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Baltimore's Ashburton Filtration Plant

ARE YOUR UTILITY'S RATES FAIR AND EQUITABLE? | ENDOCRINE DISRUPTOR UPDATE

Baltimore City in later stages of major renovations to Ashburton Filtration Plant

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Background

Ashburton Filtration Plant is one of three drinking water treatment facilities serving Baltimore City and the surrounding counties, with more than 1.7 million customers. Located at Druid Park Drive and Liberty Heights Avenue, the Ashburton facility has a nominal treatment capacity of 120 million gallons per day (mgd), and can provide up to 168 mgd to meet peak water demands. Ashburton was constructed in the mid-1950s, and has been in continuous operation for more than fifty years.

In the mid-1990s, the City's Bureau of Water and Wastewater needed to address regulations promulgated under the Safe Drinking Water Act, such as the Interim Enhanced Surface Water Treatment Rule and Stage 1 Disinfectants and Disinfection Byproducts Rule. Moreover, much of the plant's basic infrastructure and workspaces had not undergone renovation since original commissioning, and fell outside of current building codes, in addition to Occupational Safety and Health Administration (OSHA) and Americans with Disabilities Act (ADA) guidelines and requirements.

In 1997, the Bureau proposed a complete renovation of the Ashburton facility in order to modernize the plant and to optimize water quality. The Bureau retained George Miles & Buhr, LLC (GMB) to provide a comprehensive evaluation of existing plant conditions, and then to develop alternatives to improve, upgrade, rehabilitate or replace many of the major components of the facility. After completing the two-year study and design memorandum in 1999, GMB proceeded to the final design phase and produced a 561-drawing contract set designated as Water Contract No. 8652, which was advertised for bids in 2004.

This major undertaking included replacement of the existing filtration system, renovations to the existing building, renovation of the chemical systems, new process control and instrumentation, flow path renovations, and site improvements. These renovations are described in additional detail as follows:

Filter renovations

The primary focus of this project was the renovation and replacement of the twenty existing sand filters and associated appurtenances. In order to meet more stringent water quality regulations while satisfying the project goals of increased filter performance and reduced waste quantities, the Bureau needed to replace the existing filter components, renovate the existing backwash system and install new instrumentation and controls. These renovations included replacement of filter underdrains and filter media, replacement of the existing surface wash system, structural repairs to existing concrete filter cells and walkways, replacement of the backwash pumps, complete replacement of backwash piping and valves, rehabilitation of washwater storage tanks, and installation of fully automated filter controls.

The existing filters utilized a mono-media configuration with 24-inches of sand. To increase filter productivity while meeting the more stringent water quality requirements, the sand media was replaced with a deeper bed dual-media configuration of sand and anthracite. Increasing the media depth within the existing filter cells required the installation of a lower profile dual-parallel underdrain system. The original clay tile underdrain system was therefore replaced by a new low-profile PVC underdrain system.

A new air scour system also replaced the existing surface washwater system in order to increase the efficiency of the filter backwash sequence. Backwash pumps, piping, and valves were replaced to increase the potential backwash rate and to provide a low-rate wash option. By installing new dual-media filters and the new combination air-and-water backwash system, the Bureau was able to allow longer filter runs, which resulted in fewer backwashes. Prior to renovation, the average period between backwashes was typically 20 hours or less per filter. After renovation, filters could operate for up to 72 hours between backwashes.

Prior to renovation, filters were controlled using hydraulic operators with effluent rate controllers and effluent turbidity monitoring. Renovations included replacement of all control valves and instruments, installation of filter loss-of-head indicators, relocation of filter-to-waste drains, and installation of new automated controls using programmable logic controller (PLC) based control tables. Filter-to-waste drains were relocated downstream of effluent rate controllers to allow monitoring of effluent turbidity during wasting. This relocation allows a filter to be returned to service only after effluent turbidities reach the desired water quality levels. Monitoring filter-to-waste turbidity reduces the overall quantity of waste compared to the previous time-based methodology. Automated filtration controls were implemented to allow for remote monitoring, data logging, as well as consistent backwash procedures. While fully automatic operation of the filtration process is feasible with the newly renovated filters, the City typically operates the new filters in a semi-automatic mode, which requires continued interaction with facility operators.

Building renovations

Renovations to the 250,000 square-foot filter building include renovation of the Central Operating Area, Maintenance Building and second floor offices. The second floor offices of the Ashburton filter building house multiple City and Baltimore County agencies, with over 40,000 square feet of office space, which required renovation to be brought into compliance with building code and ADA requirements. Included within this renovation project was the abatement and removal of hazardous materials, including lead and asbestos.

The renovations to the existing filtration building included the complete replacement of the power distribution systems, new telephone and network cabling, installation of new air conditioning systems, replacement of the existing boilers and steam heating systems, installation of new dehumidification systems, installation of a new potable water loop, separation of all process water demands on a new non-potable water supply loop, replacement of the roof with a new multi-ply built-up roof, replacement of all doors and windows for improved energy efficiency, installation of ADA- compliant access ramp at the front entrance, installation of a new elevator in the front lobby, construction of new ADA-compliant restrooms and conference facilities, and renovation of office facilities in accordance with current building and fire code requirements.

Renovations of the chemical systems

The existing chemical systems at Ashburton include bulk storage and feed systems of aluminum sulfate (alum) for coagulation, sodium hypochlorite for pre-oxidation and disinfection, quicklime for pH control, fluorosilicic acid for water fluoridation, and sodium bisulfite for dechlorination of the backwash waste. The existing facilities also included a drum feed system of potassium permanganate for taste and odor control, and polymer for use as a settling or filtration aid.

These renovations included replacement of the alum feed system, renovation of the existing alum bulk storage tanks, replacement of the fluoride transfer pumps, replacement of the fluoride day storage and feed system, replacement of the lime delivery piping and dust collectors, automation of the lime slaker water controls, installation of a flushing water system for the lime feed and grit drains, installation of a new post-sedimentation chlorination point, installation of a potassium permanganate bulk storage and feed system to facilitate moving the point of chlorination, installation of new polymer drum feed systems, and installation of a new dechlorination bulk storage and feed system. Chemical system renovations were provided with new ventilation, secondary containment, and connection to the new plant Supervisory Control and Data Acquisition (SCADA) system. Connection to the SCADA system allows for remote access and monitoring of the chemical systems, and to facilitate pacing of the chemical dosages based on process flow rates or chemical residuals.

New process control and instrumentation

The existing central control room has been rehabilitated and equipped with workstations connected to a new state-of-the-art PLC based SCADA system, enabling plant operators to oversee the entire treatment process without needing to leave the control room. The control system is composed of redundant servers on a self-healing redundant ring topology for data reliability in the event of a PLC failure. At the completion of the project, the drinking water treatment process will be capable of operating fully automatic. However, as the Ashburton staff currently desires some operator involvement, the process is now operated in a semi-automatic mode.

To centralize the instrumentation for the operation of the facility, a new sampling station was installed adjacent to the Central Control Room. The new sampling station includes a steady stream of water from seven sample pump locations. Turbidimeters, chlorine analyzers, fluoride residual analyzers and pH probes are wall-mounted in this room, and connected to the appropriate sample source to monitor process performance within ready access to the operators. Other instrumentation installed throughout the process includes streaming current indication, ultrasonic level indication, pressure differential indication for venturi flow metering, transit time flow meters, temperature indication, and pressure indication.

Due to the increased regulatory monitoring and reporting requirements, these renovations also include the installation of a server to archive and store historical data. This historical data server will be connected to the plant SCADA system to collect and archive data on a real-time basis, for inclusion in regulatory reports and trending purposes.

Flow path renovations

In addition to the filters and chemical systems, the process water flow path renovations included concrete crack repair and cementitious coating in the channels, replacement of the accessible sluice gates, replacement of the accessible mud valves, and cleaning of the clearwell. The cleaning of the clearwell included the removal of lime deposits, cleaning the walls and floors, and replacement of the drain valves.

Site improvements

In addition to the building and treatment plant renovations, site improvements were necessary to incorporate changes and to accommodate the facility in the foreseeable future. The site improvements included a new grounds maintenance building, reconstruction of the parking lot and roadway with an upgraded heavy-duty paving cross-section, a new curb and gutter, and a new storm water collection system diverting all feasible storm water from the residuals lake.

Because of issues relating to gasoline storage, it was determined to separate the grounds maintenance facilities from the existing filter building. The corresponding space was needed for installation of the new air scour blowers and new maintenance facility restrooms. With the demolition of the original superintendent's residence, a pre-engineered metal frame building was constructed as the new grounds maintenance building, away from the treatment facilities.

Construction

Poole and Kent Poole Corporation, a subsidiary of EMCOR Group, Inc., was awarded the construction contract at a bid price of approximately $48 million, and construction began in July, 2004. The treatment process was required to operate continuously during construction, and typically operated in excess of half of the plant's capacity at all times. Construction sequencing and coordination of trades have been crucial for completion of the filter gallery renovations within the treatment off-season of October to May. During this period, half of the filters were available to be off-line; however, to meet summer demands, no more than two filters could be off-line in the summer. Construction sequencing and coordination of trades have also been critical for replacement of the power distribution system, installation of the new potable water loop, installation of the new non-potable water loop, replacement of HVAC systems, and replacement of the telephone services. These systems were replaced while maintaining the existing system in service and in use until the new systems were fully operational. Work for the second floor offices only permitted that one third of the office areas could be relocated at a time, to minimize disruptions to the office workers to the greatest extent possible.

Renovations are scheduled to be completed within the scheduled four-year construction period ending in mid-2008.

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