected the water treatment facility and distribution system. No detectable odors were identified at the facility and taste and odor concerns were only noted at two distribution locations in areas that had not been used or flushed since the Do Not Use Water Advisory was enacted.
- RSA staff performed field analysis for cyanobacteria toxins, which were not detected.
- During a meeting between ODW, RSA, and Orange County staff following the inspection, it was determined that ODW staff would support the lifting of the Do Not Drink Water Advisory while continuing activities to locate the source and identity of the odor. RSA lifted the Do Not Drink Water Advisory at 11:15 a.m.
- ODW personnel collected additional samples at non-residential locations that might not have had much water use since near the beginning of the event. The purpose of this effort was to capture samples of water where the odor was still prevalent to aid in future identification of the contaminant.
- ODW personnel collected samples to be shipped to a researcher in Texas for a more targeted screening of taste and odor compounds that can be detected at much lower detection levels.

### **Wednesday, August 28**

- ODW personnel shipped samples for analysis of carbamates, herbicides, VOCs and SVOCs collected from the raw water wet wells and the distribution system entry point to DCLS for analyses.
- ODW overnighted samples to the researcher in Texas who is a taste and odor specialist for analysis. ODW researched previous and current events of waterworks odor investigations and began outreach to those localities for additional information.
- Spotsylvania County received analysis reports from their intake sampling conducted on August 26. All sample results were below the detection limit. Based on those results, Spotsylvania County resumed drawing water from their Rappahannock River intake.
- Analysis reports for the DCLS High Resolution Mass Spectroscopy lab were received.

- VDH, DEQ, and VDEM personnel held a coordination meeting at 3:00 p.m. to set a direction for continued investigation of the source of the odor. An investigatory approach was established and VDH ODW was established as the lead on the continued investigation.
- ODW held a coordination call with RSA staff for continued engagement with operational conditions.

### **Thursday, August 29**

- ODW scheduled a meeting for September 3 between subject matter experts in the field of water treatment and environmental engineering to review actions and solicit ideas for continued investigatory processes.
- ODW and DEQ reviewed the actions taken to date and potential areas for follow-up and investigation.
- ODW requested additional test kits from DCLS for routine drinking water quality parameters not associated with odor.
- ODW personnel visited the facility for continued follow-up and operational review. ODW personnel also coordinated with RSA management on continued investigatory responses.
- DEQ submitted a request to DEQ's EPCRA Program to generate a Tier II report that contains all facilities located in Orange, Madison, and Culpeper Counties. The report was filtered for facilities within the Rapidan watershed above the WTP intake and was reviewed for BCEE and other odor causing chemical compounds.

### **Friday, August 30**

- Preliminary results from an odorant screening analysis received on August 29 identified two chemicals that could have contributed to the cause of the odor. These chemicals were identified as Isovanillin and TPIB (2,2,4-Trimethyl-1,3-pentanediol diisobutyrate). The concentration of each compound was unknown, but later determined to be a false positive from lab equipment. Analysis of existing samples and additional sampling will occur to confirm findings and try to establish concentration levels. VDH is consulting with US EPA, researchers, DEQ, and toxicology staff. ODW also completed another inspection of plant operations. Based on VDH's review and consultations, the drinking water can be used for all uses. Additional information on these chemicals, including toxicological information, can be found in the sample results/chemical fact sheets tab of the [VDH incident web page](#). VDH and DEQ will continue to investigate the source and cause of the odor. VDH will provide additional information as it becomes available.

### **Tuesday, September 3**

- ODW convened a facilitated (“crowdsource”) discussion in the morning between experts in the field of water treatment, water treatment professional organizations, waterworks leaders, the EPA, and state agencies involved in the investigation, to assess current information and crowdsource avenues for investigation that might not have been



addressed to date. Some areas for investigation were suggested and ODW staff committed to follow up on those suggestions.

- ODW and RSA staff had two conversations before the crowdsource meeting to discuss current operations and the raw water intake pumps. Tim Clemons, General Manager for RSA, stated that he did not have sufficient information to show that any pump failure would be the cause of the objectionable odor event.
- ODW collected unused sample volume from initial VOC analysis from the contract laboratory that performed the testing and shipped those samples to the Texas laboratory performing low level taste and odor analysis.
- The Texas laboratory sent information that indicated the preliminary identification of TPIB (2,2,4-Trimethyl-1,3-pentanediol diisobutyrate) was not confirmed and thought to be a potential false positive or laboratory contaminant.
- ODW staff called manufacturers of chemicals used in water treatment to obtain lists of chemicals listed as trade secrets on SDSs.

#### **Wednesday, September 4**

- Tim Clemons, General Manager for RSA, reported in an email to VDH that a catastrophic pump failure occurred on August 20.
- ODW and DEQ held multiple coordination meetings to discuss findings from activities and plan for future inquiries, especially with respect to the pump failures.
- ODW received information related to chemical components of materials used in water treatment equipment from chemical manufacturers.
- ODW coordinated with RSA on scheduling an assessment of the facility this week.
- RSA provided information about food grade lubricants used in some of the WTP equipment.
- DEQ completed a field investigation of a small sheen that was reported on the ground surface near the WTP, but not at or inside the WTP. DEQ staff reported iron bacteria as the cause of the sheen. DEQ determined this natural event would not be associated with the cause of the odor event.
- DEQ's Water Quality Monitoring & Assessment Program (WQM&A) conducted a focused sampling event of the source water area to determine whether any odor-causing chemical compounds could be identified in surface water samples. DEQ's WQM&A staff also collected samples at the water intake, plant site wet well, and the finished water. The samples were shipped to DCLS for VOC and SVOC analyses and samples were shipped to the researcher in Texas.

#### **Thursday, September 5**

- The taste and odor expert preliminarily identified a new chemical, benzaldehyde, that appears to be present in the drinking water from the samples submitted the prior week. All samples that contained the compound were in the post-treatment and distribution system and the odor could be detected in water prior to these sampling points. The expert is working with professors at Virginia Tech and Texas Tech to determine whether there might have been a chemical reaction during plant operations of a precursor chemical to form benzaldehyde.

- ODW reached out to a distributor and service technician for the RSA raw water pumps to get additional information related to pump issues experienced at the plant. A follow-up meeting is scheduled for September 6.
- ODW reached out to the chemical manufacturer of a food grade lubricant installed in raw water pumps to see if they contained isovanillin and benzaldehyde. The manufacturer is researching all hydrocarbons and additives and will report back.
- ODW consulted with a microbiological laboratory to determine potential testing that would identify a microbiological source of the odor. The laboratory determined it was unlikely that this event would come from a biological source given the facts of the investigation and recommended further organic chemical analysis. The laboratory also recommended a forensic materials scientist that could potentially link the scans already taken to a source material if it were identified depending on what the source was.
- ODW conducted a Level 2 assessment prompted by a repeat total coliform positive sampling event.

### **Friday, September 6**

- ODW issued an updated Source Water Assessment Report for the WTP's Rapidan River intake. This report identifies potential sources of contamination in the watershed upstream of the drinking water intake, which will aid in the ongoing investigation.
- ODW and DEQ met with the owner of the pump distributor and service technician for the RSA raw water pumps to get an understanding of the cause of the pump failures. The owner explained the pump failure was the result of replacing older pumps with higher horsepower pumps but not updating the electrical specifications to handle the additional load. The owner also provided a detailed description of the condition of the pumps when they were received. He noted that the pumps had experienced a significant thermal overheating event, which resulted in significant damage to the pump windings and a scorching of the mineral oil contained in the pumps.
- After that meeting, RSA provided a timeline of the pump electrical issues.
- ODW obtained additional information about the food-grade mineral oil used in the raw water pumps and is seeking information about wire coatings in the pump wire stators that had electrical issues. No identified compounds were components of the oil.
- DCLS supplied analysis results for herbicide, pesticide, VOC, and SVOC sample analyses. No chemicals of concern were identified, and results were added to the VDH incident webpage.
- An additional sample collection from intake wet wells, which had been isolated since the second pump failure on August 24, was scheduled for Monday, September 9.
- DEQ coordinated sample analysis with the Texas lab for samples collected from the September 5 sampling event.
- ODW conducted a Level 2 assessment prompted by a repeat total coliform positive sampling event.

### **Monday, September 9**

- ODW, DEQ, and Apex inspected raw water pump intake Wet Wells #1 and #2 and collected samples from water that has been valved off and stagnant since two pump

failures on August 24. The samples were sent to a VELAP-certified private laboratory and the Texas taste and odor specialist. The equipment that was used for sampling was noted to have been coated by a substance likely to be mineral oil from the failed pumps.

### **Tuesday, September 10**

- ODW continued investigating the contents and materials in the raw water pumps including the mineral oil lubricant, wire stator varnishes, and other internal components that might have caused the detections of isovanillin, benzaldehyde, and BCEE. The motor varnish manufacturer thought it plausible that the chemicals identified could be a by-product of heated mineral oil alkanes but thought it would be difficult to recreate that situation for analysis.
- ODW provided an update of the investigation to the Orange County Board of Supervisors, including a timeline for reaching conclusions in the investigation into the cause and source of the odor.

### **Wednesday, September 11**

- ODW received preliminary results from the taste and odor specialist in Texas that samples submitted from collections of Wet Wells #1 and #2 sampled on September 9 contained isovanillin but no traces of benzaldehyde. The specialist was going to analyze samples specifically for those compounds mass spectra to better quantify the results. The isovanillin was also detected in samples submitted from the DEQ survey conducted on September 4. Further analysis of the samples will be necessary due to these findings.
- VDH and DEQ personnel joined members of the Secretary of Health and Human Resources and the Secretary of Natural and Historic Resources' offices in an investigation status briefing with Senator Reeves and Delegate Scott's offices. All resource needs are met. Staff continue to investigate questions and concerns raised throughout the event. As of last week, RSA reports that they are no longer receiving complaints about odor. All parties continue to closely monitor and engage in response and investigation activities pursuant to the Governor's direction and leadership. All available effort continues to be applied to determine the source and cause of this incident and to leave no stone unturned to prevent this type of event from occurring in the future. Actions taken in the investigation thus far and a timeline of completion of investigatory events were shared.

### **Thursday, September 12**

- A sample of the mineral oil used in the raw water intake pumps was procured and shipped overnight to the taste and odor specialist in Texas to perform comparative analysis as well as some material science testing attempting to recreate some of the conditions the oil experienced during pump failures. ODW, DEQ, and the odor specialist reviewed sampling results and discussed what could be understood from the data.
- ODW received sampling reports from the VELAP-certified private laboratory for samples collected on September 9 from raw water intake Wet Wells #1 and #2 that experienced two catastrophic pump failures on August 24 and had been isolated since

that time (see detailed timeline associated with the pump failures for more details). These samples showed no detections for VOCs or SVOCs but did show detections of Total Petroleum Hydrocarbons Diesel Range Organics (TPH DRO) at a concentration of 0.603 mg/L in Wet Well #1 and 1.06 mg/L in Wet Well #2. TPH ORO were also detected in Wet Well #2 at a concentration of 1.5 mg/L. Total Petroleum Hydrocarbons is a term used for any mixture of hydrocarbons found in oils. Since oils are made up of many compounds, analytical tests scan hydrocarbons in a range based on the amount of carbon atoms present. TPH DRO analyzes hydrocarbons in the C10 – C28 range. This means the result is the total amount of compounds containing a minimum of 10 carbon atoms to compounds containing a maximum of 28 carbon atoms. TPH ORO scans from the C20 – C35 range. Mineral oils such as the ones used in the failed raw water intake pumps that were in the wells that were sampled typically contain hydrocarbons in the C15 – C50 range. These results, along with the field observation of a mineral oil-like substance on sampling equipment, makes the failed pumps a possible cause of the oil detected in the wells. Investigation will continue to link the odor to contents of the failed pumps.

- RSA scheduled a contractor to pump the remaining liquid out of the isolated raw water intake wells on September 13. ODW and DEQ were present to record observations from the emptied wells. RSA will clean the wells before reinstalling the repaired pumps.
- ODW issued a Notice of Alleged Violation to RSA for apparent violations of the PMCL for haloacetic acids.

### **Friday, September 13**

- The T&O expert in Texas confirmed that heated mineral oil, received directly from the pump repair business, and like the mineral oil used in the catastrophic pump failures, produced a “WD-40” odor identical to the odor observed in the drinking water samples.
- The T&O expert had a high level of confidence that the odor event was directly related to the mineral oil release on August 20.

### **Tuesday, September 17**

- ODW completed a Level 2 Assessment of the Wilderness water system and transmitted the results of the Assessment to RSA.

Level 1 and Level 2 Assessments are evaluations intended to identify the possible presence of sanitary defects and defects in distribution system coliform monitoring practices and are triggered by detection of coliform bacteria during routine monitoring of the waterworks distribution system. Waterworks owners typically conduct Level 1 Assessments on their own, while ODW conducts all Level 2 Assessments. ODW conducted a Level 2 Assessment of the Wilderness water system on September 5-6, 2024. ODW did not identify any sanitary defects or defects in coliform monitoring practices because of the assessment. ODW staff believes that high-velocity flushing associated with the recent odor event resulted in the release of built-up sediment in distribution system lines and abnormally high turnover of water in storage tanks, which likely contributed to the total coliform positive samples collected in August. Beginning in September, water demand has returned to more typical levels, and RSA will continue

routine bacteriological monitoring to verify that coliform bacteria is no longer present in the waterworks distribution system.

RSA conducts routine monthly bacteriological surveillance monitoring and triggered a Level 1 Assessment because they had more than one total coliform (TC) positive sample during the month of June 2024 ([12VAC5-590-392 B 1 b](#)). Two out of fifteen routine bacteriological samples were total coliform (TC) positive in June. One of the three repeat samples was also TC positive for each of the associated routine positive samples. All samples were E. coli (EC) negative. The Level 1 Assessment was due on July 7, 2024, but RSA did not complete it until July 10, 2024, so ODW issued an NOAV on July 19, 2024. RSA's Level 1 Assessment did not identify a likely cause of the TC positive samples.

RSA triggered a second Level 1 Assessment during the month of August 2024, and when there are two Level 1 Assessments triggered within a rolling 12-month period with no identified cause, a Level 2 Assessment is triggered ([12VAC5-590-392 B 2 b](#)). One out of fifteen routine bacteriological samples were TC positive in August, and one of the three associated repeat samples was also TC positive. All samples were EC negative. The TC positive samples were collected on August 28 and August 29, which were the days following the lifting of the Do Not Drink Water Advisory associated with the recent odor event.

### **Friday, September 20**

- RSA drained the two intake/wet wells where the submersible pumps catastrophically failed. Since August 24, RSA has been pumping directly from the Rapidan River with emergency pumping.
- The “WD-40” odor persists in those wet well chambers. During ODW’s inspection, staff observed a “metallic” appearance as a wall coating, which staff thought was most likely the food grade mineral oil. ODW asked RSA to remediate and remove the mineral oil and odor in the sediment and on surfaces. ODW provided remediation contractor contact information to RSA.
- RSA informed ODW in a meeting that it had determined that the temporary wiring serving the pumps was undersized, starving the pumps for current, and that this was the cause of the pump failures. RSA also advised that the general contractor has worked with the project engineer on the design for an upgrade of the temporary wiring, and an electrical contractor will be used for the work with the work checked and inspected by an independent electrical contractor who is very familiar with large construction projects.
- ODW staff inspected the raw water intake wet wells and observed residual odor and what looked to be mineral oil residue coating some of the walls and equipment surfaces in the well. ODW requested the wells be cleaned out prior to being returned to service and provided a contractor recommendation received by DEQ for the work which will require confined space certification.
- During the pump-out of the wet wells that occurred on September 13, ODW staff observed groundwater intrusion in the wet well that houses two pumps. While this issue

is not related to the odor event, and could be addressed at a later time, there is opportunity to complete repairs now since the wet wells are already being bypassed. RSA indicated support for this work, but that it would be a significant project requiring excavation around the wet wells, and therefore would need to be planned for a later time. In the meantime, ODW recommended that RSA evaluate whether a temporary fix, using a product such as hydraulic cement internal to the wet wells, would be worthwhile.

## Sampling performed

### Wilderness WTP Odor Investigation Sampling Analysis Summary 8/21/24 – 9/9/24

#### Total Event Sampling Data

- 98 total samples analyzed for over 2,357 individual analyte results reported since August 21 with some additional results pending.
- Analyses performed using 21 published analytical methods by certified laboratories.
- 6 research or pending publication methods were utilized by laboratories specializing in unknown identifications and taste and odor analysis. Two of these methods are revisions to published methods or are pending publication.

#### Sampling and Analysis Breakdown

##### 8/21/24

- DEQ contractor Apex collected 3 VOC/SVOC samples at the following locations:
  - Water Treatment Plant intake – No detections
  - Plant site pre-sedimentation basin wet well – No detections
  - Facility Entry point to the distribution system – Disinfection By-products (DBPs) detected (expected); **BCEE detected**

##### 8/22/24

- RSA collected 3 VOC samples at the following locations:
  - Entry Point to the distribution system – DBPs detected (expected)
  - Distribution System Lake Tank – DBPs detected (expected)
  - Distribution System School Tank – DBPs detected (expected)
- DEQ performed observational and WQP field tests (pH, Temp, Conductivity, Dissolved Oxygen) at 3 locations upstream and downstream of Wilderness Intake
  - Rapidan River @ Rt. 10 – observations and field tests normal
  - Rapidan River @ Rt. 3 – observations and field tests normal
  - Rapidan River @ Rt. 522 – observations and field tests normal
- Stafford County collected 3 Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) samples at the following locations:
  - River Intake – No BTEX detections
  - Plant Intake – No BTEX detections
  - Outfall – No BTEX detections

##### 8/23/24

- RSA collected 3 VOC/SVOC samples at the following locations:

- Entry Point to the distribution system – DBPs detected (expected)
- Distribution System Lake Tank – DBPs detected (expected)
- Distribution System School Tank – DBPs detected (expected)
- Apex collected 3 VOC/SVOC/DRO samples at the following locations:
  - Rapidan WTP Surface Water Intake – No detections
  - Plant site pre-sedimentation basin wet well – No detections
  - Hunting Run Reservoir Surface Water Intake – No detections

8/25/24

- ODW collected 2 samples for Gas and Liquid chromatography Mass Spectral Scans at the following locations:
  - Raw water sampling tap – No hazardous chemicals detected
  - Finished Water sampling tap – No hazardous chemicals detected

8/26/24

- Spotsylvania County collected VOC/SVOC samples at the following locations:
  - Motts Rappahannock Intake – No detections

8/27/24

- ODW collected 2 samples each for carbamate, herbicide, VOC, and SVOC analyses at the following locations:
  - Raw water sampling tap – No carbamates, herbicides, VOCs, or SVOCs detected
  - Finished water sampling tap – No carbamates, herbicides, or SVOCs detected. DBPs detected (expected)
- ODW collected 2 samples for Taste and Odor analysis at the following locations:
  - Restaurant on distribution system: No detections for methods 20 listed odorants: Scans showed **Isovanillin, benzaldehyde, and TPIB detections (TPIB later confirmed as lab contaminant); benzaldehyde detected**
  - Raw water pump station intake wet well: No detections for methods 20 listed odorants: Scans showed **Isovanillin and TPIB detections (TPIB later confirmed as lab contaminant)**

9/3/24

- ODW shipped samples collected 8/21/24 and 8/23/24 for Taste and Odor analysis from the following locations:
  - Water Treatment plant Intake – **Isovanillin detected**
  - Plant site wet well – **Isovanillin detected**
  - Facility Entry point to the distribution system – **Isovanillin detected**
  - Rapidan WTP Surface Water Intake – **Isovanillin detected**
  - Plant site wet well – **Isovanillin detected**
  - Hunting Run Reservoir Surface Water Intake – **Isovanillin detected**

9/4/24

- DEQ collected 12 samples for Taste and Odor analysis, Chlorinated hydrocarbons, and Petroleum ID in water at the following locations:
  - WTP intake well at Rapidan River – **Isovanillin detected**
  - Equipment blank – **Isovanillin detected**

- Intake at Rapidan River – **Isovanillin detected**
- WTP pre-sedimentation well next to sedimentation basin – **Isovanillin detected**
- WTP finished water – **Isovanillin detected**
- Rapidan River – **Isovanillin detected**
- Rapidan River – **Isovanillin detected**
- Rapidan River – **Isovanillin detected**
- Rapidan River – **Isovanillin detected**
- Rapidan River – **Isovanillin detected**

9/9/24

- DEQ collected 2 samples for VOC, SVOC, TPH DRO, and TPH ORO and Taste and Odor analyses from the following locations:
  - Raw Water Intake Wet Well #2 – **TPH DRO detected at 0.603 mg/L; Isovanillin detected**
  - Raw Water Intake Wet Well #3 – **TPH DRO detected at 1.06 mg/L; TPH ORO detected at 1.5 mg/L; Isovanillin detected**
- ODW collected 2 samples for Fumigant and Metals analysis at the following locations:
  - Raw Water Intake Wet Well #2 – no detects
  - Raw Water Intake Wet Well #3 – no detects

9/11/24

- ODW procured a sample of the food grade mineral oil lubricant and sent it for taste and odor analysis. **The taste and odor specialist was able to recreate the odorant observed in the submitted water samples from the event and a heated food grade mineral oil sample typically used in the pumps. The T&O expert confirmed the same odor between the water samples collected during the event and the heated food grade mineral oil using a soon to be published revision of Standard Method 2150 D Attribute Rating Test.**

## Observations and Findings

Pursuant to [12VAC5-590-1050](#), pumps shall be lubricated with water of equal or better quality than the water being pumped or with food grade oil. The phrase, “food grade oil” is not specifically defined in the Waterworks Regulations and is not used in the National Primary Drinking Water Regulations.

The Ten States Standards (2022)<sup>6</sup> states, in part at 3.2.7.1., “Line shaft pumps shall: ...c) Be water lubricated. If oil lubricated pumps are allowed, food grade lubricant shall be used.” The Ten States Standards does not define the term “food grade.” According to an article in [Lab Manager](#), there are several grades of chemicals or raw materials.

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<sup>6</sup> The Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers in 1950 created a Water Supply Committee consisting of one associate from each state represented on the Board. A representative from the Province of Ontario was added in 1978. The Committee was assigned the responsibility for reviewing existing water works practices, policies, and procedures, and reporting its findings to the Board. The report of the Water Supply Committee was first published in 1953 and revised in 2022.



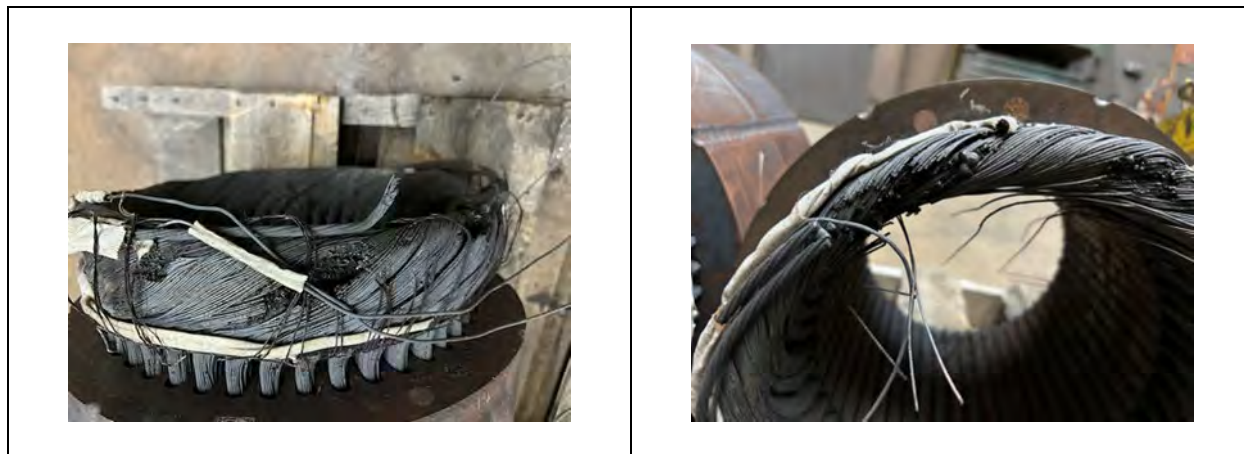
1. ACS grade meets or exceeds purity standards set by the American Chemical Society (ACS). This grade is acceptable for food, drug, or medicinal use and can be used for ACS applications or for general procedures that require stringent quality specifications and a purity of  $\geq 95\%$ .
2. Reagent grade is generally equal to ACS grade ( $\geq 95\%$ ) and is acceptable for food, drug, or medicinal use and is suitable for use in many laboratory and analytical applications.
3. USP grade meets or exceeds requirements of the United States Pharmacopeia (USP). This grade is acceptable for food, drug, or medicinal use. It is also used for most laboratory purposes, but the USP being followed should always be reviewed prior to beginning to ensure the grade is appropriate for that methodology.
4. NF grade meets or exceeds requirements of the National Formulary (NF). The USP and the NF (USP–NF) jointly publish a book of public pharmacopeial standards for chemical and biological drug substances, dosage forms, compounded preparations, excipients, medical devices, and dietary supplements. The listings here should be reviewed to determine which would be considered equivalent grades.
5. Laboratory grade is the most popular grade for use in educational applications, but its exact levels of impurities are unknown. While excellent for teaching and training, it is not pure enough to be offered for food, drug, or medicinal use of any kind.
6. Purified grade, also called pure or practical grade, meets no official standard; it is not pure enough to be offered for food, drug, or medicinal use of any kind.
7. Technical grade is used for commercial and industrial purposes; however, like many others, it is not pure enough to be offered for food, drug, or medicinal use of any kind.

Two types of standards, National Formulary (NF) and the United States Pharmacopeia (USP), provide the industry standards for drugs, dosages, chemicals, preparations, and so on. For a product to have an NF Grade, the product must meet all the requirements as per the NF monograph (single study) for that product. If no study has been made for that product by the NF, the product cannot be labeled as NF Grade. For a product to have a USP Grade, the product must meet the requirements as per the USP monograph. Again, if no study has been made for that product by the USP, the product cannot be labeled as USP Grade. Exclusion from the USP-NF does not necessarily indicate that a product is unsuitable for any purpose, only that enough research has not yet been conducted to confirm its suitability and safety. However, for assurance of safety and suitability, it is recommended to use products that do have USP-NF grades. If the oil meets one or more of the standards above noted as acceptable for food, it could be considered “food grade”.

ODW staff researched the mineral oil used in the pumps at the WTP and determined that it complied with food grade oil and complied with NSF certification.

The first intake pump failed on August 20, the day before customers started to report the objectionable odor. ODW and DEQ staff interviewed the pump mechanic who repaired all three intake pumps on September 6. The mechanic stated that he has worked as a pump mechanic for 40 years and had never witnessed such a catastrophic failure before. He stated that two to three gallons of mineral oil were lost. He provided pictures of the internal stator of the pump, which

showed that internal components were scorched, burned, or heated. Pictures of the stator show black and gray wiring from wiring being heated.



DEQ's contractors took samples from both raw water wet wells at the intake. Contractors and VDH staff observed mineral oil on its sampling equipment. The mineral oil did not have a specific odor. Laboratory sampling found the following:

**Total Petroleum Hydrocarbons Diesel Range Organics (TPH DRO) –  
0.603 mg/L (Intake / Wet Well #1) & 1.06 mg/L (Intake / Wet Well #2)**

Total Petroleum Hydrocarbons is a term used for any mixture of hydrocarbons found in oils. Since oils are made up of many compounds, analytical tests scan hydrocarbons in a range based on the amount of carbon atoms present. TPH DRO analyzes hydrocarbons in the C10 – C28 range, which means the result is the total amount of compounds containing a minimum of 10 carbon atoms to compounds containing a maximum of 28 carbon atoms.

**Total Petroleum Hydrocarbons Oil Range Organics (TPH ORO) –  
1.50 mg/L (Intake / Wet Well #2)**

TPH ORO scans from the C20 – C35 range. Mineral oil, such as the fluid used in the failed raw water intake pumps, typically contain hydrocarbons in the C15 – C50 range.

J. Hunter Adams, T&O expert in Wichita Falls, Texas, spiked two water samples with the mineral oil. One sample was 200 mL deionized (DI) water with 1 mL oil, and the other was 200 mL of tap water with 1 mL oil. Adams also pulled the two Locust Grove McDonald's tap water samples (one preserved and one unpreserved) out of the refrigerator and poured 200 mL samples from each. His team heated them to 95° C and compared the odors. Adams reported that everyone in the lab agreed that the odor was the same. Adams mixed the samples up and his Lab Supervisor could not tell the difference in which samples were spiked and which were from the Locust Grove McDonald's.

This type of test essentially followed the new *Standard Method* 2150D Attribute Rating Test, where Adams made a known standard and compared unknowns to determine if the odor matched and if it was stronger or weaker. SM 2150D is expected to be published by the end of 2024.

Adams also reported that the mineral oil-spiked samples, heated at 95° C inside a fume hood, released a “WD-40” odor and made his entire lab smell faintly like WD-40.

The following observations point to the catastrophic pump failure in the raw water intake wet well on August 20 as the cause of the objectionable odor event:

1. The timing of the catastrophic pump failure the day before 2-3 gallons of food grade mineral oil was released into the raw water intake wet well;
2. The laboratory finding hydrocarbon-based components of the mineral oil in the raw water intake wet wells;
3. The observation of chemicals such as benzaldehyde and isovanillin (an isomer of vanillin) in the water, which are used in the food industry;
4. The observation of an odor and “metallic” sheen in the wet wells where the submerged pumps failed on September 20.
5. The T&O expert’s finding that the mineral oil, when heated, produced the same odor that customers and VDH observed in the drinking water when the event started; and,
6. No other possible source found for the cause of the odor despite an extensive and exhaustive investigation.

#### **Events of August 24**

During the investigation, 98 total samples were analyzed for over 2,357 individual analyte results. Analyses included 21 published analytical methods by certified laboratories and six research or pending publication methods. By August 24, RSA was asking VDH to support lifting the advisory based on:

1. A significantly reduced number of complaints about odor;
2. Many residents (according to RSA) were not experiencing any odor in their drinking water;
3. All sampling indicating compliance with federal and state standards;
4. No impacts observed from VDH’s epidemiological investigation;
5. The VDH toxicology review, and VDH’s field inspections at the water treatment plant and distribution system did not show concern about skin contact;
6. Consultation with US EPA Region 3 and its concurrence with ODW’s observations; and,
7. But for the lingering odor, all information suggested that the drinking water fully complied with federal and state standards.

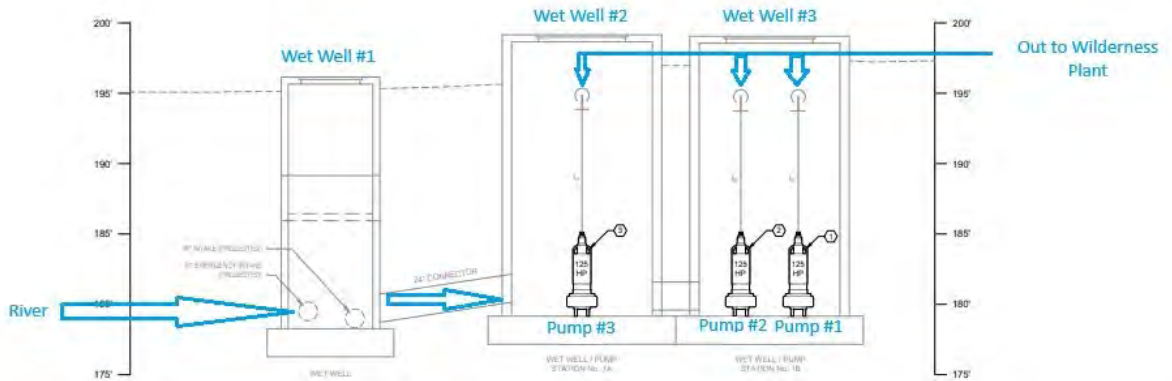
VDH and RSA had in-depth conversation about a change to the advisory on August 24. VDH agreed that the advisory could change to a “Do Not Drink” advisory and offered FAQs at that time to explain the change on its VDH incident page. RSA initially planned to move forward with the advisory change earlier in the day but subsequently had pump failures at its intake, which required RSA to bring an emergency back-up pump online. RSA changed its mind for an earlier change of the advisory because of the pump failures. RSA asked that the Do Not Use remain in effect to ensure that water pressure could be maintained throughout the distribution

system. After the emergency pump was operational, which was late on August 24, RSA again asked VDH to support a change in the advisory. The advisory changed late in the evening on August 24.

## Timeline of Information Related to Pump Failures

The following information gathered has led to the conclusion that the catastrophic pump failure on August 20, housed in the raw water intake wet well, caused the objectionable odor event. Information for this timeline was gathered from multiple sources including a timeline provided by David Jarrell, Director of Operations at RSA on September 6. The timeline shows that RSA knew a pump failed to operate on August 20 and again on August 24. RSA first reported the pump failure was catastrophic to VDH staff in an email from Tim Clemons, General Manager for RSA, on September 4.

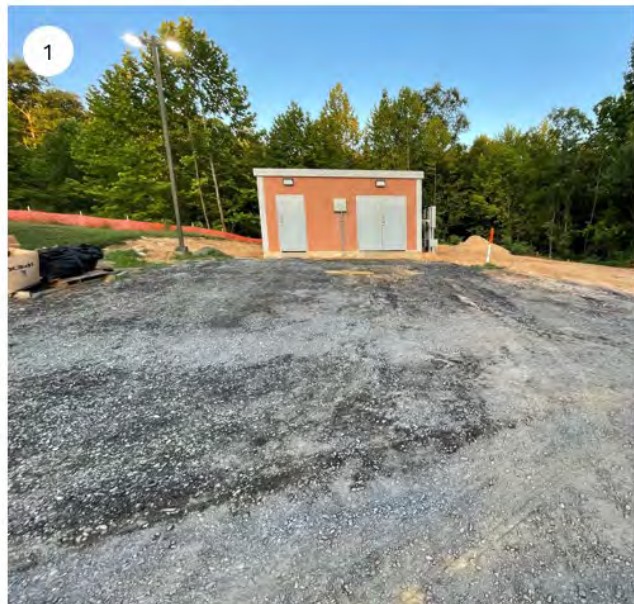
# Schematic of Raw Water Intake Wet Wells



1 PUMP STATIONS No. 1A & 1B PLAN AND ELEVATION  
SCALE: 1/4" = 1'-0"



Location of 1) WWTP and 2) wet wells



New concrete pad and building for electrical service to wet wells





Conduit for new electrical service to wet wells



Wet wells



Temporary wiring to raw water pumps

Feb 2, 2023	Atlantic Pump personnel replaced 2 existing 100 hp pumps and installed 2 new 125 hp pumps utilizing in-place wiring for the pumps. For the purposes of this timeline, these pumps will be referenced as Pump #2 and Pump #3. These pumps are in the same wet well at the raw water intake which will be referenced as Wet Well #3. A third new pump was left onsite for a future install.
July 30, 2024	According to Atlantic Pump personnel, they removed the last 100 hp pump and replaced it with the 125 hp pump left onsite from the February 2023 install. In place wiring was used to install the pump. For the purposes of this timeline, this pump will be referred to as Pump #1. This pump is installed alone in raw water intake Wet Well #2. Wet Well #1 does not contain any pumps.
Note	System Configuration - There are two pump soft starters, referred to as “Soft Start #1” and “Soft Start #2.” These are located on the sewer plant site, at the top of the hill. Soft Start #2 is configured to operate one of three submersible pumps,

	Pump #3. Soft Start #1 will operate either Pump #1 or Pump #2 depending on the configuration of a double throw disconnect switch at the bottom of the hill. Disconnect switches at the bottom of the hill are referred to as “intermediate disconnects.” Pump leads terminate at “wet well disconnects” near the raw water intake pump wet wells.
August 17	RSA noted repeated faults on Soft Start #2 for Pump #3. No cause determined. Switched to Soft Start #1, Pump #1.
August 19	Electrical subcontractor identified a loose wire connection on the pump side of Pump #3’s wet well disconnect. The electrical contractor describes this discovery as sparks shooting out from the loose connection. RSA staff witnessed this issue, which was corrected by the electrical contractor. As part of an ongoing electrical upgrade project, temporary wiring was installed between the raw water intake wet well disconnects and intermediate disconnects. On temporary wiring, Pump #3 was returned to service.
August 20	Soft Start #2 faulted again. No cause determined. Switched to Soft Start #1, Pump #1 (on temporary wiring). This soft start #2 fault was later determined to be a catastrophic failure of Pump #3 which burned the internal motor and wire stator and discharged heated food grade mineral oil lubricant into raw water intake Wet Well #2. Switching to Pump #1 then began distributing this heated mineral oil through the water treatment plant and into the distribution system. The total amount of heated mineral oil was estimated to be around 2-3 gallons. This was thought to be a routine electrical failure of the pump although this pump had only been installed 3 weeks prior to the failure.
August 21	RSA began receiving reports from customers of odor in the distribution system. RSA shut down plant operations and notified ODW. Samples are collected in the plant process as well as raw water intake Wet Well #1. Noticeable odor was observed in the area of Wet Well #1 which was initially attributed to the water coming from the river. RSA staff did not notice any odor until after receipt of reports from customers.
August 22	Incident command structure initiated. RSA participates in multiple incident command calls but does not mention the pump failure or the electrical issue witnessed in the pump disconnect.
August 23	DEQ personnel interview the contractor performing construction activities near the raw water intake wet wells. The contractor told DEQ that the subcontractors had been working on site up until August 20, and that the primary activity on site was to run conduit and wiring from the new building on the hill by the WTP and that the work had extended halfway down the hill towards the new electrical boxes. The contractor did not mention the temporary pump wiring run on August 19 or the loose wire connection found on August 20. RSA participates in Incident Management Team meetings and does not mention any issues with the pumps.
August 24	ODW and RSA met from 11:00 a.m. to 12:15 p.m. to discuss test and inspection results and the potential to lift the Do Not Use advisory. The meeting concluded with an agreement that ODW would support a move to a Do Not Drink advisory for reasons outlined in this report and the meeting adjourned to write a public

	<p>notification of this action. Immediately following the meeting, RSA officials called back to inform ODW that they had 2 pump failures at the raw water intake and could not support the water demand that would result from lifting the Do Not Use Advisory, and decided to leave the advisory unchanged until 8/25/24. RSA’s description of the failures: Soft Start #1 faulted and would not reset for Pump #1. Switched to Pump #2 on Soft Start #1. Soft Start #1 faulted for Pump #2 during ramp up period (~ 5 seconds).</p> <p>These pump failures were the second and third catastrophic pump failures to occur since the temporary wiring had been run between disconnects. ODW was at this point aware that all 3 pumps were not operational, although the severity of these failures was unclear at the time. These failures also burned the motors and wire stators and released burned mineral oil into raw water intake Wet Well #3. This water and oil mixture did not reach the plant because there were no more pumps to move this water out of the wet wells. The raw water intake wells were valved off and isolated and a temporary diesel pump was brought in to pull water directly from the Rapidan River and deliver it to the water treatment plant through the existing discharge piping downstream of the three raw water intake wet wells.</p> <p>According to RSA timeline, the following activity was performed on August 24, which was unknown to ODW at the time:</p> <ul style="list-style-type: none"> <li>• Electrical Subcontractor responded to diagnose pump issues and determined that Pumps #1 and #3 would need to be pulled and repaired.</li> <li>• General Contractor pulled Pumps #1 and #3 for pickup by the subcontractor responsible for pump installation.</li> <li>• Contractor reported no visible signs of pump failure from the exterior of the pump and the odor was not detected by the personnel removing the pumps.</li> <li>• Contractor reports a megger test was done on the temporary wiring which determined it was still good.</li> <li>• Contractor reports electrical contractor and RSA in communication during these activities.</li> </ul>
August 25	ODW begins daily plant and distribution system inspections to assess taste and odor of the water. These inspections were focused on the plant site and distribution system, and RSA employees accompanied the inspections.
August 26	According to RSA timeline: Pump Subcontractor pulled Pump #2 for repair. All three pumps required rewinding. ODW was not made aware of the removal of this pump. Another plant and distribution system inspection was performed by ODW.
August 27	Atlantic Pump performed teardown of the three intake pumps and discovered the catastrophic nature of the failures. Atlantic notified RSA personnel of these findings. RSA did not notify ODW of these findings and ODW was still unaware the pumps had been removed. Another plant and distribution system inspection was performed by ODW and the Do Not Drink Advisory was lifted.



	The Incident Management team met to discuss findings and the continuing investigation. RSA participated in the meeting but did not mention pump removals or findings.
August 28	Investigation continues and samples are shipped to a taste and odor expert in Texas.
August 29	Preliminary results from taste and odor expert in Texas indicate compounds TPIB (TXIB) and Isovanillin. While TPIB was eventually determined to be a likely lab contamination, the initial report identified it as a compound used in rotomolded equipment. While rotomolded equipment is a general term and difficult to identify, this identification solidified the internal deliberations which were narrowing the focus of investigation to equipment and construction on the plant site. DEQ was not finding any material upstream, downstream, or upslope of the intake although their investigations continued. A site visit was scheduled by ODW personnel for August 30.
August 30	ODW Field Director went onsite to look for potential equipment that could be the cause of the odor. RSA provided a fact sheet about the raw water intake pumps and safety data sheets for potential lubricants that might have been used in them.
September 3	ODW begins to narrow focus on the raw water intake wet well pumps as the likely source of the odor. Before the crowdsource meeting, RSA verbally informs ODW that the pumps had been removed from the wet wells approximately one week earlier. ODW conducted a meeting of water treatment experts to crowdsource ideas of potential sources. Prior to the crowdsourcing meeting, ODW and RSA officials met to discuss the PowerPoint crowdsourcing meeting presentation. During this meeting it was stated by ODW that the pumps were thought to be the source of the odor. This statement received vehement denial and pushback from RSA who accused ODW of looking for the “easy” solution. Ideas received at the crowdsourcing meeting included a procedure to monitor raw water on a regular interval to try and identify odors before they get into the distribution system. Discussion about the raw water intake pumps as a likely source also provided insight into instances where mechanical failures had presented as different odors. A written request for a timeline of events surrounding the pump failures was sent from ODW to RSA as well as a reminder that regulations required the use of “food grade oil” in submersible pumps.
September 4	Tim Clemons, General Manager of RSA, notifies ODW that RSA learned that day that all 3 pumps had suffered catastrophic failures and provided a Safety Data Sheet for the food grade mineral oil lubricant used in the pumps. Mr. Clemons states that he first learned from the pump repair shop of the catastrophic nature of the failure on this day. DEQ performs more sampling of the plant site and Rapidan River to send to the taste and odor specialist in Texas. DEQ sampled from raw water intake Wet Well #1 as part of this collection effort.
September 5	ODW reached out to Atlantic Pump to get information about the pumps that were sent for repair on August 26. A follow up meeting was scheduled for September 6 with additional ODW and DEQ staff and a list of questions was

	<p>prepared for that meeting. Atlantic Pump sent a timeline of activities related to those specific pumps including installation dates and pictures of the burnt motor wire stators. ODW reached out to the chemical manufacturer of a food grade lubricant installed in raw water pumps to see if they contained isovanillin and benzaldehyde.</p>
September 6	<p>ODW and DEQ staff meet with Atlantic Pump president to ask questions about the condition of the pumps as they were received. Atlantic Pump thought the likely cause of failure was that the pump was starved for current and overheated as the pumps were ramping up to speed. Atlantic supplied information about the loss of mineral oil as well as the condition of the oil that was removed from the pumps. Atlantic described the odor of the drained oil as smelling like burnt cooking oil. Atlantic mentioned other components of the pump that would have burned on failure including a wire varnish that coats the components that had been burned. The mineral oil company provided the contents of the mineral oil and the range of hydrocarbons that would be in that oil. A sample plan was developed for the raw water intake wet wells water still remaining in Wet Wells #2 and #3 and scheduled for September 9. The goal was to connect the compounds detected by testing thus far to water trapped in the wells after failures to Pumps #1 and #2. Atlantic Pump also stated they had a sample of the mineral oil used in the pumps that they would provide to ODW for testing.</p>
September 9	<p>ODW and DEQ personnel visit site to collect samples from raw water intake Wet Wells #2 and #3. Samples were collected for fumigants, metals, TPH DRO, TPH ORO and taste and odor analyses and sent to a certified laboratory as well as the taste and odor lab in Texas. DEQ noted the sampling apparatus that was used to sample the wet well had an oil like coating on it after being removed from the wet well and staff noted the presence of the odor in both wet wells but particularly in Wet Well #3. The odor was strongest as the vault doors were opened and dissipated rapidly after that.</p>
September 10	<p>ODW staff contacted the pump manufacturer, the pump motor manufacturer, the wire stator manufacturer, and the wire varnish company to determine if any components of the pump might have produced isovanillin, benzaldehyde, or BCEE when burned. A representative from the Elantis, which produces Pedegree 60-60 wire varnish used on the pump stators, indicated that the chemicals detected were unlikely to have come from the polymer resin varnish but did think they could have come from the burning of the hydrocarbons in the mineral oil. The BCEE could have come from an interaction of some of the hydrocarbons and the plant chlorination process.</p>
September 12	<p>A sample of the food grade mineral oil lubricant was collected from Atlantic Pump and shipped to the taste and odor specialist in Texas. A meeting between ODW, DEQ, and Hunter Adams was held to review the taste and odor results from all sampling events and develop a test plan for the mineral oil sample being shipped. Results from the September 9 sample collection were received by the certified private lab and showed Diesel Range Organics in Wet Wells #2 and #3 and Oil Range Organics in Wet Well #3. The results confirmed the presence of an oil-like substance in the carbon ranges expected to be seen with the presence of mineral oil in the raw water intake wet wells.</p>

September 13	Hunter Adams, Water Source & Purification Superintendent for the City of Wichita Falls, Texas, was able to recreate the odor by heating the mineral oil sample and confirmed it had the same odor characteristics using a blind panel of testers. The laboratory personnel reported a high degree of confidence that the mineral oil was the source of the odor. The results of DRO, ORO, and Taste and Odor testing along with the absence of another viable source and a timeline that provides the most reasonable explanation give ODW a high degree of confidence the catastrophic pump failures were the source of the odor event. There is no expected adverse health effect to the population of Wilderness customers as a result of this event.
September 20	RSA informed ODW in a meeting that it had determined that the temporary wiring serving the pumps was undersized, starving the pumps for current, and that this was the cause of the pump failures.

The above timeline provides a detailed sequence of events that reveals several key issues and patterns that contributed to the pump failures, mineral oil release, and subsequent odor event in the water system. VDH offers the following observations from this timeline:

### **1. Multiple Pump Failures and Electrical Issues**

- **Pump Failures:** The system experienced three catastrophic pump failures (Pump #1, Pump #2, and Pump #3) within a short timeframe. These failures led to severe internal motor damage, including burned or scorched motors and wire stators, and resulted in the release of heated food-grade mineral oil into the raw water intake wet wells. This mineral oil eventually spread through the water system.
- **Electrical Problems:** There were recurring electrical issues, including faults on Soft Start #2 and loose wiring on Pump #3's disconnect, which sparked during the failure. Despite attempts to switch pumps and soft starters, these problems persisted, culminating in a major pump failure. These electrical issues suggest underlying problems in the electrical configuration, especially given the use of temporary wiring.

### **2. Temporary Wiring and Installation Issues**

- The timeline indicates that temporary wiring was installed between the raw water intake wet well disconnects and intermediate disconnects as part of an ongoing electrical upgrade project. The temporary wiring was determined to have been undersized, starving the pumps for current, and causing the pump failures. This temporary wiring likely contributed to electrical instability, leading to repeated faults and the catastrophic failure of the pumps.
- The installation of the pumps, particularly Pump #1, which was newly installed just weeks before its failure, raises concerns about the quality and inspection of both the

pumps and the wiring configuration. It is possible that inadequate testing or improper installation practices contributed to the rapid deterioration of these pumps.

### **3. Delayed Reporting and Lack of Timely Communication**

- RSA's failure to promptly report critical pump and electrical issues to ODW and DEQ is evident. Although RSA personnel witnessed the sparks from the loose wiring and were aware of the faults, this information was not immediately shared during incident command meetings.
- Key communication failures include not informing ODW of the temporary wiring issues or the initial pump failure until after the situation had escalated, delaying an accurate diagnosis of the problem and an appropriate response.
- When RSA did finally report the initial pump failure, it became clear that these issues had been ongoing for several days. This delay in communication likely exacerbated the impact of the odor event.

### **4. Response and Mitigation Measures Were Reactive Rather Than Proactive**

- The timeline shows that RSA's response was largely reactive. RSA switched pumps when faults occurred but did not investigate the underlying cause of the failures quickly enough, resulting in additional pump breakdowns and further contamination of the system.
- Emergency actions, such as shutting down the plant and issuing advisories, came after customers had already reported odors in the distribution system. RSA only identified the odor concern at the WTP after receiving reports from customers. This suggests that monitoring systems or early warning mechanisms were either insufficient or not utilized effectively, and that RSA had inadequate monitoring and assessment of odor factors during daily testing and assessments.

### **5. Contractor Management and Oversight Issues**

- Throughout the timeline, RSA relied heavily on contractors and subcontractors for pump installations, repairs, and diagnostics. However, the lack of RSA presence or oversight during critical moments - such as when the temporary wiring was installed or when the pumps were being handled - contributed to gaps in understanding and delayed resolution of problems.
- The timeline also notes that the contractor's activities related to conduit and wiring were not fully disclosed to regulatory bodies, indicating a disconnect between contractors and RSA in terms of communication and accountability.

## **6. Poor Raw Water Monitoring and Delayed Identification of the Contaminant**

- RSA's initial assumption that the odor was related to river water rather than equipment failure shows a lack of routine monitoring and evaluation of the raw water. A more robust water quality monitoring system could have detected the presence of mineral oil earlier, allowing for quicker mitigation.
- The release of heated food-grade mineral oil into the raw water intake wet wells and its eventual distribution through the plant could have been detected earlier if better real-time monitoring systems were in place to track changes in water quality.

## **7. Escalating Equipment Failures**

- The timeline reflects an escalating series of mechanical and electrical failures that culminated in a widespread operational crisis. The failure of multiple pumps, all tied to temporary wiring and electrical issues, indicates systemic vulnerabilities in the infrastructure that were not addressed promptly.
- The failures of Pumps #1, #2, and #3, along with their respective soft starts, suggest that both the electrical system and the pumps themselves may not have been adequately tested or maintained, leading to cascading failures.

### **Key Takeaways:**

- **Communication Breakdown:** RSA did not effectively communicate key issues with its pumps and electrical systems to regulatory bodies or contractors in a timely manner, delaying an appropriate response to the contamination event.
- **Electrical and Installation Failures:** Repeated electrical issues and the use of temporary wiring played a critical role in the failure of the pumps, highlighting the need for better installation oversight and more robust electrical configurations.
- **Inadequate Monitoring and Emergency Response:** RSA lacked adequate monitoring systems to detect the presence of contaminants like mineral oil early, leading to customer reports of odors before the issue was addressed. Additionally, RSA's emergency response plan was reactive, with no contingency in place for such a large-scale failure.
- **Contractor Oversight:** RSA's reliance on contractors without ensuring close oversight contributed to the problem, as vital information about the pump installations and electrical work was not properly communicated.

These findings suggest that RSA needs to implement stronger communication protocols, improve oversight of contractors, install more advanced monitoring systems, and develop a comprehensive emergency response plan to prevent and respond to future incidents.

## Recommendations

### **1. RSA should install additional treatment processes to address taste and odor, which would also likely address concerns about disinfection by-products.**

RSA reported that it is already working on this recommendation. Once this process is complete, RSA can apply to ODW for a construction permit.

Additional treatment processes that address taste and odor issues would provide an important ability for the operating staff to address any possible future contamination event. The additional treatment process would improve water quality. The recent submersible pump failure, which led to the release of food-grade mineral oil into the water system, underscores the limitations of the current treatment infrastructure in effectively managing odor-causing substances.

Although food-grade mineral oil by definition is not a health hazard, the objectionable odor event demonstrated that a small amount, perhaps just two to three gallons of food grade mineral oil, significantly altered the taste and odor of the drinking water produced at the WTP. Significant expenses from multiple state agencies and local government occurred from sampling, investigation, and responding to the event. Setting up water filling stations, providing bottled water, and many experts and staff spent hundreds of hours responding to the event. Public concerns and questions remain.

Advanced treatment processes, such as granular activated carbon (GAC) filtration, powdered activated carbon (PAC) dosing, or advanced oxidation processes (AOPs) can target and remove organic compounds that cause taste and odor issues. GAC, for example, adsorbs organic compounds responsible for unpleasant tastes and odors while AOPs chemically degrade these compounds into harmless by-products. An engineering evaluation is necessary to properly plan and build the necessary infrastructure. Additional treatment processes would help RSA to proactively address a wider range of potential contaminants, ensuring that both safety and sensory quality standards are consistently met. This investment would not only protect against future incidents but also strengthen public confidence in RSA's ability to deliver high-quality drinking water, aligning with regulatory standards and community expectations.

### **2. RSA should be more present and directly involved with its contractors when critical equipment is being pulled for repairs to make sure information is timely shared and understood.**

RSA should take a more active role in supervising and coordinating with its contractors, particularly when critical equipment, such as submersible pumps, is being pulled for repairs. The recent odor event, caused by a catastrophic pump failure, highlights a breakdown in communication between contractors and RSA staff regarding the nature and risks of the pump failures. By being physically present, more inquiring, and more proactive during key maintenance operations and repair processes, especially during an ongoing emergency, RSA can ensure that all relevant parties are aligned on procedures, potential risks, and any necessary mitigation strategies.

Direct involvement and supervision of contractors would ensure RSA can more quickly identify and address issues as they arise, reducing the likelihood of oversights and blind spots that delay problem-solving and investigation. A more proactive approach to plant operations and work from contractors would reduce the risk of service disruptions, such as the one experienced from the objectionable odor event.

Clear, real-time communication during equipment handling is essential to reduce health hazards, such as from leaks or failures. Immediate detection of problems can be more effectively managed before impacts to water quality occur. Proactive engagement can prevent misunderstandings between contractors and internal teams, ensuring critical information is conveyed and acted upon effectively and in a timely manner. A hands-on culture and approach would likely foster more accountability and minimize operational risks. These types of actions are consistent with 12VAC5-590-360, which requires the owner of a waterworks ensure a high degree of capability and reliability, as well as to identify and evaluate factors with the potential for impairing the quality of the water delivered to customers. More frequent and detailed monitoring of the construction site might have avoided the delay in discovering the cause of the objectional odor event.

**3. RSA should improve its communication channels and develop an emergency response plan for future events. RSA should consider additional outreach to its customers, perhaps on a routine and ongoing schedule, to regain the public's trust.**

RSA should improve its communication channels and develop a comprehensive emergency response plan to better manage future incidents and provide clear, timely information to customers. The recent odor event revealed gaps in communication, both internally and externally, that delayed critical updates to staff, contractors, and the public. By enhancing communication protocols and establishing a structured emergency response plan, RSA can ensure that all personnel are promptly informed of developing issues and can respond effectively. This plan should include predefined roles, clear procedures for escalating incidents, real-time communication tools, and coordination with regulatory agencies.

RSA should engage in proactive outreach efforts to its customers on a routine basis to rebuild and maintain public trust. Transparent, ongoing communication about water quality, system upgrades, and the steps RSA is taking to prevent future issues will reassure customers that the utility is committed to their safety. This outreach could include regular newsletters, public meetings, or online updates that educate customers about the system, recent developments, and emergency preparedness. A communication strategy that prioritizes openness during non-crisis times, combined with rapid, clear updates during emergencies, will help RSA foster stronger relationships with the community and prevent misinformation from spreading in future incidents. This proactive approach would help mitigate public anxiety, maintain confidence in the water supply, and ensure that customers feel informed and supported by RSA in both routine operations and during emergencies.

**4. RSA should examine its resource and operator training needs and develop a more robust procedure to routinely monitor raw water quality, including odor. ODW already shared a best practice with RSA (Attachment 1). This best-practice procedure might have prevented the odor from reaching customers.**

RSA should carefully assess its current resource allocation and develop a more robust procedure and training program to routinely monitor raw water quality, with a particular focus on early detection of odors. The recent odor incident could potentially have been mitigated or even prevented had a more comprehensive and proactive monitoring system been in place. Routine water quality checks, including specific measures for detecting contaminants and unusual odors, would allow RSA to identify potential issues before they impact customers. A more rigorous and frequent sampling regimen, combined with real-time monitoring technology such as online sensors for organic compounds and odor-causing substances, could provide an early warning system for any abnormal changes in water quality.

ODW has already shared best practices with RSA, providing a valuable framework for enhancing their raw water monitoring protocols. There are technologies available to help with detection of undesirable contaminants that could affect odor. Gas chromatography-mass spectrometry (GC-MS) would provide more real-time VOC or SVOC detections, with more opportunity for immediate feedback on water quality.

Additionally, RSA should assess its staffing, training, and equipment needs to support these enhanced monitoring efforts. This may involve hiring or training more personnel dedicated to water quality analysis or upgrading laboratory and field equipment to handle more sophisticated testing. Adequate resources will ensure that RSA can monitor for a wide range of potential contaminants and odors on a continuous basis, providing RSA with a comprehensive picture of water quality from raw intake through treatment and distribution.

This more rigorous approach not only helps prevent future odor events but also positions RSA to respond more effectively to any emerging issues. By catching problems early, RSA can avoid the costly and disruptive consequences of contaminants or quality issues reaching customers, while also building greater public confidence in its ability to deliver safe, high-quality water.



# Attachments

## 1. Best Practice to Monitor Raw Water

Note: Shared by Virginia American Water as courtesy from September 3, 2024, Crowdsourcing Meeting

**ODOR SCALE**

1 2 3	4 5 6	7 8 9	10 11 12
Normal Low odor	Normal Strong odor	Strong, abnormal odor	Alarm situation

**SMELL TEST:**  
Complete every hour on river water (cold/warm), while conducting rounds and water testing.  
- Collect 200 mL of river water and smell, record if cold smell is usual or not, cap flask, and place in water bath until next round.  
- During the following round, carefully swirl, remove cap and smell river sample. Record if warm smell is normal or not.

**FLAVOR PROFILE:** Same test as smell test, but the odor strength is characterized by a number (from the odor scale) and the smell is described (see yellow box).  
Complete once a shift on river water and plant effluent water.  
- Collect 200 mL of river water and smell water, record cold smell number, cap flask, and place in water bath until next round.  
- Collect 200 mL of plant effluent, dechlorinate with 1 drop of sodium thiosulfate, swirl, record cold smell number. Cap flask and place in water bath until next round.  
- During the following round, swirl, remove cap, smell river and plant effluent samples. Record odor number and description for warm water samples

*The smell number/description is subjective to each individual.*

**Odor description:**  
- Normal river  
- Earthy, musty, moldy, muddy  
- Chlorineous, swimming pool  
- Grassy, hay, woody  
- Marshy, swampy, septic, sulfurous  
- Fragrant, vegetable, fruity flowery  
- Fishy  
- Medicinal, phenolic  
- Chemical, hydrocarbon  
- Other (describe)

**If a cold unusual smell is detected, check warm smell after conducting regular water testing (approx. 10 min.) and conduct a flavor profile.**

**- Report immediately to supervisor if odor number >6, and feed PAC.**

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## 2. VDH Level 2 assessment – Investigating Total Coliform Positive Event

<b>SUBJECT:</b>	Orange County
<b>Waterworks:</b>	Wilderness WTP
<b>PWSID</b>	6137999

### MEMO TO FILE

<b>Author</b>	Deborah Hoy	<b>Date</b>	9-13-2024
<b>Topic</b>	Wilderness WTP Level 2 Assessment Summary		
<b>Background Information</b>	<p>Wilderness WTP is required to collect 15 routine total coliform samples each month due to the waterworks population of 13,176.</p> <p>One routine sample and one repeat sample tested total coliform-present and <i>E. coli</i>-absent during the month of August 2024.</p> <p>On August 29, 2024, CFO received a lab alert email reporting that one routine total coliform sample collected on August 28, 2024, at 204 Freedom Road (site 18) was present for total coliform and absent for <i>E. coli</i>. The chlorine residual level reported at time of sample collection was 1.2 ppm. Three repeat samples were collected on August 29, 2024. On August 30, 2024, CFO received a lab alert email reporting that the upstream repeat sample collected at 202 Freedom Road (site 18U) was present for total coliform and absent for <i>E. coli</i>. The chlorine residual level reported at time of sample collection was 1.80 ppm. The two other repeat samples were total coliform absent.</p> <p>Due to two routine total coliform present samples received during the August 2024 monitoring period and due to the waterworks previously triggering a Level 1 Assessment during June 2024, with a cause for the contamination not found, a Level 2 Assessment was triggered.</p>		
<b>Action Taken</b>	<p>CFO mailed a Level 2 assessment required letter to Mr. Timothy Clemons on August 30, 2024.</p> <p>On September 5, 2024, Jeremy Hull, Engineering Field Director, met with David Jarrell, Wilderness RSA Director of Operations to conduct the source water and treatment portions of the assessment. On September 6, 2024, Megan Shifflett, District 9 Inspector, met with Hunter Glass, operator to complete the other elements of the assessment.</p>		

<p><b>Conclusion:</b></p>	<p>There were a variety of factors that led to atypical operation of the waterworks leading up to the collection of the total coliform present routine and repeat samples in August 2024. On August 21, 2024, a do not use order was issued after an unknown odor-causing compound was detected throughout the waterworks. The treatment plant was temporarily shut down during the beginning investigations. After the treatment plant was later returned to service, the entire plant and distribution system was heavily flushed. On August 24, 2024, the do not use order was changed to a do not drink order, which caused a significant increase in water usage throughout the system due to residents starting to flush their premise plumbing. This resulted in a drop in the level of water in the storage tanks to levels that are lower than normal. Extended periods of heavier than normal flushing caused built-up sediment to be loosened in distribution system lines. On August 27, 2024, the do not drink advisory was lifted, again causing an increase in water demand throughout the system. It is likely that high-velocity flushing releasing built-up sediment in distribution system lines and abnormally high turnover of water in storage tanks are the likely causes of the total coliform present samples collected August 28-29, 2024.</p>
<p><b>Further Action Recommended</b></p>	<p>The waterworks has conducted multiple flushing events, maintenance on the intake vaults and pumps since the August 21, 2024, odor event began. ODW, RSA, and DEQ have all collected special samples to determine the chemical responsible for the odor. The investigation is ongoing at this time.</p> <p>However, beginning in September the waterworks has returned to more normal operations, and the high-water demand that likely contributed to the total coliform-present samples has resolved. The waterworks will continue routine bacteriological monitoring by collecting 15 routine total coliform samples during the month of September 2024.</p>



COMMONWEALTH of VIRGINIA

Department of Health  
OFFICE OF DRINKING WATER  
Culpeper Field Office

400 S. Main Street, 2<sup>nd</sup> Floor  
Culpeper, VA 22701  
Phone: 540-829-7340

Karen Shelton, MD, FACOG  
State Health Commissioner

September 17, 2024

**LEVEL 2 ASSESSMENT FOLLOW-UP**

SUBJECT: Orange County  
Waterworks: Wilderness WTP  
PWSID No: 6137999

Timothy L. Clemons, General Manager  
Rapidan Service Authority  
11235 Spotswood Trail  
P.O. Box 148  
Ruckersville, VA 22968

Dear Mr. Clemons:

Enclosed is a copy of the Level 2 assessment completed on September 5-6, 2024 by Jeremy Hull and Megan Shifflett of this Office. The Level 2 assessment was required because two Level 1 assessments were triggered within a rolling 12-month period. Refer to our Notice of Level 2 Assessment Required letter, dated August 30, 2024, for details regarding the events that triggered the Level 2 assessment requirement.

**REQUIRED ACTION**

Please review the assessment, paying particular attention to the conclusions summarized on page nine. If you are in agreement, sign and date the assessment on page nine and return the form to this Office no later than Tuesday, September 24, 2024. If you are not in agreement, contact this Office within one business day upon receipt of this letter. Failure to submit the completed Level 2 assessment may be a violation of the *Waterworks Regulations*.

A potential cause for the contamination was found to be a variety of factors that led to atypical operation of the waterworks leading up to the collection of the total coliform present routine and repeat samples during August 2024. These include heavy flushing of the distribution system and significant turnover of water storage tanks.



We appreciate the assistance in completing the Level 2 assessment and look forward to your continued cooperation. If you have any questions, please contact me by email at [Jeremy.Hull@vdh.virginia.gov](mailto:Jeremy.Hull@vdh.virginia.gov) or by telephone at (540) 424-4854.

Sincerely,

**Jeremy  
Hull**

Digitally signed  
by Jeremy Hull  
Date: 2024.09.17  
15:18:43 -04'00'

Jeremy D. Hull, P.E.  
Engineering Field Director

MNS

Enclosure: Level 2 assessment

cc: David Jarrell, Director of Operations  
Orange County Administrator  
Orange County Health Department



Virginia Department of Health  
Office of Drinking Water  
Waterworks Level 2 Assessment

Waterworks Name: <b>Wilderness WTP</b>		PWSID No.: <b>6137999</b>		
Source Water Type: <b>Surface Water</b>		City/County: <b>Orange</b>		
Waterworks Type: <input checked="" type="checkbox"/> Community		Population Served: <b>13,176</b>		
<input type="checkbox"/> Nontransient Noncommunity		<input type="checkbox"/> Seasonal		
<input type="checkbox"/> Transient Noncommunity		<input type="checkbox"/> Seasonal		
Operator in Responsible Charge: <b>David Jarrell, Director of Operations</b>				Phone: <b>434-409-2801</b>
Compliance Monitoring Period: <b>August 2024</b>				
Number of Samples	Required	Collected <i>(add number and date collected)</i>	Total coliform present <i>(add number of samples present)</i>	E. coli present
Routine per monitoring period	15	7 – 8/15/2024 8 – 8/28/2024	1	0
Repeat	3	3 – 8/29/2024	1	0
Triggered source water	NA			
Date ODW Notified Waterworks Level 2 Assessment Required: <b>August 30, 2024</b>				
Assessment Due Date: <b>September 29, 2024</b>				
Assessment Conducted Date: <b>September 5-6, 2024</b>				
Waterworks Personnel Consulted For Assessment:				
1.	<b>David Jarrell, Director of Operations</b>	Phone: <b>434-409-2801</b>		
2.	<b>Hunter Glass, Operator</b>	Phone: <b>540-423-1025</b>		
ODW- FO Staff Conducting Assessment: <b>Jeremy D. Hull, Engineering Field Director and Megan Shifflett, Environmental Inspector</b>				
Reason Level 2 Assessment Is required				
1.	<input type="checkbox"/>	An <i>E.coli</i> maximum contaminant level (MCL) violation		
2.	<input checked="" type="checkbox"/>	<b>A second Level 1 Assessment required within a rolling 12-month period</b>		
3.	<input type="checkbox"/>	A second Level 1 Assessment required within a rolling 12-month period due to the failure to collect repeat samples.		

Waterworks Assessment Instructions

Consider each assessment element listed in the following evaluation form to determine if the element listed may have contributed to the “present” bacteriological sample results.

A response in a **highlighted** box suggests the assessment element may have contributed to the “present” bacteriological sample results and is a potential Sanitary Defect. Provide an explanation of why the highlighted element could have contributed to the “present” bacteriological sample results in the column titled “Describe any element of concern.” Use the “Additional Comment” space on page 8, if needed, and always refer to the assessment element number. Also, provide the date and description of Corrective Actions taken/required as required on Page 9.

Notes:

1. For wholesale and consecutive waterworks:
  - a. Review records related to flows, pressures, and water quality parameters at the connection(s) with wholesale water supplier.
  - b. Consecutive waterworks owners shall notify wholesale water supplier whenever the consecutive system has been triggered to perform a Level 2 Assessment.
  - c. Wholesale waterworks owners shall notify consecutive waterworks owners as total coliform could have spread to consecutive waterworks distribution system.
2. The Level 2 Assessment must be completed based on a site visit plus the data and documentation available and maintained on file by the waterworks and ODW-Field Office.

Virginia Department of Health  
Office of Drinking Water  
Waterworks Level 2 Assessment

Waterworks Name: <b>Wilderness WTP</b>	PWSID No.: <b>6137999</b>
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Assessment Elements		Response			Describe any element of concern
		Y	N	N/A	
<b>1. Sample Site</b>					
1.1	Were all samples collected per the approved BSSP?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.4 Sample tap is an outdoor hose bib, on a customer's house, with a yard hose regularly attached to it. Hose is removed for sampling.
1.2	If the sample site is listed on the approved BSSP, does it remain an appropriate sample site?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.3	Are the sample tap and the surrounding area clean?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.4	Describe sample tap fixture (e.g., outdoor hose bib, indoor cold water faucet, etc.)	<b>Description:</b>			
1.5	Is the sample tap fixture a swivel faucet?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1.6	Is the sample tap location used regularly?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.7	Any plumbing breaks or changes in vicinity of sample site or premise plumbing?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1.8	Are there any identified cross connections after the service connection or in premise plumbing? Describe if present.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1.9	Were all of the backflow prevention devices at the sample location operational and maintained?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
1.10	Were there any low pressure events or changes in water pressure after the service connection or in the premise plumbing: immediately prior to sample? If yes, when?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
1.11	Are there any treatment devices after the service connection or in the premises of the sample site?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>2. Sample Collection Protocol</b>					
2.1	Was the sample collector properly instructed in collection procedures?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.6 The tap was disinfected with alcohol, flushed for approximately 5 minutes, heated with a flame, flushed for 1-2 minutes longer and then the sample was collected.
2.2	Were taps flushed adequately (approx. 5 minutes)?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.3	Were aerators removed?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.4	Were sample containers sealed/unopened prior to use?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.5	Were the sample containers/rim or cap contaminated during sampling?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2.6	Were the taps disinfected?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.7	Were samples delivered per laboratory instructions?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Virginia Department of Health  
Office of Drinking Water  
Waterworks Level 2 Assessment

Waterworks Name: <b>Wilderness WTP</b>	PWSID No.: <b>6137999</b>
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Assessment Elements		Response			Describe any element of concern
		Y	N	N/A	
<b>3. Events That May Have Caused a System Upset Prior to Collection of TC Samples</b>					
3.1	Have there been any operation and maintenance activities that could have introduced total coliforms / <i>E.coli</i> ?				<p>3.1 d Raw water pump failures occurred on August 20 and August 24. The three pumps were removed and shipped for offsite repair on August 24 and August 26, and have not yet been returned to service. A generator-powered portable pump was connected to the existing pump discharge line, and has been providing raw water to the treatment plant since August 24.</p> <p>3.2 After a Do Not Use event due to an unknown odor-causing compound present throughout the water system, significant flushing was conducted through fire hydrants.</p> <p>3.9 On 8/22/2023 one routine TC+ sample was collected from 35424 Wilderness Shores Way and on 8/23/2023 a repeat TC+ sample was collected from 35424 Wilderness Shores Way. On 6/5/2024 a routine TC+ sample was collected from 207 Mount Pleasant and on 6/6/2024 a repeat TC+ was collected from 207 Mount Pleasant. On 6/12/2024 a routine TC+ sample was collected from 103 Sayers Creek and on 6/13/2024 a repeat TC+ was collected from 103 Sayers Creek. On 8/28/2024 a routine TC+ sample was collected from 204 Freedom Rd and on 8/29/2024 a repeat TC+ was collected from 202 Freedom Rd.</p>
a.	Well #	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
b.	Well Lot	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
c.	Reservoir	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
d.	Stream/River Intake	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e.	Treatment Plant / System	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
f.	Distribution piping network	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
g.	Pump Station	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
h.	Storage tanks (atmospheric or pressure)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3.2	Has there been a fire fighting event, flushing operation, sheared hydrant, etc.?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3.3	Has there been any vandalism and/or unauthorized access to facilities?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
a.	Well #	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
b.	Well Lot	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
c.	Reservoir	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
d.	Stream/River Intake	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
e.	Treatment Plant / System	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
f.	Distribution piping network	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
g.	Pump Station	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
h.	Storage Tanks (atmospheric or pressure)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3.4	Are there any visible indicators of unsanitary conditions?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3.5	Have there been any TC+ samples that were not compliance samples, including well or raw water samples?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3.6	Have there been any low or inadequate disinfectant residual readings at the entry point or in the distribution system?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3.7	Are there sites where it is historically difficult to maintain a residual without flushing?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3.8	Have any other measured water quality parameters been out of normal ranges?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3.9	Have there been any TC+ or <i>E. coli</i> results in the distribution system or raw water samples (esp. in the last 12 months)? Where?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3.10	Did the water system receive any chlorine monitoring violations in the past 12 months? If yes, when.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3.11	Have there been any reports of community illness suspected of being waterborne? (ODW/LHD)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	



Virginia Department of Health  
Office of Drinking Water  
Waterworks Level 2 Assessment

Waterworks Name: <b>Wilderness WTP</b>	PWSID No.: <b>6137999</b>
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Assessment Elements		Response			Describe any Element of Concern
		Y	N	N/A	
<b>4. Recent Operational Changes To The System</b>					
4.1	Have any new approved, previously inactive or unapproved well sources been placed into service recently?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4.2	Have any emergency or contingent/reserve well sources been placed into service recently?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4.3	Is there evidence of any potential contamination from main breaks, low pressure, high turbidity, loss of disinfection, or other similar event?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4.4	If seasonal, were there any problems during the most recent start-up procedure?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>5. Distribution System</b>					
5.1	System pressure: Is there evidence that the system experienced low or negative pressure prior to sampling? If yes, describe event and when it occurred.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5.6 Yes, fire hydrants throughout the distribution system have been heavily flushed in attempt to rid the system of the unknown odor-causing compound.
5.2	Have there been any water main breaks or utility line construction in the vicinity of the sample site? If yes, when?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5.3	Pump stations				
	a. Have there been any mechanical, electrical, or operational problems?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	b. Are pump(s) currently operable?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.4	Pump maintenance service or repair in the last six (6) months?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.5	Air valves upstream of the sample tap connection:				
	a. Is the air valve vault subject to flooding?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	b. Does the vent terminate below grade?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.6	Have any fire hydrants in the vicinity of the sample tap connection been used recently?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5.7	Have any blow-offs in the vicinity of the sample tap been used recently?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5.8	Unauthorized access or use of the distribution system suspected or reported?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5.9	Backflow Prevention Devices				
	a. Are any backflow devices in service in the distribution system near tap?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	b. Are required inspections and certifications current?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	c. Is the certification or serviceability of any backflow prevention device suspect?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Virginia Department of Health  
Office of Drinking Water  
Waterworks Level 2 Assessment

Waterworks Name: <b>Wilderness WTP</b>	PWSID No.: <b>6137999</b>
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Assessment Elements		Response			Describe any Element of Concern
		Y	N	N/A	
<b>5. Distribution System - continued</b>					
5.10	Was there any scheduled flushing of the distribution system? If yes, when?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.10 Fire hydrants throughout the distribution system have been heavily flushed in an attempt to rid the system of the unknown odor-causing compound. This disturbed sediment in distribution lines which was seen during flushing.
5.11	Is there any evidence of intentional contamination in the distribution system?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5.12	Has there been a large variation in chlorine residual values in the system?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5.13	Have any unusual circumstances/incidents involving the water distribution system been observed or reported?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5.14	Authorized/unauthorized water haul trucks filled at any fire hydrant?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5.15	Yard hydrants near sample location?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5.16	Have there been any customer complaints about pressure and/or water quality prior to sampling?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>6. Treatment Process</b>					
6.1	Have there been any interruptions in treatment processes from power outages or other causes? If yes, provide details for which part, when and for how long?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.1 An unknown odor-causing compound resulted in shut-down of the treatment plant and issuance of a Do Not Use Advisory on August 21. Raw water pump failure on August 24 also resulted in unexpected shut-down of the plant.  6.5 As of June 22, 2024, waterworks utilizes sodium hypochlorite instead of chlorine gas, and as of July 18, 2024, waterworks feeds caustic soda instead of soda ash.
6.2	Is treatment equipment operational and maintained?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6.3	Has there been any new equipment installation or repair of treatment equipment recently?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6.4	Has useful life of filter media/cartridges expired?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6.5	Have there been any recent changes in the treatment process (e.g., addition of a process, change in chemical or dosage)? If yes, provide details for the change and when it occurred?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6.6	Was the free chlorine residual measured at the clearwell effluent adequate for chlorine contact time?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6.7	Has the desired free chlorine residual goal and range been consistently achieved?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6.8	Did a review of the filter turbidity profiles reveal any anomalies?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6.9	Were there any failures in meeting the required chlorine contact time?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6.10	Was any process flow loading rate above the rated capacity?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6.11	Was there anything unusual about the settled water turbidity?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6.12	Other observations on the treatment system?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Virginia Department of Health  
Office of Drinking Water  
Waterworks Level 2 Assessment

Waterworks Name: <b>Wilderness WTP</b>	PWSID No.: <b>6137999</b>
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Assessment Elements		Response			Describe any Element of Concern
		Y	N	N/A	
<b>7. Water Storage Tanks - Atmospheric</b>				<input type="checkbox"/>	Applies to all three atmospheric storage tanks
7.1	Are the vents properly protected and screened?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.4 Tank overflow and drain lines are the same line, and it is screened.
7.2	Are the storage facilities and sites secured to prevent unauthorized access?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7.3	Are the roof access hatches properly designed as shoebox lids, properly gasketed, sealed and locked against unauthorized access?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7.4	Does the tank have a screened drain line, separate from the overflow line, discharging to the atmosphere?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
7.5	Is the tank overflow outlet screened?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7.6	Does the tank overflow line terminate above ground surface (air-gap) with a downward discharge screened end?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7.7	Are there any unsealed openings in the storage facility, such as access doors, vents or joints, target float wire penetrations; cathodic protection/ ice free electrode holder penetrations in the tank roof or wall; have any leaks been observed?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
7.8	Was any physical deterioration of the tank appurtenances (ladders, communications equipment, etc.) observed?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
7.9	Could the physical condition of the tank be a possible source of contamination?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
7.10	Does the tank "float" on the distribution system?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7.11	Are there separate inlet/outlet lines into the tank?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7.12	Does the tank have an altitude valve assembly, air release assembly or other device associated with the tank inlet/outlet or fill/release line?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>8. Water Storage – Hydropneumatic/Bladder Storage Tanks</b>				<input checked="" type="checkbox"/>	
8.1	Are the tanks properly secured to prevent unauthorized access?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8.2	Are the tanks properly screened to prevent unauthorized access?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8.3	Are the tanks properly gasketed, sealed and locked against unauthorized access?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8.4	Does the tank have a screened drain line, separate from the overflow line, discharging to the atmosphere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8.5	Is the tank overflow outlet screened?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8.6	Does the tank overflow line terminate above ground surface (air-gap) with a downward discharge screened end?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	



Virginia Department of Health  
Office of Drinking Water  
Waterworks Level 2 Assessment

Waterworks Name: <b>Wilderness WTP</b>	PWSID No.: <b>6137999</b>
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Assessment Elements		Response			Describe any Element of Concern
		Y	N	N/A	
<b>9. Water Supply Well(s)</b>				<input checked="" type="checkbox"/>	
9-1	Is well house free of pest infestation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9-2	Is exposed well casing free of rust/pitting or damage?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9-3	Is well casing floor penetration sealed?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9-4	Wellhead with Sanitary Seal				
a.	Is the sanitary seal intact and tightened down?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
b.	Is the tool joint (if used) sealed properly?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
c.	Are other penetrations through the seal protected?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9-5	Wellhead with Cap (includes staged installations)				
a.	Is the cap a PAS-97 water tight cap?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
b.	Is the water tight cap and gasket properly installed and evenly tightened?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
c.	Is the vent pipe intact?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
d.	If the cap has been modified for any purpose, is the cap properly sealed and is any vent securely installed and secured?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9-6	Is the well casing cover fitted to permit measurement of depth to water level?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
a.	If yes, is the installation satisfactory?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9-7	Does the well blowoff terminate with approved air cap and screened end?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9-8	Are there any unprotected cross connections at the wellhead?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9-9	Does the well casing extend 12 in. above ground?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9-10	Is there evidence of standing water near the wellhead?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a.	In the wellhead enclosure	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b.	Around the concrete pad	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9-11	Does the Well have a suitable 6 ft. x 6 ft. concrete pad in good condition?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9-12	Is the wellhead secured in a locked enclosure?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9-13	Have there been any sewer spills or other contamination activities in or around wellhead within 50 ft.?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9-14	Are there any aspects of well or wellhead construction that do not comply with the VA-Uniformed Regulations Manual or affect bacteriological quality?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Virginia Department of Health  
Office of Drinking Water  
Waterworks Level 2 Assessment

Waterworks Name: <b>Wilderness WTP</b>	PWSID No.: <b>6137999</b>
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Assessment Elements		Response			Describe any Element of Concern
		Y	N	N/A	
<b>10. Source – Surface Water Supply (Lake/Reservoir)</b>				<input type="checkbox"/>	
10.1	Have there been any sewer overflows, chemical spills or other disturbances into the source?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.1 An unknown odor-causing compound resulted in shut-down of the treatment plant and issuance of a Do Not Use Advisory on August 21.
10.2	Have there been any algal blooms?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
10.3	Has water turnover occurred?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
10.4	Has there been heavy rainfall, flooding, or rapid snowmelt in the past 60 days that have resulted in raw water turbidities exceeding 100 NTU?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.4 This is a run-of-the-river intake, and elevated turbidity is relatively common following storm events. Most recent date with raw water turbidity >100 NTU was August 11.
10.5	Any other surface water comments relevant to bacteriological quality?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>11. Source – Spring(s)</b>				<input checked="" type="checkbox"/>	
11.1	Have there been any changes in the availability of water supply, such as a significant drop in water table, ground well levels in the wells, reservoir capacity, etc.?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11.2	Have there been any extremes in heat or cold?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
11.3	Have there been any changes in the water quality of the source?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11.4	Have there been any changes in the water quantity of the source?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11.5	Have there been any changes in the water chemistry of the source?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>12. Environmental Events</b>					
12.1	Have there been changes in the availability of water supply, such as a significant drop in water table, ground well levels in the wells, reservoir capacity, etc.?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
12.2	Have there been any extremes in heat or cold?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>Additional Comments</b>					

Virginia Department of Health  
Office of Drinking Water  
Waterworks Level 2 Assessment

Waterworks Name: <b>Wilderness WTP</b>	PWSID No.: <b>6137999</b>
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Summary																									
Assessment Elements/Sanitary Defects	Corrective Action Taken and Date																								
No sanitary defects identified	N/A																								
<p><b>Conclusions:</b> There were a variety of factors that led to atypical operation of the waterworks leading up to the collection of the total coliform present routine and repeat samples in August. On August 21, 2024, a do not use order was issued after an unknown odor-causing compound was detected throughout the waterworks. The treatment plant was temporarily shut down during the beginning investigations. After the treatment plant was later returned to service, the entire plant and distribution system was heavily flushed. On August 24, 2024, the do not use order was changed to a do not drink order, which caused a significant increase in water usage throughout the system due to residents starting to flush their homes. This was seen in the drop in the level of water in the storage tanks to levels that are lower than normal. Extended periods of heavier than normal flushing caused built-up sediment to be loosened in distribution system lines. On August 27, 2024, the do not drink advisory was lifted, again causing an increase in water demand throughout the system as businesses re-opened and flushed their lines. It is likely that high-velocity flushing releasing built-up sediment in distribution system lines and abnormally high turnover of water in storage tanks are the likely causes of the total coliform present samples collected in August 2024.</p> <p><input type="checkbox"/> Attach additional sheets as necessary</p> <p><input type="checkbox"/> A cause for the contamination was not found.</p> <p>Assistance with assessment provided by: Jeremy Hull and Megan Shifflett</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 45%;"></th> <th style="width: 5%;">Yes</th> <th style="width: 5%;">No</th> <th style="width: 40%;">Comments</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Was likely reason for TC+ occurrence or <i>E.coli</i> violation found?</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td rowspan="2">Beginning in September, flushing has decreased and water demand has returned to more typical levels</td> </tr> <tr> <td>2.</td> <td>Have all identified problems or sanitary defects been corrected by waterworks?</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td></td> <td>a. If 'No', has an approved schedule to complete remaining corrections been developed and accepted by the waterworks? See attachment</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td></td> </tr> <tr> <td></td> <td>b. If a correction schedule is necessary, has schedule been entered into SDWIS?</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td></td> </tr> </tbody> </table>				Yes	No	Comments	1.	Was likely reason for TC+ occurrence or <i>E.coli</i> violation found?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Beginning in September, flushing has decreased and water demand has returned to more typical levels	2.	Have all identified problems or sanitary defects been corrected by waterworks?	<input checked="" type="checkbox"/>	<input type="checkbox"/>		a. If 'No', has an approved schedule to complete remaining corrections been developed and accepted by the waterworks? See attachment	<input type="checkbox"/>	<input type="checkbox"/>			b. If a correction schedule is necessary, has schedule been entered into SDWIS?	<input type="checkbox"/>	<input type="checkbox"/>	
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Print name of ODW staff completing the form: Jeremy Hull and Megan Shifflett

Signature: Jeremy Hull Digitally signed by Jeremy Hull  
Date: 2024.09.17 15:19:24 -0400 Date: \_\_\_\_\_

Print name of Waterworks Representative: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Name of Reviewer (Print) \_\_\_\_\_ Date: \_\_\_\_\_

Comments:

### 3. Disinfection Byproducts Notice to RSA



## COMMONWEALTH of VIRGINIA

Department of Health  
OFFICE OF DRINKING WATER  
Culpeper Field Office

400 S. Main Street, 2<sup>nd</sup> Floor  
Culpeper, VA 22701  
Phone: 540-829-7340

Karen Shelton, MD, FACOG  
State Health Commissioner

September 12, 2024

#### NOTICE OF ALLEGED VIOLATION

SUBJECT: Orange County  
Water: Wilderness WTP  
PWSID: 6137999

Timothy L. Clemons, General Manager  
Rapidan Service Authority  
11235 Spotswood Trail, P.O. Box 148  
Ruckersville, Virginia 22968

Re: Primary Maximum Contaminant Level for Haloacetic Acids in Community Waterworks

Mr. Clemons:

We have received the results of total trihalomethane (TTHM) and haloacetic acid (HAA5) analyses that were performed on water samples collected during 3<sup>rd</sup> Quarter 2024 from the subject waterworks. Below, you will find a summary of the results of TTHM and HAA5 sampling for the previous four quarters.

Results for TTHM (mg/L)						
Sample Location	Fourth Quarter 2023	First Quarter 2024	Second Quarter 2024	Third Quarter 2024	LRAA	OEL
DS001 – Ramsay	0.034	0.035	0.061	0.072	0.051	0.060
DS002 – Library	0.051	0.036	0.064	0.053	0.051	0.052
DS003 – Wilderness Shores	0.028	0.027	0.045	0.038	0.035	0.037
DS004 – Germanna	0.040	0.044	0.064	<b>0.089</b>	0.059	0.072

Results for HAA5 (mg/L)						
Sample Location	Fourth Quarter 2023	First Quarter 2024	Second Quarter 2024	Third Quarter 2024	LRAA	OEL
DS001 – Ramsay	0.057	0.053	<b>0.072</b>	0.056	0.060	0.059
DS002 – Library	0.043	0.057	0.058	0.031	0.047	0.044
DS003 – Wilderness Shores	0.044	0.035	0.052	0.033	0.041	0.038
DS004 – Germanna	0.057	<b>0.076</b>	<b>0.073</b>	0.039	<b>0.061</b>	0.057

Bold text indicates results that are higher than the Primary Maximum Contaminant Level for TTHM or HAA5. The TTHM maximum contaminant level is 0.080 mg/L and the HAA5 maximum contaminant level is 0.060 mg/L. Compliance with the TTHM and HAA5 maximum contaminant levels is based on the four-quarter locational running annual average (LRAA). The operational evaluation level (OEL) is also calculated on a quarterly basis and compared to the maximum contaminant levels as an early warning sign.





This notice is to advise that you may be in violation of §12 VAC 5-590-384 of the *Waterworks Regulations* for exceeding the Primary Maximum Contaminant Level (PMCL) for Haloacetic Acids (HAA5) during the 3<sup>rd</sup> quarter 2024 compliance period.

According to our records, the LRAA for HAA5 was 0.061 mg/L at the DS004 Germanna sampling location. The *Waterworks Regulations* characterizes this as a Tier 2 violation.

#### Required Actions

**Public Notice:** Section 12 VAC 5-590-540 of the *Waterworks Regulations* requires you to give public notice whenever a PMCL is exceeded. The public notice must be handled as follows:

- **You must distribute a notice to consumers no later than October 12, 2024.**
- Your notice to consumers must be mailed or directly delivered to each customer receiving a bill, and to other service connections served by your waterworks.
- If your waterworks serves consumers who do not pay water bills, or who do not have service connection addresses (apartment dwellers, university students, or nursing home patients, for example) you must also use other delivery methods to provide notice to these consumers as well. Examples of other methods include (but are not limited to) publication in local newspapers, delivery of multiple copies to apartment buildings, or posting in public places served by the system.
- Until the violation is resolved, you must give a copy of the notice to all new billing units or new customers, before or at the time service begins.
- You must repeat distribution of the notice every three months, for as long as the violation persists.

**Draft Notice:** Attached is a draft notice for you to distribute to consumers. You may use this notice as is, or modify it to better meet your situation, as long as the information is accurate and the notice contains all of the required elements and mandated language. If you decide to change the notice, we ask that you contact this Office to verify that your proposed changes meet the requirements of the *Waterworks Regulations*.

**Public Notice Confirmation:** Within ten (10) days of completing public notification, you must provide this Office with a copy of the notice you distributed, along with a signed certification that the distribution was completed in the required time and manner. Failure to distribute public notice and report to the Virginia Department of Health may be a violation of the *Waterworks Regulations*. A certification form is enclosed for your use.

If you have any questions or would like to meet to discuss this situation, please do not hesitate to contact me at [Jeremy.Hull@vdh.virginia.gov](mailto:Jeremy.Hull@vdh.virginia.gov) or (540) 829-7340.

Sincerely,

Jeremy  
Hull

Digitally signed by  
Jeremy Hull  
Date: 2024.09.12  
10:03:18 -0400

Jeremy D. Hull, P.E.  
Engineering Field Director

MNS

Enclosures:

1. Public Notification Template
2. Certification of Public Notification

cc: David Jarrell, Rapidan Service Authority  
Orange County Health Department  
Orange County Administrator



NOTICE TO CUSTOMERS  
OF THE  
RAPIDAN SERVICE AUTHORITY'S  
WILDERNESS WATER SYSTEM

**Levels of Haloacetic Acids Above Drinking Water Standards**

In keeping with National Primary Drinking Water Regulations, we are obliged to inform you that we may be in violation of state regulations because drinking water being served to our customers in the Wilderness water system did not comply with the Primary Maximum Contaminant Level for Haloacetic Acids.

We routinely monitor for the presence of drinking water contaminants. Testing results we received from the four quarterly monitoring periods from fourth quarter 2023 through third quarter 2024 show that our system exceeded the standard, or maximum contaminant level (MCL), for Haloacetic Acids at one location. The standard for Haloacetic Acids is 0.060 mg/L. The average level of Haloacetic Acids during the fourth quarter 2023 through third quarter 2024 compliance period was 0.061 mg/L at the DS004 Germanna sample location.

**You do not need to use an alternative (e.g., bottled) water supply.** However, if you have specific health concerns, consult your doctor. This is not an immediate risk. If it had been, you would have been notified immediately.

Some people who drink water containing haloacetic acids in excess of the MCL over many years may have an increased risk of getting cancer.

For more information, please contact Rapidan Service Authority at (540) 972-2133.

Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.


This notice is being sent to you by Rapidan Service Authority.

Date distributed: \_\_\_\_\_

## 4. Food Grade Mineral Oil Safety Data Sheet


PRODUCT INFORMATION SHEET

# CLARION® Food Grade White Mineral Oils



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### OVERVIEW




- High-purity oils refined by ultra-high pressure hydrotreatment and stabilized with vitamin E oxidation inhibitor.
- Available in five viscosity grades.
- Do not contain any natural products derived from animals, nuts, or genetically modified organisms (GMOs).
- Suitable for use where vegetarian and nut-free food is prepared.

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### FEATURES & BENEFITS



- Meet the requirements of U.S. FDA regulations 21 CFR 172.878 for contact with food for human consumption, and 21 CFR 178.3620 (a) for use as a component of nonfood articles intended for use in contact with food for human consumption.
- NSF 3H and H1 registered for use in food plants under the jurisdiction of the USDA.
- Meet the current standards of the National Formulary (NF) or US Pharmacopeia (USP)
- **Certified under NSF/ANSI/CAN Standard 61, Drinking Water System Components - Health Effects (Grades 200 and 350 only).**
- Certified as Kosher with the Union of Orthodox Jewish Congregations of America (U).
- Certified as Halal with the Islamic Food and Nutrition Council of America (M).




Certified to  
NSF/ANSI/CAN  
Standard 61

Clarion Food Grade  
White Mineral Oils 200 and 350  
(ONLY)

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### APPLICATIONS



- Coatings for fruits and vegetables, defoamers, shell egg spray, bakery pans and dough dividers, cutters, knives, meat packers' benches, boards, trays, and hooks.
- Rust preventative and lubricant for food processing machinery.
- For use in cosmetics, suntan lotions, baby oils, bath oils, as a base for ointments, as a pelletizing aid, and as a drug processing agent.

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<b>CITGO</b> Petroleum Corporation Houston, Texas	<b>Customer Service Line</b> 1-800-331-4068 LubestCS@CITGO.com	<b>Product Answer Line</b> 1-800-748-4684 lubeshelp@CITGO.com	<b>Online at</b> <a href="http://www.ClarionLubricants.com">www.ClarionLubricants.com</a>	Manufactured in USA	CL10107
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**APPLICATIONS**



- For use in the food processing area as a release agent on grills, pans, and other food processing equipment.
- As a drip oil for water well line shaft bearings where an H1 food grade lubricant is required or desired. Clarion Food Grade White Mineral Oils 200 and 350 are certified under NSF/ANSI/CAN Standard 61 for use in potable water systems. Always consult State and local regulatory agency requirements for water system lubricant requirements.
- For use as a dust control agent for wheat, corn, soybean, barley, rice, rye, oats, and sorghum. Applied amount should not exceed limit specified in FDA 21 CFR 178.878

**PROPERTIES**



**Typical Properties for CLARION Food Grade White Mineral Oils:**

	70	90	200	350	500
Material Code	633507009	633509009	633512009	633514009	633516009
ISO Grade	10	15	32	68	100
Gravity, °API ASTM D4052	34.4	32.2	32.3	31.6	31.1
Density, lb/gallon	7.10	7.2	7.23	7.23	7.25
Flash Point, °C (°F) ASTM D92	188 (370)	190 (374)	218 (424)	246 (475)	246 (475)
Pour Point, °C (°F) ASTM D97	-33 (-27)	-27 (-17)	-12 (+10)	-12 (+10)	-9 (+16)
Viscosity ASTM D445					
cSt at 40°C	12.6	16.0	37.5	65.04	107.8
cSt at 100°C	3.0	3.47	6.03	8.58	12.00
SUS at 100°F	72	87	193	337	562
Color, Saybolt, ASTM D156	+30	+30	+30	+30	+30
NF/USP	NF	NF	USP	USP	USP
USDA Shell Egg Oil	✓	✓	—	—	—
Kosher	Ⓢ	Ⓢ	Ⓢ	Ⓢ	Ⓢ
Halal	Ⓜ	Ⓜ	Ⓜ	Ⓜ	Ⓜ
NSF Registered	3H/H1	3H/H1	3H/H1	3H/H1	3H/H1
(Registration Number)	(124614)	(124616)	(124609)	(124612)	(124618)
NSF/ANSI/CAN Standard 61 Certified	—	—	✓	✓	—
FDA 21 CFR					
172.878	✓	✓	✓	✓	✓
178.3620(a)	✓	✓	✓	✓	✓

NOTE: All oils above are colorless (Saybolt  $\pm 10$  Color), odorless and tasteless and surpass the requirements of FDA and U.S. Pharmacopoeia standard for Neutrality, Sulfur Compounds, Solid Paraffins, Readily Carbonizable Substances, and Residual Solvents.

CLARION is a registered trademark of CITGO Petroleum Corporation. All other registered trademarks or trademarks are the property of their respective owners. Values shown are typical values only and do not constitute a specification. The information contained herein is subject to change without notice.

CITGO  
Petroleum Corporation  
Houston, Texas

Customer Service Line  
1-800-331-4068  
LubesCS@CITGO.com

Product Answer Line  
1-800-248-4684  
lubeshelp@CITGO.com

Online at  
www.Clarionlubricants.com

Manufactured in USA

CL10107