



# **TENNESSEE BUREAU OF INVESTIGATION**

## *Forensic Services Division*

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### Toxicology Quality Assurance and Procedures Manual

#### 6.18 LC/MS/MS

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#### **6.18 High Performance Liquid Chromatography/Mass Spectrometer/Mass Spectrometer (LC/MS/MS)**

The following section shall be used to ensure that the High Performance Liquid Chromatography/Mass Spectrometer/Mass Spectrometers (LC/MS/MS) are properly maintained for accurate qualitative and/or quantitative analysis of case samples.

The Toxicology Unit currently uses Agilent liquid chromatographs (1200 series and 2600 infinity) and AB SCIEX (formally Applied Biosystem) 3200 Q Trap mass spectrometers. This system utilizes liquid chromatography as the separation technique and triple quadrupole mass spectrometers/hybrid linear ion trap with electrospray ionization as analyzers.

##### **6.18.1 Maintenance**

###### **6.18.1.1 Before each run, the examiner shall:**

- Check and/or fill needle wash bottle.
- Check and/or fill both mobile phase A and B bottles.
- Empty waste container if needed.
- Perform a tune check on the mass spectrometers.

###### **6.18.1.1.1 Tune Check**

The tune check is a specific measurement option available in the Analyst software where polypropylenglycol (PPG) is used as the tuning check solution (positive mode). This feature checks various parameters to ensure sensitivity and mass accuracy of quadrupole 1 (Q1) and quadrupole 3 (Q3) over the mass range of their intended use. Evaluation of the 175 and 616 ions shall be based on the following criteria:

- Intensity data should be compared to past tune checks for trends and recorded in the maintenance logbook
- The peak width should be 0.6 – 0.8
- The mass shift should be less than 0.1

Note: Loss of abundance in high mass ions (i.e., 906, 1254, and 1545) may have little or no effect on drug performance, but may be an indication of future required maintenance.

If the examiner determines that the instrument is fit for use based on the tune check results, the instrument shall be available for casework. This tune will be good for 24 hours or until the continuous batch(es) are complete.



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#### **6.18.1.1.2 Additional Adjustments**

If it is determined that the instrument requires additional adjustments due to a unsatisfactory change in peak width, mass accuracy, etc., this should be corrected using the following methods and re-tuned:

##### **Peak Width Adjustments**

- Perform an instrument optimization or software equivalent
- Perform a manual adjustment of offsets

##### **Mass Calibration Adjustment**

- Perform an instrument optimization or software equivalent
- Perform a manual mass calibration

##### **Reduced Sensitivity Adjustment**

- Clean Turbo V ion source (including spray electrode)
- Replace the spray electrode probe
- Clean Q0

Note: Consult instrument operator's manual for maintenance/repair instructions.

**6.18.1.2** If the instrument is determined to remain unfit for use, the instrument shall be marked as "out of service" until the instrument is repaired/replaced.

**6.18.1.3** The mechanical pump oil conditions should be periodically monitored (e.g., level, color, etc.) and should be changed every six months or whenever needed.

**6.18.1.4** As a part of preventative maintenance, the following should be evaluated before each run and done as needed: replace the column, clean the source, clean Q0, flush the lines, etc.

**6.18.1.5** All maintenance or repairs shall be recorded in the instrument's maintenance notebook and include at a minimum: the date of the maintenance or repair, the initials of the person performing the maintenance or repair, and a description of the type of maintenance or repair performed. All maintenance or repairs performed by a technical service representative shall be recorded in the same manner.

**6.18.1.6** After maintenance or repair, a performance check will be done by performing a tune check and/or analyzing calibrators and/or controls.

#### **6.18.2 Data Evaluation**

**6.18.2.1** Instrument operation shall be verified by analyzing known calibrators and/or controls with each batch of unknown samples.

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**6.18.2.2** Quality is evaluated in each sample. General guidelines are that retention times are consistent with calibrator/control standards, there is sensitivity across the expected limits of detection and/or quantitation, masses are accurate, MRM transitions are present, ion ratios are consistent, and EPI full scan mass spectra are present. The specific acceptance criteria for these parameters, where applicable, shall be listed in the procedure for each analytical method.

**6.18.2.4** Instrumental data may be temporarily stored as data files on the appropriate instrument computer and, if possible, should be archived electronically via an external hard drive, recordable compact discs, etc. A hard copy will serve as documentation and shall remain within the case file until dictated by section 5.11.4 of the TBI QAM.

#### **6.18.3 Quality Assurance and Prevention of Carryover**

**6.18.3.1** The vial sequence shall be checked by the analyst or designee both prior to and after the injection of samples.

**6.18.3.2** The needle rinse bottle shall be filled with an adequate amount of solvent to ensure that carryover does not occur.

**6.18.3.3** A negative control shall be run immediately following each highest standard to demonstrate that no carryover is present. This negative control shall be evaluated to the same extent as a case sample.

**6.18.3.4** Each method shall be validated for carryover limits. Sample drug concentrations greater than the validated limit could potentially be a source for carryover (e.g., benzodiazepines, zolpidem, or zopiclone above 3000 ng/mL); therefore, the subsequent samples shall be examined. Any of the examined samples suspected to contain a compound as a result of carryover will be rerun.

**6.18.3.5** See section 6.4 (Calibrators and Controls) for additional information.

Note: See section 5.5 (Equipment) of the TBI QAM for additional information.