

CSIR - NATIONAL PHYSICAL LABORATORY

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From: Director, CSIR-NPL

Tender No. 14-VI/NV(1109)22PB/T-94

Dated: 18.09.2023

CORRIGENDUM

With reference to NPL's Global Tender ID: **2023_CSIR_725293_1**, Pre-Bid Conference (PBC) was concluded on 05.09.2023 for "XRF Instrument". Consequent upon the outcome of PBC, **some changes have been made in the technical specification of captioned tender. Revised specifications are as follows:**

General Specifications: XRF Instrument

X-Ray Fluorescence Spectrometer with high speed and high precision for qualitative and quantitative analysis of elements from Boron (5) to Uranium (92) in different types of sample in concentration ranges from ppm level to 100%. The system should have the following features/specifications and must be supplied with all accessories and consumables:

- **Measurable Elemental Range:** Boron (5) to Uranium (92).
- **X-Ray Generator:** High Frequency X-Ray Generator with minimum power rating of 4KW.
- **X-ray Tube voltage:** 20-60 kV or better, computer control.
- **X-ray Tube Current:** 2 - 150 mA or better, computer control.
- **Stability:** minimum $\pm 0.005\%$ at $\pm 10\%$ input variation (for both voltage and current).
- The generator should be a microprocessor-controlled, water-cooled unit with a recirculating system that utilizes ion exchange resin. It should have built-in protective features, including abnormal cooling water temperature detection, a water failure relay, tube voltage leakage detection, an overvoltage limit, and provisions for tube current limit and automatic aging function of the X-Ray Tube.
- **X-ray Tube:** It should be an end-window type X-Ray tube with a Rh-target and equipped with programmable settings. The minimum distance between the sample and the X-Ray tube target should be set to achieve maximum intensity, preferably with a thinnest Beryllium Window of 50 μ or less.
- **Goniometer:** It should be a compact, high-precision, and high-speed microprocessor-controlled goniometer with a stepper motor driver and an independent driving

mechanism for both θ - 2θ measurements. It should have a minimum stopping angular reproducibility of ± 0.005 degrees, ensuring high sensitivity and high-resolution measurements. The scanning range of the goniometer should cover at least the element range from Boron to Uranium. The slew speed should be $200^\circ/\text{min}$ (2θ) or higher.

➤ **Spectrometer Optics:**

- (i) The spectrometer should be equipped with a minimum of an 8-position bi-directional crystal changer and should be supplied with LiF (200), Rx 26, PET curves, Ge curve crystals, or their equivalents for high sensitivity.

(a). The instrument should have required crystals for analysis of light elements such as Boron, Silicon, Sodium, Magnesium, and Fluorine and lower limit for these elements preferably $<50\text{ppm}$ and lower limit for carbon is $<500\text{ppm}$.

- (ii) The temperature stability inside the spectrometer chamber should be maintained within $\pm 0.1^\circ\text{C}$. A separate electrical connection for the temperature control and spectrometer chamber or an equivalent solution should be provided to avoid frequent conditioning time. The X-Ray path should offer the option to select either vacuum or Helium for liquid sample analysis. Furthermore, the spectrometer must be equipped with a high-speed vacuum pump (for the Sample chamber and Preparatory chamber) to maintain a stable vacuum condition, along with an air lock mechanism.

- **Detectors:** The spectrometer should be equipped with two types of detectors: a Flow Proportional Counter (F-PC) and a scintillation counter (SC). Both detectors must incorporate a digital multichannel analyzer for X-ray counting, ensuring higher counting linearity and improved precision. The scintillation counter should have a minimum counting linearity of 1200 kcps or higher, while the F-PC counter should have a minimum counting linearity of 2500 kcps or better
- **Collimators:** Provision should be made for at least three primary collimators (Fine / Coarse / Ultra-coarse) to ensure optimum sensitivity and resolution across the complete analytical range (B to U). The collimators should be automatically controlled through software
- **Area Limiting Diaphragm:** Four or more area limiting diaphragms should be there for optimum S/N ratio.
- **Primary X-Ray beam filters:** Minimum four suitable primary beam filters should be supplied for the X-Ray Optics with minimum filter thickness.
- **Mapping Mechanism:** The XRF system should include a provision for a mapping mechanism, which combines a CCD camera and a multi-directional sample stage. This

mechanism allows for the identification of inclusions and contaminants on the sample surface using a very small amount of sample, with a spot size as small as 500 μ or less.

- **Automatic Sample Changer:** The main system should be supplied with a sample tray capable of holding a minimum of 10 samples, with provisions for up-gradation to 30 positions. Additionally, a minimum of 20 stainless steel sample holders should be provided, along with different-sized mask covers such as 30 mm, 20 mm, and 10 mm, or their equivalents.
- **Sample Handling:** The spectrometer should be capable of handling solids, powders, pressed powder pellets, liquids, fused beads, etc. The sample presentation port should be equipped with an air lock mechanism, and the sample spinning mechanism should be provided as a standard feature.

Data Acquisition System and Software: The system software should be user-friendly, and the operating system must have the latest MS Window configuration built-in, along with necessary software. Additionally, the system should provide printing, copying, and scanning facilities to enable smooth delivery of observed data to the users. The software should perform the following functions:

The system should allow for qualitative, quantitative, and semi-quantitative analysis (standard less) with automatic theoretical correction for overlapping peaks, photoelectroncorrection using Fundamental Parameter Software, correction for atmospheric effects, and correction for impurities. The system should also include a matching library and standardization library. Additionally, there should be provisions for quantification based on a standard less Fundamental Parameter method.

- **Fixed Precision measurement:** By setting the required precision preceding measurement, the software should calculate the shortest measuring time after pre-measurement including peak to background intensity.
- The software should be user friendly and must guide the user for best conditions for matrix correction.
- The software should be equipped with data transfer facility. Output of X-ray tube should be reduced automatically in accordance with standby period of operation.

Analysis

- The automatic analysis is made according to the analysis schedule table preset for each sample. Displaying of "Analysis result" and "Status of operation" should be available.

Data processing

- Saved data of qualitative and quantitative analyses can be re-processed.

Qualitative application

- Editing measuring conditions used in the qualitative analysis with analysis program and data analysis conditions, and creating files for each analysis purpose can be made.

"Select Element Range", "Parameters", "Check Measuring Condition" and "Output Information" should be included in that.

Quantitative application

- Editing measuring conditions used in the quantitative analysis with analysis program and quantification calculation conditions, and creating files for each analysis purpose can be made. Setting of "Application information", "Standard sample", "Analysis condition", "Measuring condition determination", "Regression calculation (Calculation curve creation)", "Analysis control information" and etc., and the measurement program should be included in that. Automatic calibration function (for various sample state: metal, powder, polymer, ceramics) should be included.

Chiller:

- Compatible recirculating type chiller for the proposed instrument should be supplied with the minimum warranty period of three years. It should have noise level of 60dB or lesser.

UPS

- Compatible UPS equipped with 30 minute battery backup (for the Chiller and the main instrument) should be supplied with the system. The UPS should have minimum warranty period of three years

Sample Preparation Equipment:

- 30 ton or higher automatic pellets press with die set (different dia ranges from 5 mm, 10 mm, 15 mm, 20 mm, 25 mm and 30 mm for making suitable pellets). 1000 Nos. of Aluminium Rings and 100 Nos of SS rings should be provided along with the system.
- The vendor should provide Pestle mortar (6" dia:5 Nos) along with the system.
- Mylar film or Polypropylene film (Min. 5 rolls) to be provided for packing loose powder samples.

Supply of CRM

The vendor should provide the following standard reference materials (SRM) or equivalent CRM for instrument calibration along with valid certificate from any National Measurement Institute (NMI). The vendor should also provide necessary set of standards for instrument calibration and performance testing (of detectors).

1. SRM 114 - Portland Cement
2. SRM 1880b - Portland Cement (Microanalysis)
3. SRM 1881a - Ordinary Portland Cement
4. SRM 1884b - Portland Cement (Type I/II)
5. SRM 1885b - Portland Cement (Type III)
6. SRM 1886b - Portland Cement (Type V)
7. SRM 1887b - Portland Cement (Blended)
8. SRM 1888b - Portland Cement (Type I)
9. SRM 1889b - Portland Cement (Type II)
10. SRM 2670a - Hydrated Portland Cement

Gas cylinder(s):

- Gas cylinders for P10 & He gas (each 01 No) along with regulators (double stage).

Power rating:

- As per Indian standards

Warranty:

- Minimum 3 years for XRF Instrument after successful installation and commissioning.

Training:

- One week (seven days) onsite training should be given after successful commissioning of the equipment.

Therefore, following extension in due date of submission & date of opening of the said tender may be read exactly as follows:

Due date & time of tender submission

For : 26.09.2023 up to 3:00 PM (IST)

Read as: 03.10.2023 up to 3:00 PM (IST)

Date & Time of Tender Opening

For : 27.09.2023 at 3:00 PM (IST)

Read as: 04.10.2023 at 3:00 PM (IST)

All other terms & conditions of said tender will remain the same.


Sr. Controller of Stores & Purchase

Minutes of the Technical Sub Committee (TSC) meeting

Date: 06th Sept. 2023

The technical sub-committee meeting was held on 5th Sept. 2023 at 3 PM in CSIR-NPL (Second Floor Conference Room) for the procurement of XRF instrument. Based on the specifications which were finalized during first TSC meeting was discussed in the present Pre Bid Conference Meeting. The following members were present during the meeting.

1. Dr HK Singh, Chief Scientist & Chairman, TSC
2. Dr Sachchidanand Singh, Chief Scientist, Member, TSC
3. Dr Anjana Dogra, Sr. Prin. Scientist, Member, TSC
4. Dr Vibhav Pandey, IOCL, Faridabad, External Expert
5. Dr N Vijayan, Indenter, CSIR-NPL

The technical specifications were floated in the NPL website and wide circulation was given to major companies about the PBC. The representatives from M/s. Rigaku Corporation, Sh. Birendra Kumar Srivastava & Sh. Kuldeep Kumar attended the meeting and gone through the specifications and asked us to carry out few changes in the existing specifications. It was well discussed along with the TSC members (including external expert) and the revised point-wise specifications are attached separately in a tabular column.