# TITLE: Analytical Measurement Range

**PRINCIPLE:**

The ANALYTICAL MEASUREMENT RANGE (AMR) is the range of analyte values that a method can directly measure on the specimen without any dilution, concentration, or other pretreatment not part of the usual assay process.

**AMR VALIDATION**

Is the process of confirming that the assay system will correctly recover the concentration of the analyte over the Analytical Measuring Range. The AMR of an assay is established initially as part of the instrument/reagent validation. The results of these studies are compared to the manufacturer’s claims to determine the range which will be assigned. The materials used for the validation must be known to have matrix characteristics appropriate for the method. The matrix of the sample (i.e. the environment in which the sample is suspended or dissolved) may influence the measurement of the analyte. In many cases, the method manufacturer will recommend suitable materials. The test specimens must have analyte values, which at a minimum, are near the low, midpoint, and high values of the AMR. Specimen target values can be established by comparison with peer group values for reference materials, by assignment of reference or comparative method values, and by dilution or admixture ratios of one or more specimens with known values.

# USE OF THE AMR

It is important that the laboratory knows the AMRs of its methods. Patient samples that have measured values that fall within the AMR of a method can be reported by the laboratory without further analytical steps. If a patient sample has a measured value that is outside the AMR, then that value may be erroneous and the concentration

of the analyte in the patient sample should be adjusted, usually by dilution, to bring it within the AMR.

In the case of samples with very high anlyte concentrations or activity, a very large dilution may be needed to bring the concentration or activity into the AMR.

If it is not possible to achieve a measured value that is within the AMR by using allowable dilutions, then the result may be reported as "greater than" the value of the upper end of the AMR.

# LINEARITY AND THE AMR

Validation of the AMR is accomplished by demonstrating a linear relationship for an appropriate set of samples that cover the AMR. A plot of measured results for an analyte obtained across the AMR vs. expected concentrations or concentration relationships (or expected activity or activity relationships) in a set of samples should show a

linear relationship. One can use matrix appropriate materials of known analyte concentration and demonstrate that measured values correspond with target values in a linear relationship. Note that for commercially available "linearity" sample sets, it is not expected that the measured values are the same as the target values because the

"linearity" samples are not commutable with clinical samples. For commercially available "linearity" sample sets, it is expected that a plot of the measured values vs. the target values has a linear relationship because there is a known quantitative relationship between the concentrations or activities in the sample set. Alternatively, one can

make admixtures of appropriate materials of high and low analyte concentrations and demonstrate that there is the expected linear relationship between measured values of these admixtures and the expected values based on the proportion of low and high concentration samples in each admixture. With either approach, the values should

be suitably spaced across the AMR, preferably equidistant from each other.

# REQUIRED FREQUENCY OF AMR VALIDATION

When initially introducing a new method, it is necessary to verify the AMR independently from the calibration process. The AMR must be verified at least every six months after a method is initially placed in service and following the criteria defined in the checklist. Additionally, when multipoint calibration that spans the AMR are utilized, a set of calibrators from a different lot number than that used to calibrate the system may be suitable for independent AMR verification.

**CALIBRATION VERIFICATION**

Is the process that involves the testing of calibrators or other appropriate matrix materials with known values for the purpose of confirming the calibration of a test system has remained stable since its last calibration. For many analytes the calibration is performed frequent enough so a calibration verification becomes unnecessary.

1. A change of reagent lots for chemically or physically active or critical components, unless the laboratory can demonstrate that the use of different lots does not affect the accuracy of patient/client test results, and the range used to report patient/client test data

2. If QC fails to meet established criteria

3. After major preventive maintenance or change of a critical instrument component

4. When recommended by the manufacturer.

A list of assays which currently require a calibration verification/linearity every 6 months are attached.

**REAGENTS**

Matrix appropriate materials which span the measuring range of the analyte being tested.

1. Maine Standards Company Validate Products.
2. Audit MicroControls Linearity FD Immunoassay for Abbott Architect i Series. Ref# K833M-5 for TSH

# EQUIPEMENT

1. Abbott Architect ci4100 chemistry analyzer

# PROCEDURE

1. Run 2 - 3 replicates of each level of Linearity material on the appropriate instrument.
2. For Maine Standards, record the results from each instrument and each test on the appropriated worksheet and email to Maine Standards. Maine Standards will evaluate the data and email the results back to the lab.

The results will include the raw data and graph of the AMR. If available, it will also include a PEER comparison graph.

1. For Audit Microcontrols enter the data into the website: https://www.auditorqc.com/

EP Evaluator program may also be used for evaluating Linearity data.

1. In each level plot on the Y-axis the mean concentration value corresponding to the specific manufacturer labeled value on the X-axis.
2. The EP Evaluator program will draw a graph with the expected and recovered values.
3. If the entire line of best fit is within the acceptable tolerance limit range the instrument (assay) provides linear readings. If any part of your line exceeds your tolerance limits then the point at which the line best fits exceeds the tolerance limits define the limits of linearity.
4. Tolerance limits for the product are usually found within the linearity product package insert and generally do not exceed 25% of the reportable guidelines listed.
5. Calibration records shall be retained within the section for applicable instruments.
6. Studies should be completed every six months for analytes whose calibrators do not span the analytical measurement range.

**PROCEDURAL NOTES:**

If the results of the study do not cover the stated AMR, Recalibrated the assay and repeat the study.

**REFERENCE:**

1. CAP Chemistry and Toxicology Checklist dated 09.25.2012.
2. Copley Laboratory General lab Procedure 4840-G-215