



Next Generation Noble Gas Systems Acceptance Process

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¹Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization

- In 1999 the Preparatory Commission tasked the PTS to conduct a noble gas equipment test – the ‘**International Noble Gas Experiment (INGE)**’
- The purpose of INGE is to assess the state of the art of the noble gas technology and its capability to meet the Treaty verification goals.
- The major goals of INGE are to verify that:
 - *Noble gas monitoring is a reliable technique for monitoring nuclear tests*
 - *The IMS minimum requirements set for noble gas monitoring can be fulfilled;*
 - *The noble gas systems are suitable for operation under typical IMS conditions.*

The Experiment has been carried out in three phases:

- Phase I – development and/or upgrading of existing equipment
completed in 2000
- Phase II – simultaneous laboratory testing of the equipment (Freiburg, Germany)
completed in 2001
- Phase III – Field testing: **ongoing**

Main tasks of INGE Phase III:

- Testing and Evaluation of installed noble gas systems
- Assessment of O&M aspects and development of maintenance strategies
- Development of certification requirements
- Development of a QA/QC system for the noble gas network (noble gas laboratories)
- Development of software for noble gas analysis
- Development of a categorisation scheme
- Development and Assessment of Atmospheric Transport tools for noble gas
- Development of Operational Manuals (Ops manuals for noble gas, station specific operational manuals for noble gas systems)

IMS NG Systems Distribution as of Q4 2018:

	SPALAX (2gen)	SAUNA (2gen)	ARIX (2gen)	Total
Certified	9	16	0	25
Installed	10	17	4	31
To be installed soon	2*	1	0	3*

* SPALAX to replace obsolete ARX01 ARIX

Next Generation Systems: a new Phase for INGE

Four new noble gas systems/system generations have been presented in various fora (WGB, INGE WS, etc); In particular:

- SAUNA III from FOI
- SPALAX NG from CEA
- MIKS from VNIIA
- Xenon International from PNNL/TBE

Before a new system can be considered suitable for operations, each new system must: (i) Undergo general acceptance testing to validate basic system performance; and (ii) accomplish a testing phase in typical IMS conditions (like in INGE phase III) at its respective IMS site demonstrating 95% data availability over a span time of a 1 year¹.

These criteria constitute the basis for the PTS evaluation for the purpose of certification.

¹As per Operational Manual requirement CTBT/WGB/TL-11,17/18/Rev.5 and updates from CTBT/WGB/TL-11,17/59/Rev.1

Next Gen Systems Acceptance

In order to consider a new system generation for replacement (during station re-capitalization) or as a candidate for a station's first installation, the system should have already been accepted for IMS application.

Even if compliant with the IMS minimum requirements, a new system generation may have different levels of impact when integrated into the IMS network and specifically:

- Current station infrastructure, i.e. power, cooling, space, new type of gas carrier etc.
- System calibration, i.e. new procedure, need of source mock-up, new hardware
- System output data both in size and type
- Different collection periods and number of samples per day
- System SoH, i.e. new sensors definition
- Data processing and analysis, e.g. modified data formats and new analysis algorithms
- Costs of installation and operation

All those aspects will impact IMS, IDC, and all NDCs.

It is duty of the new system developers/vendors to provide enough information on:

- System design
- System infrastructure requirements
- System calibration method
- System review method
- System SOH data including the definition of all sensors
- System data format and size if not complaint to the IMS2.0
- Example of data, both SoH, SAMPLEPHD, GASPHD (if any), BACKPHD, QCPHD
- Operating Manual (SSOM)
- Maintenance Plan including list of spare parts with frequency and costs
- Sustainability plan including manufacturer and plan for sustaining the new design

Next Gen Systems: How to Evaluate

The design of a new system generation focuses on the improvement of modularity, maintainability, robustness, MDC, time resolution and other.

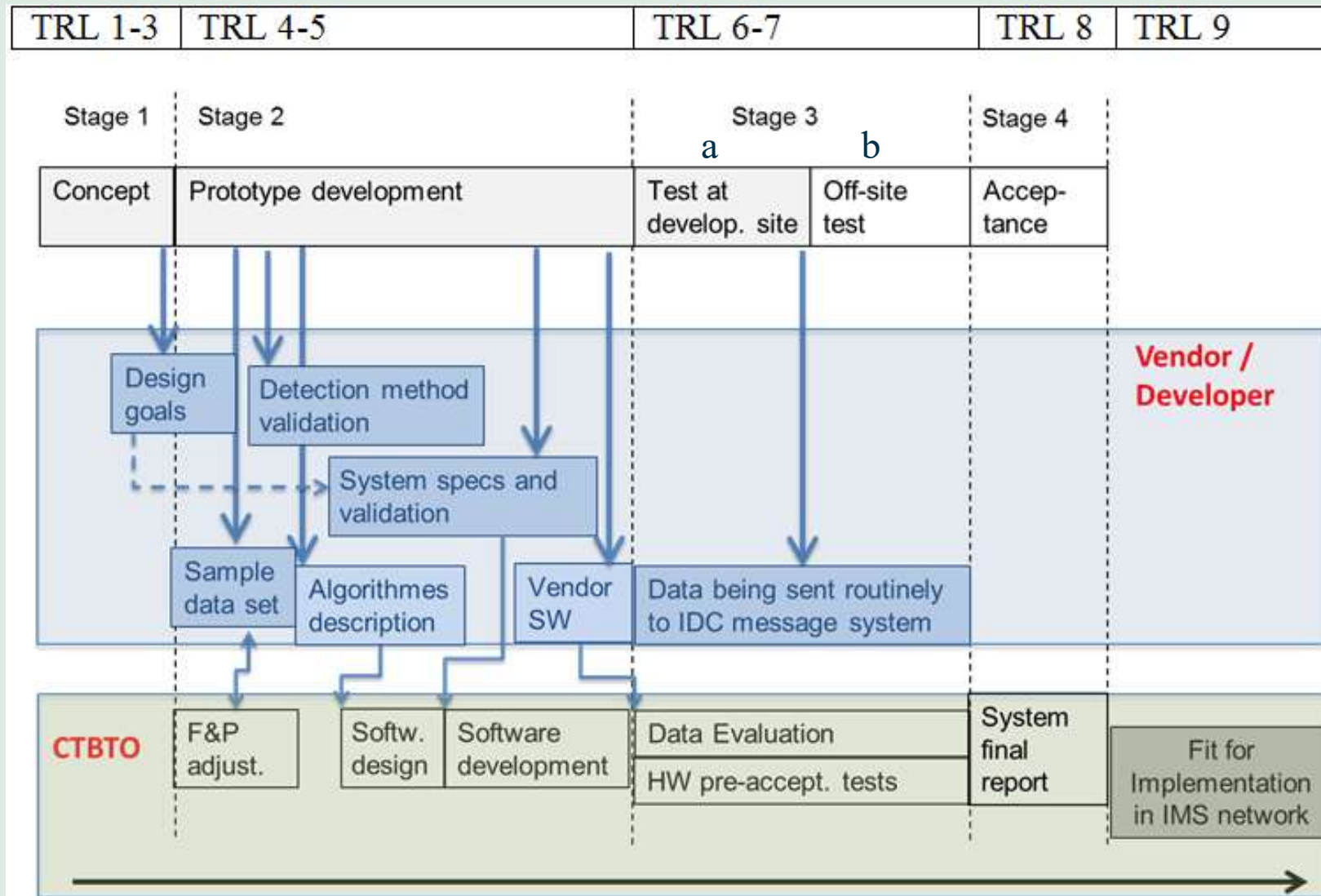
Some systems will not impact the type of data and the review methods, others may if using:

- new detector technology (like SiPIN)
- different geometry (i.e. symmetric vs asymmetric)
- different ROIs (in definition and in number)
- higher resolution and therefore larger data size

If new data type, calibration, review methods apply to a new system, it is duty of the system developers to:

- present to PTS/INGE, new methods (calibration and review) for approval and provide enough details for the PTS to implement
- provide a validation report on the methods to be used
- provide SW prototype based on these methods to be used during the evaluation period
- Facilitate the processing and analysis with the method currently in IDC operations for certified stations

Next Gen Systems: Acceptance Process



Next Gen Systems: Testing Plans

SPALAX NG

- Stage 1: completed
- Stage 2: prototype completed - algorithm description, system specs and validation, sample data and preliminary SW source code received
- Stage 3 part a: System installed at CEA HQ with continuous data sending (from Sep 2018)
- Stage 3 part b: System to be moved to Health Canada in parallel to SPALAX 2 gen with continuous data sending (Q2 2019)

SAUNA III

- Stage 1: completed
- Stage 2: prototype completed - system specs and validation and sample data
- Stage 3 part a: System installed at SCIENTA/FOI HQ with continuous data sending 6 months completed.
- Stage 3 part b: System to be installed at USX75 in parallel with IMS SAUNA II with continuous data sending (Q1 2019)

Xenon International (XEI)

- Stage 1 : Completed
- Stage 2 : First system information documentation and some sample data received. Series of regular meetings for information exchange
- Stage 3 : Planned to start in Q1 2019. Planning under progress

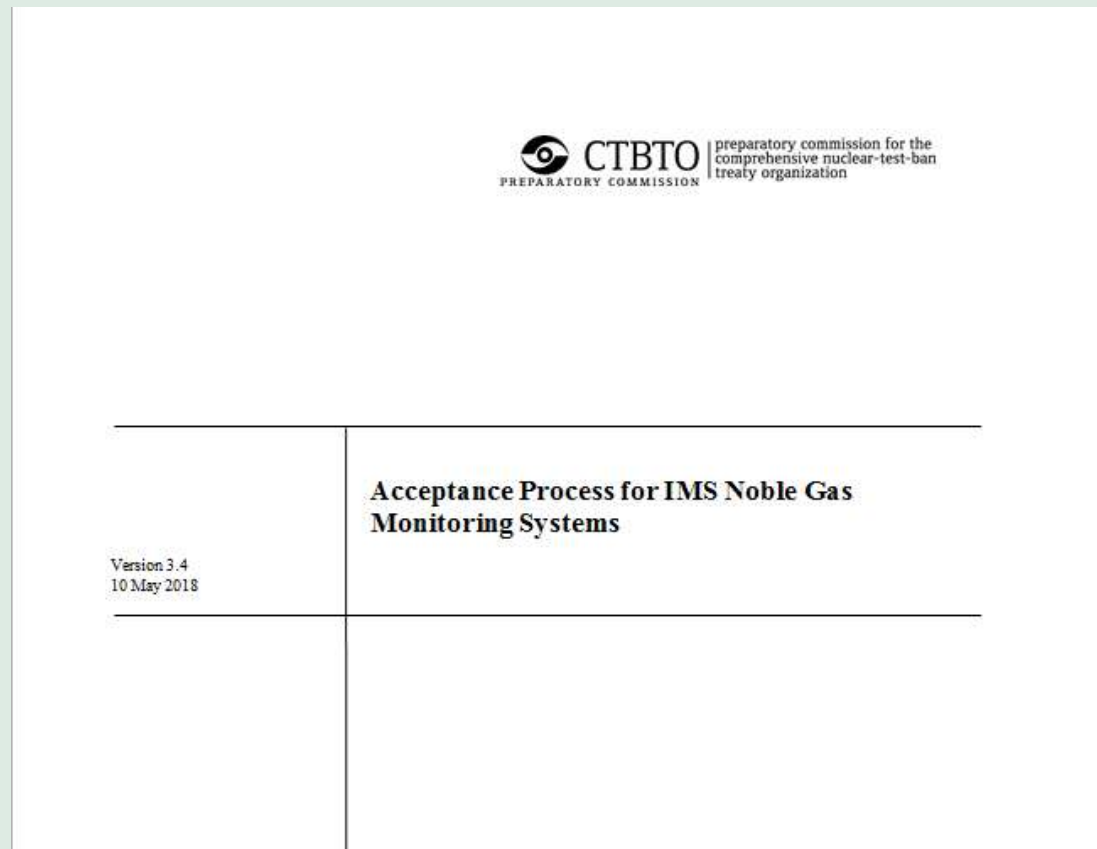
MIKS

- Stage 1 Completed
- Stage 2: prototype not finalized, some documentation on system specs and validation have been received.
- Stage 3: TBD

Next Gen Systems: Acceptance Process



The Acceptance process is described in the document “**Acceptance process for IMS Noble Gas Monitoring Systems**” which provides details to the system developer on the acceptance process. This document is available at the INGE website and it was reviewed by all stakeholders and it is now considered final.



Thank you