

COGNMAS3

Maintain and review nuclear material measurement quality control



Overview

This NOS forms part of a suite of standards which cover the activities carried out by individuals working within and on behalf of nuclear site licensed companies to meet nuclear material accountancy, control and safeguard (**NMAS**) requirements.

What is the NOS about?

A nuclear licensed site must ensure that nuclear materials are accounted for, controlled and safeguarded in order to demonstrate; good governance arrangements; meeting international safeguards commitments; and compliance with legal requirements and any voluntary undertakings. This NOS describes the standard expected of individuals who are responsible for the performance of measurement systems used by the NMAS system.

Who is the NOS for?

This NOS is primarily for Technical Specialists within or working for the nuclear site licence companies who are responsible for managing compliance with NMAS requirements for measurement quality control at a plant or site level.

The main outcome of this activity is a control programme to maintain appropriate performance of the measurements of nuclear materials. This includes routine analysis of the output data to maintain quality control.

Where text is highlighted in bold, it is more fully defined in the Glossary section of this NOS.

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Performance criteria

You must be able to:

- P1 maintain accurate **documentation of the NMAS measurement requirements**
- P2 operate a:
 - P2.1. **measurement control programme** for NMAS measurement points and associated reference materials
 - P2.2. measurement **asset management** system
 - P2.3. measurement configuration management system
- P3 analyse measurement performance and respond appropriately to **measurement quality issues**. This includes resolution of differences identified by independent safeguards measurements
- P4 ensure measurement stability and availability
- P5 review appropriateness of **estimation and assignment methods** used to derive mass assignments
- P6 ensure all measurement data/records are authentic, approved, actively managed, secured and retained
- P7 ensure data is appropriately cross referenced (sample, sample method, measurement method and dates) to allow evaluation
- P8 determine and control the impact on the material balance of any measurement process changes and ensure changes are documented and communicated to the relevant interfaces
- P9 apply good practice identified in participation in benchmarking with other organisations and international inter-laboratory performance/comparison exercises

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Knowledge and understanding

You need to know and understand:

- K1 **general metrology, measurement systems, calibration systems and measurement terminology**
- K2 **sampling, analysis and measurement requirements** and techniques and good practice
- K3 measurement system investigation, optimisation and troubleshooting techniques
- K4 the measurement control programme, measurement traceability and tamper proofing
- K5 configuration and asset management procedures including plant modification proposals and maintenance schedules
- K6 the **process context** and nature and condition of the current measuring and test equipment, **sampling arrangements** and waste procedures
- K7 independent safeguards equipment or **branching** from operator's equipment installed in the plant
- K8 the material balance and key measurement points and the associated measurement requirements and NMAS **capability requirements**
- K9 the requirements for risk analysis and operability assessments
- K10 measurement uncertainty determination, management, reporting, application of correction factors (e.g. **buoyancy**), linkage between measurement system uncertainty analysis and plant conditions
- K11 applied Mathematics and basic statistics tools for distributions, variances, standard error, correlations, interpolation and extrapolation, and statistical sampling plans
- K12 performance data obtained from commissioning trials, inter-process comparisons, regular re-calibration, acceptance tests and historical records
- K13 types of instrumentation in a nuclear environment, including the plant control philosophy, distributed control systems in place, loop controls and programmable logic control, and contamination controls
- K14 relevant metrology software

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Additional Information

Glossary

Asset management: the management of equipment resources, including routine and breakdown maintenance, equipment degradation, obsolescence, replacement and disposal.

Branching: an independent off-take from operating equipment used for regulatory verification.

Buoyancy: describes atmospheric and environmental conditions which affect the accuracy of measurement equipment.

Calibration systems: includes calibration procedures, methods, processes and practices, control of the calibration environment, and manual and automatic systems.

Capability requirements: including:

- 1 inventory and flow measurements.
- 2 precision and accuracy specifications.
- 3 identification of which measurements have most impact on the accountancy material balance.
- 4 measurement techniques.

Documentation of the NMAS measurement requirements: includes:

- 1 the key measurement points in the accounting area.
- 2 accountancy data and its transmission.
- 3 values for equipment precision and accuracy.
- 4 the measurement goals and target achievements set out in the design.

Estimation and Assignment methods: include modelling, statistical analysis and historic review.

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General Metrology: includes SI units, factors and fundamental constants, types of measurement and standards, traceability and measurement terminology.

International Target Values: the International Target Values, issued under the auspices of the IAEA as document STR368 set out expected values for random and systematic measurement uncertainty components for destructive analysis (DA) and non-destructive assay (NDA) measurements performed on nuclear material.

Measurement Control Programme: a system to ensure the effectiveness of measurement and analytical systems and the quality and validity of resulting data that is generated for nuclear material accountancy and safeguards purposes. Quality controls include performance monitoring, testing and analysis, calibration and certification, control of certified reference materials and sources.

Measurement quality issues: may include :

- 1 making appropriate on-plant adjustments.
- 2 investigating and reporting any suspected unauthorised tampering or attempts to bypass measurement points.
- 3 eliminating or compensating for bias, reduce factors which impact on measurement variability.
- 4 reviewing correction/compensation factors and drive measurement quality improvement and trials.

Measurement systems: includes measurement methods, characteristics, systems and capabilities, measurement records, primary error sources and measurement assurance.

Measurement Terminology: used in measurement systems includes bias, linearity, stability, accuracy, repeatability, discrimination, resolution, reproducibility etc.

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Process Context: includes the plant design, the measurement envelope, the physical and chemical properties of materials in the plant flow-sheet, the ionising radiation environment, measurement system maintenance and eventual decommissioning policy and the plant operating parameters and expected throughputs.

Sampling, analysis and measurement requirements: including legal and regulatory requirements and any voluntary undertakings concerning certification, accreditation, reference materials, ISO standards, and **International Target Values**. Requirements include equipment systems used for nuclear material mass determination and for nuclear material control

Sampling arrangements: including: homogeneity, sample size, sub sampling, sample preparation, transfer, analysis, retention, and sample disposal.

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