

QUALITY ASSURANCE AUDIT REPORT

Auditee: BIOTEC, Inc.

Facility Profile: Startup Clinical Reference Laboratory (approx. 30 FTEs)

Audit Scope & Standards: Evaluation of Quality Management Systems (QMS), Good Clinical Laboratory Practice (GCLP), and Analytical Operations against 42 CFR Part 493 (CLIA), College of American Pathologists (CAP) Standards, New York State Department of Health (NYSDOH) Clinical Laboratory Standards of Practice, ISO 15189 (Medical Laboratories — Requirements for Quality and Competence), ISO/IEC 42001 (Artificial Intelligence Management Systems), ICH E6(R3) GCP Guidelines, FDA 21 CFR Part 11, and MHRA GxP Data Integrity Guidance (2018).

Executive Summary & Audit Scope

A comprehensive, risk-based quality assurance audit of BIOTEC, Inc. was conducted to evaluate the facility's quality system architecture, personnel qualifications, analytical test controls, equipment maintenance, and computerized system data integrity. BIOTEC, Inc. operates as a high-complexity clinical testing startup supporting early-phase clinical trial sample analysis with 32 full-time personnel across executive leadership, clinical laboratory operations, quality assurance, and technical support. The scope of this evaluation encompassed wet-lab operations, sample accessioning and chain of custody, analytical method verification, computerized data workflows (LIMS and standalone instruments), automated algorithmic data pipelines, and archival practices in full alignment with federal, state, and international quality and AI governance frameworks. Overall, the laboratory demonstrates strong leadership engagement, robust technical competencies, and an operational commitment to regulatory compliance; however, targeted remediation is required to address procedural gaps, computer system validation controls, and data governance.

System-by-System Evaluation

Organization, Personnel, and Quality Governance

The organizational structure is well-defined, with clear operational separation between the independent Quality Assurance Unit (QAU) and analytical testing personnel. Review of personnel files confirmed that analytical chemists, medical technologists, and laboratory supervisors possess verified educational credentials, active CLIA qualifications, and up-to-date Good Clinical Practice (GCP) certifications. Annual competency evaluations and job descriptions detailing delegated duties were available and current for active staff, meeting ISO 15189 competency criteria and NYSDOH supervisory qualification mandates. The laboratory maintains an established Quality Manual and standard operating procedures (SOPs) governing document control, risk assessment, change management, and internal audit scheduling.

Facilities, Environmental Controls, and Equipment

Laboratory space allocation is adequate for current testing throughput, providing distinct separation between specimen accessioning, reagent preparation, and high-throughput extraction/analysis suites to minimize cross-contamination risks. Environmental monitoring logs for ambient temperature, humidity, and critical cold storage units (e.g., -80°C freezers, 2–8°C refrigerators) demonstrated routine oversight consistent with NYSDOH and CAP facilities requirements. Analytical instruments, including liquid chromatography-mass spectrometry (LC-MS/MS) systems and automated microplate readers, are maintained on active calibration and preventive maintenance schedules with NIST-traceable reference standards.

Analytical Controls, Reagents, and Sample Management

Assay validation protocols and standard operating procedures for analytical method verification conform to established clinical validation frameworks and ISO 15189 technical requirements. Sample accessioning follows documented chain-of-custody protocols from intake through processing and post-analytical storage. Reagents, reference standards, and assay kits are documented upon receipt with assigned expiration dates and lot qualification procedures; however, secondary reagent labeling consistency and container tracking require minor operational tightening.

Computerized Systems, AI Governance, and Data Integrity

Electronic data systems, automated data-reduction algorithms, and the Laboratory Information Management System (LIMS) were evaluated against FDA 21 CFR Part 11, MHRA Data Integrity principles (ALCOA+), and ISO/IEC 42001 AI governance standards. Routine daily server backups, automated archiving routines, and disaster recovery frameworks are established. While algorithmic decision-support tools used in data screening showed basic documentation, access control reviews on standalone analytical equipment revealed critical gaps in user permission tiers and audit trail enforcement.

Audit Findings and Observations

1. Major Finding (Internal Remediation Required; Non-Reportable)

- Area: Computerized System Access Control and Data Integrity (21 CFR Part 11 / MHRA Data Integrity / ISO 15189 §8.9 / ISO 42001 §9.2)
- Condition: During the inspection of the LC-MS/MS analytical suite, it was observed that two standalone instrument control workstations utilized a shared generic "Operator" Windows login and lacked individual user account provisioning for analytical chemists. Furthermore, the audit trail functionality within the instrument acquisition software was disabled during sequence setup, allowing data acquisition parameters to be modified without capturing unique user attribution or time-stamped change logs.
- Impact & Classification: This is classified as a Major Internal Finding due to non-alignment with 21 CFR § 11.10(e), ISO 15189 technical control standards, and ALCOA+ attributable data principles. Because an internal data audit confirmed that all clinical study batch runs remained intact, were verified against raw backup files, and showed no evidence of unauthorized alteration or unblinded data manipulation, this issue does not constitute a systemic clinical reporting breach requiring immediate notification to regulatory authorities (such as NYSDOH or FDA) or external trial sponsors. However, immediate technical access restriction, workstation configuration overhaul, and complete retrospective audit trail verification are required prior to running upcoming clinical study batches.

2. Minor Finding

- Area: Reagent Labeling and Expiration Control (CLIA 42 CFR § 493.1252 / NYSDOH Reagent Controls / ISO 15189 §5.3 / CAP General Checklist)
- Condition: In the immunoassay preparation area, three in-use secondary wash buffers and two prepared working standard solutions lacked secondary container labeling detailing the date of preparation, expiration date, and technician initials, contrary to BIOTEC SOP-QC-204 (*Reagent Labeling and Lot Management*).
- Impact & Classification: This is categorized as a Minor Finding. The primary lot records and parent reagent kits were valid and unexpired, presenting minimal risk to current run validity, but

demonstrating inconsistent adherence to internal good documentation and quality control practices.

3. Opportunity for Improvement (OFI 01)

- Area: AI Algorithmic Governance and Model Verification (ISO/IEC 42001 §6.1 / §8.2)
- Observation: While automated chromatographic peak-integration and curve-fitting algorithms within the data processing software undergo standard initial installation qualification (IQ/OQ), there is no formalized annual algorithmic drift monitoring SOP or documented risk-treatment plan as outlined in ISO/IEC 42001. Establishing periodic blind-control testing and documented human-in-the-loop review criteria will strengthen algorithm traceability and prevent unmonitored model drift.

4. Opportunity for Improvement (OFI 02)

- Area: Vendor Qualification and Approved Supplier List Maintenance (ISO 15189 §5.3.2 / NYSDOH Quality Management)
- Observation: While primary analytical reagent and instrument vendors are qualified with formal quality agreements, third-party laboratory supply vendors providing non-critical general consumables (pipette tips, standard centrifuge tubes) are managed across disparate departmental purchasing logs rather than a single, centralized Approved Supplier List (ASL). It is recommended to centralize the ASL within the electronic Quality Management System (eQMS) with periodic re-evaluation triggers.

Conclusion & Required Actions

BIOTEC, Inc. maintains a foundational Quality Management System capable of supporting regulated clinical trial testing. Formal Corrective and Preventive Action (CAPA) plans addressing the Major and Minor findings must be submitted to the Quality Assurance Unit within 30 calendar days of this report's issuance. Systemic re-configuration of instrument user access, audit trail enforcement, and preliminary alignment with ISO 42001 algorithmic monitoring frameworks must be verified and closed out prior to initiating analytical runs for the next clinical study cohort.