

**INDIAN INSTITUTE OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING**

**Enquiry letter for Engineering Services Consultancy for National Aerosol
Facility at IIT Kanpur**

Sub: Quotation for Scope of the work and technical specification: “Engineering Services Consultancy for National Aerosol Facility at IIT Kanpur

Reference: IITK/CE/2015/1008

Dated: September 1, 2015

Sir / Madam,

With reference to the subject mentioned above, you are invited to submit the quotation (technical and price bids) in a separate envelopes.

Technical Specification:

A National Aerosol Facility is being set up at IIT Kanpur as part of a collaborative research programme between BARC, Mumbai and IIT Kanpur. The main objective of this programme is to undertake R&D studies on aerosol behaviour in different piping sections pertaining to the PHT (Primary Heat Transport) system of Indian nuclear reactor.

The important supporting infrastructure that needs to be established for the said facility includes various systems such as aerosol generation system, steam generation system, inert gas/steam/air injection system, aerosol mixing chamber and aerosol scrubbing system. Layout of the different systems, equipment and associated piping with different control points are required to be planned properly to facilitate appropriate composition of fluid and its flow rate through the section under investigation. High quality data sampling for process and aerosol measurements at different locations are also required. Necessary electrical and civil supports are also required to be established for conducting the experiments.

This technical note presents the salient features of the National Aerosol Facility (NAF) along with its peripheral systems as mentioned above with the objective of defining the scope of consultancy work entitled “Engineering Services Consultancy for National Aerosol Facility at IIT Kanpur” proposed to be undertaken for setting up the facility.

A schematic of the facility is given in Fig. 1. Typical process parameters and the main components of the facility are given in Table 1 and Table 2 respectively.

1. Objectives and Deliverables:

The main objective of this consultancy work is to get total multidisciplinary engineering services required to establish the NAF facility from a reputed vendor having wide experience.

The work will include basic engineering of the whole facility followed by detailed engineering. The key deliverables of this work are outlined below:

- 1.1. Process and Instrument Diagram (P&ID) of NAF.
- 1.2. 3-D Process Flow Diagram (PFD), preferably using PDMS software.
- 1.3. Design and layout of injection system for various gases (nitrogen, argon, air and steam) via a gas mixing station along with monitoring, control and recording of gas temperature, pressure, flow etc.
- 1.4. Detailed technical specification of steam generation system including the associated peripherals, instrumentation and piping up to the steam injection point.
- 1.5. Mechanical and process design of the mixing chamber along with instrumentation nozzles, support and foundation design.
- 1.6. Process and mechanical design of aerosol scrubbing system(s), collection tank, bypass system for scrubbing of aerosols before discharging the gas into atmosphere along with exhaust system.
- 1.7. Washing system design for removal of aerosols deposited in the piping section and at other places.
- 1.8. Complete Instrument datasheet for procurement by EPC Contractor. The work will include detailed technical specifications for the various process instruments and preparation of detailed process and instrumentation flow sheets.
- 1.9. Specification of PLC system/ DAS with control panel and emergency power back-up.
- 1.10. Design of structural supports needed for installation of all equipment like mixing chamber, piping, gas scrubbers, steam generator etc.
- 1.11. Design of special civil foundation apart from the standard one is required, if any.
- 1.12. Design and specification of power requirements with electrical panels and distribution layout.
- 1.13. Design and technical specification of insulation, heating system and/or cooling systems for various components like piping, gas injection, mixing chamber etc.
- 1.14. Operating and Control Manual.
- 1.15. Documents for construction.
- 1.16. Cost estimation.
- 1.17. Tender documents for procurement, construction and commissioning.

2. Scope of the work:

The detailed scope of work is given below:

2.1. Process:

- 2.1.1. Process design basis and process description.
- 2.1.2. Review of BARC's operating and control philosophy.
- 2.1.3. P&ID and PFD.
- 2.1.4. Line and equipment list.
- 2.1.5. Process design for aerosol scrubbing, aerosol retention and carrier gas venting to the atmosphere after scrubbing.

- 2.1.6. Washing system for removal of aerosol deposits in mixing chamber and test sections
- 2.1.7. Process Data Sheets (PDS), Instruments Process Data Sheet (IPDS) for mechanical equipment and packages.

2.2. Mechanical:

- 2.2.1. Mechanical data sheet of mixing vessel, tanks, monorail, aerosol scrubbing-retention-venting system, washing system.
- 2.2.2. GA and fabrication drawing of the above mentioned items.
- 2.2.3. Bill of material (BOM) and Material take off (MTO).

2.3. Piping:

- 2.3.1. Valve list and other piping special item list.
- 2.3.2. Piping and equipment layout drawing.
- 2.3.3. Piping 3-D model with GA and isometric drawings.
- 2.3.4. Piping and equipment support drawing with specification.
- 2.3.5. Valve and piping data sheet.
- 2.3.6. BOM inclusive of pipe support and MTO.

2.4. Electrical:

- 2.4.1. Load List.
- 2.4.2. SLD (Single Line Diagram) & Electrical equipment list.
- 2.4.3. Specification of MCC, Power Distribution Box and erection hardware.
- 2.4.4. Provision of emergency lighting system in case of power failure.
- 2.4.5. Cable schedule.
- 2.4.6. Cable tray and equipment layout.
- 2.4.7. Earthing protection layout for various components and equipment.
- 2.4.8. Floor/wall penetration layout.
- 2.4.9. Battery back-up load calculation (should include all sensors with data acquisition system, control system and emergency lighting).
- 2.4.10. BOM & MTO.

2.5. Instrumentation (Field):

- 2.5.1. P&ID review and support.
- 2.5.2. Instrument index.
- 2.5.3. Complete instrument data sheet.
- 2.5.4. Instruments and JB location layout.
- 2.5.5. Inst. JB schedule.
- 2.5.6. JB termination drawing.
- 2.5.7. Inst. Cable layout.
- 2.5.8. Inst. Cable schedule.

- 2.5.9. Instrument hook-up drawing.
- 2.5.10. Mounting stand fabrication drawing.
- 2.5.11. Electrical-Instrumentation interface diagram.
- 2.5.12. BOM and MTO.

2.6. Instrumentation (Control):

- 2.6.1. Control system architecture.
- 2.6.2. I/O list.
- 2.6.3. Control logic narratives.
- 2.6.4. Cause & effect matrix.
- 2.6.5. Control logic and interlock logic diagrams.
- 2.6.6. DCS specification.
- 2.6.7. Graphic display drawing.
- 2.6.8. Control room layout.
- 2.6.9. SLD for instrumentation power supply.
- 2.6.10. Loop wiring diagrams.
- 2.6.11. BOM and MTO.

2.7. Civil:

- 2.7.1. Specific foundation requirement other than standard if any.
- 2.7.2. Floor cut-out, insert plates in slab or column and corner angles in columns – mark up to civil.

2.8. Procurement Assistance:

- 2.8.1. Cost estimation.
- 2.8.2. All tender inquiry documents preparation.
- 2.8.3. Vendor drawing and documents review.
- 2.8.4. Bid evaluation and technical recommendation to place EPC Contract.
- 2.8.5. Vendor list preparation.

3. Inputs from BARC and/or IIT Kanpur:

- 3.1. Conceptual layout, Plot layout and building floor plan of the site for proposed NAF.
- 3.2. All the relevant process parameters e.g. flow rate, temperature, aerosol concentration etc., process description.
- 3.3. Mixing vessel dimensions and integration scheme of PTAG with it.
- 3.4. Data sheet for aerosol generation system including PTAG, powder feeder, power unit and chillerunit.
- 3.5. Aerosol measurement instrument specification.
- 3.6. Position and number of tapping points for aerosol instruments.

- 3.7. Required physical data, location of data sampling and data sampling frequency for the section under investigation.
- 3.8. General layout for piping test section for provision of foundation.

4. Exclusions:

- 4.1. Construction supervision.
- 4.2. Commissioning assistance.
- 4.3. Any site survey.
- 4.4. Plot layout and building design.
- 4.5. HAZOP and other related safety studies.
- 4.6. Applying/obtaining approvals/registrations/licences from relevant/statutory body.
- 4.7. Any meeting outside Mumbai region.
- 4.8. Post-order vendor co-ordination.
- 4.9. Maintenance manual and schedule.
- 4.10. Equipment storage procedure.

5. Milestones, Time Schedule and Payment Schedule

Sr. No.	Milestone	Time Schedule (in weeks) from issue of Purchase Order	Payment Applicable Schedule (%) of PO value
1	Award of Contract	Advance payment	20
2	Completion, submission and approval of basic engineering, drawings, documents, etc.	8	20
3	Completion, submission and approval of detailed engineering, drawings, documents, etc.	8	40
4	Tender document for EPC bidding	2	10
5	Bid evaluation and technical recommendation to place EPC Contract (*)	2	10
Total		20	100

(*): The time gap between milestones at Sr. No. 4 and 5 could be up to 4 months.

6. Evaluation of Bids:

- 6.1. A two-stage procedure will be adopted in evaluating the bids: i) technical evaluation and ii) financial evaluation.
- 6.2. The weightage of technical evaluation will be 70 % and of financial evaluation will be 30 %.

- 6.3. Technical and price bids should be submitted in separate envelopes. The bids should be submitted by **September 30, 2015 to Professor S. N. Tripathi, Department of Civil Engineering, I. I. T. Kanpur, Kanpur-208016.**
- 6.4. Price bids should clearly mention the price of overall work (lump sum) and taxes separately.
- 6.5. The date and venue for opening of bids will be communicated to the bidders by email.
- 6.6. Technical evaluation will be based on the criteria detailed in the General Terms and Conditions given below. If required, evaluation of the bidder's resources would be undertaken by the client by visiting the bidder's premises.
- 6.7. Technically qualified bidders will be evaluated for their financial bids. Each bid will be ranked using a combined technical and financial score and the contract will be awarded to the bidder with the highest score.

7. General terms and conditions:

- 7.1. All the discussions and review meetings required for this work will be held at BARC, Mumbai premises.
- 7.2. Bidders should ensure that they qualify for all the items of the Assignment. The bidders shall be firms having experience and expertise in engineering services.
- 7.3. The bidders should have experience relevant to the scope of work of this consultancy. They should have experience in design, analysis, layout drawings for process systems, electrical systems, civil engineering design, control and instrumentation and plant services like fire protection system, and compressed air systems.
- 7.4. The bidders should have licensed software for the required jobs mentioned in the scope of the work.
- 7.5. The bidders should have a well-established Quality Management System in position and it should preferably have an appropriate Bureau of Indian Standards (BIS)/International Organisation for Standardisation (ISO) certification(s).
- 7.6. The key professional staff of the bidder's organisation should have very good knowledge of codes and standards like ASME, ASTM, IEEE, ISO, ASHRAE, BIS etc., and computer codes and programmes for design, analysis, 3D CAD modelling etc.
- 7.7. The successful bidder shall be responsible for preparation of all the reports/design notes of the work assigned in Contract. Report shall be prepared in English language. The format of the report shall be as per the IITK/BARC specified format. Reports shall be submitted in three copies for review and approval. Final report(s) including drawings etc. shall be given in the form of hard copies and soft copies in electronic media in a format specified by IITK/BARC.
- 7.8. The successful bidder shall be responsible for the correctness and accuracy of the drawings, documents and reports prepared by him. Approval of the drawings and documents by IITK/BARC shall not relieve him of his responsibility for correctness and accuracy of such drawings and documents. No compensation or extra payment

shall be made by IITK for any correction or changes made in the drawings or documents.

- 7.9. The bidders should have a proven track record and should have satisfactorily completed 3 similar assignments, each costing not less than the quoted price, during the last five years. Written evidence to this effect should accompany the bid submission.
- 7.10. Technical Proposal should provide a brief description of the bidder's organization and an outline of recent experience on assignments of a similar nature.
- 7.11. Bidders may request clarification on any of the documents furnished to them with the tender up to seven days before the Proposal submission date. Any request for clarification must be sent in writing by **email (snt@iitk.ac.in)** to the Client's address (**Tel. No. : 0512-2597845**). The Client will respond by email to such requests and copies of the response (including an explanation of query but without identifying the source of enquiry) will be sent to all invited bidders who intend to submit the Proposal, and also posted at Tenders link of IITK website.
- 7.12. The key professional staff, listed in the offer, should be available for the entire duration of the execution of the Assignment. They shall preferably be the permanent employees of the firm or have an extended and stable working relation with it.
- 7.13. Proposed staff must have relevant educational qualifications and experience, preferably under conditions similar to those prevailing at the locations of the Assignment.
- 7.14. List of Engineering & Management software and workstations, office space etc. available with the bidder should be provided.
- 7.15. The validity of the offer **should not be less than 3 months from the closing date of bid submission.**
- 7.16. The final responsibility for the correctness, adequacy and accuracy of the designs, drawings, technical specifications, tenders documents, purchase specifications, installation instructions etc. furnished by the bidders, shall lie with them.
- 7.17. IIT Kanpur shall not be responsible for any cost or expenses incurred by the bidders in connection with the preparation and delivery of bids, including costs and expenses related to visits to work site.
- 7.18. The acceptance of bids will rest with Director, IITK who does not bind himself to accept the lowest bid and reserves to himself the authority to reject any or all the bids received without assignment of any reason. Also, Director, IITK reserves to himself the right to accept the whole or any part of the bid and the bidder shall be bound to perform the same at the rate quoted.

Table 1: Typical range of operating parameters of peripheral systems of NAF

Sl. No.	Parameter	Range	Remark
1	Steam, Air, Argon	To be specified by the bidder on the basis of process requirements provided by the user.	Super heater may be needed for steam. Combination of Steam/Air/Ar (will be confirmed during design stage).
2	Nitrogen as plasma gas	100 slpm	-
3	Argon as plasma gas	200 slpm	-
4	System Pressure	1.3 – 5 bar (g)	System operating pressure
5	System Temperature	120-400 °C	System operating temp.
6	Flow velocity in the test section (indicative)	1-10 m/s	-
7	Size of the test section	25-100 mm dia.	-
8	Aerosol Material	Sn, Mn, CsI, CsOH	-
9	Power Feed Rate	0.01 – 0.5 g/s	-
10	Aerosol Conc.	0.05 -5 g/m ³	depending on conditions
11	Aerosol Size (AMMD)	0.3- 5.0 μm	depending on conditions
12	Aerosol Type	Single or mixture of above-mentioned materials	Insoluble and/or Soluble
13	Flow Duration Time	~ 1.5 hour	-
14	Plasma Torch Aerosol: Generator (PTAG)	2x40 KW	-

Table-2: Main components of the facility

Sl. No.	Component	Description
1	Gas Injection System	Bank of cylinders / gas generators for gas(es) to be used as carrier / plasma gases for aerosol generation / transport
2	Steam Generator	Discharge Pressure: 1-5 kg/cm ² (g), Flow will be as per process requirement
3	Mixing Chamber	Required for homogenization and characterization of aerosol before injection into test piping section Design pressure = 10kgf/cm ² (g), Design temperature = 500 ⁰ C
4	Heating System for piping section and gas inlet lines	Strap-on heaters of adequate capacity for keeping the various piping and tubing sections heated
5	Aerosol Instrumentation	Instruments for measurement of aerosol properties like size, concentration, etc.
6	Process Instrumentation and Control	Instruments for measurement/regulation of pressure, temperature, flow, venting, draining, isolation, etc.
7	Bypass System Including off-gas System	For bypass of aerosol-laden carrier gas till homogenous aerosol concentration is achieved at the mixing chamber outlet.
8	Scrubber and Discharge System	For scrubbing and retention of aerosols coming out of the test piping section

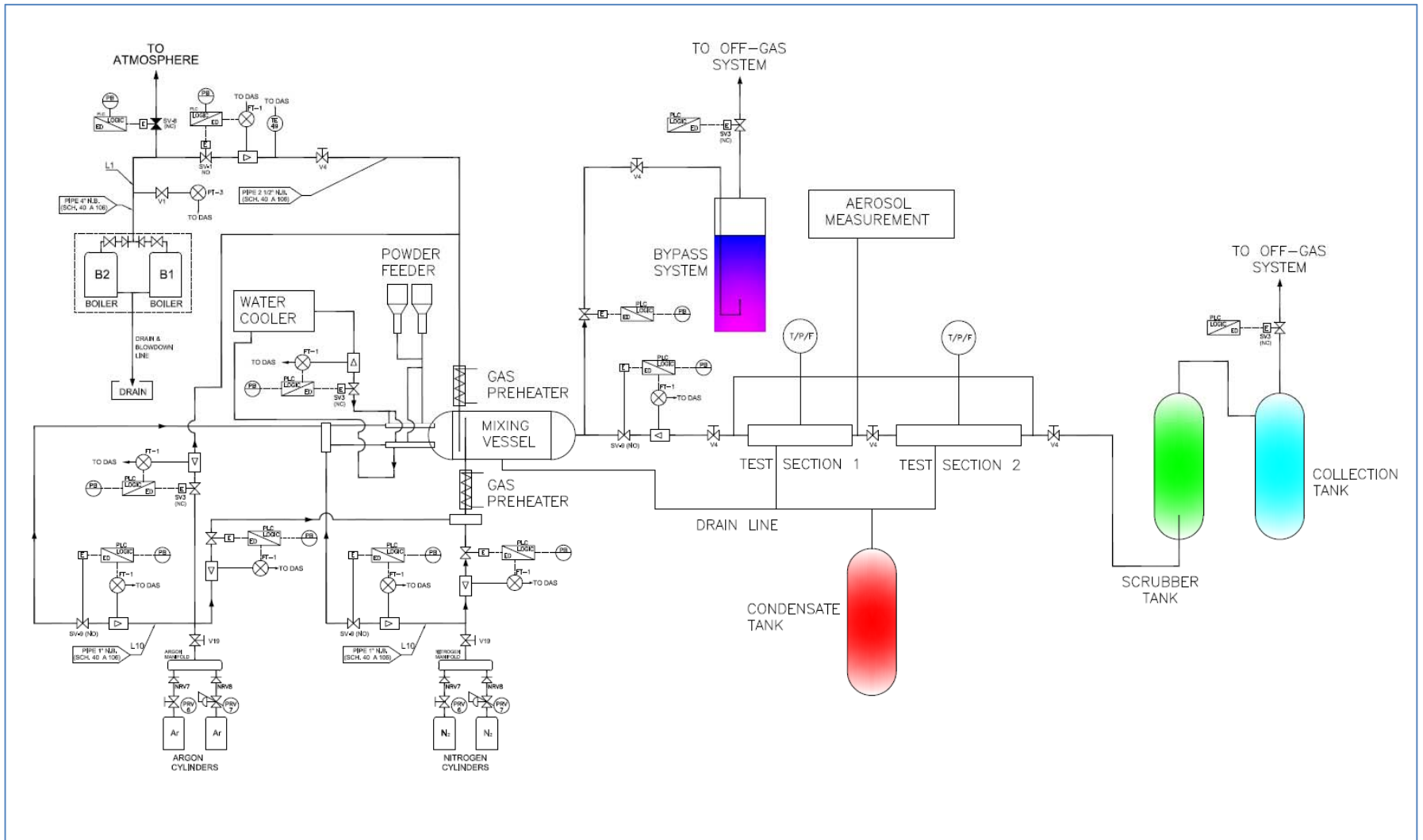


Fig.1. Schematic of the proposed NAF facility