
QUALITY METRICS

National Currency Printing and Secure Banknote Production Facility Project
(NCPBF)



Project Title:

National Currency Printing and Secure Banknote Production Facility Project
(NCPBF)

Project Sponsor:

Central Bank

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Quality Metrics:

Project: National Currency Printing and Secure Banknote Production Facility Project (NCPBF)

1. Purpose:

The purpose of this section is to define the Quality Metrics that will be used to measure, monitor, and evaluate the quality performance of the National Currency Printing and Secure Banknote Production Facility Project (NCPBF). Quality Metrics establish measurable performance indicators that enable the project team and governance bodies to verify that all project deliverables meet the defined technical specifications, regulatory requirements, operational standards, and security controls required for a national currency printing facility.

Given the critical national importance of currency production infrastructure, the project requires strict adherence to engineering, operational, cybersecurity, and physical security standards. The Quality Metrics defined in this document provide a structured framework for assessing whether construction works, facility infrastructure, production machinery, information systems, security controls, and operational processes conform to approved project requirements and internationally recognized standards.

These metrics support systematic quality management by enabling the project team to measure key aspects of project performance, including construction quality, equipment reliability, system integration effectiveness, cybersecurity resilience, environmental stability, operational readiness, and personnel competency. Through the use of objective measurements and clearly defined acceptance thresholds, the project team will be able to identify

quality deviations, assess risks associated with non-conformance, and implement corrective or preventive actions in a timely manner.

The application of these Quality Metrics also supports the broader governance and assurance mechanisms established for the project. Quality performance data will be used to inform management decisions, support transparency in project reporting, and provide evidence that project deliverables meet the required standards before approval for subsequent phases of the project lifecycle.

Furthermore, the Quality Metrics provide a structured basis for evaluating compliance with project scope requirements and technical design specifications. By establishing measurable indicators for critical systems and infrastructure components, the project ensures that performance expectations are clearly defined and consistently monitored throughout the implementation process.

Quality Metrics will be monitored continuously throughout the project lifecycle. Monitoring activities will occur during key project phases including facility construction, equipment procurement and installation, information system deployment, security infrastructure implementation, system integration testing, commissioning activities, staff training, and operational readiness verification. During these stages, inspection results, testing reports, monitoring data, and performance assessments will be collected and analyzed to confirm that the project meets its quality objectives.

These metrics will also play a critical role in the project's stage-gate governance framework. Before transitioning between major project phases, the project governance bodies will review quality performance data to ensure that required standards have been achieved. Only after the successful verification of quality metrics will the project

proceed to subsequent stages such as system commissioning, operational readiness validation, and final project handover.

In addition, Quality Metrics contribute to the long-term sustainability and reliability of the facility. By ensuring that infrastructure systems, production machinery, cybersecurity architecture, and operational procedures meet strict quality standards, the project establishes a strong foundation for secure and efficient currency production operations.

Ultimately, the implementation of these Quality Metrics ensures that the NCPBF project delivers a secure, reliable, and high-performance currency printing facility that meets national security requirements, supports operational excellence, and complies with the highest standards of quality management.

2. Quality Metrics Framework:

Quality metrics for the project are organized into the following major categories:

1. Construction and Facility Infrastructure Quality
2. Mechanical and Production Equipment Quality
3. Environmental and Utility System Quality
4. IT Systems and Cybersecurity Quality
5. Physical Security Systems Quality
6. Integrated Systems Performance Quality
7. Production Quality and Operational Performance
8. Training and Human Capacity Quality
9. Operational Readiness Quality
10. Governance and Documentation Quality

Each category contains specific measurable indicators to ensure the integrity, reliability, and security of the facility and its operations.

3. Construction and Facility Infrastructure Quality Metrics:

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Structural Construction Compliance	Verification that facility structures comply with approved engineering designs and structural standards	100% compliance with approved structural drawings and codes	Engineering inspections, structural testing reports	During construction milestones	Construction Quality Engineer
Foundation Integrity	Quality of foundation structures supporting production machinery and building loads	No structural defects or settlement beyond engineering tolerance	Geotechnical inspection and load testing	During construction	Civil Engineering Team
Perimeter Security Structure Quality	Strength and reliability of perimeter walls, fencing, guard towers, and security gates	No physical vulnerabilities detected during inspection	Security infrastructure inspection and penetration simulation	Post construction	Security Engineering Team
Secure Zone Construction Quality	Compliance of controlled access zones with design requirements	All classified zones constructed according to approved security design	Security inspection and zone validation	Construction completion	Security Authority
Vault Structural Resistance	Security strength and penetration resistance of vault structures	Vault meets certified security standards and passes penetration tests	Independent structural security testing	Before commissioning	Security Certification Authority

4. Mechanical and Production Equipment Quality Metrics:

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Printing Press Installation Accuracy	Alignment accuracy of printing presses and mechanical components	Installed within manufacturer tolerance limits	Vendor calibration and engineering validation	During installation	Machinery Vendor
Machine Vibration Stability	Mechanical vibration levels during machine operation	Within manufacturer operational limits	Vibration monitoring systems	During trial production	Engineering Team
Equipment Integration Compatibility	Integration compatibility between machines and facility infrastructure	No system conflicts during integration testing	Integration validation tests	During commissioning	Systems Integration Team
Calibration Precision	Accuracy of machine calibration settings	Calibration error not exceeding defined tolerance limits	Calibration reports	During commissioning	Technical Engineering Team
Equipment Reliability	Operational reliability of machinery under sustained production load	Equipment uptime \geq 98% during testing	Production testing data	Trial production stage	Production Engineering Team

5. Environmental and Utility System Quality Metrics:

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Temperature Stability	Environmental temperature stability in production areas	Within defined operational tolerance levels	Environmental monitoring systems	Continuous monitoring	Facility Engineering
Humidity Control	Humidity levels necessary for secure banknote printing	Maintained within \pm 3% of required range	Environmental sensors and logs	Continuous monitoring	Facility Engineering

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Air Filtration Efficiency	Air purity and particulate control in printing areas	Air filtration systems meet defined cleanliness standards	Air quality testing	Monthly testing	Environmental Systems Team
Power Supply Reliability	Reliability of electrical systems supplying critical machinery	Minimum 99.9% uptime	Power monitoring systems	Continuous monitoring	Infrastructure Engineering
Backup Power Failover	Response capability of backup generators and UPS systems	Automatic failover within defined response time	Failover simulation testing	Quarterly testing	Infrastructure Engineering

6. IT Systems and Cybersecurity Quality Metrics:

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Production Management System Availability	Operational availability of the production control system	≥ 99.5% system uptime	System monitoring dashboards	Continuous monitoring	IT Operations
Inventory Tracking Accuracy	Accuracy of secure material tracking and reconciliation	100% traceability of materials	Inventory reconciliation reports	Daily monitoring	Inventory Management Team
Cybersecurity Vulnerability Level	Number of critical cybersecurity vulnerabilities	Zero unresolved critical vulnerabilities	Independent penetration testing	Periodic security audits	Cybersecurity Team
Data Encryption Compliance	Protection of sensitive data during storage and transmission	All sensitive data encrypted according to security standards	Security audits	Periodic audits	IT Security Team
Disaster Recovery Capability	System recovery capability following system failure	System recovery within defined recovery time objective	Disaster recovery simulations	Annual testing	IT Infrastructure Team

7. Physical Security Systems Quality Metrics:

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Access Control Accuracy	Reliability of access control authentication systems	100% accurate authentication for authorized personnel	Access system logs	Continuous monitoring	Security Systems Team
Biometric Identification Accuracy	Accuracy rate of biometric identification devices	Error rate below defined threshold	Biometric testing and logs	Periodic verification	Security Systems Team
CCTV Surveillance Coverage	Coverage of surveillance cameras across facility zones	No blind spots in critical security areas	Security inspections and camera audits	Quarterly audits	Security Monitoring Team
Intrusion Detection Response Time	Response time for intrusion detection alerts	Alerts generated within predefined response time	Intrusion simulation tests	Periodic testing	Security Monitoring Team
Visitor Management Traceability	Traceability of visitor entry and exit records	100% traceable visitor activity	Visitor management system logs	Continuous monitoring	Security Administration

8. Integrated Systems Performance Metrics:

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
System Integration Reliability	Successful integration between IT, machinery, and security systems	No critical failures during integrated system testing	System integration test reports	Commissioning stage	Integration Team
Data Flow Integrity	Accuracy and reliability of data exchange between systems	No data loss or corruption during system operations	System audit logs	Continuous monitoring	IT Systems Team

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Operational System Stability	Stability of systems under operational load	No system failure during sustained testing	Stress testing reports	Commissioning stage	Systems Engineering Team

9. Production Quality Metrics:

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Trial Production Defect Rate	Percentage of defective banknotes produced during testing	Defect rate below defined quality threshold	Quality inspection and sampling	Trial production stage	Quality Control Team
Production Throughput	Production capacity of printing machines	Achieve planned production capacity	Production performance reports	Trial production stage	Production Engineering
Material Reconciliation Accuracy	Accuracy of material usage tracking	100% reconciliation between material input and output	Inventory audit	Production cycles	Production Control Team

10. Training and Capacity Development Metrics:

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Operator Competency Level	Skill level of machine operators	≥ 90% competency assessment pass rate	Training assessment tests	After training sessions	Training Department

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Security Awareness Compliance	Staff understanding of security protocols	100% participation in security training	Training attendance and assessments	Training completion	Security Training Team
Maintenance Capability	Capability of maintenance personnel to perform preventive maintenance	Successful completion of maintenance training certification	Maintenance skill evaluation	Post training	Maintenance Engineering Team

II. Operational Readiness Metrics:

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Operational Readiness Compliance	Completion of operational readiness requirements	100% completion of readiness checklist	Readiness assessment reports	Pre-handover	Project Governance Board
Standard Operating Procedure Approval	Approval and documentation of operational procedures	All SOPs approved and under configuration control	Documentation review	Pre-operational stage	Documentation Authority
Performance Benchmark Validation	Validation of production performance benchmarks	Performance targets achieved during sustained testing	Benchmark testing reports	Commissioning stage	Production Management

12. Governance and Documentation Quality Metrics:

Metric	Description	Acceptance Criteria	Measurement Method	Frequency	Responsible Authority
Documentation Completeness	Completeness of project documentation and records	100% required documents archived and approved	Document control audit	Periodic reviews	PMO
Configuration Management Compliance	Compliance with document and configuration control procedures	No unauthorized document modifications	Configuration audit	Periodic review	Project Governance Office
Lessons Learned Documentation	Capture of project learning and improvement insights	Lessons learned documented at each major phase	Lessons learned register	Phase completion	PMO

13. Quality Monitoring and Reporting:

13.1 Purpose of Quality Monitoring and Reporting

Quality Monitoring and Reporting provide the structured processes and governance mechanisms used to measure, track, evaluate, and communicate the quality performance of the National Currency Printing and Secure Banknote Production Facility Project (NCPBF). Given the strategic importance and security sensitivity of the facility, maintaining strict quality control throughout the project lifecycle is essential to ensure that all deliverables meet the required engineering, operational, security, and regulatory standards.

The purpose of quality monitoring is to ensure that construction activities, equipment installation, information technology systems, physical security systems, and operational procedures comply with the defined project quality

standards and acceptance criteria. Continuous monitoring enables early detection of deviations from quality standards, allowing corrective measures to be implemented promptly to minimize risk to project objectives.

Quality reporting provides a formal mechanism for communicating quality performance to the Project Steering Committee, governance bodies, and relevant stakeholders. These reports support informed decision-making, reinforce accountability, and ensure transparency in project execution.

Quality monitoring activities will be integrated into the broader project governance framework and will support stage-gate decision-making, operational readiness assessments, and final project acceptance.

13.2 Quality Monitoring Framework

Quality monitoring for the NCPBF project will follow a structured framework consisting of continuous inspections, systematic testing procedures, system performance monitoring, and governance oversight reviews. This framework ensures that all project components meet the required standards before progressing to the next stage of implementation.

Quality monitoring activities will occur throughout the project lifecycle, including during construction, equipment installation, system integration, commissioning, training, and operational readiness stages.

The monitoring framework includes the following core components:

1. Inspection Activities

Inspection activities involve systematic verification of physical deliverables to ensure that construction works, infrastructure components, and equipment installations conform to approved specifications and engineering standards. These inspections will be conducted by qualified engineering teams and independent verification authorities where necessary.

Construction inspections will verify structural integrity, compliance with architectural designs, and adherence to safety and security requirements. Equipment installation inspections will ensure that printing machinery, finishing equipment, and support systems are correctly installed and aligned according to manufacturer specifications.

Security inspections will confirm that physical security measures, including vault structures, perimeter defenses, and controlled access zones, meet the defined security standards required for currency production facilities.

2. Testing and Validation Procedures

Testing procedures are essential for validating that installed systems and equipment function correctly and meet operational performance requirements. The NCPBF project will conduct several categories of testing activities, including factory acceptance testing, site acceptance testing, integrated system testing, and performance validation testing.

Factory acceptance testing will verify equipment functionality at the vendor's manufacturing facilities before shipment. Site acceptance testing will confirm that equipment operates correctly after installation within the facility. Integrated system testing will validate the interoperability of mechanical systems, IT systems, and security infrastructure.

Performance validation testing will assess production throughput, quality output levels, and operational stability during controlled trial production runs. These tests ensure that the facility is capable of meeting the required production standards before transitioning to operational use.

3. System Monitoring and Performance Tracking

Continuous system monitoring will be implemented to track the performance of critical systems throughout the project lifecycle. Monitoring tools and digital dashboards will be used to observe operational parameters such as environmental stability, system uptime, security event detection, and production equipment performance.

Environmental monitoring systems will track temperature, humidity, and air quality within production zones to ensure that the required environmental conditions for currency printing are maintained. IT monitoring systems will track system availability, network performance, and cybersecurity events.

Security monitoring platforms will track access control events, intrusion detection alerts, and surveillance system performance to ensure that the facility maintains the highest level of operational security.

This continuous monitoring approach enables real-time detection of anomalies and provides valuable data for quality analysis and operational readiness assessments.

4. Governance Reviews

Quality monitoring results will be reviewed regularly through the project governance structure. Governance reviews ensure that quality performance remains aligned with project objectives and that appropriate actions are taken when deviations occur.

Quality performance data will be presented to the Project Steering Committee and other governance bodies through structured reporting mechanisms. These reviews will assess the status of key quality metrics, evaluate risks associated with quality issues, and determine whether corrective actions are required.

Governance reviews will also support stage-gate approvals and ensure that project deliverables meet the required quality standards before advancing to subsequent phases of the project lifecycle.

13.3 Quality Reporting Procedures

Quality reporting provides the formal communication mechanism through which quality performance information is documented and shared with project stakeholders. Quality reports will summarize inspection results, testing outcomes, system monitoring data, and corrective actions implemented during the reporting period.

The reporting structure will ensure that project leadership and governance bodies receive accurate and timely information about the quality status of the project.

Quality reports will typically include the following elements:

- Summary of completed inspections and testing activities
- Status of key quality metrics and performance indicators

- Identification of quality deviations or non-conformances
- Root cause analysis of identified quality issues
- Corrective and preventive actions implemented
- Status of ongoing quality improvement initiatives
- Recommendations for further action or escalation if required

Quality reports will be prepared periodically and submitted to the Project Steering Committee as part of the project governance reporting cycle. These reports will also be archived within the project document management system to maintain a complete audit trail of quality performance throughout the project lifecycle.

13.4 Non-Conformance Management

When deviations from defined quality standards are detected, the issue will be documented as a non-conformance and recorded in the project issue management system. Non-conformances may arise from construction defects, equipment malfunctions, system integration issues, cybersecurity vulnerabilities, or operational process failures.

Each identified non-conformance will be analyzed to determine its root cause and potential impact on project performance. The project team will then develop appropriate corrective and preventive actions to address the issue and prevent recurrence.

Corrective actions may include rework of defective construction elements, recalibration of machinery, modification of system configurations, or updates to operational procedures. Preventive actions may involve process improvements, additional training, or enhancements to monitoring mechanisms.

All corrective actions will be tracked through the project issue management process until the issue is fully resolved and verified.

13.5 Integration with Change Control

Quality issues that impact the project scope, schedule, cost, or security architecture may require formal approval through the project's integrated change control process. In such cases, a change request will be submitted to the Change Control Board for review and decision.

The change control process ensures that any modifications to approved project baselines are evaluated carefully and approved through the appropriate governance channels. This prevents uncontrolled changes that could compromise project quality or operational integrity.

Quality monitoring results therefore play a critical role in identifying when changes to project deliverables or processes are necessary.

13.6 Stage-Gate Quality Reviews

Quality monitoring outputs will serve as key inputs to the project's stage-gate governance framework. Before the project transitions from one phase to the next, a stage-gate review will be conducted to verify that all required deliverables meet the defined quality standards.

These stage-gate reviews will examine inspection results, testing reports, system monitoring data, and documentation completeness. The governance board will assess whether the project is ready to proceed to the next phase based on the quality evidence presented.

Stage-gate quality reviews are particularly critical during the following transitions:

- Completion of facility construction
- Completion of machinery installation
- Completion of system integration
- Completion of testing and commissioning
- Completion of operational readiness verification

Only after the successful completion of these quality reviews will the project receive authorization to proceed to the subsequent phase.

13.7 Operational Readiness Verification

Quality monitoring will play a crucial role in determining whether the facility is ready to transition into operational production. Operational readiness verification ensures that all systems, processes, personnel, and documentation are prepared for full-scale operation.

The operational readiness review will evaluate several critical factors, including system reliability, equipment performance, personnel competency, security system effectiveness, and documentation completeness.

Quality metrics collected during testing and commissioning will provide objective evidence supporting the readiness decision. If the facility meets all operational readiness criteria, the Project Steering Committee will authorize the formal transition to operational production.

13.8 Continuous Quality Improvement

Quality monitoring and reporting will also support continuous improvement throughout the project lifecycle. Lessons learned from inspections, testing activities, and operational trials will be documented and incorporated into project processes.

Continuous improvement efforts will focus on enhancing operational efficiency, strengthening security controls, improving production quality, and optimizing system reliability.

Lessons learned will be captured in the project lessons learned register and will be reviewed during governance meetings to ensure that knowledge gained during the project is applied effectively.