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**SPECIFICATION FOR THE PROVISION OF A GAS CHROMATOGRAPH MASS SPECTROMETER FOR THE HEALTH & SAFETY EXECUTIVE**

**TERMS OF REFERENCE (SPECIFICATION)**

 **Introduction**

1. The HSE Science and Research Centre is Britain's leading industrial health and safety facility. It supports HSE’s mission to protect people's health and safety by ensuring risks in the changing workplace are properly controlled.

2. This equipment is required to enhance the analytical capability of HSE and enable it to meet the requirements of both the Health and Safety Executive (HSE) and external customers. This system would be used for the analysis of very low levels of analytes in complex biological matrices.

4. The analytes of interest are primarily aliphatic and aromatic amines, analysed in negative chemical ionization after heptafluorobutyric anhydride derivatisation.

5. General requirements are low detection limits and good reliability, ease of use and robustness.

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| **Note to Tenderers:**Key requirement: To deliver and install the system and establish one HSE method (achieving at least existing HSE specification) by 26 March 2021. |

6. The more detailed specification is outlined below and is not based on any particular individual supplier’s system. **HSE require interested parties to show how their proposed systems could meet such parameters.** Where options are listed, these may either be included in the given price or costed separately, please specify.

 **Specification**

7. HSE is seeking a complete system of autosampler (liquid injection) with gas chromatograph and single quadrupole mass spectrometer with both EI and CI ionization. The system must be fully integrated and controlled by a computer system and appropriate software.

8. Tenderers should nominate at least one previous client with similar instrumentation who would be prepared to discuss their system with HSE staff.

9. The essential requirements are as follows (any additional options should be made clear and priced separately):

Gas Chromatograph – Mass Spectrometer

1. A bench top, single quadropole GC-MS with electron impact and chemical ionisation modes and autosampler.

Autosampler

1. For liquid injections, indicate the following:
* Size of syringe, maximum and minimum injection volume.
* Number of vials held on autosampler (must accept standard 32 x 12 mm, 2 ml GC vials). A minimum of 95 vials is required.

Gas Chromatograph

1. For the gas chromatograph, indicate the following:
* Split/splitless injection
* Specify flowrate range and temperature ranges (oven, inlet, transfer)
* Compatibility of consumables (septum, liner, ferrules) with previous models
* Describe the control of gas flows (e.g. electronic pressure control)
* State cool-down/cycle time from 150oC to 40oC and from 300oC to 150oC.

Mass Spectrometer

1. Include both electron impact and chemical ionisation modes including all sources;
* indicate changeover time and procedure between ionisation modes
* specify usable gases for chemical ionisation source.
* indicate whether sources from previous models are compatible
* provide a separate cost for an additional NCI source

Vacuum system

1. A vacuum system capable of rapid pump down and venting; state number and type of pumps. State whether sound boxes are included in the quotation or price separately.

Ion Optics and Detector

1. An autotune ability for focusing of ion lenses;
2. Specify:
* linear dynamic range of instrument
* mass range
* scan rate
* minimum dwell time
* stability of instrument response over a 24 hour period;
* stability of mass calibrations and background levels over a 24 hour period;
* sensitivity daily tune for both EI and CI modes;
1. Fully integrated software/communications with main computer and printer. Please specify in detail software to be supplied.

Data System

1. A minimum specification for the data system is attached in Appendix 1. Instruments should be configured for optional internet access (including via WiFi) and be robust to system interruption from anti-virus scans etc.
2. Appropriate software to control the autosampler, the gas chromatograph system and the mass spectrometer; specify model and version.
3. Data processing software, including chromatography, calibration and quantitation; specify model and version. Ability to export data to Excel and to quantify a fit-factor, based on several qualifier ions, required.

Training

1. State number of training days included and whether on-site/off-site/flexible. A minimum of full training for two (2) people in both the operation of the equipment and in basic maintenance at the time of installation.
2. Separate optional cost for at least two people-days (i.e. one day for two people or two days for one person) follow up training.

Consumables

1. An appropriate tool kit and start-up consumables;

Delivery, Installation & Commissioning

1. HSE currently has laboratory benching measuring 180cm x 91 cm. Please state whether the instrument will fit on such benching. Please state the maximum load the bench must bear.
2. Please indicate what procedure required for delivery, installation and commissioning.
3. Specify electrical power supply and any gases (including purity and flowrates) required.
4. One HSE method (see Appendix 2) to be established on-site during installation and achieving at least existing HSE specification.

Safety Considerations

1. The system is required to emit no harmful substances, radiation or noise. It is required to meet all UK electrical and environmental regulations and operate in a laboratory temperature range of 10 to 40 degrees Centigrade. Please include any necessary equipment to vent emissions to ventilation system if appropriate.

Maintenance Agreement

1. Provide an example quotation for a one year maintenance agreement (including all travel and labour, based on unlimited callouts, but not parts).
2. Where multiple suppliers are listed, please specify whether maintenance agreements for all equipment are covered by one company or each individual manufacturer.

Warranty

1. Please state minimum warranty period (must be at least 12 months). This must include unlimited callouts and parts.
2. State minimum supported lifespan for the offered system (specific to the model versions proposed).
3. State any (optional) trade-in value for an Agilent 5890/5973 system (currently operational with EI/CI capability).

**Appendix 1 - Minimum PC requirements**

Components (equivalents or better accepted)

1. As a minimum PC with quad core processor, with Microsoft windows operating system, 16 GB RAM, at least 1TB hard drive. MS Office to be installed.
2. 27” monitor;
3. Active USB ports for data transfer
4. Laser printer (monochrome);
5. Appropriate software to simultaneously control the autosampler, gas chromatograph and the mass spectrometer;
6. Data processing software, including chromatography, calibration and quantitation.
7. Software requirements:
* The instrument software must be capable of instrument control data acquisition, data processing and reporting.
* System (computer/autosampler/GC-MS) should be fully integrated.
* Ability to output data to Excel spreadsheets
* Copy of MS office including MS Excel.
* The data system shall include remote communications software for technical support and fault diagnosis.

**Appendix 2**

The method to be established can be accessed here:

Hexamethylene diisocyanate, 2,4‐toluene diisocyanate, 2,6‐toluene diisocyanate, isophorone diisocyanate and 4,4′‐methylene diphenyl diisocyanate – Determination of hexamethylenediamine, 2,4‐toluenediamine, 2,6‐toluenediamine, isophoronediamine and 4,4′‐methylenedianiline in urine using gas chromatography‐mass spectrometry [Biomonitoring Methods, 2017]

<https://onlinelibrary.wiley.com/doi/full/10.1002/3527600418.bi82206e2217>