

**NATIONAL BIOSOLIDS PARTNERSHIP
RE-VERIFICATION AUDIT REPORT**

**City of Richmond,
Department of Public Utilities
Wastewater Treatment Plant
Richmond, Virginia**

Audit conducted by

NSF-International Strategic Registrations

William R. Hancuff, Lead Auditor

References:

**National Biosolids Partnership (NBP) BMP Elements
NBP Third Party Verification Auditor Guidance – November 2001
(Latest Revision August 2011)
NBP Code of Good Practice
City of Richmond, Virginia
Wastewater Treatment Plant
Biosolids Management Program Manual
Issued and Approved by Rosemary Green - Deputy Director
(Revised – 2020)**

Final Report – 12 December 2020

INTRODUCTION

The purpose of the Biosolids Management Program (BMP) re-verification audit is to verify the program's health and effectiveness through evaluation of the entire management system. The third party on-site audit provides an independent review and supports credibility of the management program. In addition, one of the purposes of the audit is to collect and evaluate objective evidence related to all 17 of the elements to ensure the City of Richmond Wastewater Treatment Plant BMP is functioning as intended, that practices and procedures are conducted as documented, and that the BMP as implemented conforms to the NBP's Code of Good Practice and BMP program objectives. The cornerstone of the audit is the determination of if and how the program is continually improving.

RECOMMENDATION

The results of the City of Richmond Wastewater Treatment Plant BMP re-verification audit are positive, and it is the recommendation of the audit team that the City of Richmond BMP attain Certification at the Platinum Plus recognition level.

AUDIT SCOPE

The NSF-International Strategic Registrations, Ltd. (NSF-ISR) conducted a third party re-verification audit of the City of Richmond Wastewater Treatment Plant BMP from November 30 through December 4, 2020. The on-site audit team consisted of Dr. William R. Hancuff, Lead Auditor.

The scope of the interim audit specifically included a review of the requirements of all of the Elements and the organization's progress toward goals and objectives; BMP outcomes (environmental performance, regulatory compliance, interested party relations, and quality practices); actions taken to correct minor non-conformances; the management review process; and corrective and preventive action requests and responses. Because other system elements interact with the above goals and objectives requirements the audit also included how some specific elements interacted with the accomplishment of the goals, specifically activities found in elements 1, 2, 4, 6, 9, 15, and 16. The audit involved document review, interviews, and activity evaluations.

The physical biosolids facilities included in the audit and reviewed during the interim audit included the following critical control points of the biosolids value chain: bar screens, scum tanks, anaerobic digesters, two biosolids storage tanks, final dewatering centrifuges, effluent filter building, truck biosolids loading facilities, truck scales, and concrete pad biosolids storage area and auxiliary landfill pad, and the former sludge drying beds being temporarily used for stabilized biosolids storage. It also involved a

field visit to the biosolids contractor's largest off-site enclosed biosolids storage facilities in Cumberland County, Virginia.

The following individuals were interviewed as part of the audit process:

Rosemary Green, Deputy Director II, Wastewater Treatment Plant Operations
Edwin Edmondson, Utility Operations Superintendent II – Plant Manager
Noureddine E. Elamghari, Utility Operations supervisor and BMP coordinator
Faheem Abdulwahhaab, Operations Supervisor
Jarvis S Koonce, Operations Supervisor, Senior
Barbara Jackson, Supervisor (Internal Auditor)
Donald Carter, Project Management Analyst, Maintenance (Internal Auditor)
Eric Whitehurst, Environmental Compliance Officer
Cordell Hayes, Maintenance Program Manager
Don Bruner, Operations Chief
David Simons, President, Nutriblend (biosolids applicator - contractor)
James Joyner, Permit Writer, Nutriblend (biosolids applicator - contractor)
Neil Zahradka, State of Virginia, Department of Environmental Quality, Biosolids Program Manager

RE-VERIFICATION AUDIT FINDINGS

The re-verification audit found no major non-conformances, 2 minor non-conformances, 13 opportunities for improvement and 2 positive commendations.

The following is a review of the positive observations made during the audit. The minor nonconformities follow and then the opportunities for improvement are presented. The findings are listed by item number, which correspond to the element minimum conformance requirements found in the NBP Third Party Verification Auditor Guidance. These findings are presented in the sequence of the NBP standard elements.

Positive Observations and Commendations:

The Richmond Wastewater management and all plant personnel involved in the biosolids environmental management program development and maintenance should be recognized for their outstanding achievements, and the exceptional features of their Biosolids Program. The following are the positive observations made during the re-verification audit.

The city has appointed an individual with overall responsibility for ensuring that the biosolids management program and EMS are implemented and maintained. In the year since Faheem has taken on this responsibility he has implemented several improvements that deserve recognition: he has initiated an aggressive training program to ensure all employees are aware of their biosolids management system responsibilities, he had used the CAR form to recommend a spill control improvement for minimizing the impact of polymer spills, and he has instituted an increase in communication and coordination of biosolids improvements with operations personnel.

The City of Richmond's biosolids contractor maintains a massive enclosed biosolids storage facility, which is capable of storing an entire season of Richmond's final product biosolids during the rainy season when it can't be land applied. This flexibility not only saves the City a considerable amount of money, but it also results in the environmentally beneficial use of the biosolids for agriculture or silviculture activities as opposed to the wasteful disposal of a resource in a landfill.

The hard work and dedication of the BMP Team must also be acknowledged. Reaching the BMP platinum plus level certification recognition is a major accomplishment that few agencies have attained. It is obviously a team effort and the BMP team is to be commended. Additionally, the support, encouragement and active participation of Rosemary Green, Deputy Director II ensured the continuous improvement of the program.

Minor Nonconformities:

Requirement 8.4 – Nutblend has not formally identified its training program for communication of the Richmond BMS Policy to its employees, its BMS roles and responsibilities, its communication responsibilities related to Richmond's biosolids, its Emergency Preparedness and Response Plans and Procedures; and its operational controls and monitoring and measurement responsibilities (with assistance of DEQ).

Requirement 14.5 and 14.6 – The standard requires that the organization document corrective action plans and describe what actions will be taken to address the audit findings and tracks progress in completing the corrective actions and periodically updates the status **to reflect completion**.

A corrective action plan was developed to address the following finding from the 2019 interim audit:

Element 2 – Opportunity for improvement – The City is committed to the NBP Code of Good Practice, which sets forth as one of its principles the preparation and maintenance of a formal plan for preventive maintenance. The City uses "Mainsaver" as a tool in accomplishing preventive and corrective actions. The City has identified three Key Performance Indicators (KPIs) to improve performance for each of the maintenance trades and each of the employees within each trade. There is reported to be tracking, checking and regular monthly reporting on number of work orders completed, number of open work orders, hours planned for each work order versus actual hours required for completion, total hours each employee spent working on work orders versus total hours paid, average time required to complete work orders in each priority category, etc.

There is no monthly summary of the minutes of the monthly meetings to include date, time, attendees, discussion of overall performance in meeting KPIs, identification and praising those individuals who are star performers in each of the appropriate KPI categories, as well as individuals who are most improved on a monthly basis, discussion of what things went well, discussion of areas of concern, and action items. Also provide recommendation of items that should be published in the periodic "Biosolids News" to

share the accomplishment of the maintenance management group with all plant employees.

In spite of periodic checks and reminders on the corrective action needed to implement this corrective action no record (date, agenda, attendees, minutes and recommendations) of any monthly meetings was made in the last year. While this is a minor nonconformance this year, it has the potential, if not addressed, of becoming a major nonconformance next year and keeping Richmond from maintaining its certification status.

Opportunities for Improvement:

Multiple Elements – Several elements of the NBP standard have specific requirements for contractors (prime contractors and all their subcontractors) in their service agreements. These are: Requirement 7.4 - Service agreements must define and document the roles and responsibilities of contractors retained to perform various biosolids management activities and EMS functions; Requirement 8.4 - Service agreements require contractors to establish their own training programs consistent with their roles and responsibilities in biosolids management activities; Requirement 9.4 - Contractors' roles and responsibilities in the communications program must be defined; Requirement 10.4 - Contractors must establish their own operational controls consistent with their roles and responsibilities in biosolids management activities; Requirement 11.4 - Contractors are required to establish and maintain Emergency Preparedness and Response Plans and Procedures to assure effective responses to accidents and emergency situations associated with biosolids management activities; Requirement 12.4 - Contractors service agreements require contractors to establish documentation, document control and record requirements for biosolids management activities conducted by them, and that these are incorporated into its EMS for biosolids; and Requirement 13.3 - Contractors are required to establish and maintain regular monitoring and measurement procedures and practices for all their assigned biosolids management activities, as defined in their service agreements. The existing contract with Nutriblend does not have these requirements specifically identified in their subcontract for hauling biosolids. Also ensure that each of these requirements is included in the specifications of all future biosolids contract solicitations.

Requirement 5.5 – based on discussions with biosolids management personnel the following clarifications should be made to the goals and objectives:

For the goal related to lowering the average time of completion of Work Orders, the modified goal will be that within 30 days completely close 100 % of the work orders that have been open for more than 90 days. Also continue to track the average time for completion of work orders to ensure the average time continues to decrease.

For the goal to improve the ratio of preventive to corrective work, continue to track the ratio of the number of preventive work orders versus the number of corrective work orders with a ratio goal of 70/30 based on work order numbers. Also, track the actual number of work hours required to complete preventive work orders, versus the actual

work hours required to complete corrective work orders. These should be used to establish an acceptable ratio goal in the future.

For the goal associated with planned work hours verses actual work hours on individual work orders, specify that no work hours should be expended beyond 20% more than the estimated hours. (note: an exception to this goal on an individual work order may be made through authorization from the supervisor.) This goal is to be implemented within three months.

For the goal associated with covering the biosolids storage area establish the measurability as lowering the weight of biosolids removed from the storage area compared to the weight of the biosolids added to the storage area by 18%. That is, the quantity of biosolids removed from the storage area should be 18% less than that added due to loss of water associated with evaporation and solids drying. (Note: the percent value can be adjusted based on new information).

Requirement 6.4 – The standard requires that interested parties be provided with meaningful opportunities to express views and perspectives relative to biosolids management activities. A key area of interpretation of this requirement is that interested parties and regulators should be provided with a notice of intent to receive a third party audit along with information on approaches for observing the audit. Richmond did not provide such a notice for the re-verification audit.

Requirement 7.3 – Consider including specific measurable targets related to the Biosolids Management Program in individuals’ annual performance evaluations.

Requirement 8.1 – Consider having two or three plant personnel trained in ISO 14001 – Environmental Management System Auditor Training so that they can supplement and eventually replace the current internal auditors as part of succession planning.

Requirement 9.1 – The standard requires the establishment of a proactive communication program that provides ongoing information about the BMP to interested parties and the public. Consider periodically posting information on the beneficial uses of biosolids on the appropriate Richmond Facebook site.

Requirement 9.4 – Nutriblend should consider preparing a printed brochure or handout describing Richmond’s biosolids land application program, which its employees and subcontractors can distributed to anyone requesting information.

Requirement 11.2 – The standard requires that the organization reviews and evaluates the effectiveness of emergency preparedness and response procedures, including communication systems, and revises them as necessary. The City of Richmond performed a mock spill exercise on 9 September 2020 but did not include a written summary of evaluation of the effectiveness.

Also the Standard Operating Procedure entitled Biosolids Spill Response Plan does not address periodic reviews and evaluations of the emergency preparedness and response procedures, such as spill drills or tabletop exercises.

Requirement 11.2 – The standard requires that the organization reviews and evaluates the effectiveness of emergency preparedness and response procedures, including communication systems, and revises them as necessary. Because the contractor has fairly frequent incidents associate with biosolids spills it should consider using those occurrences for its review and evaluation of the effectiveness of it emergency preparedness and response procedures. If there have been no incidents within a year the contractor should consider implementing a spill drill.

Requirement 13.1 – In section 5.23 Operational problems of EMS procedure: Control Building Digesters #1-5 SOP consider including in the definition of a temperature decrease problem the value of a drop below 95 degrees F, and in the definition of a temperature increase problem the value of an increase above 102 degrees F.

Requirement 13.1 – In section 5.0 Procedures of EMS Procedure: Class B Biosolids sampling consider describing the specific method used to monitor and record the digester temperatures. Also consider maintaining a record of the 15-day rolling average of digester temperatures to ensure that the regulatory standard of having an average temperature of between 35 and 55 degrees C (95 – 131 degrees F) for the mean cell residence time of 15 days is met.

Element 14 – BMP Element 14 – Nonconformance: Preventive and Corrective Action procedure does not currently document in the procedure the process of using CARs to address opportunities for improvement.

Element 14 – Consider promoting the use of CARs for the improvement of operations identified by operating and maintenance personnel.

CITY OF RICHMOND COMMENTS

The City of Richmond is proud to achieve the National Biosolids Partnership platinum plus recognition certification. This is a remarkable milestone which shows that Richmond continues its commitment to best management practices and continual improvement. The re-verification audit helped us find organizational strengths and weaknesses. The City is pleased to work with Dr. Bill Hancuff, the lead auditor and to address the audit's recommendations in a timely manner.

The Biosolids management program (BMP) has been very helpful and beneficial for the City to achieve its strategic goals and objectives. In 2020, The City of Richmond has made great improvement in several areas resulting in annual cost savings. As we embark upon a new year, Richmond's BMP will maintain its efforts for continual improvement.

OUTCOMES MATTER

The City of Richmond Public Utilities Biosolids Management Team worked at improving its approach to more clearly formulating and rechecking its goals employing Specific, Measurable, Achievable, Relevant, and Time Bound (SMART) criteria. The wastewater treatment plant biosolids goals for its BMP were established cognizant of each of the four outcome areas of the NBP program as identified below:

- Environmental Performance,
- Regulatory Compliance,
- Relations with Interested Parties, and
- Quality Biosolids Management Practices

The biosolids team revised the goal numbering system and use the date on which the goal was established as its unique identifier. The narrative title is also used for clarification. The discussion below is presented using the goal number (date of origin) and descriptive titles. Currently there are six on-going goals and objectives.

While it is not a requirement to accomplish all goals and objectives, it is a critical component of the system to make progress towards achieving the majority. The City of Richmond continued improvement of its Environmental Management System for Biosolids through progressing and completing goals established in previous years as well as the current year. A brief summary of the facilities' performance is presented below and the outcome groups affected by the goal are addressed at the end of each discussion. It should be noted that the above-mentioned goals in some cases fulfill more than one outcome area.

10/01/14 – Improve Maintenance Management Work Order Processing And Closure (In Progress).

The objective of improving maintenance management was originally established in 2011. It was associated with improving the response time for maintenance work requests for biosolids related critical control points. This was found to be highly successful, and logically lead to establishment of two new objectives namely: generation of work requests for 100% of the incidents in the biosolids areas and improving internal communication in the biosolids areas such that the number of days a work order remains open is reduced. The latter was accomplished through daily monitoring of work order status.

In 2014 an evolved objective demonstrated considerable measurable improvement. The target was to lower the total days spent to close work orders. This was tracked by measuring three parameters: 1) lowering the percentage of open work orders closed in 100 days and up, to fewer than 10%, 2) increasing the percentage of work orders closed in less than two weeks to over 85%, and 3) increasing the percentage of work orders closed the same day to over 5%. Once this target was achieved the next goal for 2015 was established.

For 2015 the target was to lower the percentage of open work orders closed in 100 days and up, to fewer than 6%, to increase the percentage of work orders closed in less than two weeks to 90%, and to increase the percentage of work orders closed the same day to over 10%. The results thus far in 2015 showed a reduction to only 3.9% open after 100 days, 40% closed in less than two weeks, and 9.6% work orders closed the same day. The over 100 day open work orders surpass the target and the same day closures are close to the target, while the closure of work orders within two weeks is below target, but considerably improved from 2014 measure of 26%.

By the close of 2016 there was a significant increase in work orders open more than 100 days and was running 13% - over double the intended percentage and an increase of over triple the percentage of the previous year. The work orders closed in two weeks were 38% (less than half off the desired target) and virtually no improvement over the past year; and the same day closure were 12%, slightly better than the desired target, and the best showing to date. The latter target was the only one accomplished in 2016.

In 2017 the goal was redefined to lower the average time required to close biosolids related open work orders by 5% from 37 days to 35 days for 2017. For comparison the average time required to close work orders in 2015 was 84 days, in 2016 was 37 days, in June 2017 was 33 days and in October 2017 was 29 days. The measurement for 2017 will more than meet the goal.

In 2018 the goal was modified to lower the average time required to close open work orders by 5% from 33 days to 31 days for 2018. For comparison the average time required to close work orders in 2016 was 37 days, in 2017 was 29 days and for 2018 was 16.3 days.

For 2019 the goal was modified to include all wastewater treatment plant operations, not only biosolids related activities, and the target established for the year was a reduction of 5% in total days to complete from the average in 2018 of 40 days to 38 days in 2019. There was a significant variation month-to-month throughout 2019 from as low as 20 days to as high as 65 days, with the average for the first 10 months being 36.8 days.

For 2020 the goal was once again modified to specifically reduce the average time for work order completion to 30 days through completely closing 100% of the backlog of open work orders that exceed 90 days. This latter action plan is to be completed within 30 days.

Outcome Areas: Environmental Performance.

01/01/15 – Improve Ratio of Preventive/Corrective Maintenance Work Hours (In Progress).

This was a new goal in 2015, which had long-term implications. To change the ratio of hours spent on preventive work orders to corrective work orders requires a long lead-time. Preventive measures reduce the frequency and resources required for corrective

measures however, many assets that have not been properly maintained will fail even if the required preventive measures are employed. This is due to the fact that the asset may have already sustained damage because of the lack of maintenance. The true savings associated with the improvement in this ratio is the cost reduction in replacement parts, materials, supplies and equipment associated with high cost assets.

A view of the history of preventive hours to corrective hour's ratios showed how the variation stayed within a range for the entire facility (including biosolids related activities): 2012: 51/49; 2013: 41/59; 2014:43/57; 2015: 52/48; and as of Aug 2016: 55/45. The shift in this ratio requires a few years to demonstrate an improvement. It was contemplated that by increasing as much as possible the number of assets in the preventive maintenance program that this will increase the preventive hours used for maintenance, and hopefully concurrently reduce the corrective hours required in the future. Also, the measurement of material/equipment/supply costs have been added to the tracking system, since this component can ultimately be a controlling variable in equipment replacement decision making.

In 2017 it was determined to refine the goal to be only applied to the biosolids areas, namely: thickening building, and dewatering control building (digesters 1 & 2). The goal for 2017 was set at a ratio of 62/38. For historical comparison purposes the ratios were: 2015 – 72/28; for 2016 – 67/33; for June 2017 – 66/34 and for Oct 2017 – 63/37.

In 2018 the goal was adjusted back to the entire plant; and modified to reflect this change by establishing a goal of 38/62 ratio. The historic ratio values were as follows: 2015 – 28/72; 2016 – 33/67, June 2017 – 34/66; Oct 2017 – 37/63; Oct 2018 – 39/61. By September 2019 the ratio had improved to 56/44.

For the 2020 a new goal was established to increase the ratio to 59/41, and by September 2020 it was 60/40; however it appears the ratio was based on work order numbers as opposed to work order hours to complete. Therefore the goal was maintained at 60/40 ratio for work hours.

Outcome Areas: Environmental Performance and Quality Biosolids Management Practices.

02/19/16 – Remove 90% of the influent grit through the new headworks degritting operation – redefined to measure the increase in total quantity of grit removed.

This goal and objective was established to reduce the quantity of grit entering the facilities as the first process in the biosolids value chain. Grit has been demonstrated to cause an increase in wear and tear on all moving parts of treatment most notably pumps and other conveyance mechanisms. It also fills the digesters with inorganic nondegradable material that reduces the capacity of the tanks and reduces the efficiency of anaerobic digestion and biosolids stabilization. The measurable goal for this objective is to increase the quantity of grit removed at the headworks by 50%. The baseline established in 2018/2019 was 150 tons per month. So, a target was established to remove

225 tons per month. However, it was observed there were inaccuracies in the measurement of material removed. Therefore a new baseline needed to be established. It was observed that the quantity of grit removed varies widely on a month-to-month basis (in some cases as much as an order of magnitude.) The new baseline established based on 10 months of data for 2020 showed an average monthly quantity of grit removed to be 207 tons per month. Based on this value a new target was established to remove 310 tons per month on an annual average basis.

The action plan to accomplish this increase is the installation of a new headworks and grit chamber. The final engineering design was completed in June 2016. Permitting and approvals were granted in August and after numerous delays the bid and award was scheduled for August 2018. The bids received substantially exceeded the budget and redesign of the headworks was required. The new design was 50% complete by December 2019. Construction was anticipated to be completed by early 2021 with operation by August 2021. However, once again there were significant delays and a bid meeting was finally held in November 2020, pushing off completion of the project until early 2022.

Outcome Areas: Environmental Performance and Quality Biosolids Management Practices.

09/22/17 – Improve centrifuge operations to obtain a monthly average solids concentration of 26% by October 2018 (initially).

A goal to improve centrifuge operating efficiencies was first established several years earlier and all the improvements were accomplished. The most recent past goal was to attain 25% solids, which was attained. During that period, it was observed that occasionally solids of 26% to 28% were achieved. Therefore, a new goal was established to regularly meet 26% solids on a monthly basis by October 2018. As of November 2018 the average was 26.2% and for the next twelve months the monthly average ranged from 26.2% to 28.8% with a full year of 27.6%.

Based on the attainment of the goal in 2018 a new goal was established for 2019, which was to not have any single monthly average drop below 27%. Unfortunately the monthly average from January through September was 26.4%, a full percentage point below the previous years average. Nevertheless, the annual cost savings attributable to this improvement is approximately \$20,000.

The time bound criteria was extended through all of 2021 with the same measurable goal of 27% solids on a daily basis as opposed to a monthly average.

Outcome Areas: Environmental Performance and Quality Biosolids Management Practices.

10/12/2018 – Reduce the Weight of Biosolids Material Removed from the Pad compared to the Material Added to the Pad

Currently the biosolids storage and drying pads are not covered and subject to long periods of precipitation increasing the average moisture content of the biosolids but also washing off material into surface waters. The net effect appears to increase the hauling cost of stabilized biosolids to land application sites.

The original measurability of the goal of 100% coverage of solids did not actually identify the true measurable benefit of providing a cover. Therefore the measurability was modified to reducing by 18% the weight of hauled biosolids material from the pad when compared with the weight of material placed on the pad.

The action plan identified to accomplish this goal was the construction of a cover for the pad area. As of December 2019 the design was reported to be 75% complete and construction scheduled for mid-2020; however changes in the design have delayed this project by a year and construction has been rescheduled for the end of 2021.

Outcome Areas: Environmental Performance, Regulatory Compliance, Relations with Interested Parties, and Quality Biosolids Management Practices.

10/16/2018 – Improve Recordation of “Planned” labor hours in each work order to meet 100% of all work orders (preventive and corrective) by June 2019.

Presently only 51% of work orders have “planned” labor hours recorded in the work order. By making it a requirement that no work orders will be issued without an estimate of the “planned” hours included in the work order will accomplish this goal.

The goal was not attained and performance was quite poor – only meeting 74% of planned labor hours recorded by November 2019. No measurable improvement was observed in 2020.

Outcome Areas: Environmental Performance, Regulatory Compliance and Quality Biosolids Management Practices.

CONCLUSIONS AND RECOMMENDATIONS

The results of the re-verification audit are positive. The corrective action reports for the minor nonconformities have been reviewed and approved by the auditor. In addition, as part of the emphasis on continual improvement, corrective action plans were prepared for each of the opportunities for improvement. The implementation of the corrective action for all of the observations will be accomplished according to the corrective action schedules and will be reviewed during the next third party interim audit. In the mean time, it is the recommendation of the audit team that the Richmond BMP attain its certification at the platinum plus recognition level.

As was mentioned previously, the BMP is a continually improving process. The results of this and future audits will provide value added to the system and should be viewed as an overall opportunity to improve. Every audit is a snapshot in time, and does not, or cannot, identify each and every area for improvement. And yet, while no single audit identifies all of the areas for improvement the results of each audit provide an additional incremental step in the overall system's improvement.

Based on discussions between the Plant's BMP Coordinator and the third party auditor, the schedule of individual elements to be audited in their entirety such that all the elements of the BMP are covered before the next re-verification audit are as follows:

Year 11 (third party) – Elements 3, 10, 12, 13 (external interim)

Year 12 (third party) – Elements 1, 8, 15, 17 (external interim)

Year 13 (third party) – Elements 5, 6, 9, 14, 16 (external interim)

Year 14 (third party) – Elements 2, 4, 7, 11 (external interim)

Year 15 (third party) Re-verification

Attachment 1

Documents and Other Objective Evidence Reviewed During the Re-Verification Audit

Element 1. Documentation of Biosolids Management Program

- City of Richmond Wastewater Treatment Facility Biosolids Management Program Manual Issued and Approved by Rose Mary Green, Deputy Director II – 2020.
- BMP Element 1 – Documentation, Rev 15, 11/07/2016.
- Table 1.1 – BMP Organization by Categories.
- BMP Element 2 – Biosolids Management Policy, Rev 14, 10/28/2015.
- BMP Element 3: Critical Control Points, Rev 15, 11/08/2016.
- Element 3: Critical Control Points, Table 3.1- Critical Control Points (CCP) Operations (undated).
- BMP Element 6 – Public Participation in Planning, Rev 14, 10/28/2015.
- BMP Element 7 – Roles and Responsibilities, Rev 15, 11/10/2016.
- BMP Element 9 – Communication, Rev 15, 11/11/2016.
- BMP Element 11 – Emergency Preparedness and Response, Rev 14, 10/28/2015.
- Interview with Rosemary Green, Deputy Director II
- Interviews with Faheem Abdul-wahhaab.

Element 2. Biosolids Management Policy

- BMP Element 2 – Biosolids Management Policy, (including Code of Good Practice), Rev 14, 10/28/2015.
- BMP Element 9 – Communication, Rev 15, 11/11/2016.
- Interview with Rosemary Green, Deputy Director II
- Interviews with Faheem Abdul-wahhaab and Ed Edmondson.
- Policy displayed throughout wastewater treatment plant on posters.
- Policy communicated to interested parties through availability on web site.
- Policy discussed during BMP training activities.

Element 3. Critical Control Points

- BMP Element 3: Critical Control Points, Rev 15, 11/08/2016.
- Element 3: Critical Control Points, Table 3.1- Critical Control Points (CCP) Operations (undated).
- Operations (including relationship to value chain, operational control references and environmental impacts). (undated)
- Field observation of select biosolids significant Critical Control Points
- Interviews with plant personnel: Ed Edmondson, Faheem Abdul-wahhaab, Noureddine E. Elamghari, Jarvis S Koonce, Donald Carter, Eric Whitehurst, Cordell Hayes and Don Bruner, Operations Chief

- Interview with contractor personnel: David Simons, President, Nutriblend (biosolids applicator) and James Joyner, Permit Writer, Nutriblend (biosolids applicator - contractor).

Element 4. Legal and Other Requirements

- BMP Element 4 – Legal and Other Requirements, Rev 17, 11/01/2018.
- Table 4.1 List of Relevant Legal and Other Requirements.
- Interviews with Ed Edmondson, Faheem Abdul-wahhaab, Eric Whitehurst, and Donald Carter.
- Interviews with contractor personnel: David Simons, President, Nutriblend (biosolids applicator) and James Joyner, Permit Writer, Nutriblend (biosolids applicator - contractor).
- Interview with State Regulator – Neil Zahradka, State of Virginia, Department of Environmental Quality, Biosolids Program Manager.
- Reviewed VPDES Permit #VA 0063177 Permit Reissuance Application – VPDES Sewage Sludge Form Section B. – Sept 2018.
- Reviewed VPDES Permit # VA0063177 including Sewage Sludge Forms A & B.

Element 5. Goals and Objectives for Continual Improvement

- BMP Element 5 – Goals and Objectives for Continual Improvement, Rev 14, 10/28/2015. (Element Procedure)
- BMP Element 5.1 (Table) – Goals and Objectives for Continual Improvement, Rev 17, 11/17/20.
- 2019 Biosolids Management Program Performance Report.
- Biosolids Goal Action Plan form for tracking outcomes and objectives and targets (print date 11/19/20).
- Evaluated each G&O for conformance with SMART criteria.
- Reviewed detailed data on work order processing and corrective action vs preventive action work order hours’ ratio and all other Key Performance Indicators (KPIs).
- Interview with Rosemary Green, Deputy Director II.
- Interviews with Ed Edmondson, Faheem Abdul-wahhaab, Nouredine E. Elamghari, Donald Carter, Cordell Hayes and Jarvis S Koonce, Operations Supervisor, Senior.
- Reviewed progress on the measurability of each goal and objective.

Element 6. Public Participation in Planning

- BMP Element 6 – Public Participation in Planning, Rev 14, 10/28/2015.
- BMP Element 9 – Communication, Rev 15, 11/11/2016.
- Reviewed the new and old City’s Biosolids BMP website information.
- Interview with Faheem Abdul-wahhaab.

- Interviews with contractor personnel: David Simons, President, Nutriblend (biosolids applicator) and James Joyner, Permit Writer, Nutriblend (biosolids applicator - contractor).
- Interview with State Regulator – Neil Zahradka, State of Virginia, Department of Environmental Quality, Biosolids Program Manager.
- Discussed the need for Biosolids Brochures as general handouts.

Element 7. Roles and Responsibilities

- BMP Element 7 – Roles and Responsibilities, Rev 15, 10/29/2019.
- Table 7.1 – Biosolids BMP Responsibilities.
- Reviewed Wastewater Treatment Plant Organization Chart dated October 2020.
- Interview with Rosemary Green, Deputy Director II
- Interviews with Ed Edmondson, Faheem Abdul-wahhaab and Nouredine E. Elamghari.
- Discussed BMP roles and responsibilities of contractors with contractor personnel: David Simons, President, Nutriblend (biosolids applicator) and James Joyner, Permit Writer, Nutriblend (biosolids applicator - contractor).

Element 8. Training

- BMP Element 8 – Training, Rev 14, 10/28/2015.
- Interviews with Faheem Abdul-wahhaab and Ed Edmondson.
- Interviews with plant personnel: Donald Carter, Cordell Hayes, and Don Bruner.
- Discussed BMP training requirements with contractor personnel: David Simons, President, Nutriblend (biosolids applicator) and James Joyner, Permit Writer, Nutriblend (biosolids applicator - contractor).

Element 9. Communications

- BMP Element 9 – Communication, Rev 15, 11/11/2016.
- BMP Element 6 – Public Participation in Planning, Rev 14, 10/28/2015.
- Richmond new and old Public Utilities webpage on Biosolids.
- Periodic Treatment Plant publication – Biosolids News.
- Interview with Rosemary Green, Deputy Director II
- Interviews with Faheem Abdul-wahhaab and Ed Edmondson.
- Discussed the need for Biosolids Brochures as general handouts.
- Interviews with contractor personnel: David Simons, President, Nutriblend (biosolids applicator) and James Joyner, Permit Writer, Nutriblend (biosolids applicator - contractor).
- Interview with State Regulator – Neil Zahradka, State of Virginia, Department of Environmental Quality, Biosolids Program Manager.
- Discussed lack of communication on maintenance performance.
- Discussed possibilities of social media (Facebook) for communication on BMP.

Element 10. Operational Control of Critical Control Points

- BMP Element 10 – Operational Control of Critical Control Points, Rev 15, 11/11/2016.
- Element 3: Critical Control Points, Table 3.1- Critical Control Points (CCP) Operations (including relationship to value chain, operational control references and environmental impacts). (undated)
- BMP Element 13 – Monitoring and Measurement, Rev 14, 10/28/2015.
- Reviewed detailed hours for work orders processed, including the lack of data on estimated hours required for each work order issued.
- Interview with Rosemary Green, Deputy Director II
- Interviews with Faheem Abdul-wahhaab, Nouredine E. Elamghari and Ed Edmondson.
- Interviews with plant personnel: Jarvis S Koonce, Donald Carter, Cordell Hayes, and Don Bruner.
- Interviews with contractor personnel: David Simons, President, Nutriblend (biosolids applicator) and James Joyner, Permit Writer, Nutriblend (biosolids applicator - contractor).
- Reviewed low digester temperature records for the month of November 2020.
- Reviewed Operations SOP – Digester Automatic Feed Rev 2 dated 6-1-2020.
- Reviewed Operations SOP – Digester Manual Feed to Digester 1 Rev 3 dated 6-4-2020.
- Discussed corrective action related to drop in digester temperature performance.
- Reviewed EMS Procedure: Control Building Digesters # 1 – 5 SOP, Rev 10, dated 7/11/2019.
- Reviewed SOP: Biosolids Landfilling when pathogen reduction & volatile solids reduction requirements not met. Rev 001, dated 10/29/2016.
- Reviewed Biosolids Use for Land Application O&M Manual, dated May 11, 2010.
- Reviewed undated Biosolids Odor Control Plan.

Element 11. Emergency Preparedness and Response

- BMP Element 11 – Emergency Preparedness and Response, Rev 14, 10/28/2015.
- Reviewed SOP: Emergency Action Plan, Rev 004, dated 1-8-2020
- Reviewed SOP: Biosolids Spill Response Plan, Rev 14, 10/18/2018.
- Interviews with Faheem Abdul-wahhaab
- Discussed multiple spills experience by hauling contractor with contractor personnel: David Simons, President, Nutriblend (biosolids applicator) and James Joyner, Permit Writer, Nutriblend (biosolids applicator - contractor).
- Discussed the need for post evaluation report for spill drills, including most recent one last month.
- Reviewed Contractors report on biosolids spill in Cumberland County on 22 October 2020.

Element 12. BMP Documentation and Document Control

- BMP Element 12 – Documentation, Document Control, and Record Keeping, Rev 15, 11/01/2018.
- Reviewed Manual Element Change Log from 2014 to 2020.
- Interview with Faheem Abdul-wahhaab.
- Interviews with contractor personnel: David Simons, President, Nutriblend (biosolids applicator) and James Joyner, Permit Writer, Nutriblend (biosolids applicator - contractor).

Element 13. Monitoring and Measurement

- BMP Element 13 – Monitoring and Measurement, Rev 14, 10/28/2015.
- Element 3: Critical Control Points, Table 3.1- Critical Control Points (CCP) Operations (including relationship to value chain, operational control references and environmental impacts). (undated)
- BMP Element 10 – Operational Control of Critical Control Points, Rev 15, 11/11/2016.
- Reviewed EMS Procedure: Class B Biosolids sampling. Rev 001, dated 7/7/2020.
- Reviewed detailed hours for work orders processed, including the lack of data on estimated hours required for each work order issued.
- Reviewed progress in reducing the backlog of work orders and average days to close work orders.
- Discussed the need for KPIs related to individuals BMP measurable performances
- Discussed documenting acceptable temperature range for digesters.
- Interview with Rosemary Green, Deputy Director II
- Interviews with Faheem Abdul-wahhaab and Ed Edmondson.
- Interviews with plant personnel: Jarvis S Koonce, Donald Carter, and Cordell Hayes.
- Interviews with contractor personnel: David Simons, President, Nutriblend (biosolids applicator) and James Joyner, Permit Writer, Nutriblend (biosolids applicator - contractor).
- Reviewed detailed records of Biosolids Land Applied for all of 2020 to date.

Element 14. Nonconformances: Preventive and Corrective Action

- BMP Element 14 – Nonconformance: Preventive and Corrective Action, Rev 14, 10/28/2015.
- Reviewed CARs prepared to address third party interim audit from 2019.
- Reviewed CARs prepared to address internal audit from 2020.
- Reviewed CAR for addressing low digester temperatures Nov 2 & 3, 2020.
- Reviewed Wastewater Plant Biosolids BMP Internal Audit Findings for audit conducted in 2020.
- Discussed use of CARs to implement improvements.
- Interview with Faheem Abdul-wahhaab,
- Interview with internal auditors - Donald Carter and Barbara Jackson.

Element 15. Periodic Biosolids Program Report

- BMP Element 15 – Performance Report, Rev 14, 10/28/2015.
- BMP Element 6 – Public Participation in Planning, Rev 14, 10/28/2015.
- BMP Element 9 – Communication, Rev 15, 11/11/2016.
- Reviewed Biosolids Quarterly Reports for first three quarters of 2020.
- Reviewed 2019 Biosolids Management Program Performance Report (BMPPR)
- Interview with Rosemary Green, Deputy Director II
- Interview with Faheem Abdul-wahhaab.

Element 16. Internal BMP Audit

- BMP Element 16 – Internal BMP Audit, Rev 14, 10/28/2015.
- Reviewed Wastewater Plant Biosolids BMP Internal Audit Report for 2020 audit conducted in November 2020.
- Reviewed 2020 internal audit results and discussed actions to be taken in response to the audit findings.
- Reviewed CARs prepared to address internal audit from 2019.
- Interviews with Faheem Abdul-wahhaab, Nouredine E. Elamghari, Barbara Jackson and Donald Carter.

Element 17. Periodic Management Review of Performance

- BMP Element 17 – Periodic Management Review of Performance, Rev 14, 10/28/2015.
- Reviewed 2019 Biosolids Management Program Performance Report.
- Discusse BMP Management Review Meeting for 2020.
- Interview with Rosemary Green, Deputy Director II
- Interviews with Ed Edmonson and Faheem Abdul-wahhaab.