ASTM INTERNATIONAL
Helping our world work better

Statistical Quality Control and Control Charts;
A Tool Set for Accuracy and Precision Improvement
Fuel Ethanol Laboratory Conference
Omaha, NE

Chris McCullough
General Manager, Laboratory Services Program Development
October 16, 2024
www.astm.org

Laboratory Objectives

Keys to Meeting Objectives: Competent Analysts & Well Running Equipment

The Objective of a laboratory is to generate **Accurate Test Results**, on a **Consistent Basis**, in a **Timely Manner** while keeping **Costs Reasonable**.

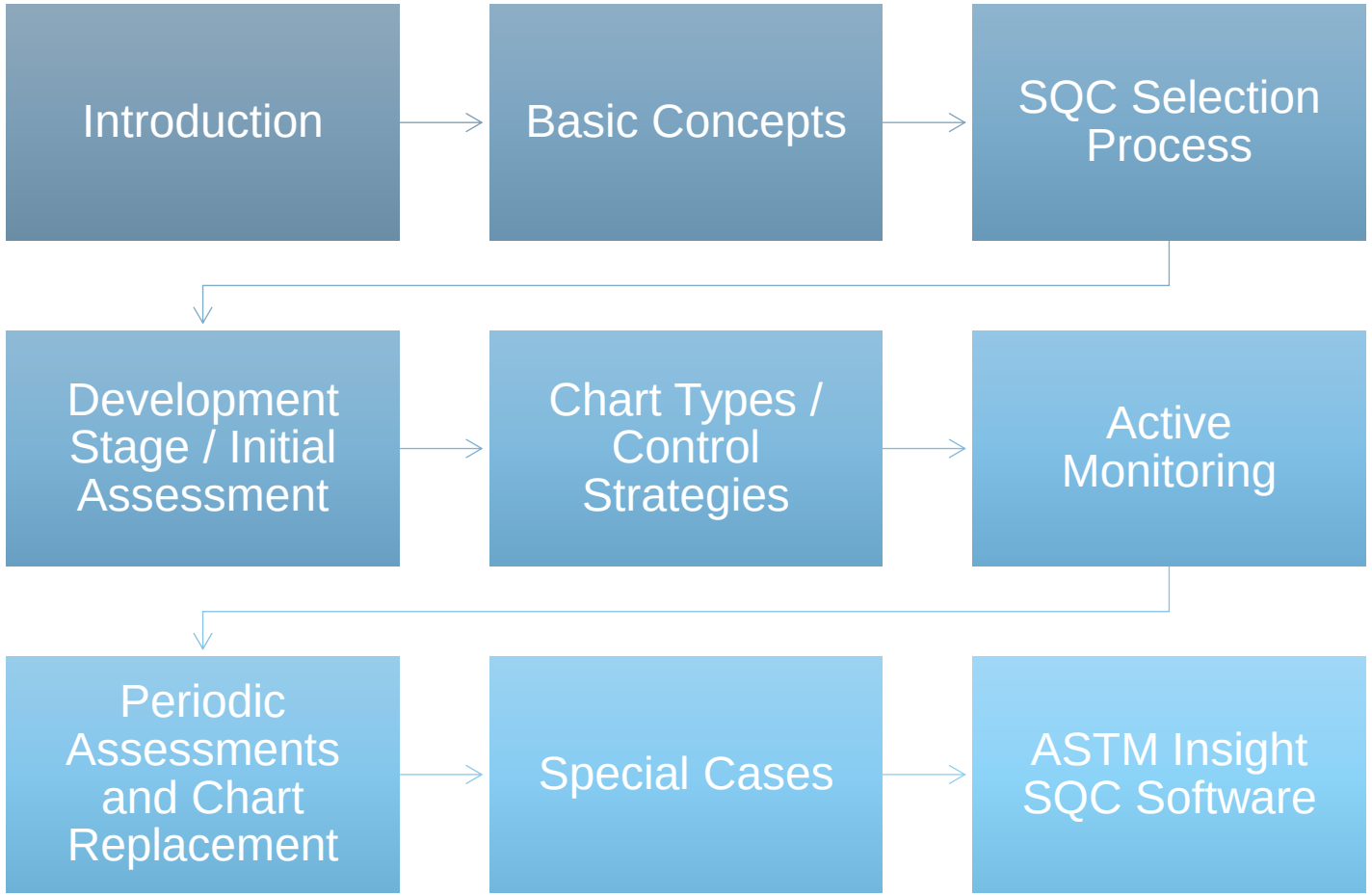
ASTM International Laboratory Services enable laboratories to meet these challenges by providing high quality, user friendly, integrated solutions at a reasonable cost.

Laboratory Challenges

Partial List

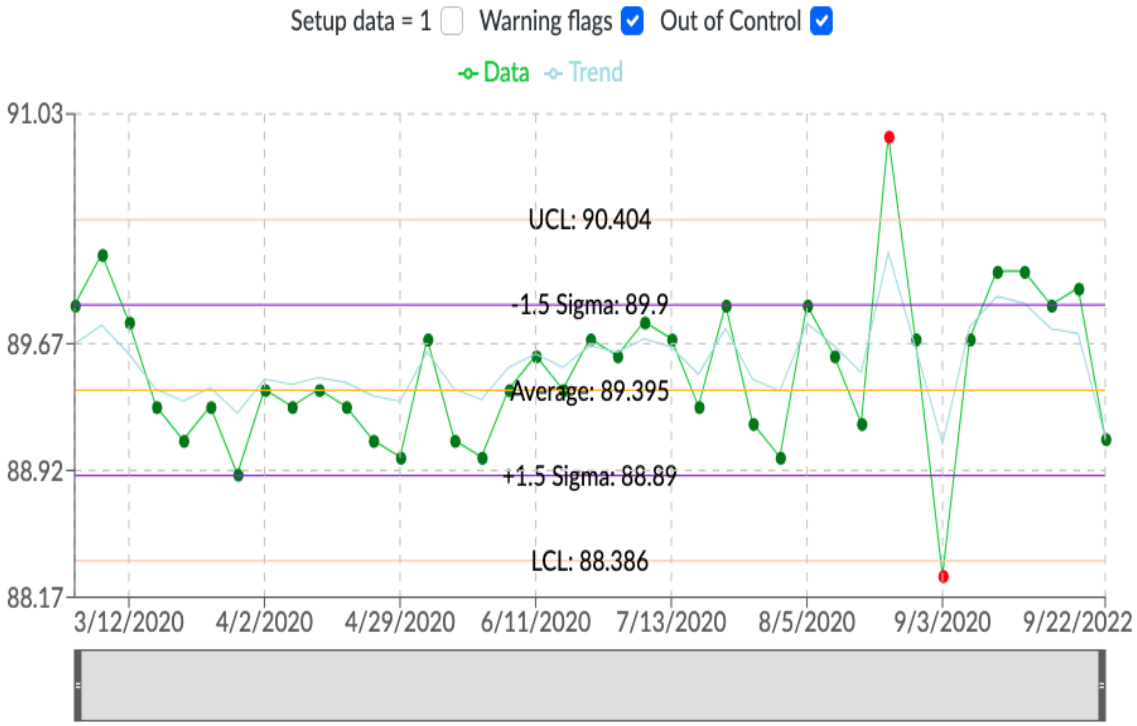
- Pressures to lower operating costs
  - Extension of equipment life cycle (Capex)
  - Lower costs of consumables
- Pressures to maintain customers and win new ones
  - Accuracy of test results
  - Customer Service
  - Timeliness (Demurrage)
- High staff attrition rates
  - Knowledge/experience vacuum
- Regulatory compliance
- Internal and Customer Reporting
- Supply Chain Disruptions

Agenda

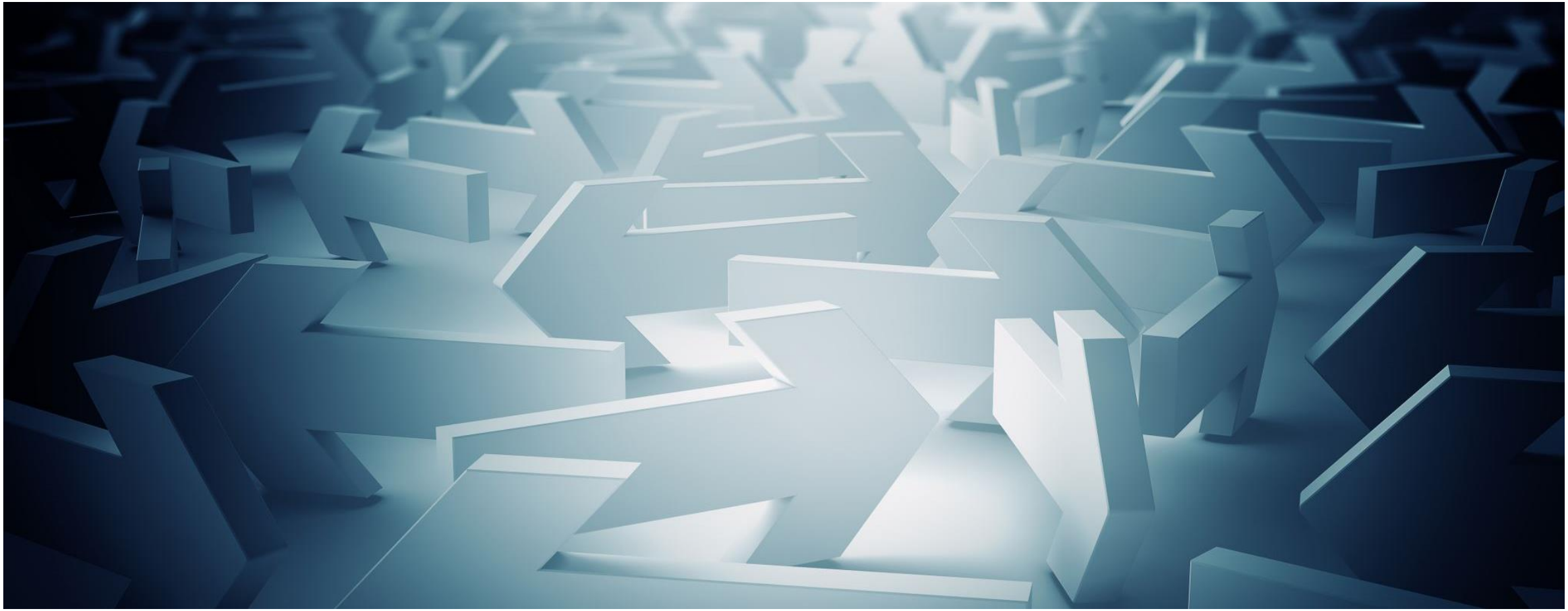


Statistical Quality Control and Control Charts

- **statistical quality control, n**—set of techniques for improving an analytical process by reducing variation through the use of control charts or other mechanisms coupled with a corrective action strategy used to bring the process back into a state of statistical control.
- Statistical Process Control (SPC) vs. Statistical Quality Control (SQC)



Basic Concepts



Definitions

statistical quality control, n—set of techniques for improving an analytical process by reducing variation through the use of control charts or other mechanisms coupled with a corrective action strategy used to bring the process back into a state of statistical control.

control chart, *n*—chart on which are plotted a statistical measure of a subgroup versus time of sampling along with limits based on the statistical distribution of that measure so as to indicate how much common, or chance, cause variation is inherent in the process or product. ASTM E456-13a(2022)

normal distribution, *n*—frequency distribution characterized by a bell shaped curve and defined by two parameters: mean and standard deviation. ASTM D4175-22

accepted reference value (ARV), n—a value that serves as an agreed-upon reference for comparison and that is derived as (*1*) a theoretical or established value, based on scientific principles, (*2*) an assigned value, based on experimental work of some national or international organization, such as the U.S. National Institute of Standards and Technology (NIST), or (*3*) a consensus value, based on collaborative experimental work under the auspices of a scientific or engineering group. ASTM D6299-22

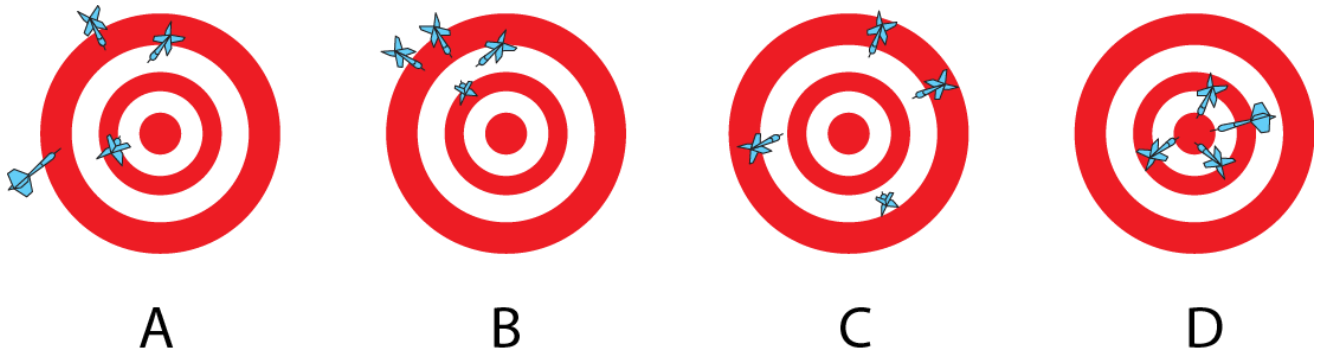
system [site] expected value (SEV), n—for a QC sample this is an estimate of the theoretical limiting value towards which the average of results collected from a single in-statistical-control measurement system under site precision conditions tends as the number of results approaches infinity. ASTM D6299-22

Definitions Continued

accuracy, *n*—the closeness of agreement between a test result and an accepted reference value. ASTM E456-13a(2022)

precision, *n*—the closeness of agreement between independent test results obtained under stipulated conditions. ASTM E456-13a(2022)

bias, n—a systematic error that contributes to the difference between a population mean of the measurements or test results and an accepted reference or true value. ASTM D6299-22



https://manoa.hawaii.edu/exploringourfluidearth/physical/world-ocean/map-distortion/practices-science-precision-vs-accuracy

Definitions Continued

repeatability conditions, n—conditions where independent test results are obtained with the same method on identical test items in the same laboratory by the same operator using the same equipment within short intervals of time.

reproducibility conditions, n—conditions where independent test results are obtained with the same method on identical test items in different laboratories with different operators using different equipment.

Discussion—Different laboratory by necessity means a different operator, different equipment, and different location and under different supervisory control.

site precision conditions, n—*for a single analytical measurement system (see 3.2.4)*, conditions under which test results are obtained by one or more operators in a single site location practicing the same test method on a single measurement system using test specimens taken at random from the same sample of material, over an extended period of time spanning at least a 20 day interval.

Discussion—It is defined as 2.77 times $\sigma_{R'}$, the standard deviation of results obtained under site precision conditions.

Discussion—Site precision conditions should include all sources of variation that are typically encountered during normal, long term operation of the measurement system. Thus, all operators who are involved in the routine use of the measurement system should contribute results to the site precision determination. In situations of high usage of a test method where multiple QC results are obtained within a 24 h period, then only results separated by at least 4 h to 8 h, depending on the absence of auto-correlation in the data, the nature of the test method/instrument, site requirements, or regulations, should be used in site precision calculations to reflect the longer term variation in the system.

r, R and R’

Condition	Repeatability (r)	Reproducibility (R)	Site Precision (R’)
Test Method	Same	Same	Same
Test Item (sample)	Same	Same	Same
Laboratory	Same	Different	Same
Operator	Same	Different	Different
Equipment	Same	Different	Same
Time Span	Short	Not Short	Not Short

ASTM D6299 Scope & Summary of Practice

1.1 This practice covers information for the design and operation of a program to monitor and control ongoing stability and precision and bias performance of selected analytical measurement systems using a collection of generally accepted statistical quality control (SQC) procedures and tools.

1.6 This practice assumes that the **normal** (Gaussian) model is adequate for the description and prediction of measurement system behavior when it is **in a state of statistical control**.

4.1 QC samples and check standards are regularly analyzed by the measurement system. Control charts and other statistical techniques are presented to screen, plot, and interpret test results in accordance with industry-accepted practices to ascertain the in-statistical-control status of the measurement system.

Selection Processes

How to Start – Decisions to make

Test Selection

- Frequency of Use
- Criticality of Test
- System Stability / Performance
- Business Economics
- Regulatory, contract, test method requirements

Parameters and Units

- Criticality / Importance
- Indicative of Issues
- Quantity of Parameters
- Unit Conversion

Sample Selection

- With or Without ARV (Precision vs Accuracy)
- Sufficient Quantity
- Stable
- Homogeneous
- Novel Approaches

QC Frequency per ASTM D6792-22

10.1.4.1 If site precision for a specific test has not been established as defined by Practice **D6299**, then the recommended frequency for analysis of QC samples is one QC out of every ten samples analyzed. Alternatively, one QC sample is analyzed each day that samples are analyzed, whichever is more frequent.

10.1.4.2 Once the site precision has been established as defined by Practice **D6299**, and to ensure similar quality of data is achieved with the documented method, the minimal QC frequency may be adjusted based on the Test Performance Index (TPI) and the Precision Ratio (PR).

10.1.4.3 **Table 1** provides recommended minimal QC frequencies as a function of PR and TPI. For those tests, which are performed infrequently, for example less than 25 samples are analyzed monthly, it is recommended that at least one QC sample be analyzed each time samples are analyzed.

QC Frequency Continued

ASTM D6792-22

Standard Practice for Quality Management Systems in Petroleum Products, Liquid Fuels, and Lubricants Testing Laboratories

TABLE 1 Minimal QC Frequency as a Function of Test Performance Index

TPI for Standard Test Methods with PR<4	TPI for Standard Test Methods with PR≥4	Nominal QC Frequency (1 QC out of every X Samples) Values of X	Approximate Percentage of QC Samples/ Total Analyses
Not determined	Not determined	10	9
<0.8	<1.6	10	9
0.8–1.2	1.6–2.4	20	5
1.2–2.0	2.4–4.0	35	3
>2.0	>4.0	40	2

12.1.1 The test performance index (TPI) can be used to compare the precision of the laboratory measurements with the published reproducibility of a standard test method. The term TPI is defined as:

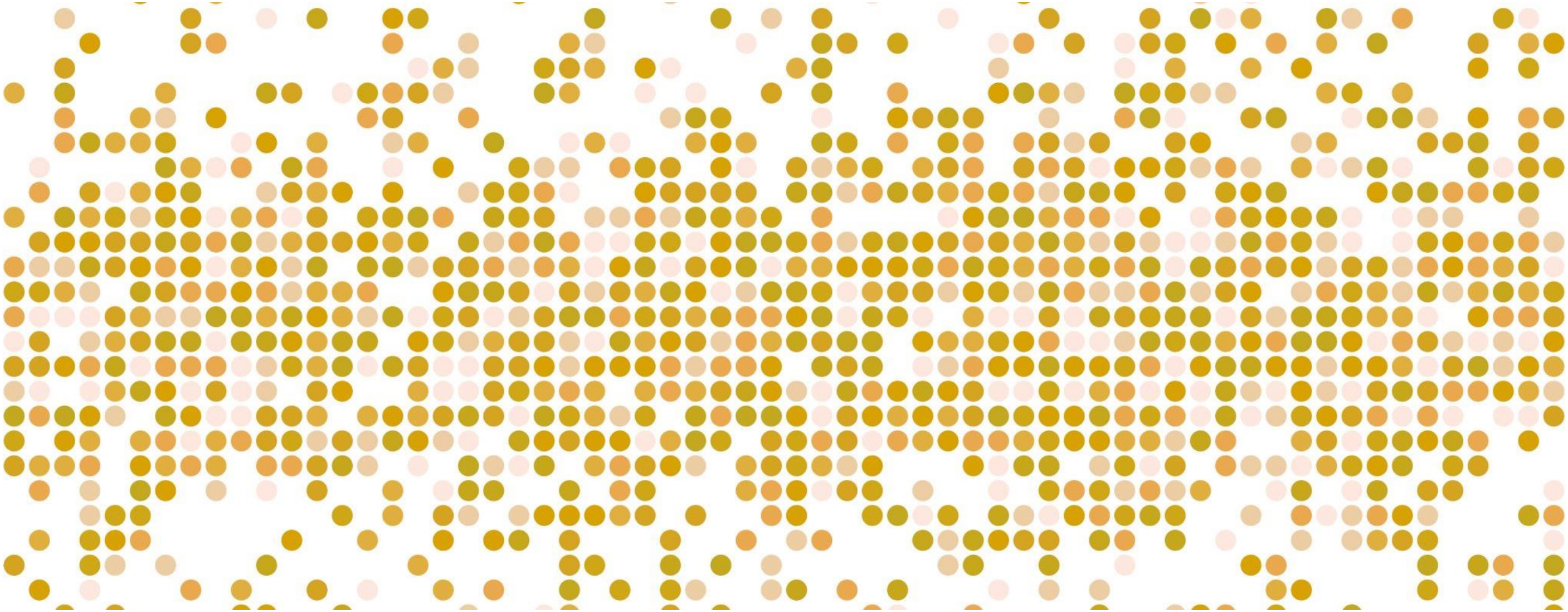
$$\text{test performance index} = \frac{\text{test method reproducibility}}{\text{site precision}} \qquad (1)$$

12.2 A precision ratio (PR) is determined for a given published test method so that the appropriate action criteria may be applied for a laboratory's TPI. The PR for a published test method estimates the influence that non-site specific variations has on the published precision. The PR can be calculated by dividing the test method's reproducibility by the repeatability as shown in Eq 2.

$$\text{Precision Ratio, PR} = \frac{\text{Test Method reproducibility (R)}}{\text{Test Method repeatability (r)}} \qquad (2)$$

10.1.4.4 In many situations, the minimal QC frequency as recommended by Table 1 may not be sufficient to ensure adequate statistical quality control, considering, for example, the significance of use of the results. Hence, it is recommended that the flowchart in Fig. 1 be followed to determine if a higher QC frequency should be used.

Development Stage and Initial Assessment



ASTM D6299 on testing requirements

7.4.1 Conduct both QC sample and check standard testing under site precision conditions.

3.2.20 site precision conditions, n—*for a single analytical measurement system (see **3.2.4**)*, conditions under which test results are obtained by one or more operators in a single site location practicing the same test method on a single measurement system using test specimens taken at random from the same sample of material, over an extended period of time spanning at least a 20 day interval.

3.2.20.1 Discussion—Site precision conditions should include all sources of variation that are typically encountered during normal, long term operation of the measurement system. Thus, all operators who are involved in the routine use of the measurement system should contribute results to the site precision determination. In situations of high usage of a test method where multiple QC results are obtained within a 24 h period, then only results separated by at least 4 h to 8 h, depending on the absence of auto-correlation in the data, the nature of the test method/instrument, site requirements, or regulations, should be used in site precision calculations to reflect the longer term variation in the system.

7.4.3 It is recommended that a QC sample be analyzed at the beginning of any set of measurements and immediately after a change is made to the measurement system.

7.4.4 Establish a protocol for testing so that all persons who routinely operate the system participate in generating QC test data.

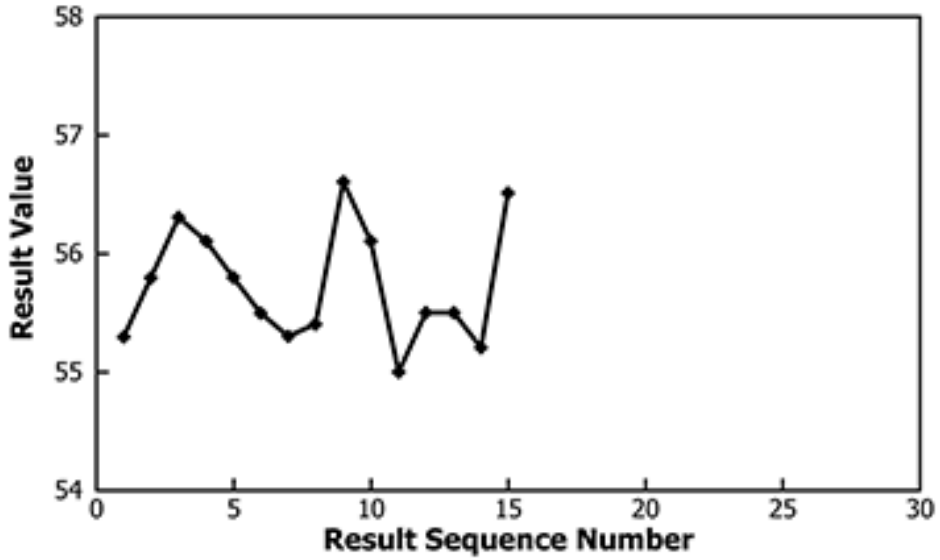
7.4.5 Handle and test the QC and check standard samples in the same manner and under the same conditions as samples or materials routinely analyzed by the analytical measurement system.

7.4.6 When practical, randomize the time of check standard and additional QC sample testing over the normal hours of measurement system operation, unless otherwise prescribed in the specific test method.

NOTE 13: Avoid special treatment of QC samples designed to get a better result. Special treatment seriously undermines the integrity of precision estimates.

Basic Run Chart

FIG. A1.1 Example of a Run Chart for QC Results



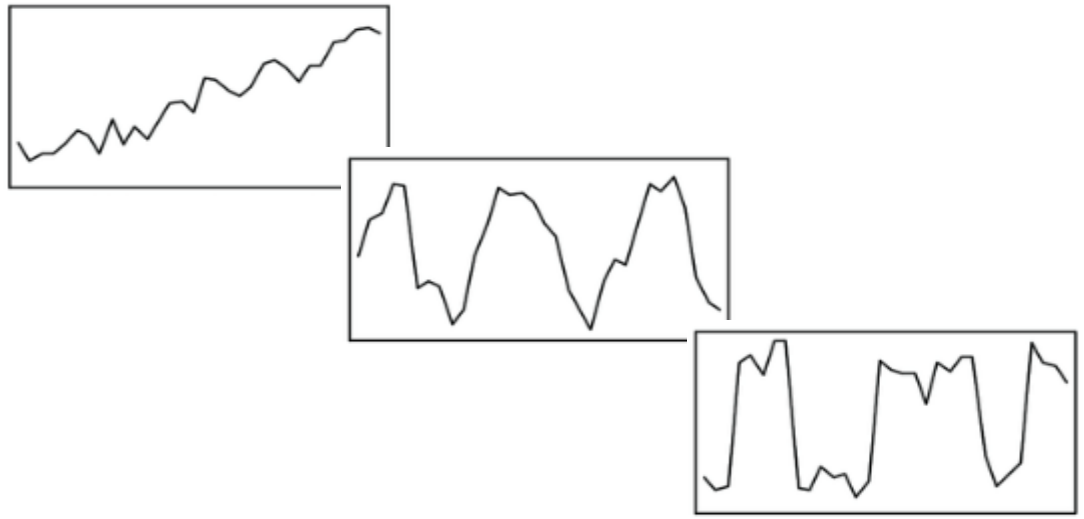
Initial Assessment

8.4 Assessment of Initial Results—Assessment techniques are applied to test results collected during the initial startup phase of or after significant modifications to a measurement system (see **Note 19**). Perform the following assessment after at least 20 results (pretreated if appropriate) have become available. The purpose of this assessment is to ensure that these results are suitable for deployment of control charts (described in **A1.4**).

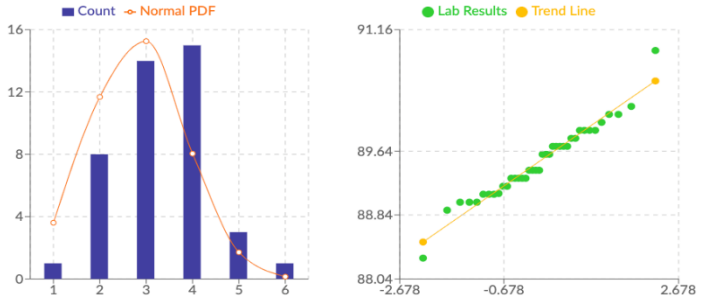
8.4.1 Screen for Suspicious Results—Results (pretreated if appropriate) should first be visually screened for values that are inconsistent with the remainder of the data set, such as those that could have been caused by transcription errors, followed by an outlier assessment using GESD (see Practice **D7915**) or other equivalent statistical technique. Those flagged as suspicious should be investigated. Discarding data at this stage must be supported by evidence gathered from the investigation. If, after discarding suspicious pretreated results there are less than 15 values remaining, collect additional data and start over.

3.2.5 assignable cause, n—a factor that contributes to variation and that is feasible to detect and identify.

8.4.2 Screen for Unusual Patterns—The next step is to examine the results (pretreated if appropriate) for non-random patterns such as continuous trending in either direction, unusual clustering, and cycles. One way to do this is to plot the results on a run chart (see **A1.3**) and examine the plot. If any non-random pattern is detected, investigate for and eliminate the root cause(s). Discard the data set and start the procedure again.



8.4.3 Test "Normality" Assumption, Independence of Test Results, and Adequacy of Measurement Resolution—For measurement systems with no prior performance history, or as a diagnostic tool for initial data collected on a new batch of QC material, it is useful to test that the results from the measurement system are reasonably independent, with adequate measurement resolution, and may be adequately modelled by a normal distribution. One way to do this is to use a normal probability plot and the Anderson-Darling Statistic (see **A1.4**). If the results show obvious deviation from normality or obvious measurement resolution inadequacy (see **A1.4**), follow the guidance in **A1.4.2.6**, Case 2.



https://www.researchgate.net/figure/Examples-of-typical-control-chart-patterns_fig1_221965555

D6792 TPI Expectations

TABLE 2 Guidelines for Action Based on TPI

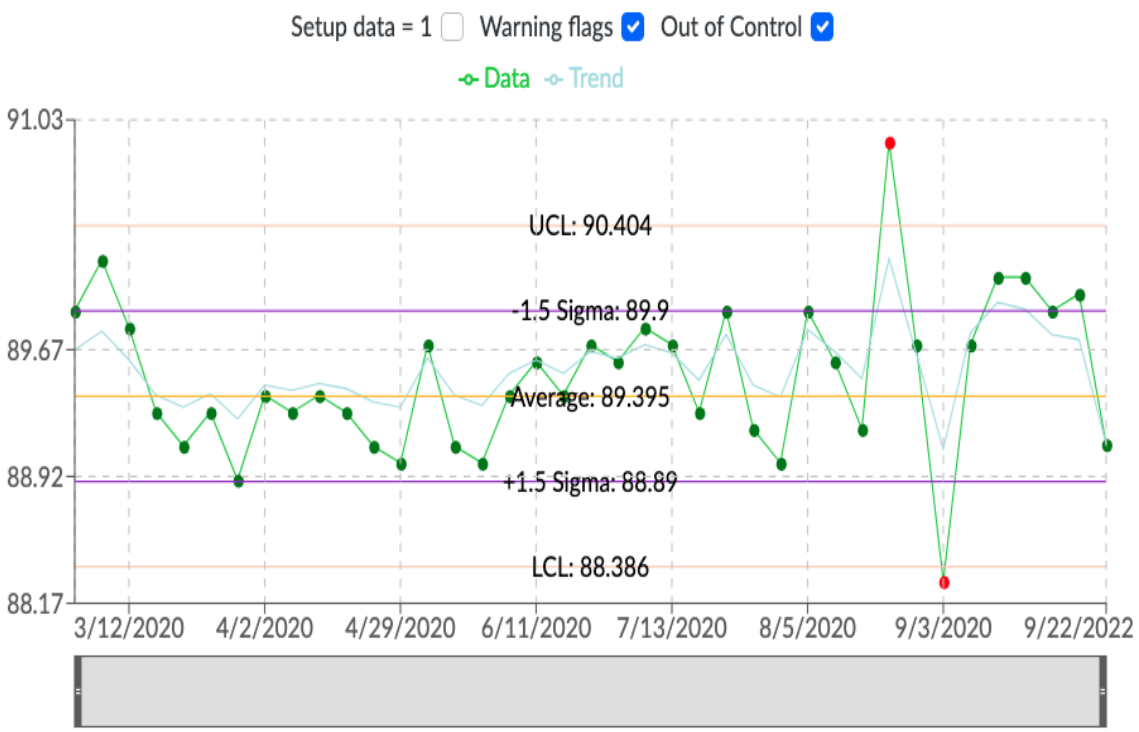
TPI for Standard Test Methods with PR < 4	TPI for Standard Test Methods with PR ≥ 4	Recommended Quality Improvement Action
> 1.2	> 2.4	Indicates that the performance is probably satisfactory relative to ASTM published precision.
> 0.8 and < 1.2	> 1.6 and < 2.4	Indicates that the performance is probably satisfactory relative to ASTM published precision, however a method review could be necessary to improve its performance.
< 0.8	< 1.6	This condition suggests that the method as practiced at this site is not consistent with the ASTM published precision. Either laboratory method performance improvement is required, or the ASTM published precision does not reflect precision achievable. Existing interlaboratory exchange performance (if available) should be reviewed to determine if the latter is plausible.

- 10.1.2.4 A laboratory's site precision (R′) that is significantly worse than the published test method reproducibility may indicate poor performance. As appropriate, investigate to determine the root cause for this performance so that corrective action can be undertaken if necessary.
- NOTE 12: Experience has shown, for some methods, published reproducibility is not in good agreement with the precision achieved by participants in well-managed proficiency testing programs. Users should consider this fact when evaluating laboratory performance using TPI

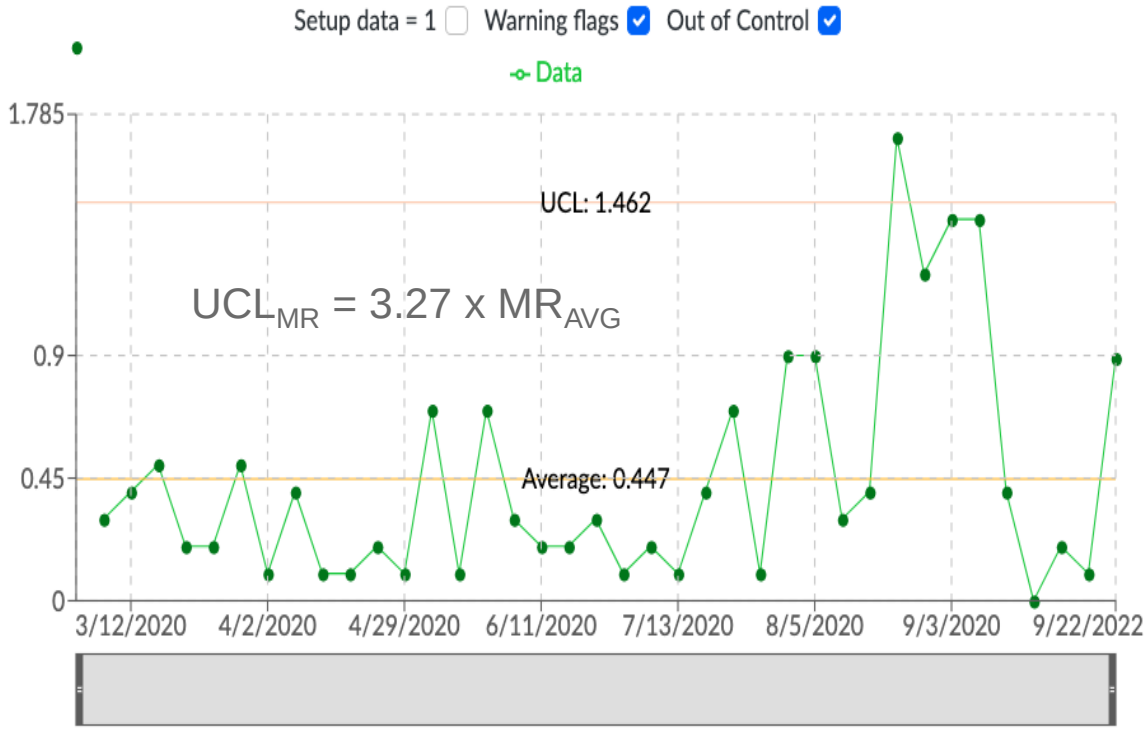
Chart Types and Control Strategies

Control Charts

I Chart

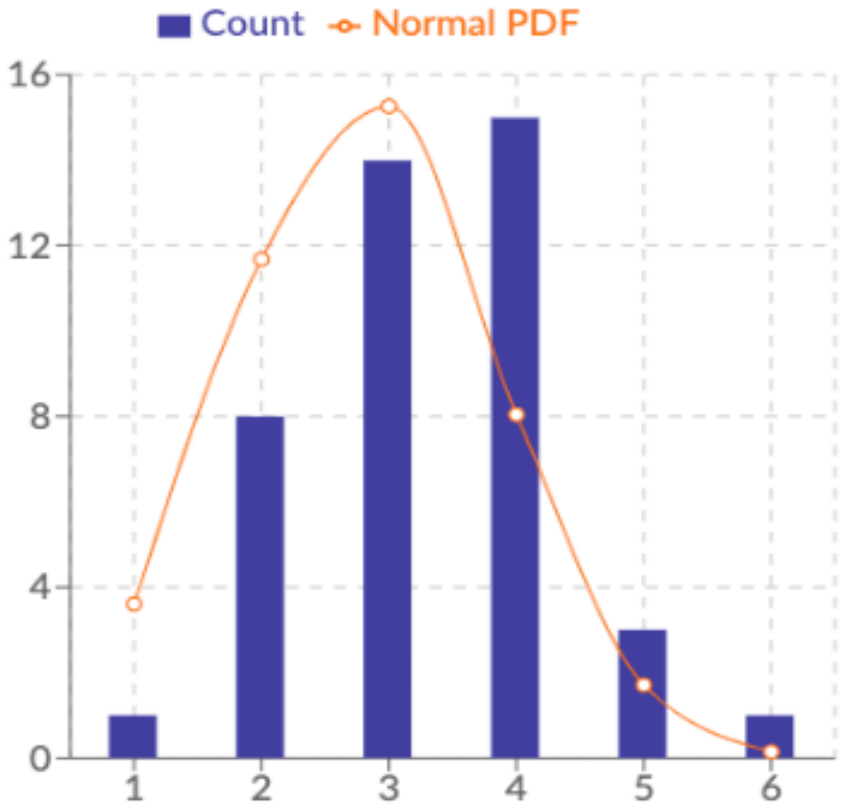


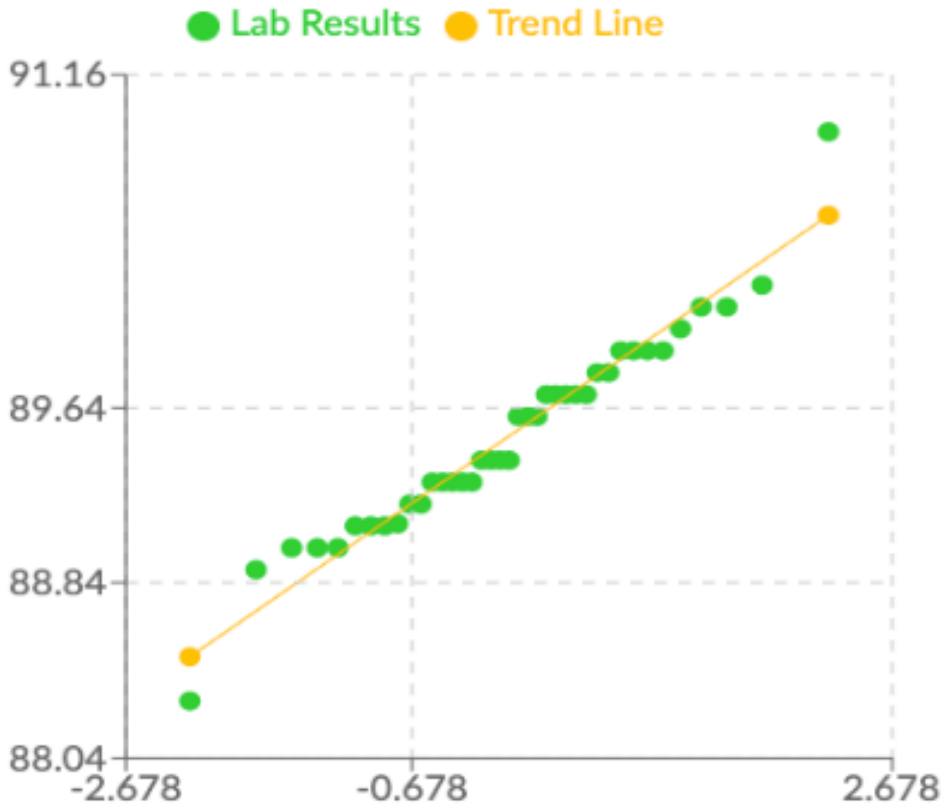
MR Chart



Distribution Charts

Histograms and Normal Probability (q-q) Plots





Control Strategies

Run Rule Strategy

Control Chart Elements
- CL, UWL, LWL, UCL, LCL, UCL_{MR}

Control Rules
- Any result above UCL or below LCL
- 2 of 3 CR > UWL or 2 of 3 CR < LWL
- 5CR > 1σ or 5CR < 1σ
- 9 CR > CL or 9 CR < CL
- 7 CR increasing or 7 CR decreasing
- 5 of last 20 MR values < UCL_{MR}

Warning Rules
- A single result > UWL or < LWL
- A single MR result > UCL_{MR}

EWMA Strategy

Control Chart Elements
- CL, UCL, LCL, UCL_{EWMA}, LCL_{EWMA}, UCL_{MR}

Control Rules
- Any result above UCL or below LCL
- EWMA Value above UCL_{EWMA} or below LCL_{EWMA}
- 9 CR > CL or 9 CR < CL
- 5 of last 20 MR values < UCL_{MR}

Warning Rules
- A single MR result > UCL_{MR}

Active Monitoring Stage

Keys to Success

Active Monitoring

8.4.5 Control Chart Deployment—Put these control charts into operation by regularly plotting the test results (pretreated if appropriate) on the charts and immediately interpreting the charts.

8.5 Control Chart Interpretation:

8.5.1 Apply control chart rules (see **A1.5**) to determine if the data supports the hypothesis that the measurement system is under the influence of common causes variation only (in statistical control).

8.5.2 Investigate Out-of-Control Points in Detail— Exclude from further data analysis those associated with assignable causes, provided the assignable causes are deemed not to be part of the normal process.

NOTE 21: All data, regardless of in-control or out-of-control status, needs to be recorded.

A1.5.4.1 I-chart—Individual values that are outside the upper (UCL) or lower (LCL) control limits are strong indications of an out-of-statistical-control condition. Therefore, the system shall be declared out-of-statistical-control, followed by an immediate retest of a new QC sample to confirm the out-of-statistical-control event. In situations when the QC sample is immediately retested and there is no change to the measurement system between the original test and the retest, if the retest result is not more than $2\sigma_{R'}$ from the center line in either direction, then the system is not considered to be out-of-statistical-control since the out-of-statistical-control event is not confirmed. The original and retest results shall be documented.

Additional Responses to Violations

- Check QC sample – they can get contaminated, degrade, be handled poorly, etc.
- Check instrument calibration – check standard (reference material or other material with ARV).
- Interview or witness analyst – analyst competence being one of the leading causes for inaccurate test results
- Re-evaluate control chart set up – were set up results obtained in accordance with D6299 guidance (site precision conditions)?

Charting must be Real Time!

Periodic Assessments and Chart Replacement

Periodic Assessment

8.6.2 When a minimum of 20 new in-control data points becomes available, perform an *F*-test (see **A1.8**) of sample variances for the new data set versus the sample variance used to calculate the current control chart limits. If the outcome of the *F*-test is not significant, and, if the sample variance used to calculate the current control limits is based on less than 100 data points, statistically pool both sample variances and then update the current control limits based on this new pooled variance and I-chart center line ($\bar{I}$ in equations **Eq A1.10-A1.13**) if updated (see **8.6.2.2**).

8.6.2.1 If the outcome of the *F*-test is not significant, and if the sample variance used to calculate the current control limits is based on more than 100 data points, the statistical pooling of both sample variances to be used for update of the current control limits is recommended, but may be at the discretion of the user.

8.6.2.2 If the outcome of the *F*-test is not significant, compute the t value in **Eq 3** using the average of the new in-control data, the current center line of the *I*-chart, and the current chart standard deviation ($\sigma_{R'}$) used to compute the *I*-chart control limits. Re-compute and update the *I*-chart center line to reduce its statistical uncertainty is permissible if all of the following conditions are met:

(1) $|t| \leq 1.7$

(2) $ewma_{newdata}$ on one side of center line < 75 %

NOTE 22: The value 1.7 is based on a one-sided t-test of a “difference = 0” null hypothesis versus an alternate hypothesis of either greater than or less than zero as chosen by the user at 5 % significance level, 40 to 250 degrees of freedom rounded up to 1st decimal for simplicity

Periodic Assessment Continued

As a safeguard against slow drift in one direction that is below the detection power of the control chart rules, four consecutive adjustment of the *I*-chart center line in the same direction shall trigger an accuracy verification by Check Standard (CS). Follow Practice D6617 to determine the acceptable tolerance zone for the difference between the result obtained versus the Accepted Reference Value (ARV) of the CS.

8.6.3 If the outcome of the *F*-test is significant, investigate for assignable causes. Update the current control limits based on sample variance and average calculated using the new data if it is determined that this new variance and average is representative of current system performance under common cause variation.

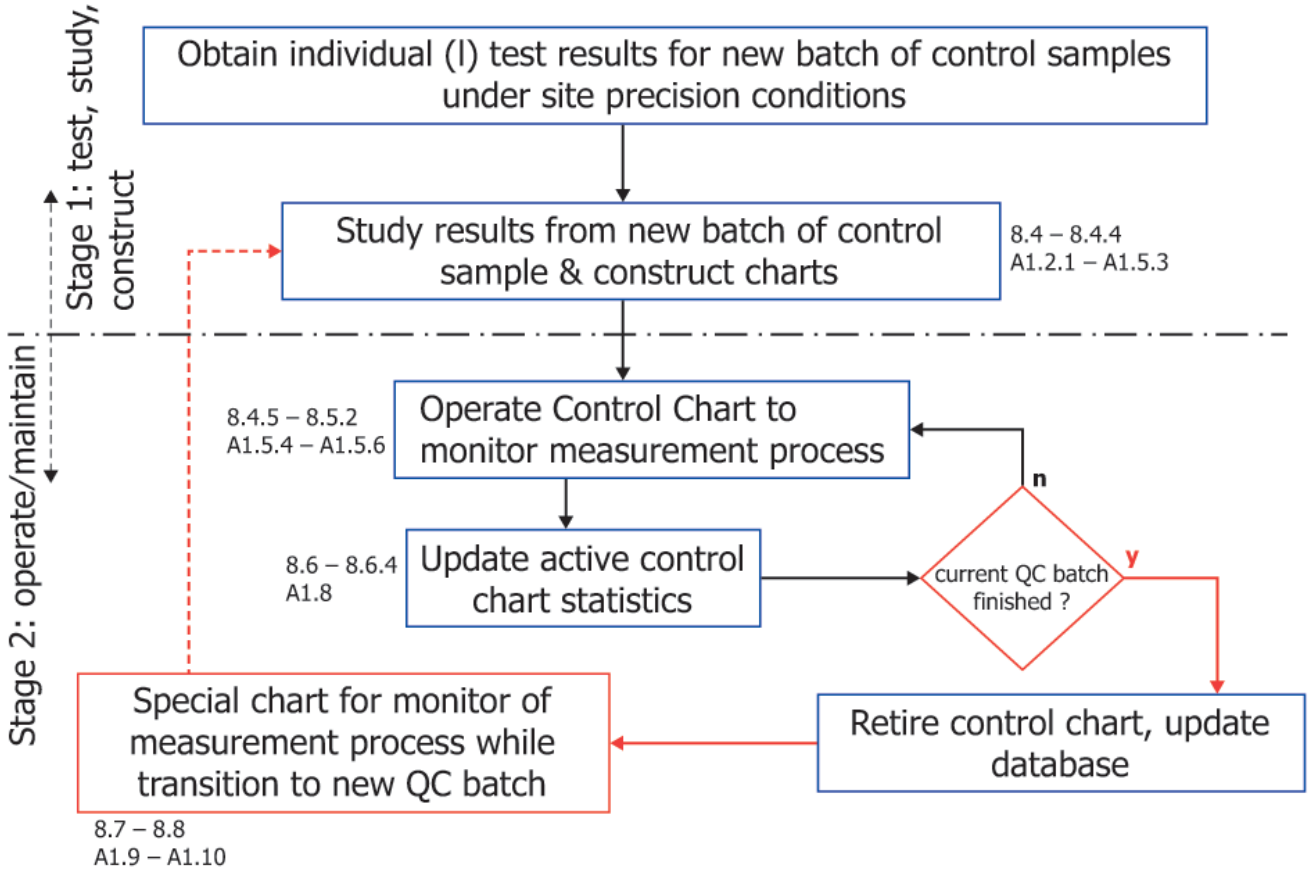
9.1.2 Compare *R′* to published reproducibility of the test method at the same level, if available. *R′* is expected to be less than or equal to the published value. Use the χ^2 test described in A1.7.

9.2 Measurement System Bias Estimated from Multiple Measurements of a Single Check Standard—If a minimum of 15 test results is obtained on a single check standard material under site precision conditions, then calculate the average of all the in-control individual differences plotted on the *I* chart. Perform a *t*-test (see A1.6) to determine if the average is statistically different from zero.

9.2.1 If the outcome of the *t*-test is that the average is not statistically different from zero, then the bias in the measurement process is negligible.

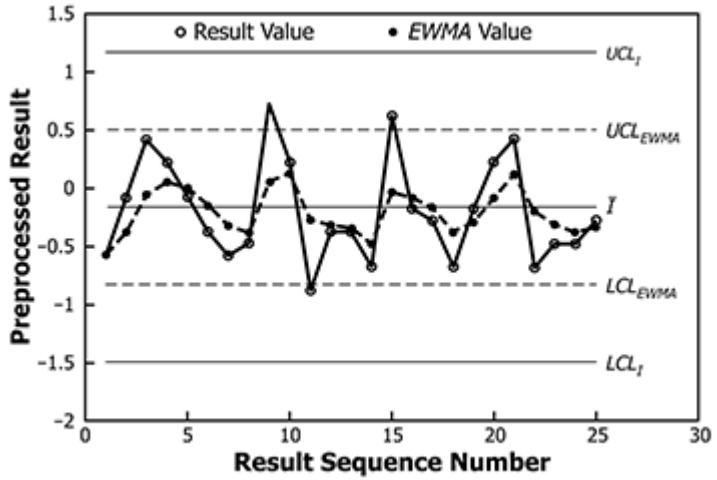
9.2.2 If the outcome of the *t*-test is that the average is statistically different from zero, then the best estimate of the measurement process bias at the level of the check standard is the average. If bias is deemed to be of practical significance by the user, investigate for root causes, and take corrective measures.

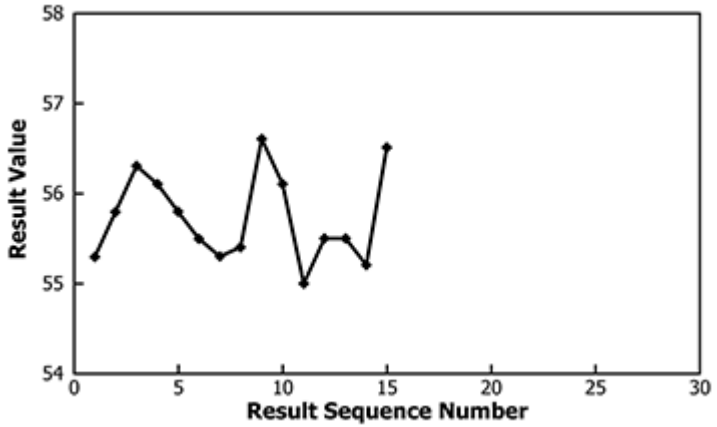
ASTM D6299-22 - FIG. 1 Control Chart Work Process Block Diagram



Options for Chart Replacement

8.7.2 Procedure 1, Concurrent Testing:
8.7.2.1 Collect and prepare a new batch of QC material when the current QC material supply remaining can support no more than 20 analyses.
8.7.2.2 Concurrently test and record data for the new material each time a current QC sample is tested. The result for the new material is deemed valid if the measurement process in-control status is validated by the current QC material and control chart.
//
Involves the performance of multiple F-Tests (old data vs new data, old data vs Test Method R, new data vs Test Method R), statistical pooling and other decision criteria.





Options for Chart Replacement

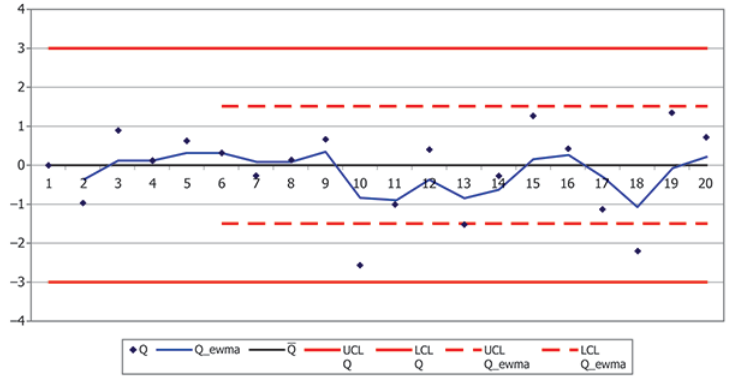
8.7.3 Procedure 2-A, Q-Procedure (see A1.9):

8.7.3.1 This procedure is designed to alleviate the need for concurrent testing of two materials. A priori knowledge of the measurement process standard deviation (σ_{known}) is required. $\sigma_{achieved}$ meeting the requirements in **8.7.1.1** can be used as σ_{known} for this purpose. A Q_r statistic is computed with the arrival of each new QC result commensurate with the 2nd result, and compared against its theoretical mean (0) and 3 sigma limits (± 3). See **A1.9** for details.

NOTE 24: It is recommended that this standard deviation estimate be based on at least 50 data points.

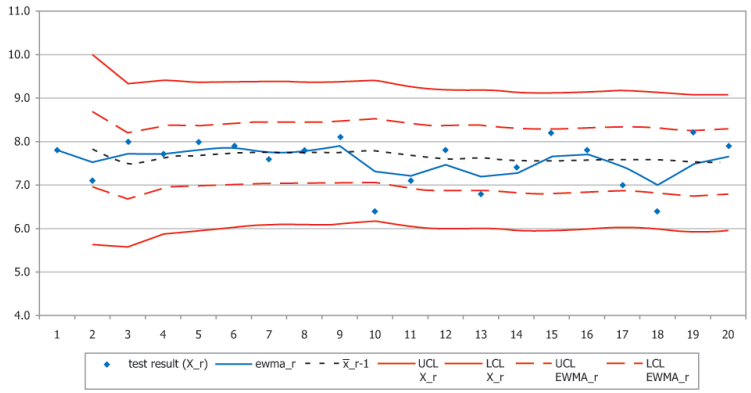
8.7.3.2 When the *Q*-procedure is operational (minimum of two data points), it may be used in conjunction with a *MR* chart constructed using the observations and $MR_{achieved}$ per **8.7.1.1** to provide QA of the measurement process.

8.7.3.3 After a minimum of 20 data points have been accrued (by the *Q*-procedure), execute the steps from **8.7.2.4** to **8.7.2.7**. Because the Q-procedure is technically equivalent to the I chart procedure, the user may either construct a new *I/MR* control chart for the new batch of QC material as instructed in **8.7.2.7**, or continue to operate the *Q*–chart and MR chart for measurement process stability and precision monitoring, respectively, using the new batch of QC material.



Options for Chart Replacement

8.7.4 Procedure 2-B: Dynamically Updated I / EWMA Chart—This is essentially an I-chart and EWMA with varying control chart limits that are updated with the arrival of each new result, which is judged using limits computed from all previous results. The dynamic update combines the σ_{known} (see 8.7.3.1) for the individual result with the varying standard error associated with the center line computed with all previous results. This standard error (for the I-chart) steadily decreases as the number of results used for its computation increases, whilst for the EWMA, the standard error typically decrease initially and then increases towards its asymptotic value. See A1.10 for details.



NOTE 25: Procedure 2-B was formerly referred to as Q-chart Option 1.

8.7.5 Operate Procedure 2-B in conjunction with an *MR* chart per 8.7.3.2. After a minimum of 20 in control data points have been accrued, execute the steps from 8.7.2.4 to 8.7.2.7. Because Procedure 2-B is technically equivalent to the *I* chart procedure, the user may either construct a new *I*/*MR* control chart for the new batch of QC material as instructed in 8.7.2.7, or continue to operate Procedure 2-B and *MR* chart for measurement process stability and precision monitoring using the new batch of QC material.

Special Cases

Special Cases

8.8 Short Run Scenario—Procedures described in 8.7.3 and 8.7.4 may also be used to address short run situations where a single batch of QC material may provide only a limited number (less than 20) of QC test results and replacement of exactly the same material is not feasible or possible. For these short run QC batches, since there is insufficient data to properly characterize the mean of batch, these procedures can only be used to monitor stability and precision of the measurement process.

8.9 Instrument Replacement or Post Overhaul Scenario—The procedures described in 8.7.3 and 8.7.4 may be used to address situations where an instrument is taken out of service and is replaced by another qualified instrument, or, when the primary instrument is returned to service after a major overhaul such as replacement of critical parts or factory re-calibration. For these situations, the existing system precision parameters may be used, in conjunction with the MR chart, to monitor stability and precision of the replacement or overhauled measurement process, respectively, based on the assumption that the existing system precision parameter is still valid. After sufficient data is accrued, a statistical assessment shall be performed to confirm this assumption, or update the system precision parameters accordingly. Use of the existing precision will enable the system to be immediately put into service, while providing a safeguard against the situation where the new system performance with replacement or overhauled instrument is statistically worse than the previous system performance. Use of these procedures is in addition to any steps such as calibration and running check standards needed to qualify replacement instruments.

Other Special Cases

Non-Normal Distributions

Low Resolution Data Sets
Bi-Modal Data Sets
Strong Autocorrelation (clustering)

Alternate Control Strategies

Control Limits Only
– Low Resolution Data Sets

Tolerance Limits Only

Other Special Cases

Pre-Treatment

8.2 Pretreatment of Test Results—The purpose of pretreatment is to standardize the control chart scales so as to allow for data from multiple check standards or different batches of QC materials with different property levels to be plotted on the same chart.

8.2.2 For check standard sample test results that are to be plotted on the same control chart, two cases apply, depending on the measurement system precision:

8.2.2.1 Case 1—If either (*1*) all of the check standard test results are from one or more lots of check standard material having the same ARV(s), or (*2*) the precision of the measurement system is constant across levels, then pretreatment consists of calculating the difference between the test result and the ARV:

$$\text{Pretreated result} = \text{test result} - \text{ARV(for the sample)} \qquad (1)$$

8.2.2.2 Case 2—Test results are for multiple lots of check standards with different ARVs, and the precision of the measurement system is known to vary with level,

Minute Uncorrectable Bias

Not in Standard

There may be times when a laboratory's precision is quite small, but there is an established bias against an ARV. In such cases:

Confirm TPI >> 1

Perform t-Test to evaluate if bias is significant

Useful References

ASTM D6299-22e1

Standard Practice for Applying Statistical Quality Assurance and Control Charting Techniques to Evaluate Analytical Measurement System Performance

ASTM D6792-23a

Standard Practice for Quality Management Systems in Petroleum Products, Liquid Fuels, and Lubricants Testing Laboratories

ASTM D7915-22

Standard Practice for Application of Generalized Extreme Studentized Deviate (GESD) Technique to Simultaneously Identify Multiple Outliers in a Data Set

ASTM D6300-23

Standard Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products, Liquid Fuels, and Lubricants

ASTM D3244-21a

Standard Practice for Utilization of Test Data to Determine Conformance with Specifications

insight SQC

Insight Statistical Quality Control (SQC) Software

ASTM Insight SQC (Statistical Quality Control) software is a powerful statistical software package designed for quality control and process improvement applications.

Key Features:

- Cloud Based Software works easily with users LIMS systems
- Automatic data upload
- Auto Notifications (rich)
- ASTM D6299 and 40 CFR 1090 Workflows
- Preloaded with Test Method Master data for 100's of D02 Standard Test methods
- Highly Configurable
- Automated Chart Assessment Process
- Ability to filter by Analyst and overlay multiple QC charts to detect potential bias
- Ability to overlay charts for instruments to detect potential bias between instruments
- Insight SQC Software User-e-Learning modules available to all users

insight SQC

For more information or to schedule an Insight SQC Product Demonstration, please contact Lab Services Sales to sqc@astm.org

Vehicle Analogy

- Laboratory (Car)
- PTP (Rear View Mirror)
- Reference Materials (Windshield)
- ASTM Insight SQC (Dashboard)
- Test Methods (Driving Rules)
- Training (Driver's Ed)
- SOP (User Manual)
- Analyst Certification (Driver's License)

ASTM International Laboratory Services

Our Vision

To be the comprehensive total solution provider for a Laboratory's QA/QC needs by providing cost-effective, best-in-class products, programs and solutions to:

"help laboratories work better" and provide a foundation for Laboratories of the Future.

ASTM INTERNATIONAL
Helping our world work better

Thank you

Chris McCullough
General Manager, Laboratory Services
cmccullough@astm.org

Angelique Fontenot
Director, Laboratory Services Sales
afontenot@astm.org

www.astm.org