

How to apply AML Analyser Management in day to day maintenance activities



One step beyond your imagination

Table of Contents

1	Introduction.....	3
2	Key incentives for using AML Analyser Management?	3
3	Functional overview.....	4
3.1	Analytical Performance / Validations.....	4
3.1.1	Validation Methods.....	4
3.2	Analyser availability.....	5
3.3	Analyser maintainability	5
3.4	Maintenance support	5
4	Uses of AML Analyser Management	6
4.1	Maintenance engineers.....	6
4.1.1	Analyser Maintenance.....	6
4.1.2	Analyser Maintainability.....	6
4.2	Maintenance Planners / Supervisors	6
4.3	Asset/maintenance management	7
4.4	QC laboratory / LIMS.....	7
4.5	Control room operators.....	7
4.6	Operations management	7

1 Introduction

What is AML Analyser Management? AML Analyser Management is a software application. The principal goal of AML Analyser Management is to monitor, evaluate validate and improve the performance of online process analysers in a process plant and offline analysers in a laboratory. The definition “performance” in this context is:

- Analytical performance (precision and accuracy)
- Availability
- Maintainability

AML Analyser Management is able to acquire information in several ways:

- Automatic data collection of real-time data:
 - directly from the analysers
 - via the DCS
- Manually-entered data entered by maintenance personnel, operators, and lab technicians:
 - maintenance activities performed
 - analyser readings, e.g. for analysers without automatic readout facilities.

The Hint AML-Analyser Management solution is based on the ASTM-D3764 standard and the Shell standard for AML Analyser Management (Shell Report OP 97-30425.)

2 Key incentives for using AML Analyser Management?

If applied properly, the benefits of AML Analyser Management can be significant. Incentives for using AML Analyser Management exist in the following areas:

- Maintenance Engineer
 - Elimination of unnecessary maintenance.
 - Indication of the most likely problems requiring maintenance (i.e. problem in the analyser or the sampling system)
- Maintenance Planner / Supervisor
 - Earlier information on upcoming maintenance needs
 - Allow harmonizing with other maintenance activities
- Maintenance / Asset management System
 - Intelligent front-end to a central Maintenance / Asset management system such as SAP, Avantis, Maximo. (translate field data into analyser health information)
 - Eliminate need for manual data entry
 - Basis for selection of equipment for future projects
 - Basis for determining stock levels for spares and consumables
- QC laboratory
 - Possibly reduce the need for/frequency of routine lab analysis (e.g. eliminate work during night shift)
 - Eliminate/reduce need for manual data entry into LIMS
 - Aids in quality audits and certifications
- Control room operator
 - Higher confidence in operating results
 - Possibly increased job satisfaction
- Operations Management
 - Closer control, reduced quality giveaway

3 Functional overview

The main functionalities of AML Analyser Management are:

- Monitor and control analytical performance
 - Automatic and manual validation, using Statistical Process Control (SPC) techniques
- Monitor and control availability
 - Keep track of operational states of analysers
 - Time rated performance indicators
- Monitor and control maintainability
 - Registration of maintenance activities
- Support of maintenance activities
 - Show details of plant, streams, components and instruments
 - Online access to documents and procedures

3.1 Analytical Performance / Validations

To monitor and control analytical performance of the analysers, they should be validated on a regular basis. In the past, the most common method for assuring analyser performance was “periodic calibration / maintenance” as laid down in the work procedures of the client. With AML Analyser Management the focus can switch from “periodic calibration / maintenance” to “condition based calibration / maintenance”. A properly running analyser should not be maintained, just because “it is on the list for this week”. AML Analyser Management is monitoring whether an analyser runs within its operation limits, which means that no calibration is required when an analyser is performing within these operation limits. The AML Analyser Management system informs the user (by use of Statistical Process Control charts - SPC) of the need and urgency for analyser calibration and/or maintenance.

3.1.1 Validation Methods

The Hint AML-Analyser Management package supports several validation methods. Two of the most common used methods are described in this section.

Line sample method

For the “line sample” validation method samples are taken from the process (in a sample bomb or bottle) and sent to the QC laboratory. Process samples are normally collected according to a sample schedule. The sample taking time has to be recorded, to allow identification of the analyser readings at sample taking time, especially if the sample taking time deviates from the sample schedule. When the test results are provided by the laboratory the results and sample taking time must be entered into the AML Analyser Management system, transmitted to it via a LIMS, or from the DCS (in case the QC laboratory provides analysis results to the control room by phone). After receiving the results from the QC laboratory the SPC charts for the analyser/stream point will be updated. Some characteristics of the line sample method are:

Line sample method	
Advantages	Disadvantages
Finds problems in analyser and in sample system	More time needed to identify analyser problem
	Several human actions are required to get information into AML Analyser Management, with associated chance for error

Reference sample method

For the reference sample mode the laboratory is not involved. Instead the SPC charts are generated automatically by trending the results of periodic analysis of a reference gas or liquid. Some characteristics of the reference sample method are:

Reference sample method	
Advantages	Disadvantages
Fast way to identify analyser problem	Problems in sampling system are not identified
Potentially reduce need for routine analyses in QC laboratory	
Fewer sources of human errors in data entry	

Common for both methods is the use of SPC charts for plotting the deviations to provide information on the operational condition (accuracy and precision) of the analyser. In addition AML Analyser Management applies statistical rules (“Western Electric Rules”) to generate warnings and alarms.

3.2 Analyser availability

The AML Analyser Management system provides three Key Performance Indicators (KPI’s) as a minimum relating a predefined (configurable) start time to the elapsed periods, the analyser was in one of the following modes:

- Normal Operation (available for process measurement)
- Checking (Scheduled maintenance, validation (ref. sample))
- Breakdown (analyser is broken, out of service or not available for process measurement)

Optionally additional KPI’s can be defined, i.e. for the time period the analyser readings were “questionable” but not “bad”.

3.3 Analyser maintainability

Major advantages of the AML Analyser Management system are that it can provide statistics on causes of breakdown and the maintenance activities that were required and thus can be part of quality improvement program.

3.4 Maintenance support

The AML Analyser Management system provides is a complete overview of all analyser instrumentation with instrument details, measured components, connected streams and also the possibility to upload all analyser related documentation (maintenance procedures, manuals etc). All information is stored and available in one application.

4 Uses of AML Analyser Management

To gain all benefits from AML Analyser Management, it is essential that its use is fully embedded in the day to day activities. This requires discipline from all parties involved. Paramount is that management at all levels and disciplines is using the AML Analyser Management information in their decision making, planning and reviews with their personnel. Users of AML Analyser Management include the maintenance engineers, maintenance planners / supervisors, the asset/maintenance management software, QC laboratory / LIMS, control room operators and operations management. Their role can be "active", meaning they have to enter information into the AML Analyser Management or passive, when they are just using information provided by the AML Analyser Management.

4.1 Maintenance engineers

4.1.1 Analyser Maintenance

Like all other equipment, process analysers require maintenance. This means that the analyser is temporary taken offline from the process, for maintenance activities such as calibration, cleaning, exchange of sample gas etc. To get good KPI's on the analyser performance it is mandatory that the AML Analyser Management system becomes an integral part of the maintenance procedures and is fully incorporated in the maintenance workflow. This means that AML Analyser Management must be informed of all manual actions for every analyser, by initiating the action via data entry to the AML Analyser Management.

A typical procedure could be:

1. Put the analyser (the one that requires maintenance) in checking mode using the instrument controls on the "instrument overview" in the AML Analyser Management application
2. Perform maintenance / calibration of the analyzer, in the field or in the maintenance workshop
3. After finalizing maintenance activities: Put the analyser in normal operation (or breakdown when analyser is damaged) using the instrument controls on the "instrument overview" in the AML Analyser Management application.

NOTE: if the usage of the controls is not incorporated in the maintenance work procedures, the NORMAL operation KPI will probably indicate 100%, an excellent performance, however not in line with the reality.

4.1.2 Analyser Maintainability

AML Analyser Management can keep track of all maintenance activities. A user is able to register all maintenance details with the related time expenses.

To provide a good maintenance track record of every analyser "activity sets" should be defined in AML Analyser Management. When performing maintenance, the maintenance personnel can indicate the activities that were required for maintaining the analyser. This way more insight can be gained in the required maintenance activities (e.g. in form of Pareto charts), which can ultimately result in reducing the need for maintenance, e.g. by a change of procedures or modification of the equipment. The "Operational States" option in the "States Overview" display of AML Analyser Management allows to register all maintenance activities that were performed.

4.2 Maintenance Planners / Supervisors

The term "Statistical Process Control" may imply that "it is all automatic" and that no further manual involvement is required. This is however not true. Warnings and/or alarms from the AML Analyser Management system should not result in immediate action, without a careful review of the situation. Some known event in the process, sampling system or analyser that occurred in the past may have created unrealistic analysis results. These false signals corrupt the control charts and generate false alarms and warnings. AML Analyser Management offers facilities to detect and eliminate such "outliers". Such checks should be performed by a maintenance planner / supervisor, before submitting a request for maintenance to the maintenance management system and/or issuing a work order for maintenance.

In addition to this check / reconciliation, the maintenance planner / supervisor can try to interpret the SPC charts for potential causes of the problem.

Examples:

AML Analyser Management information	Potential cause
Low variance in a range chart	Blocked sample line or filter
Deviations on some, but not all components for different streams	Aging of a GLC column, dirty electrodes
Analyser shows alarms with line sample method, but not with reference sample method	Problem probably in sampling system

Such information can possibly improve the efficiency of the maintenance crew. As time goes on, the maintenance planner/ supervisor can collect more information on potential causes, eventually such information could be incorporated as “artificial intelligence” in AML Analyser Management.

4.3 Asset/maintenance management

Asset management /maintenance management packages are a passive user of the AML Analyser Management information. AML Analyser Management can provide “equipment health” indicators to these systems for scheduling maintenance, ordering of spares and consumables and planning turnarounds. Our recommendation is to only submit data to this level that has been “screened” beforehand by the maintenance planner/supervisor.

4.4 QC laboratory / LIMS

Personnel in the QC lab should enter analysis results including all necessary information to allow its use in AML Analyser Management to correlate the results with the on-line analyser data at the time, the sample was taken. Data can be entered via a dedicated AML Analyser Management station via the LIMS or by informing the control room operator.

4.5 Control room operators

If the laboratory submits analyser results to the control room e.g. by phone, the control room operator should enter it into the DCS including all identifying information of sample point and sample taking time to allow AML Analyser Management to relate the information to the real-time data stored in its historical database.

The control system / DCS support should be configured to accept the analyzer health data from AML Analyser Management and show it on the operator workstation (i.e. by colour coding of the displayed data) to aid in the decision making of the operators.

4.6 Operations management

Operations management are a passive user of AML Analyser Management. They should periodically review analyser performance data with the goal to possibly adjust controls and set points and thus reduce unneeded quality giveaway.