

**GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
WASTE MANAGEMENT DIVISION
WASTE MANAGEMENT FACILITY, TROMBAY**

Ref: WMD/EE&I/VGG/A33_PLC/2021/ 19444

Date: 14 /12/2021

NOTICE INVITING TENDER

Sealed quotations are invited on behalf of President of India by 'Chief Plant Superintendent, WMD, Trombay' for the following work from contractors having adequate experience and capabilities to execute such magnitude of similar works and who have similar experience with different units of Department of Atomic Energy (DAE), Nuclear Power Corporation of India Ltd., Public sector undertakings etc.

Name of work:

Minor works w.r.t. **Design, Engineering, Fabrication, Supply, Installation, Testing and Commissioning of PLC & SCADA based Control System** at WIP, Trombay as per details given in Annexure No. 'WMD/EE&I/VGG/A33_PLC/ 2021/Work-details'.

Terms & Conditions -

- a. The tenderer may contact telephonically on '02225591090' for clarifications, if any w.r.t. scope and details of the works. Last date for entertaining such queries shall be 20 . 12 . 2021 up to 18:00 hrs, only on working days.
- b. Bid Security Declaration form as per the attached Annexure-V, shall be submitted along with the offer.
- c. Vendor shall be an Authorized Partner/System Integrator of the offered product. Certificate to be attached along with the offer.
- d. Tenderer shall send the quotation in attached proforma and printed on letter-head with GST and break-up of Taxes, duties, levies, other charges, if any.
- e. Sealed quotation should clearly indicate Name of Work, Reference No. & Due date of submission of quotation. Address on the envelop should read:

Kind attention: Vijaykumar Gaikwad, SO/E,
Room No - 309, Waste Immobilization Plant, Waste Management Division,
Bhabha Atomic Research Centre, Trombay, Mumbai-400085

Such sealed quotation should reach above address through 'registered post/speed post' only through Indian Postal Service. **Last date for receipt of sealed quotation is 22 . 12 . 2021 up to 14:00 hrs.**

- f. The Sealed Quotations will be opened on 23 . 12 . 2021 at 14:30 hrs in Divisional office, NRG, BARC, Trombay.
- g. Chief Superintendent, WMD, Trombay, reserves the right to accept / reject any or all the quotations, without assigning any reason thereof.

- h. Quoted offer by the tenderer shall be valid for **minimum 45 days** from the date of opening and also the quoted price shall remain firm during the period of execution of the order.

Encl: Annex- 'WMD/EE&I/VGG/A33_PLC/2021/Work-details'.

: Format proforma for quotation



Chief Supdt. 13/12
WMD, Trombay

डॉ. सी. पी. काँशिक / Dr. C. P. Kaushik
निदेशक, नाभिकीय पुनश्चक्रण वर्ग
Director, Nuclear Recycle Group

Annex- 'WMD/EE&/VGG/A33_PLC/2021/Work-details'

1.0 Overview :-

A standalone PLC & SCADA based control system is planned to cater the C&I requirement of Demonstration Facility for upcoming project. The continuous display of various associated process parameters, the control operation with safety interlocks, the equipment start/stop operation, information pertaining to the status of operation of control equipments, on-line & historic parameter trending, report generation, alarm annunciation shall be made available on two (2 Nos.) PC based operator consoles. One Operator Control station (OCS) shall be located in Demonstration facility area (near the PLC panel) and one in the main control room (located approximately 100 mtrs. away from PLC location) of WIP, Trombay. All the monitoring and control operations shall be possible from both the Operator control stations (OCS).

This PLC system shall be seamlessly integrated with the existing Data Acquisition and Control System (DACS) located in the main control room (approximately 100 mtrs. away from this PLC).

2.0 Scope of work :-

The scope of work includes design, engineering, fabrication, supply, installation, testing & commissioning of PLC & SCADA based System at WIP, Trombay site. The detailed scope of work is as follows.

- Preparation of panel GA drawings and Bill of Material (BoM).
- Software development of plant specific application programme & SCADA development as per the requirement.
- Supply of PLC Panel -1 No. as per the tender specifications.
- Supply of power supply-
 - field interrogation power supply for powering filed instruments (24V DC/10A) – 2 Nos. in dual redundant mode (with oring module).
 - Power supply for powering control elements (24 V DC/20A) – 2 Nos. in dual redundant mode (with oring module).
- Supply of 2 Nos. of PC based Operator Control Station (OCS) as per the tender specifications.
 - 1 No. - near the PLC panel +
 - 1 No. - in the main control room (located approx. 100 mtrs. away from PLC).
- Supply of licensed System Software (programming + GUI).
- Supply of Computer furniture (for OCS) –Table & chairs – 2 Nos.
- Conduct of system acceptance test (FAT & SAT).
- Seamless integration with another PLC system- Hooking up this PLC based system with the main Data Acquisition and Control System (DACS) (M/s Schneider make PLC based System) located in the main control room (located approx. 100 mtrs. away from PLC).
 - It shall be possible to import database of this existing DACS system to this PLC.
 - Any hardware/software required for the integration shall be in the supplier's scope.
- Supply of CAT-6 armoured Network cables – 200 mtrs.
- Supply of network switch (8 port) – 2 Nos.

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Annex- 'WMD/EE&I/VGG/A33_PLC/2021/Work-details'

- Supply, laying of Network cables, Jack panels, Information outlets, patch cords, connectors etc.
- Installation, testing & commissioning of the entire system.
- Observation of the system performance for a period of 30 days from the date of completion.

Note :- Any other hardware/software required for entire commissioning of the system shall be in the supplier's scope.

2.1 System Capacity :-

I/O Type	I/O Capacity
Analog Input (4-20mA Current)	66 Nos.
Digital Input (24 V DC) sinking type	50 Nos.
Analog Output (4-20 mA Current)	14 Nos.
Digital Output (24 V DC)	58 Nos.
PID Loops	10 Nos.

NOTE :- PLC shall have 20 % extra I/O capacity than specified to accommodate modifications/additions arising due to process requirements.

3.0 Programming Logic Controller (PLC) :-

The PLC shall comprises of I/O modules, CPU, interfacing module, if any for communication with the main CPU, rack power supply module and Field interrogation Power supplies (for powering field instruments + control elements). The PLC shall scan all I/Os, execute interlock logics and closed loop controls, send all the data to OCS via CPU and accept commands from OCSs. It shall have all the necessary hardware and software to execute above functions.

The PLC shall be modular in construction. It shall have plug in type easily removable / replaceable I/O modules. It shall be possible to remove /replace the I/O modules while the system is running i.e. they should be hot swappable. It shall have exhaustive fault monitoring and diagnostics features so that any module / channel failure can be reported / represented on OCS.

The I/O modules shall have backplane rack type design. All the I/O modules shall have each channel status indication along with fault indication and shall have inbuilt protection. I/Os shall communicate with CPU through I/O bus.

Detailed specification of exiting CPU and I/O modules is given in Annexure-I.

The PLC cabinet shall have general arrangement easily accessible for servicing and maintenance. It shall comply for general requirements, like modular expandability, service conditions, mechanical construction etc. All the associated hardware inside the cabinet shall be properly tagged/labeled. The detailed PLC cabinet specification is given in Annexure –II.

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5.0 Power Supply :-

Power supply to the entire system shall be provided by an Uninterrupted Power Supply (UPS) in the scope of purchaser. The power supply to PLC system shall be 230 V AC, $\pm 10\%$, 50 Hz.

5.1 PLC Rack Power Supply :-

The various DC levels required within the PLC Rack shall be generated in the system and shall be in the supplier's scope. The power supply type shall be plug-in rack type.

5.2 Field Interrogation Power Supply :-

24 V DC power supply required for analog inputs (2 wire), analog outputs (if it sinking type), discrete inputs shall be within the scope of supplier. PLC panel shall have dual redundant Power Supply for powering Field instruments. The rating of power supply shall be SMPS type 24 V DC/10A. The dual power supply arrangement shall have diode oring module or suitable arrangement to take care of paralleling.

A dedicated dual power supply (24 V DC/ 20A) for powering interposing relays (used for discrete outputs), which in turn used for final control elements, shall also be in the scope of supplier.

Detailed specification of SMPS type Regulated DC Power Supply is given in Annexure – IV.

6.0 Interposing relays :-

Interposing relays for discrete outputs shall also be housed in this panel. The relay shall be with base and shall have 24 V DC operating voltage with 2 c/o contacts of 5A ratings.

7.0 Operating Conditions :-

Operating Temperature :- 0 to 50 °C

Relative Humidity (Non-condensing) :- 5 – 95 %

8.0 Operator Control Station (OCS) :-

The Operator Control Station shall be Personal Computer (PC) of latest configuration with WINDOWS Operating System compatible with the PLC programming software & SCADA software (Rune Time + Development) preloaded in it. One OCS shall be located 100 mtrs. away from the PLC in the main control room & the other one shall be located near the PLC panel. Cabling & any other hardware/software required w.r.t. communication shall be in the suppliers scope. The OCS shall have required hardware & software so as to program the PLC for monitoring & control of the system. The detailed specification of OCS is given in Annexure – III.

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9.0 Software :-

9.1 PLC programming software :-

The PLC programming software shall be licensed software for the specified system configuration. Programming language shall be confirming to IEC 61131-3.

9.2 SCADA software :-

The SCADA software shall be licensed software with suitable no. of tags for the specified HMI configuration for OCS in main control room – 1No. & for OCS near PLC panel – 1 No.

The SCADA shall be user configurable, upgradable. The software shall have security features with different privilege levels for managers, engineers, supervisors and operator to view and communicate with the entire operation through graphical representations of process.

10.0 Software Development :-

PLC shall be programmed for plant specific application programme for sequential operation of systems planned in the demonstration facility along with safety interlocks & the equipment start/stop operation as per the interlock write-up (shall be provided after placement of order).

HMI screens & control pop-ups shall be configured using the SCADA software as per the details (shall be provided after placement of order).

11.0 Network Communication :-

The network cable laying, routing through proper conduits, termination at the jack panels, termination at the field ends for Field Monitoring Station (Viewing Station) shall be in the scope of supplier.

12.0 Inspection & Testing :-

All the items covered under the order shall be referred for inspection at the manufacturers place. Relevant standard tests shall be conducted to verify and establish various hardware and software features. A test setup shall be made ready at the manufacturer's place wherein the application programs can be loaded and tested before installing the system at site. The test setup shall consists of minimum no. of Input / Output modules and rest of the inputs through simulated signals, so as to check all the associated loops. A performance test for this set up shall be carried out to evaluate the overall system performance.

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13.0 Testing :-

13.1 Factory Acceptance Test (FAT) :-

Detailed testing by following approved FAT procedure (by the purchaser) shall be carried out at various stages of implementation. After the completion of application software development, subsequent checking shall be done. Calibration check of all channels of AI & AO modules and functional check of all channels of DI & DO modules shall be carried out. Simulated testing of all the safety interlocks shall be carried out during FAT at the supplier's premises. Redundancy features at various levels shall be thoroughly checked. Type test certificates for noise immunity of PLC modules, FRLS test certificates for cable, panels test certificates as per the relevant standards shall be made available during the inspection /testing.

13.2 Site Acceptance Test (SAT) :-

After erection and installation of the PLC panel & manual backup panel, network switches racks, OCS, view station etc. and termination of all the field cables, the integrated testing by following approved SAT Procedure (by the purchaser) shall be done. Simulated testing of safety interlocks and checking of all the HMI screens shall also be carried out at site. HMI screens shall be updated as per the additions/modifications suggested by the process engineers.

14.0 Documentation :-

Supplier shall submit one set of software (PLC programming as well as SCADA) and hardware manuals, as built drawings, I/O allocation, termination details, inspection and test reports.

The supplier shall also provide the followings.

- Installation CDs of SCADA software and any other software used.
- Wiring /termination details inside PLC cabinet.
- Hard copy of logics developed.
- Back-up of final application program, HMI Screens, Reports etc. on CD.

15.0 Installation and Commissioning :-

Installation and commissioning of the entire system at site shall be carried out by the engineers of the supplier. If shut down of the plant is needed, for integration with the existing DACS system, the entire activities shall be carried out with detailed plans and schedules, to minimize the shutdown time.

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16.0 Guarantee :-

12 months of trouble free operation shall be guaranteed from the date of final commissioning.

17.0 Bill of Materials (BoM) :-

As per the enclosed Annexure-A.

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Annexure-A
Bill of Material (BOM)

Sr.No.	Description of item	Qty.
1.	Enclosure for PLC Panel (2000H x 800W x 800D)	1No.
2.	8-Ch Analog Input Module (4-20 mA)	10 Nos.
3.	32-Ch Digital Input Module, 24 VDC	2 Nos.
4.	8-Ch Analog Output Module (4-20 mA)	2 Nos.
5.	32-Ch Digital Output Module, 24 VDC	3 Nos.
6.	24 V DC, 10 A Power Supplies	2 Nos.
7.	ORING Unit – 10A	1 No.
8.	Licensed PLC programming software	1 No.
9.	Licensed SCADA software (Run Time + Development)	2 Nos.
10.	Operator station/workstation (Tower Type) with 24" LED monitor	2 Nos.
11.	Software Development (PLC + SCADA) as per specified	1 Lot
12.	Plug in Relays 2 C/O-24 V DC/2A for Digital Outputs	96 Nos.
13.	Relay Base with clamp	96 Nos.
14.	24 V DC, 20 A Power Supplies	2 Nos.
15.	ORING Unit- 20 A	1 No.
16.	Ethernet switch – 8 port	2 Nos.
17.	LaserJet Printer -Monochrome	1 No.
18.	Supply of information outlet (Dual)	4 Nos.
19.	Supply of patch cord-CAT-6 – 5 ft length	10 Nos.
20.	CAT-6 armoured cable for SCADA connectivity	200 mtrs.
21.	Computer furniture (for OCS & view station) – Table & chairs	2 Nos.

Note :- Any other hardware/software required for entire commissioning of the system shall be in the supplier's scope.

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Annexure – I

Specification of CPU Module

Preferred Make	:- Schneider /Siemens
Model	:- To be specify by the supplier
CPU Type	:- Standalone
I/O capacity	:- 1024 Discrete + 256 Analog I/O
Watchdog Timer	:- 250 mS, software adjustable
User Memory	:- 1 MB RAM, expandable
Communication ports	:- Ethernet, Modbus
Diagnostic Indication	:- Power-up, Run Time
Programming port	:- 1 USB
Mounting	:- Rack, plug-in type

Specification of AI Module

Model	:- To be specify by the supplier
Input Type	:- 2 wire, 4-20 mA DC through 24 V DC 4 wire, 4-20 mA Differential Current input
No. of channels	:- 8 channel Differential
Resolution	:- 14 bit or better
Accuracy	:- ± 0.125 % of full scale
Update Time	:- 15 ms for all channels.
Input Impedance	:- 250 Ω
Isolation	:- 1400 VDC for field to bus
CMRR	:- > 90 dB @ 50 Hz
Reverse polarity protection	:- Shall be provided
Diagnostics	:- Broken wire indication

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Annexure – I

Specification of DI Module

Model	:- To be specify by the supplier
Input Type	:- 24V DC (Sinking Type)
No. of channels	:- 32
Input voltage Range	:- 15 – 30 V DC
Input Current	:- min 2.5 mA
Reverser polarity protection	:- inbuilt
Isolation	:- 1400 VDC for field to bus
Status of channels	:- on board LED indication
Diagnostics	:- Broken wire detection
Fail Safe Condition	:- Off (Logic 0)

Specification of AO Module

Model	:- To be specify by the supplier
Output Type	:- 4-20 mA DC current (Sinking type)
No. of channels	:- 8
Update Time	:- 5 ms for all 8 channels
Resolution	:- 14 bit or better
Accuracy	:- $\pm 0.2\%$ of full scale
Loop Voltage	:- 6 -30 V DC max.
Isolation	:- 1400 VDC for field to bus
Diagnostics	:- open circuit channel detection Current monitoring
Fail Safe Condition	:- 4 mA

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Annexure – I

Specification of DO Module

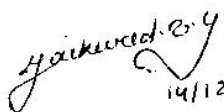
Model	:- To be specify by the supplier
Output Type	:- 24 V DC (Sourcing Type) Potential free, both NO & NC contacts shall be provided using interposing relay modules (of sufficient load current (5A) rating) along with interconnection wiring with DO modules.
No. of channels	:- 32
Operating voltage load	:- 15- 30 V DC
Maximum Load Current	:- 16 A per module
Response (Resistive) Time	-
OFF-ON	:- 1 ms
ON-OFF	:- 1 ms
Isolation	:- 1400 VDC for output to bus
Protection	:- Fuse
Diagnostics	:- Channel wise status indication
Fail Safe Condition	:- Off (Logic 0)

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Annexure – II

Specification of PLC cabinet

Make	: - Rittal or equivalent
Panel Details	: - shall be furnished by the supplier for approval before taking up for actual fabrication.
Fabrication	: - shall be of 14 SWG, CRCA sheet, powder coated RAL- 7035 (Siemens Grey).
General Arrangement	: - sufficient to accommodate internal wiring, easy maintenance etc.
Cable entries	: - Top, bottom, side bottom – site specific
General	: - Material used shall be free from dents, scratches and any other flaws. Welded joints shall be nicely finished. Cutouts shall be neat and free from burrs. The PVC wire channels shall be of reputed make with locking type of arrangement. The workmanship of the panel shall be by skilled workers and follow the standard industrial practices. Fuse Terminal Blocks (FTBs) used shall have blown fuse indicator and shall be preferably with spare fuse holding. The panel shall be completely wired with all wiring accessories and components like indicating lamps, MCBs, wire channels, insulated lugs, ferrules etc. The panel shall have a copy of documents like termination details, wiring diagrams, power diagrams etc. by providing drawing pockets.
Power socket	: - 5/16 A (Combo)- 2 Nos.
Labeling	: - The terminal blocks shall have proper TB markers and shall be labeled as per the wiring details.
Tags	: - Tags of anodized Aluminum with legends printed on it (silver printed with black background) shall be fixed on the panel. Details of description shall be provided at the time of execution.


14/12/2021
CUNAYKUMAR CAIKWAD
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Annexure – III

Specification of Operator Control Station (OCS)

Type	:- Commercial Grade Personal computer
Make	:- shall be specified
Processor	:- I7 Processor- 3.3 GHz or better
Hard Disk	:- 1 TB or more
Memory	:- 16 GB
Preloaded Operating System	:- Windows 10 Professional Compatible with offered PLC & SCADA programming software
Keyboard	:- USB standard
Mouse	:- USB standard Optical Mouse
Video Adaptor	:- support upto 1600 x 1200 resolution
Drive	:- DVD RW
Network Controller	:- 2 Nos. of Gigabit TCP/IP Network ports for teaming
Monitor	:- 24" HD LED
Preloaded softwares	:- shall be as per requirement

Vijaykumar C. Aikwad
14/12/2021
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Annexure – IV

Specification of SMPS type Regulated DC Power Supply

Type	: - Fixed Type, with $\pm 10\%$ of output voltage adjustable by potentiometer
Input Voltage	: - 230 V AC, 50 Hz
Output Voltage	: - 24 V DC
Output Current Rating	: - 10A 20A
Regulation	: - shall be specified
Protections	: - Thermal overload - Short circuit
Reset	: - Automatic fault on reset
Indications	: - Output voltage status
Mounting	: - shall be specified.

Gaikwad B.G
19/12/2021
CV NAYKUMAR GAIKWAD
SO/E

Annexure-V

Form of Bid-Security Declaration

(On Bidder's letter head)

Date: (insert date (as day, month and year))

Bid No.: (WMD/EE&I/VGG/A33 PLC/2021/19444
dated: . . .2021

Name of the work:- **Design, Engineering, Fabrication, Supply, installation and commissioning of PLC & SCADA based Control System at WIP, Trombay**

To,
Accounts Officer
BARC Trombay
Mumbai – 400 085

I/We understand this Bid Security Declaration is in lieu of Bid Security (Earnest Money Deposit) and I/We accept that if the bids are withdrawn or modified during the period of the validity, I/We will be suspended for the time specified in the NIT for this work, from the date of issue of suspension order.

Signature:

Name: (insert complete name of person signing the Bid Security Declaration)

Dated on _____ day of _____, _____ (insert date of Signing)

Seal

Annex- 'WMD/EE&I/VGG/A33_PLC/2021/Work-details'

Format proforma for quotation

Sr. No.	Item Description	Qty	Rate	Basic Cost
		(System)	(Rs) / %	(Rs)
1	Design, Engineering, Fabrication, Supply, Installation Testing and Commissioning of PLC & SCADA based Control System	1		
2	GST	---	%	
3	P&F	---	%	
4	Freight	---	%	
	Grand Total			

For

Handwritten signature
14/12/2021
(VNAYKUMAR GAIKWAD)
S/O/E