


Plant Caustic Soda	Client Punjab Alkali	Contract Code PACL	Document ID 0215-PRC-00-DC-0003	Contract No. 66-0215
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Annexure-I: ICP-OES Spectrophotometer for Brine

1. GENERAL

This specification covers the general requirements for supply of ICP atomic emission / optical emission spectrometer laboratory analyzer for the elemental analysis of NaCl brine for caustic chlorine plant.

2. APPLICABLE CODES AND STANDARDS

Instrumentation Codes / References Standards for the design and installation of instrumentation system shall comply with the International Standards and codes for Laboratory.

IEC 61010 safety standard for measurement, control and laboratory equipment,
EN 61326 for Electrical equipment for measurement, control and laboratory use

3. ENVIRONMENTAL CONDITIONS

The ICP spectrometer shall be suitable to be operated in indoor laboratory environment (dust free) with a temperature between 15 °C and 35 °C.

4. DETAIL SPECIFICATIONS

4.1 Type & Construction

4.1.1 The Inductively coupled plasma optical emission spectrometer laboratory analyzer shall be suitable for the elemental analysis of NaCl brine for caustic chlorine plant.


4.1.2 The ICP OES spectrometer should have capability of analysis of element analysis in parts per billion with continuous wavelength coverage from 160 - 800nm.

4.1.3 Following minimum shall be supplied for complete functioning of ICP OES Laboratory Spectrometer

- a. ICP-OES spectrometer with sample introduction system which comprises of peristaltic pump, nebulizer and spray chamber, energy Source comprising of RF generator, load coil and torch to generate the plasma, spectrometer, detector and electronics to measure and process the output of the detector.
- b. Argon gas and standard solutions for calibration
- c. Dedicated computer system with latest windows operating system and required peripheral hardware / drives for overall system performance. PC shall be loaded with applicable analyzer licensed software. Color laser printer with cartridges shall be supplied by vendor.

4.1.4 The vendor shall be responsible for the verification of sample media analysis method, utilities and gas requirements of analyzer systems, conditioning system, and installation materials for specified application in accordance with the matrix data furnished.

4.1.5 The system should perform auto optimization of plasma parameters like plasma power, gas flow etc. The instrument software shall allow auto-tuning to enable the instrument to be used with the consistent and reproducible day to day performance independent of the operator.

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- 4.1.6 A common power supply input connection will be provided by client for the system. Vendor has to consider the required distribution board / power adaptor for all equipment's.
- 4.1.7 All equipment, instruments, panels, and accessories shall be provided with a permanently attached corrosion resistance nameplate engraved or stamped with Instrument Tag Number.
- 4.1.8 Vendor to submit the offer with general arrangement drawing of ICP OES lab Spectrometer with its peripheral equipment for allocation of space in existing plant laboratory facility and connection details for laboratory fume hood.

Any specific hardware / peripheral equipment, utilities required for complete operation of ICP-OES Spectrometer shall clearly indicated in offer

4.2 Standard solutions / Gas for Plasma Formation.

The vendor shall supply one set of Standard solutions required for calibration of instrument with analysis certificates. NIST traceable certified standards shall be provided by vendor. Vendor shall supply gas cylinder with pressure regulator and required tubing for plasma. The required capacity and no's of cylinders to be specified in the quotation. Also unit rate to be quoted for supply & refilling purpose.

4.3 PC monitor and printer:

Windows 7 PC with at least the following specifications:

- a) Intel i3 Quad-Core 3.1GHz Processor; Minitower Casing; 800 MHz DDR2 RAM
- b) 2*1TB SATA II Hard disk (RAID 1).
- c) DVD-RW Drive; 10/100 LAN card.
- d) Windows 7 Professional; Recovery DVD.; MS Office 2013 Professional (English)
- e) 1-Year on-site guarantee; Norton Antivirus 2013 (2 Year Subscription)
- f) 20" TFT LCD Monitor

Printer shall be colour laser type.

Vendor shall ensure the software compatibility with PC.


4.4 Consumables; Spare Parts List

Vendor shall quote recommended consumables/standard solutions / commissioning spares for lab ICP-OES spectrometer, sample introduction system and its peripheral equipment.

Vendor shall quote optional prices for consumables such as tubing, torch, and standard solutions required for calibration.

4.5 Guarantee / Warrantee

Vendor shall include warranty of 12 months for the ICP spectrometer with its peripheral equipment's supplied in the offer. During warranty period; vendor shall supply all spares and consumables for supplied systems or replace any faulty hardware free of cost within the warranty period.

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4.6 Site Assistance

Vendor shall depute his engineer at site for supervision of installation, Calibration & Commissioning of the Lab ICP spectrometer with its peripheral equipment's / accessories quoted.

Man-Days for Erection supervision of laboratory instrument erection and software set-up by service engineer	2 working days
Man-Days for commissioning assistance of laboratory instrument by application engineer, including training of laboratory staff proving of instrument with standard solutions and providing reports on PC / software	15 working days
Man-Days for training of laboratory staff regarding instrument operation / maintenance and PC / software	2 working days
Maximum number of trips during Commissioning and assistance	4


The above man-days shall be inclusive of to / from site travel, Lodging / Boarding and Local Conveyance at site. In addition to above, vendor shall also quote for per diem rate.

5. INFORMATION REQUIRED WITH THE BID

Vendor shall submit the following with the bid.

- a. Detail offer which shall include information regarding schematic, layout, sample introduction system details etc., bill of material indicating all with consumables & their sub-vendor name & model no.
- b. Catalogues/literature for all models offered including suitability for the specified application.
- c. Spare parts / Consumables / Standard solutions required for two years continuous trouble-free operation.
- d. Power Consumption of laboratory instrument including all accessories.
- e. Composition of argon gas with consumption calculation considering at least 6 months of continuous operation and 30 samples per day.

Minimum measurable value for various elements, time required for analysis of sample from powering up of instrument / cold start.

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6. PROJECT SPECIFIC REQUIREMENTS

The ICP-OES shall be suitable for measurement of below listed elements in NaCl brine used in chlor – alkali electrolysis plants. The ICP instrument shall have a radial torch arrangement. This design of sample introduction system and torch shall allow higher salt content of the samples. Following are the main components of the brine required to be analyzed.


Component	Norm.	Max.	Unit
NaCl	290	310	gpl
Na ₂ SO ₄	10		gpl
Na ₂ CO ₃	0.4		gpl
NaClO ₃	10		gpl
NaOH	0.2		gpl
H ₂ O	(Balance)		

The analytical detection limits (about 10 sigma of the blank) have to be clearly below the listed brine specification. If possible, the instrument shall be capable of analyzing 30% w/w brine without dilution. Dilution means additional sources for contamination with calcium and magnesium and makes analysis of pure brine more difficult. Experience shows that used sampling ware and glassware needs a long time to become free of calcium and magnesium.

The instrument's optical system shall cover the wavelength range from 160 to 800 nm.

A choice of analytical Wavelengths and Expected values of elements in pure brine solution (290-310gpl) are as follows:

Element to be analyzed	Analytical Line [nm]	Remarks	Expected value of element [µg/l]
Aluminum	396.152		< 10
	394.401		
Barium	455.403	Very high intensity	< 30
	493.408	Very high intensity	
Bromine	163.340		< 50 mg/l
Calcium	396.847	Very high intensity	< 10 (Instrument shall be capable to detect upto 1 ppb)
	393.366	Very high intensity	
Cadmium	228.802	Less intense than 214.439	
	214.439	Interference with Fe, intensive line	
Cobalt	238.892		< 10
	230.786		
Chromium	357.868		
	267.716		

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Copper	327.395		
	324.754		
Iron	259.940		< 50
	238.204	Interference with Phosphorus	
Iodine	178.218	Low intensity	< 50
	182.976		
Magnesium	279.553	Very high intensity	< 10 (Instrument shall be capable to detect upto 1 ppb)
	280.270	Very high intensity	
Mercury	194.163		< 20
Nickel	231.096		< 10
	230.299		
Lead	283.305		< 10
	220.353		
Silicon	288.158		
	252.411		
Strontium	407.771	Very high intensity	< 60
	421.552	Very high intensity	
Zinc	213.857		
Manganese			< 10
Heavy metals (Sum of Cr, Mo, Co, Ni, Cu, Zn, Cd, As, Sb, Pb)			< 150

Vendor shall provide lower (minimum) detection capability for all the above specified elements and also for other common elements which can be analysed by the ICP.

7. Frequency of Analysis

The frequency of analysis for the above mentioned trace elements is

Normal – Once in a day (19 elements)

Maximum – Three times a day (19 X 3 elements).