The System must include a Gas Chromatograph, Mass Spectrophotometer, and Data System (Computer, Printer, and Software).

- **Gas Chromatograph** must have the following minimum specifications and include a column oven, injection port and autosampler:
- Must have capability to accurately and reproducibly execute up to 20 oven ramps and 21 oven plateaus in a run.
- Must be able to execute negative temperature ramps.
- Must be able to execute three pressure/flow ramps in a runs.
- Control of six heated zones (two inlets, two detectors and two auxiliary,) in addition to the GC oven.
- Functional keyboard with a four-line alphanumeric display.
- Run time programming.
- Clock time programming.
- Stopwatch function.
- Two channels of single column baseline compensation.
- Retention time is reproducible to within 0.0008 minutes using n-decane.
- System must automatically shut off gases in event of a leak.
- Built in diagnostics and comprehensive self-tests.
- Built in control of the autosampler.
- Automatic capture and storage of control deviation events within the instrument.
- 16 independent channels of pneumatic controls shall be available. Stability over 72 hours varies less than 0.060 psi.
- To precisely replicate retention times, pressure set points may be adjusted by increments of 0.001 psi, with typical pressure control resolution of ±0.001psi for the range 0.000 to 99.999 psi.
- Injectors and detectors must be modular to permit exchange in 5 minutes.
- Must have a short (ca. 4.5”) direct capillary interface for the MSD to provide better sensitivity and less sample degradation.
- Must have built in, permanently calibrated barometer and thermometer to compensate for ambient laboratory changes for maximum reproducibility.
- Safety certifications: The unit must be CSA certified and NRTL listed, and also IEC self-certified.

Column Oven:

- Operating temperature: 4°C above ambient to 450°C.
- Must have a temperature set point resolution of 0.1°C.
- Must be able to achieve oven cool down (22°C ambient) from 450 to 50°C in 4.0min (3.5 min with oven insert accessory).
- Must have maximum set point temperature rate of at least 75°C per minute with 120V oven.
- Maximum run time of at least 999.99 minutes.
- Must have ambient rejection of <0.01°C per 1°C.

Injection Port: Single split/splitless injection port minimum specifications.

- Split/splitless programmable from 0-100 psi @ 0.01-99 psi/min.
- Total flow setting range: 0 to 1,250 mL/min H2 or He.
- Quantitatively inject up to 5ul of sample using pressure pulse mode.
- Pressure pulse injection must also be available to minimize sample degradation due to the hot injection port.
- The split/splitless inlet must operate in back pressure regulated mode for split injections to allow independent adjustment of the split flow rate and septum purge without affecting column flow rate. It shall operate in forward pressure regulated mode for splitless injections for improved performance, especially for large volume injections.
- Multi-ramp pressure/flow programming is possible.
- Gas saver mode must be standard to reduce split vent flow during analysis.
- Constant Flow Mode (inlet pressure changes in real time to maintain constant volumetric flow) must be included to maintain flow irrespective of back pressure increases due to temperature ramping.

Liquid Autosampler: at least 150 sample capacity with the following performance specifications:

- Control shall be built into the GC and the tray to eliminate interface boxes.
- Shall use robotic arm with active gripper and sensor technology to ensure positive sample transfer to autoinjector module.
- Must have the capability of offering **priority sampling** without stopping an autosequence.
- Must have random access, fast injection technique and self-alignment mounting capabilities.
- The autosampler control must be built into the GC and the tray to eliminate any interface box.
- Must include an autoinjector for the GC, which has the ability to inject samples independently of any autosampler feeding device.
- The injector must have the ability to make ambient headspace injections using a 100ul gas tight syringe. In addition, the autoinjector must have options to accommodate large volume liquid injection syringes (up to 250ul) and must have the ability to program needle depth for full automation.
- The autosampler must be able to perform injections in less than 100 milliseconds or slow enough to make automated on-column capillary injections directly into 0.25 and 0.32mm columns.
- The autosampler must have the ability to add a second injection unit at a later date that can perform simultaneous injections into a second injection port.
- Shall be able to be connected to recirculating bath for constant temperature control.
- Syringe carriage assembly shall be lit for easy viewing.
- The autosampler must be able to operate in the “overlap” mode, that is, to prepare a sample for injections while the GC oven is cooling down. This feature is required in order to reduce sample cycle time, such that a sample is injected as soon as the oven stabilizes at the starting temperature.
- Better than 0.3% RSD area reproducibility and less than 1 part in 100,000 carryover.

Mass Spectrophotometer: The system must have a Mass Selective Detector included which meets the following minimum specifications:

- 1 picogram of octafluoronaphthalene injected in 1uL iso-octane solvent onto a 30m x 0.25mm x 0.25um HP-5MS ultra inert column with data acquired at 2.9 scans/second over the mass range 50-300amu shall yield an RMS signal/noise of at least **550:1** for the extracted ion signal at mass 272.00, using helium as the carrier gas and a diffusion vacuum system.
- The EI SIM IDL, using Helium carrier gas with an autosampler performing 8 sequential 1uL injections of 100fg/uL OFN standard solution at the nominal 272u ion must be less that 24fg when using a diffusion vacuum pump system.
- The Mass Spectrophotometer must use an ion source where the metallic parts are constructed from inert material. Ion source must be controllable from 100-350°C. Stainless steel is NOT acceptable nor is coating the metallic parts with an inert material.
- The Mass Spectrophotometer must utilize a Quadrupole Mass Filter consisting of a monolithic quartz structure. A quadrupole consisting of 4 separate rods is NOT acceptable. The rods must have a true hyperbolic shape in keeping with quadrupole theory. The Quadrupole is to be independently heated and its temperature is to be user selectable from 100-200°C.
- The Mass Spectrophotometer's Detector must place the HED-EM doubly off axis of the transmission quadrupole.
- The Mass Filter and Detector should be placed on the same plate as the Ion Source for better accessibility.
- The quadrupole must have its electrode surfaces coved by titanium composite and gold thin and thick films.
- Mass Accuracy must give the following results: 1uL injection of 100pg/uL OFN, scanning from 50 to 300u, will give its monoisotope at m/z 272.987 plus or minus 0.005.
- Spectral Accuracy must give the following results: 1uL injection of 100pg/uL OFN, scanning from 50 to 300u, will yield spectral accuracy of 99.0%.
- The Mass Spectrometer must have a Gain Normalized Autotune which optimizes the EM's gain to ensure the optimal balance between ion count, linearity, and EM life expectancy.
- The Mass Spectrometer must have an electronic scan rate of 200,000u/sec.
- The instrument must scan from 1.6 to 1050u.
- The Mass Spectrometer must have the capability to create 100 SIM ion groups with up to 50 ions per group.
- SIM speed must be down to 0.1msec.
- The Mass Spectrometer's electronics must have the efficiency to support Synchronous SIM/Scan. SIM/Scan is a mode of operation that enables both collection of SIM data and full scan data in the same acquisition cycle. The fast electronics of the GC/MS system provides very fast and flexible SIM and Scan. The SIM dwell times must be able to be set in 1msec increments from higher than 100msec to as low as 1msec dwell time, allowing rapid analysis with more compounds and more samples.
- The Mass Spectrometer must have an automated SIM setup that can convert a full scan method to a SIM or SIM/Scan method. The software must automatically configure the number of SIM groups, SIM cycles across the peak, and the ions added to each group.
- The Mass Spectrometer data system must have an integrated retention time-locking module for analyzing target compound in complex matrices. The software module must provide the creation of custom compound databases as well as the utilization of vendor databases to include drugs of abuse.
- The Gas Chromatograph must have time clock programmability to allow a user to have the instrument come on at a specific time, and be at operating temperature and stable when use is required. This will also allow automated shutdown.

- Vendor must supply an **Ion Gauge Controller** high vacuum for diagnostic purposes.
- Vacuum System must be an air cooled vacuum system with 2.5m³/hr mechanical rough pump and 65L/sec oil diffusion high vacuum pump. **An oil diffusion pump is an absolute requirement in order to minimize downtime and maintenance costs.** The systems must allow venting of the high vacuum and access to the source volume without requiring column removal.

- **The data system** must be able to process data and use methods from existing HP/Agilent 5973, 5975 GC/MS and 5977 GCMS systems, as well as archived data in the HP/Agilent data file format.
- The data system must be able to automatically upload compatible data files for existing Agilent Technologies Chemstation data processing workstations for data review and production of finished reports.
- The software must have computer-bases training for self-paced training.
- A complete software package for control of the gas chromatograph, mass spectrometer and autosampler is required. In addition, it must include the capability to control autotunes, data acquisition, data analysis, method automation, macro programming, reporting, and system management utilities.
- The system must be capable of performing an autotune with PFTBA, DFTPP, and BFB per EPA targets without operator intervention as well as Gain Normalization Tune, user specified Target Compound tune, and Manual time with ramping of the following voltages: Repeller, Ion focus Lens, entrance lens, entrance lens offset, X-ray, amu gain and amu offset. Data acquisition shall be in either a scan mode, a selected ion monitoring mode, or an interleaved SIM/Scan mode.
- The software is to allow complete control of all operating parameters; including control of all the pressure programming capabilities of the electronic pneumatics controls capillary injection port.
- Data analysis should allow individual spectra to be selected, subtracted, and searched against either published or user created libraries.
- In addition, parametric retrieval of reference spectra through specifications of molecular weight, molecular formula, CAS number or text information must be standard.
- System must have the capability for the user to add additional libraries or to create custom libraries from their own spectra.
- System must be able to search a library and if match quality is not greater than user defined threshold, automatically search a second library.
- The user shall be able to generate custom reports.
- The software must be multi-tasking and be able to run unattended the following schedule:
    1. Acquire date from MS and GC detectors simultaneously.
    2. Produce custom report with library search from target and non-target compounds.
    3. Quantitate.
    4. Re-calibrate for new analyses.
    5. Export data to Excel spreadsheet

- A drug quant analysis software package must be included as part of the standard software to allow for specific forensic needs.