



National Biosolids Partnership
Biosolids Management Program Interim Audit Report

Knoxville Utilities Board
Kuwahee Wastewater Treatment Plant
Knoxville, Tennessee

Audit Dates: December 7 to 8, 2015

Audit Conducted By: DEKRA Certification, Inc. (Chalfont, PA)

Audit Team: Jon Shaver, Biosolids EMS Lead Auditor / Biosolids Auditor

Report Written By: Jon Shaver, Biosolids EMS Lead Auditor

Report Date: December 21, 2015

Reviewed By: Adonia Phillips, Knoxville Utilities Board

Approved By: Michelle Hunn, DEKRA Operational Excellence Director

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1. SUMMARY

DEKRA Certification, Inc. (DEKRA) conducted an independent Third Party Audit of the biosolids management program being used by Knoxville Utilities Board (KUB) at the Kuwahee Wastewater Treatment Plant in Knoxville, Tennessee. The audit was conducted December 7 and 8, 2015 at KUB's request. It was Interim Audit #1-4 following DEKRA's Verification of the KUB Biosolids Environmental Management System (BEMS) in December 2011.

Audit Purposes

This interim audit was conducted to:

- Verify that the KUB BEMS continues to meet NBP expectations and conforms with all requirements of the NBP Biosolids Management Program (BMP) Elements.
- Confirm that the KUB Biosolids Environmental Management System (BEMS) is functioning effectively, with practices and procedures being performed as documented.
- Examine outcomes KUB is achieving by using a systematic approach for managing its biosolids program.
- Verify that effective corrective action has been taken in response to open nonconformances from previous third party audits.

Summary of Audit Activities and Results

DEKRA reviewed the dynamics of KUB's BEMS and audited parts of that program for conformance with expectations and requirements of the NBP BMP Elements (audit criteria). The audit scope was consistent with NBP requirements and the interim audit program agreed by KUB and DEKRA.

Three minor nonconformances with respect to the audit criteria were found during this audit. KUB has developed corrective action plans to address these nonconformances that have been approved by DEKRA's Lead Auditor.

Audit Conclusions

Based on results of this audit, DEKRA has determined that:

- All nonconformances from prior third party audits have been effectively corrected.
- The KUB BEMS is functioning effectively, generating positive outcomes, and meets NBP expectations and requirements of the NBP BMP Elements, with minor exceptions.

Based on results of this audit, DEKRA's Verification of the KUB biosolids management program continues and we recommend continuing Certification within the National Biosolids Partnership Biosolids Management Program.

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2. AUDIT DETAILS

2A Local Agency Details

Agency Detail

Agency Name: Knoxville Utilities Board, Knoxville TN (referred to as KUB in this report)

Number of Employees = 55

Biosolids Production Sites: Kuwahee Wastewater Plant, Knoxville, TN

Volume of Wastewater Treated = 33 MGD (average); design 44MGD, capacity 120 MGD

Biosolids Produced = 8,000 dry tons per year (28,000 wet tons per year); 100% Class B

KUB Biosolids Program

KUB's Biosolids Program includes defined processes for Pretreatment, Wastewater Treatment and Solids Generation, Solids Stabilization, Dewatering, Biosolids Storage and Transportation and Biosolids Disposition (agricultural land application). A contractor (Synagro) is employed to manage and operate centrifuge dewatering and biosolids storage and transportation and for controlling biosolids use options. KUB manages their biosolids program using a Biosolids Environmental Management System (BEMS) based on the NBP BMP Elements.

2B Audit Scope and Criteria

Audit Criteria

Requirements stipulated in the NBP BMP Elements (July, 2011) and the documented KUB Biosolids Environmental Management System (BEMS) were used as criteria for this audit.

Audit Scope

The scope of this audit included parts of the KUB biosolids value chain, with special attention to practices and management activities that directly support biosolids-related operations, processes and activities. The audit covered the following topics, consistent with NBP requirements for interim audits, the interim audits program previously agreed to by DEKRA and KUB and the Scope of Work for this audit agreed by KUB and DEKRA.

1. Biosolids Management System Dynamics Review, including:
 - Review of any significant changes affecting the biosolids program
 - Consistency with Biosolids Policy commitments
 - Communications (internal and external)
 - Review of Effectiveness:
 - Corrective and Preventive Action Process
 - Goals and Objectives Process
 - Management Review Process
 - Review of Internal Audits (and related Corrective Action)

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2. Process Audits:
 - Biosolids Dewatering (incl contractor control)
 - Biosolids Use – Land Application
 - Goals & Objectives (for improvement)
 - Management Involvement (direction, BMP planning)
 - Internal Audits
3. Verification of effective correction of open nonconformances from previous DEKRA audits (i.e. Interim Audit, December, 2014)
4. Examination of outcomes being achieved through KUB's BEMS

Biosolids Use Sites Audited

Jim Jarnigan farm, Knox County

Contractors Participating in Audit

Synagro Inc. – dewatering, biosolids transportation, biosolids land application

Interested Parties Interviewed

Jim Jarnigan, biosolids user
Garland Heidel, biosolids user
Rod Williams, farm owner (biosolids land application)

2C Audit Methodology

The audit was conducted by interviewing key personnel with biosolids responsibilities, observing practices in place and reviewing pertinent documents and records. Interested parties were interviewed and transaction tests were performed to verify management system effectiveness. It was performed in a manner that is consistent with the NBP Auditor Guidance. Standard audit sampling techniques were used. This audit was conducted as a systems audit and is not a verification of compliance with any legal requirements applicable to practices performed by KUB or its contractors.

2D DEKRA Audit Team

KUB requested DEKRA Certification Inc. to conduct this independent Third Party Audit of their biosolids program. Mr. Jon Shaver led the audit on behalf of DEKRA. Mr. Shaver is certified by the National Biosolids Partnership as a Biosolids EMS Lead Auditor and Biosolids Auditor. DEKRA asserts that our firm and auditor each have an independent and impartial relationship with KUB that meets NBP criteria for Third Party Audit Companies and Auditors.

2E Definitions of Audit Findings & Required Corrective Action

Major Nonconformance – a serious omission from requirements and/or other departure that represents, or could cause, a systemic failure, or the existence of multiple related minor nonconformances, or failure to effectively correct a nonconformance in a timely manner. For verification to proceed, correction of major nonconformances must be verified by a third party audit within 90 days.

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Minor Nonconformance – an isolated departure from requirements that does not represent a systemic failure. Minor nonconformances require timely and effective correction by the agency and verification by a Third Party Auditor during the next third party audit.

Opportunity (for improvement) – possible improvement in the EMS based on auditor observations. There is no obligation for action in response to these observations.

2F Reference Materials

The following documents were used as references during this audit:

- KUB BEMS Manual (current version)
- NBP “BMP Elements” (July 2011)
- NBP Biosolids Management Program Third Party Auditor Guidance (August 2011)
- NBP Code of Good Practice
- NBP Manual of Good Practice

2G Additional Information

Further information about this audit and/or the National Biosolids Partnership Biosolids Management Program can be obtained from the Knoxville Utilities Board. Contact Ms. Adonia Phillips (e-mail: adonia.phillips@kub.org).

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3. SUMMARY OF AUDIT RESULTS

3A Verification Conclusion

Based on the results of this audit, DEKRA has verified that the KUB biosolids management program is functioning effectively, generating positive outcomes and meets NBP expectations and requirements with minor exceptions (minor nonconformances). DEKRA Verification continues and we recommend continuing NBP “Platinum” certification

3B Nonconformances Found This Audit

The following nonconformances were found with respect to the audit criteria. KUB has submitted Corrective Action Plans for each nonconformance and DEKRA’s Lead Auditor has approved those plans. KUB will complete the corrective action plans in a timely manner and DEKRA will verify the effective correction of each nonconformance during the next Third Party Audit.

Minor Nonconformance JS/15-01/5 NBP BMP Element 5 requires the organization to establish and periodically review goals and objectives for its biosolids management activities to continually improve BMP performance. The process for developing biosolids goals (& subsequent objectives) is not clearly defined with inputs and outputs.

Minor Nonconformance JS/15-02/10 NBP BMP Element 10 requires the organization’s operational controls to include appropriate preventive maintenance procedures and work management systems. Operational controls identified on the “process control points and operational controls” table do not include maintenance or equipment reliability.

Minor Nonconformance JS/15-03/14 NBPBMP Element 14 requires the organization’s corrective action process to identify actions to correct the nonconformance; and document the necessary corrective actions taken to prevent a recurrence. Corrective action plans for third party and internal audit findings note how the problem is being corrected (i.e. correction / containment) but do not consistently address action to eliminate the identified cause to prevent recurrence (i.e. corrective action).

3C Summary – Process Audits

DEKRA audited the following processes within the KUB BEMS. The level of conformance with NBP expectations and requirements is summarized in the table below. More details are available upon request.

Process	Conformance with Applicable BMP Elements
<u>BMP Dynamics</u> Significant changes affecting the biosolids program Consistency with Biosolids Policy commitments Communications (internal and external)	Conforms

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Process	Conformance with Applicable BMP Elements
<u>Effectiveness:</u> Corrective and Preventive Action Process Goals and Objectives Process Management Review Process	Conforms, except as noted in Minor Nonconformances 15-01 &15-03
Biosolids Dewatering (incl contractor control)	Conforms
Biosolids Use – Agriculture Land Application (+ related control of contractor)	Conforms
Goals & Objectives (for improvement)	Conforms
Management Involvement (direction, BMP planning)	Conforms, except as noted in Minor Nonconformance 15-02
Internal Audits	Conforms

3D Opportunities for Improvement

The following “Opportunities” for improving the KUB biosolids program were noted during the audit. KUB has no obligation to take any action in response to these Opportunities.

- Consider formalizing the procedure to notify interested parties about upcoming third party audits to offer the option to attend.
- Key performance indicators could be based on acceptable performance ranges (e.g. 24%-27% solids) rather than meet/not meet targets (e.g. no compliance violations).
- The objective to achieve 60% energy self-sufficiency could be a biosolids objective (+ action plans)
- The Contractor Performance Assessment could begin with a summary of conclusions based on details that follow. The Assessment could also include any need for follow-up action
- Consider responding to concerns expressed on the “post application questionnaire” returned by persons using biosolids. These concerns could also be reviewed when developing biosolids objectives.
- The “Summary” page for internal audit reports could clearly state the purposes and scope for the audit and conclusions that relate directly to the purposes.
- Handwritten notes on operating equipment (e.g. electrical equipment in Dewatering) should be removed to avoid confusion and/or improper use.

3E Agreements

KUB will prepare corrective action plans for each nonconformance and submit these to DEKRA’s Lead Auditor for approval. KUB will implement these plans in a timely manner.

The next audit of the KUB BEMS will be a Reverification Audits to be conducted as a third party audit in December 2016. KUB will make arrangements for this audit with DEKRA.

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3F Appeals

The NBP provides an appeals process for biosolids organizations and interested parties that disagree with the Verification conclusion of a third party audit. The appeals process involves an Appeals Board; representing a balance of biosolids management interested parties, including an environmental advocacy group and wastewater industry professionals. An appeal must be submitted within 30 days of the Audit Company's verification decision or interim audit decision. Information about the appeals process is available from the National Biosolids Partnership. Contact Ms. Lisa McFadden at lmcfadden@wef.org.

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4. BIOSOLIDS MANAGEMENT PROGRAM DYNAMICS

Review of the management system dynamics and outcomes is intended to verify that the biosolids management system is functioning effectively and generating positive outcomes (results) and that changes are being incorporated into the system. The following summarizes DEKRA's review of the dynamics of the KUB BEMS.

4A Significant Changes

The previous Plant Manager has been promoted to Assistant to the Chief Operating Officer for KUB. Ms. Billie Jo McCarley has assumed Acting Plant Manager responsibilities. Ms. McCarley is familiar with the BEMS from previous responsibilities.

A new grit washer has been installed and is recognized in "process control points" and "operational controls."

4B Revisions to the Management System and Related Documentation

The BMP Manual was reviewed in 2015 and was modified to be more process based (Plan-Implement-Check-Act). No significant changes have been made in the past two years.

4C Management Involvement

Biosolids Policy Commitments

The KUB Biosolids Management Policy approved April 2011 remains in place and was reviewed during the recent management review meeting. The Policy commits to follow the principles of the NBP Code of Good Practice. Review of performance in meeting commitments made in that Policy demonstrated the Policy has been effectively incorporated into the biosolids program.

Management Reviews

Management involvement has been demonstrated through actions taken regarding issues raised in management reviews and programs for measurement and improvement. The actions taken are consistent with defined objectives. The review process includes discussion of BEMS performance and any need for changes at bi-annual BEMS Management Review led by the BEMS Coordinator. The review and follow-up actions are recorded.

4D Effectiveness Reviews

Communications Program

Regular communications with biosolids regulators occurs through meetings and e-mails. Biosolids users interviewed were positive and complementary about communications with KUB and Synagro. A Biosolids Performance Report for 2014 was prepared and issued publicly. The KUB website includes information about the Biosolids Management System. Internal communication occurs through training and regular staff meetings.

Biosolids Goals and Objectives Process

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Eight of eleven objectives set for 2014 were achieved and adequate progress is being made on the other three. Updated objectives were set for 2015. The Goals and Objectives process is working effectively, except as noted in Minor Nonconformance JS/15-01.

Corrective and Preventive Action Process

The Corrective and Preventive Action process was used to address nonconformances from previous Third Party Audits and internal audits. The process used includes a dynamic database that monitors progress in completing corrective / preventive actions. The process is functioning effectively, except as noted in Minor Nonconformance JS/15-03.

Internal Audits

Two internal audits of the KUB BEMS were conducted in 2015. Corrective actions from that audit were recorded and implemented. KUB performs quarterly inspections of biosolids use sites to monitor compliance and general conditions. The internal audit process is functioning effectively.

4E Review of Nonconformances from Previous DEKRA Audits

Corrective action taken in response to nonconformances from DEKRA's Interim Audit of the KUB Biosolids Management Program in December 2014 were reviewed for effectiveness. The status of those nonconformances is summarized below.

Minor Nonconformance JS/14-01/5 NBP BMP Element 5 requires the organization to develop biosolids program goals and objectives using SMART criteria (i.e., be Specific, Measurable, Achievable, Relevant, and Time-bounded). Some biosolids objectives are not measurable and do not have an expected completion time.

Corrective Action - KUB determined that this nonconformance was caused by an omission in documenting the biosolids objectives. In response, KUB reviewed the goals and objectives set for the program and modified them to be specific, measurable, achievable, relevant and time-bound. Review by DEKRA's Lead Auditor verified that this action was effectively completed to prevent recurrence of the nonconformance. This nonconformance is now closed.

Minor Nonconformance JS/14-02/12 NBP BMP Element 12 requires the organization to establish and maintain records of its biosolids management activities. The table identifying documents and records requiring control does not distinguish between documents and records and some documents and/or records are not clearly identified (e.g. compliance documentation, training, safety program).

Corrective Action - KUB determined that this nonconformance was caused by an ambiguous document. In response, KUB distinguished between records and documents by developing two separate tables within the BEMS Program manual. Review by DEKRA's Lead Auditor verified that this action was effectively completed to prevent recurrence of the nonconformance. This nonconformance is now closed.

Minor Nonconformance JS/14-03/16 NBP BMP Element 16 requires the organization to establish and maintain an internal audit program to periodically analyze the effectiveness of its BMP

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and KUB's internal audit process requires internal audits at least every 6 months to analyze and improve the BMP. Internal audits were conducted in April 2013 and November 2014. The timing of the internal audits was not consistent with KUB requirements and those audits did not fully analyze the management system for improvement opportunities.

Corrective Action - KUB determined that this nonconformance was caused by lack of priority. In response, KUB revised the internal audit scope and schedule to evaluate the program's effectiveness based on process audits. Management and subject matter experts provide input to ensure the audit scope, criteria, frequency, and methodologies are consistent with the program goals and objectives. The internal audit process analyzed the BEMS for system problems and improvement opportunities. Review by DEKRA's Lead Auditor verified that this action was effectively completed to prevent recurrence of the nonconformance. This nonconformance is now closed.

4F Interested Party Interviews

During this audit, DEKRA interviewed three local farmers who use biosolids. All were positive about the product and with KUB and Synagro communication.

4G Examination of Outcomes

The KUB BEMS is improving through the use of a systematic approach to managing their biosolids activities. The following improvement outcomes within the past two years were confirmed.

Relations with Interested Parties

New grit removal equipment is improving quality of biosolids to and from digesters & centrifuge resulting in better quality product being land applied.

Environmental Performance

Automated control of DO measurement using probes has reduced blower use, with 20% energy reduction.

Regulatory Compliance

The "Operator Qualification Program" is establishing a consistent operator knowledge base, improving public confidence and preparing for anticipated TDEC requirements

Quality Practices

Cleaning the digester has improved operation, including 50% improvement in pathogen reduction and increase from 40% to 50% volatile solids reduction and reduced centrifuge operating time and energy cost.

Replacing the DAF with a gravity belt thickener led to significant increase in solids content to digester (from 3% to 5½ %)

A Process Control Plan for wet weather events has led to improved equipment use, more consistent plant operations. Defoamer use lowered, reducing costs \$100K.

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APPENDICES

List of Participants

The following persons participated in this audit. Other persons provided additional explanations, as needed.

KUB & Synagro Personnel

Janalyn Brown	Technical Services BMA
Hannah Claytor	Analyst
David Combs	Plants Engineer
Daniel Dodson	Technical Service Manager (Synagro)
Jimmy England	Plant Supervisor
Leslie Glover	Lab Analyst
John Gresham	Manager, Assistant to the Chief Operating Officer
Kelly Lane	Communications BMA
Billie Joe McCarley	Plant Manager
David Obenschain	Program Technician
Wayne Pearson	Field Manager (Synagro)
Adonia Phillips	BEMS Coordinator, Plant Supervisor
Stephanie Pickens	Operations Manager (Synagro)

Interested parties

Garland Heidel (farmer, biosolids user)
Jim Jarnigan (farmer, biosolids user)

List of Documents & Records Reviewed

BEMS Manual Rev 1/2014	Synagro training plans
Plant Energy Efficiency data	Synagro SOPs
KUB website (biosolids)	KUB WIDs
BM Policy 4/2011	Procedure 5.4 – internal audits
Corrective and Preventive Action records (various)	Internal audit reports May 2015, October 2015
Biosolids Performance Report 2014 (June 2015)	BEMS roles & responsibilities
Biosolids Spill Response Plan	Process control point & operational controls table
Internal audit program 2015 - 2019	Key performance indicators tracking 2015
Management Review 5/21/15, November 2015	Goals and objectives 9/15/15
Contractor performance assessment 11/5/15	Post biosolids questionnaire
NANI 3/1/15 – 4/30/15	

END OF REPORT