

Technical Specifications: Dual headed SPECT

Please quote latest model - state of the art equipment

One latest technology SPECT system upgradable to CT, for supply and commissioning by the vendor.

The upgradable CT cost should be mentioned separately and its validity

Scope of the work: Primary vendor shall be responsible for supply, installation and commissioning of the SPECT/CT on turn-key basis.

The final price comparison of rates for awarding the contract will be made after addition price of all the components (price of the SPECT including accessories & CMC and turnkey part).

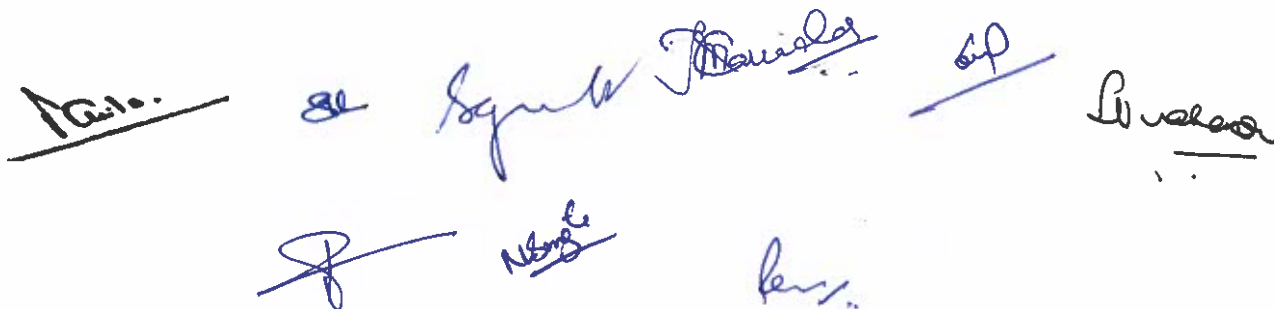
Vendor should visit the department to have a look of the space available for installation of the new system. A certificate should be attached that the space is adequate for the installation of the quoted systems.

The radiation equipment offered against this tender shall duly conform to the prescribed international/national standards and norms of radiation safety. Type approval certificate/NOC for AERB, Mumbai for the quoted model MUST be attached with the technical bid or else the bid will be summarily rejected.

All the QA / acceptance tests as per NEMA-NU1-2018 and AERB need to be carried out by company engineer in the presence of Nuclear Medicine Physicist of the department. A detailed report needs to be submitted in a stipulated time frame for onwards transmission to AERB to get the license for operation of the equipment. All the required. phantoms for QA tests will need to arranged by the vendor. The Company will also arrange such phantoms during periodical QA tests during the duration of warranty and CMC period.

The system shall allow for scheduled daily, weekly and monthly quality control procedures without manual intervention.

Automatic quality control should be provided.



The tenders along with all the commitments, claims, specifications, guarantee, warrantee etc. pertaining to the equipment should be submitted directly by the Manufacturer/Principal Company or their Vendors who shall be wholly and solely responsible for all the statements/commitments in this connection.

Any options or added facilities not indicated in the specifications may also be quoted as optional items, if not a standard feature. Any improved modifications or updated versions of the system can be included in the quotation.

Third party items procured to complete the tender requirements must include in warranty period and CMC and copy of the undertaking to this effect should be included

#### **General:**

Gantry design should be wide open and image acquisition capability with clockwise and anticlockwise movement.

Height, width and depth should be adequate to conveniently locate the gantry in existing space available in the department. In order to access this, tenders are required to mention the dimensions.

Auto contouring: The detectors should be equipped with automatic body counteracting (ABC).

Gantry should have emergency stop buttons.

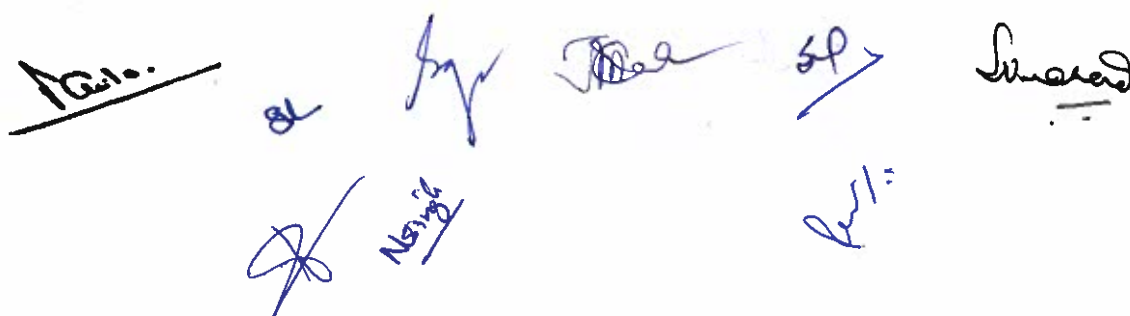
Persistence scope mounted on the gantry for continuous display of patient position and gantry parameters.

Change based attenuation correction.

CT image acquisition and fusion with nuclear medicine image.

Image fusion software & hardware.

Capable of acquiring multi slices SPECT scan.

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Max CW/CCW: 365°/180°

Rotation precision: 0.1°

Rotation speed: 0.03-3.0 rpm

Centre of rotation (COR): Less than  $\pm 1$  mm

Gantry should have emergency stop buttons.

Persistence scope mounted on the gantry for continuous display of patient position and gantry parameters

**Detector:**

Detectors shall have true rectangular FOV

UFOV Field of View shall be equal to or larger than 52 cm x 37 cm (20.5 in x 14.5 in)

Should have facility for automatic correction for energy, linearity and uniformity.

Crystal: NaI(Tl) 3/8"

Energy range 40 -620 keV

**Photomultiplier Tubes:**

Number of PMTs: 56 or more per detector

Hexagonal array with box type dynodes and high overall efficiency.

**Shielding characteristics of Detector:**

Back: 9.5 mm

Sides: 12.7 mm

Patient Direction: Max – 36.4 mm; Min – 27.9 mm.

Edge to edge: Detector housing and FOV – 7.6 mm.

DICOM ready system along with stand alone image compliant PC (latest version with optimal processor speed) (minimum minimum 2 TB hard disc), supported with complete networking. For this purpose the supplier would be required to supply a minimum six image compliant PC's equipped with necessary software e.g. reporting and analysis terminals to enable access and analysis of the patient images from different locations of the department. Dicom compliance statement/certification should be provided.

Manufacturer to provide a comprehensive list of users of dual head SPECT gamma camera in India and their performance profile.

Number of installations & company profile: Company should preferably be manufacturer of the equipment and in case non-manufacturing vendors (third party supplier) are allowed to participate the same should be mentioned clearly in bid document. In case of third party supplier the liabilities of principal manufacturing company and third party supplier needs to be clearly demarcated and ensured.

**Gantry:**

Gantry design should be wide open to avoid claustrophobic imaging with clockwise and anticlockwise movement.

Height, width and depth should be adequate to conveniently locate the gantry in existing space available in the department. In order to access this, manufacturer are required to mention the dimensions.

Axis of rotation: 100-104 cm.

Patient opening for high energy collimator (HE): Max 66 cm and Minimum: 12cm.

Patient opening for low energy high resolution (LEHR) collimators: Max: 70 cm; Minimum: 19 cm.

Auto contouring: The detectors should be equipped with automatic body counter (ABC) both for 90° & 180° SPECT with an average auto contour distance of 1.1 cm.

LED persistence display unit

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**Intrinsic Spatial Resolution:**

FWHM in CFOV:  $\leq 4$  mm

FWHM in UFOV:  $\leq 4$  mm

FWTM in CFOV:  $\leq 8$  mm

FWTM in UFOV:  $\leq 8$  mm

**System Spatial Resolution (LEHR at 10 cm):Specify**

**Intrinsic Energy Resolution:**

FWHM in UFOV:  $\leq 10$  %

**Intrinsic Flood Field Uniformity:**

Differential (CFOV):  $\leq 2.5$  %

Differential (UFOV):  $\leq 2.7$  %

Integral (CFOV):  $\leq 3.0$  %

Integral (UFOV):  $\leq 4.0$  %

**Intrinsic Spatial Linearity:**

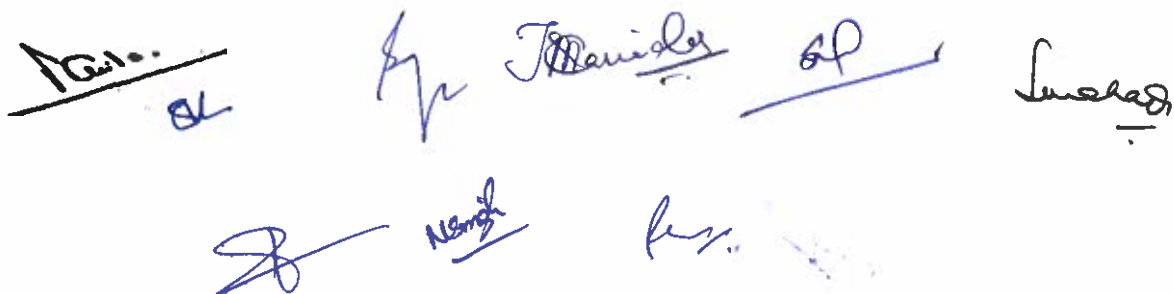
Differential (CFOV):  $\leq 0.2$  mm

Differential (UFOV):  $\leq 0.2$  mm

Absolute (CFOV):  $\leq 1$  mm

Absolute (UFOV):  $\leq 1$  mm

**Multiple window spatial registration:  $\leq 1.0$  mm**

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**Intrinsic maximum count rate: 310 kcps**

**System Planar sensitivity (LEHR at 10 cm)**

**Absolute: 200 cts/min/uCi or more**

**System planar sensitivity (MEGP at 10 cm)**

**140- 400 cpm /  $\mu$ Ci or more**

**Reconstructed spatial resolution with scatter (LEHR):  $\leq 12.00$  mm**

**Collimator Specification:**

Following collimators along with collimator exchange cart for each set of collimators based on requirements

1. Low Energy High Resolution (LEHR)
2. Medium Energy General Purpose (MEGP)
3. High Energy General Purpose (HEGP)

Collimator changing shall be possible without moving the patient table away.

**Patient Bed specifications:**

The patient bed shall have a patient pallet thickness  $< 15\text{mm}$  ( $< 0.6$  in) to minimize distance between patient and detector during SPECT rotation.

The patient bed shall have motorized vertical & horizontal motion activated from the hand controls, as well as preset positions.

Minimum patient bed height should be 54cm or more for easy loading/ unloading of patients.

Patient bed shall have ability to position any part of body under the detectors without moving the patient. All pallet motions shall be activated from the hand controller.

Length 180 cm or more for whole body SPECT studies.

Pallet material: Attenuation at 140 keV: less or equal 10%.

Whole body scan speed: minimum of 3.8 cm/min or more, maximum of 30 cm/min or greater

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Maximum weight bearing capacity: 200 kg or more.

Table must be able to pivot to a 45 degree angle for access to the gantry to image patients

Adjustable head holder for brain scan, butterfly arms support including cardiac arm support, leg support, cushion pad and wide straps for decreasing breast attenuation for optimized cardiac SPECT studies.

Pediatric & scinti-mammography pallets.

Separate pallet for imaging to enable radiotherapy planning.

ECG Trigger to be provided with two sets of spare leads.

Scale at bedside for faster patient positioning.

#### **System Requirements:**

The processing workstation shall be capable of supporting dual monitor display.

The system shall be totally and easily configurable by the user (acquisition, processing and display).

The system shall support user-defined SPECT acquisition and processing protocols.

The user should be able to create, change, modify and combine acquisition and processing protocols easily and quickly.

The system shall support automated data transfer for viewing, automated archiving and hardcopy printing.

The software shall offer on-line help capability.

System must offer an iterative reconstruction technique, or 1/2 time imaging solution for all SPECT imaging including cardiac.

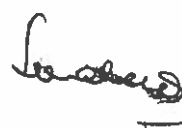
System must offer an advanced iterative reconstruction technique including recovery collimator resolution and partial volume.

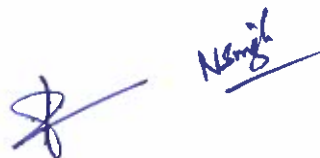
Start and stop acquisition control from Camera, hand control Computer or Persistence Scope must be possible.













Access to viewing and interacting with the patient positioning monitor from the acquisition workplace must be possible.

The system shall allow the user to combine acquisition and processing protocols in one protocol. In addition the system shall be capable of combining multiple SPECT acquisitions (e.g. Cardiac Stress & Rest acquisitions) in one protocol.

ECG shall be integrated into the system to avoid excess wires in the workspace during the exam.

System should be able to acquire full cardiac data in 5 minutes and provide equivocal data to traditional full time imaging without the use of half time reconstruction techniques.

Whole body SPECT scan length shall be at least 200 cm.

Acquisitions must be in the form of static, dynamic, whole-body, gated, SPECT, dynamic SPECT, WB SPECT and gated SPECT.

System shall provide factory-recommended protocols with full automatic contouring for all clinical acquisitions, including cardiology, oncology, neurology.

#### Acquisition Unit:

Integrated Operator console should perform all functions such as acquisition protocol customization, scheduling, protocol selection, all standard evaluation applications. Minimum 19 inch or more size monitor, 1024x1024 resolution or better.

Should have raw data storage with at least 2 TB GB hard disk.

It should also have CD and DVD combo drive with writer facility.

Image acquisition and data display should be from 64x64 matrix up to 256x1024 matrix. Acquisition termination by preset time, preset count or manual stop

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Pre-defined acquisition protocols as well as facility for user to configure his own customized protocols

Should provide ECG gating device with R wave display

**The acquisition workstation should be DICOM ready to permit-**

- (i). Exchange of images and other informations
- (ii). Communication with other manufacturer's equipments/work stations.
- (iii). Workflow with hospital information system and other radiological information systems.
- (iv). Coverage for access controls of patient multiple data CD writers.
- (v). Maximum intensity projections, multiplanar reconstructions, various display format in routine use.

**Processing & Software workstations:** Following software may be asked for based on the requirements.

High performance intel duo core PC with multi-tasking workstation with full DICOM ready with image transfer print etc

Processing computers should have latest technology available at the time of purchase, the minimum being processor of high clock speed of 2.6 GHz, RAM of 16 GB and should have antiglare surface. Keyboard, mouse and speaker to be provided with each computer.

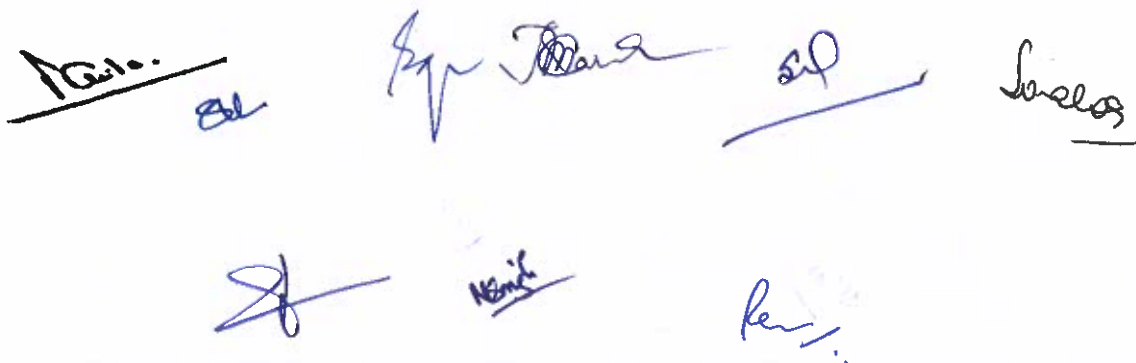
More than 2 TB SCSI hard drive logically divided in to 3-4 partitions

Minimum 21 inch high resolution LED monitor.

Standard DVD & CD combo drive for data archiving and retrieving with write facility for both.

The computer is to be connected via a DICOM network for processing and storage of the data to the already existing processing and acquisition computers and documentation devices

Broad band remote diagnostic facility to be provided

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The software, apart from other state of the art applications, should also provide following applications

- (i). Real time display of volume data set and enable automatic quantification of stenosis and evaluation of aneurysms.
- (ii). Clinical processing software and comprehensive protocols for wide spectrum of SPECT.
- (iv). Manual correction of automatically registered images (fusion alignment) in all planes, direction and rotation (in clinical app).
- (v). Pre-defined acquisition protocols as well as facility for user to configure customized protocols
- (vi). Zoom and rotate features.
- (vii). On line live display of acquired data and imaging parameters during acquisition.
- (vii). Cinematic display of dynamic, MUGA and all multi frame studies.
- (ix). Gated data acquisition: There should be ECG and R to R histogram display during acquisition, indicate frames/R-R interval and maximum frame rate capability.
- (x). Attenuation correction for any clinical area for studies performed in H-mode and L-mode.
- (xi). Simultaneous visualization/comparison of images with and without AC for any of SPECT study.
- (xii). IMAGE DISPLAY MONITOR: (common with the gamma camera) Monitors should be flat screen to last full life of the scanner with continuous and uninterrupted use without significant deterioration of display quality.
- (xiii). Integrated Operating Console should perform all functions such as CD writing, acquisition protocol customization, scheduling, protocol selection, all standard evaluation applications.
- (xiv). Integrated Operating Console should perform all functions such as CD writing, acquisition protocol customization, scheduling, protocol selection, all standard evaluation applications.

*Ag.*  
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(xv). Capable of simultaneous acquisition and post processing, preferable swappable with the main console should be provided. These should have option for providing enhancement of storage capacity and future upgrades. (Details of Hardware of workstations/console to be provided at the time of bidding).

(xvi). Acquisition termination by preset time, preset count with ability to manually pause, resume and stop all type of acquisitions.

**APPLICATION SOFTWARE:** Various software package should be available in the system to execute a variety of clinical studies- both static and SPECT imaging, should include:

(i). Cardiac studies SPECT Gated cardiac studies (with Integrated ECG Gating device), Quantitative Gated tomography, cardiac first pass studies, myocardial perfusion quantification, cardiac serial quantitative SPECT package, cardiac shunt studies. Dedicated licensed cardiac software 4DM SPECT/ Cedars Sinai QGS-QPS and mandatory Emory Cardiac Toolbox for Gated cardiac SPECT quantification

(ii). Cerebral Studies - latest neurology software for quantitative SPECT analysis (specify) including blood flow quantification.

(iii). Gallium whole body anterior/posterior image reconstruction and analysis.

(iv). Ventilation/perfusion quantification studies.

(v). Compete Renal processing software including Transplant evaluation, Diuretic renography, Package for GFR, ERPF, Renal Extraction Fraction, Deconvolution analysis.

(vi). Liver, hepatobiliary and all abdominal studies.

(vii). Gastric emptying analysis and oesophageal transit studies.

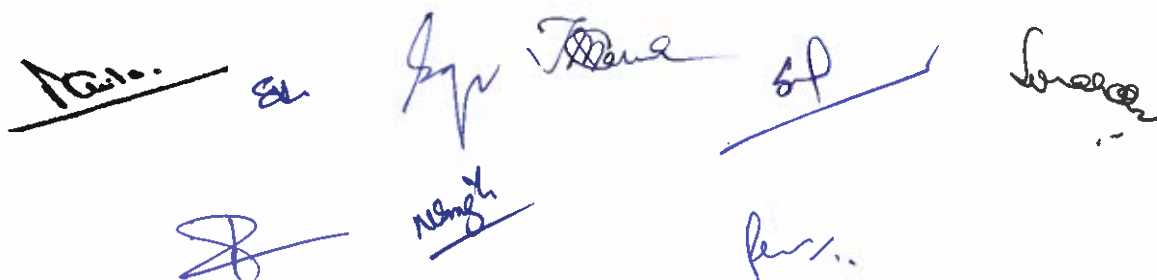
(viii) Whole body Studies – anterior & posterior, dual intensity

(ix). Bone static, Three phase and SPET with 3-D display

(x). Thyroid uptake Study Imaging-Thallium/Technetium Subtraction Protocol

(xi). Parathyroid imaging: Thallium/MIBI – Pertechnetate subtraction protocol

(xii). Gall bladder ejection fraction

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- (xiii). 3D interactive display function
- (xiv). All I-131 related studies.
- (xv). Motion correction software.
- (xvi). Change based attenuation correction software
- (xvii). Any other any advanced software's available and assured software upgradation during the period under warranty and CAMC.
- (xviii). General reconstruction activities.
- (xix). Quality control features – sinogram, lino gram, summed images etc.
- (xx). Volume viewer software.
- (xxi). Image fusion software & hardware
- (xxii). Automated organ definition on SPECT. Quantification (SPECT SUV) based on patient demographics tracer information.
- (xxiii). 3-D volume rendering display with Maximum Intensity Projection (MIP)
- (xxiv). Cine review capability, curve generation and image manipulation tools
- (xxv). Application enabling dosimetry (including third party software e.g. Olinda software) & quantification of changes in radiopharmaceuticals absorption at multiple body organs over time through analysis of SPECT, planar & SPECT resulting in calculated residents time for organ, tumour and whole body for help in isotope/radiotherapy planning. The package should be FDA approved and should include any third-party software if needed for complete dosimetry procedures.
- (xxvi). Collimator- detector response- resolution recovery algorithm (software and hardware) that allows half dose and half acquisition time in SPECT including bone, cardiac, and planar images should be standard feature.

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(xxvii). COMPUTER SUB-SYSTEM: The system should have separate acquisition and advanced processing work stations (two) capable of functioning independently, with minimum 19" flat colour LED monitors with display resolution of 1280 x 1024 or more. This advanced workstation should have all licenses loaded for advanced processing tools for cardiac, Neuro, oncology, nephro (renal) and other body systems. Both the processing computers may have to be located at two different locations in the same building, to be connected via LAN by the vendor.

(xxviii). Image fusion facilities – latest available at the time of procurement.

(xxix). Remote diagnostic facilities complete with hardware and software.

(xxx). Apart from inbuilt SPECT software for fusion, separate software for fusion of imported CT and MRI data with SPECT is also to be provided

(xxxi). Software for various scatter corrections and filters, standard attenuation correction with CT data, patient motion correction etc

(xxxii). Various clinical application softwares including SISCOM, SEGAMI, NEUROGAM on NEURO MATCH and SPM2 etc.

(xxxiv). Should be able to support windows or mac.

xxxv). Company to take care of all license's management without extra cost during warranty and CMC.

#### **Advanced Clinical Applications:**

Latest collimator-detector response – Resolution recovery algorithm (software and hardware) option that allows half dose and half acquisition time in SPECT including cardiac SPECT, BONE SPECT and planar images should be offered as a standard features.

**QC Utilities:** Choice to be made based on equipment choice and level of QC and experimentation / research likely to be performed.

Fillable flood phantom for rectangular field of the size adequate for the gamma camera to be supplied.

SPECT phantoms for total performance

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One Four Quadrant BAR phantom for rectangular detector size compatible with the detector systems size of the camera to be supplied.

Acquisition software should include camera quality control activities including Centre of Rotation (COR) correction, Uniformity correction maps, Energy, Sensitivity and Linearity maps, Daily/Weekly QC including Gantry calibration, Energy spectrum histogram (PHA) display.

QC software package (NEMA NU2-2018 or latest protocol) with documentation.

**Accessories:**

Photo quality laser color printer.

Future up gradation of the software or new developments shall be required to be done by the vendor free of charge from time to time.

Clinical programming language for user programming.

Tread mill with 12 lead ECG display and processing and a hard copy out put device

Infusion pump with 5 to 50 ml range syringe capacity

Radioisotope calibrator for beta and gamma activity measurement (specify make ).

Syringe carrier and holders.

System to be supplied with online digital UPS of reputed make of appropriate capacity providing 30 minutes backup with maintenance free batteries. ( please specify if the back up is required for whole SPECT or computer only).

One lead lined Fume hoods with appropriate exhaust system, Airfoil, Air Baffle and Adjustable Slots, Sliding Sash, Bypass Slots, Exhaust Duct and Damper sinks etc for radioactivity handling (GMP Model).

Two lead lined L-Benches

Interlocking lead bricks-150 nos.

Cutie Pie for Gamma detection.(specify make): 1

10.10.10 10.10.10 10.10.10 10.10.10 10.10.10 10.10.10

10mCi Cobalt flood phantom.

One colour laser printer

Lead lined dustbin:4

Digital contamination monitor: 1

Live demonstration of the equipment is required from technically qualified vendors.

Minimum two stretchers of latest model with side rails to be provided for shifting the patients.

TMT for cardiac stress study with computer and printer

#### **GENERAL CONDITIONS & REQUIREMENTS:**

All claims regarding compliance with the specifications shall be duly supported by appropriate, latest technical catalogues/ brochures from the manufacturer.

The vendor will assure smooth functioning of the machine & if any up gradation of installed version of software during the duration of warranty and CMC period.

The vendors shall submit point-wise compliance statement in regard to the specifications asked for in the tender and should mention corresponding page numbers matching with the technical details in the compliance statement and the technical brochure- reciprocally.

All the equipments/ accessories/ software offered against this tender shall have approval of the FDA or CE as well as that of the regulatory board of the country of origin of the equipments and the AERB, India.

A list of installations existing in the country with 'satisfactory service certificate', if available from the user, may be submitted to support the claim of a good performance of the equipment. The supplier shall mention the number of installations in India and worldwide, for the quoted model only. Such installations should have been supplied directly by the quoting firm itself. Current performance and status report from the user departments for the model quoted must be attached.

#### **SITE PREPARATION**

The supplier shall be required to undertake all the site preparatory work in the area where the SPECT will be installed, as per the turnkey details.



Equipment is to be installed as per AERB requirements. Qualified personnel from the company should install and commission the scanner.

Appropriately sized lead glass in the acquisition terminal room.

Warranty: The complete system should have a guarantee / warranty including the radioactive reference source, crystals, detectors and for a period of FIVE years after the satisfactory commissioning and handing over of the equipment. Warranty for the air-conditioning system will also be part of the main equipment.

CMC: Comprehensive maintenance contract for whole system and accessories for a period of FIVE years after the expiry of warranty period. CMC for the air-conditioning system will also be part of the main equipment.

The peripherals/ accessories, electronic / electrical consumables (leads, probes, batteries etc.), phantom source and calibration source and batteries of UPS will also form part of the warranty and CMC. Service, repair and maintenance of all third-party items will be the sole responsibility of primary vendor. Replacement / Replenishment of the coolant for gantry will also form the part of warranty as well as CMC.

DICOM networking so that all the data from these SPECT workstations is transferred to the existing server available in the Centre.

At least 95% uptime should be maintained during warranty as well as CMC period. Other rules as per tender conditions.

Commissioning should be completed within 90 days from the date of receiving AERB clearance for the layout plan to be prepared by vendor in consultation with the department.

After sale service to be available locally in Lucknow with availability of an onsite engineer.

Onsite training by trained engineers and application specialists (SPECT applications) to nuclear medicine physicians and technologist/ staff for at least 2 weeks period.

The acceptance of the installation shall be subject to satisfactory handing over of the system to the department and certificate to this effect will be issued by the institute. Warranty of equipment will start from the date of receiving of all documents and satisfactory acquisition of first patient.



### TURNKEY SPECIFICATIONS FOR THE SPECT FACILITY AREA

The prospective vendor must inspect the site before submission of tender and submit the certificate that the site is suitable for installation of a SPECT scanner.

Vendor shall provide an accurate architectural & structural layout plan. Logical workflow and radiation safety norms should be adhered to in the layout.

The layout plan should be made in consultation with the user. The vendor should facilitate the user department for getting the same approved from AERB.

The whole work should be carried out as per local authority and AERB norms.

Suggestive layout plan (as attached) may have the following rooms.

SPECT Scanner and Console room.

Recovery room

Radiopharmaceutical injection room

Three post injection waiting rooms

One hot toilets

General public toilets

Waiting area

Electrical equipment room

AHU equipment room

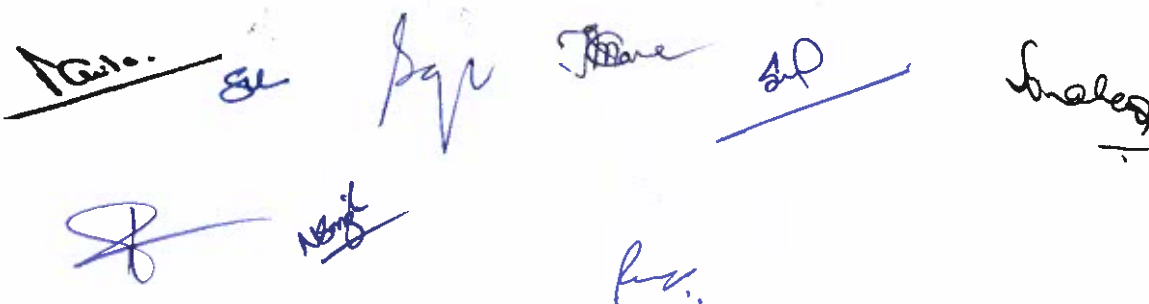
Equipment should be installed based on layout and water drainage in the SPECT rooms.

### SCOPE OF WORK

Civil Work: In the civil work, following works are required to be undertaken

All walls, as per AERB requirements, will be of RCC.

The room walls should be finished with acrylic / plastic emulsion.

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All switches and other materials to be used should be as per approved makes.

Fire stop seal to be used on cable entries in the building.

Fire Protection: Non water based fire protection is to be integrated as per requirement. Addressable type fire alarm system should be provided and connected with main fire control room of the institute. Other works include.

Fire extinguishers as per norms (Clean agent, CO2 & ABC).

Fire door for the electrical panel room and AHU.

Gas suppression system for electrical panel and UPS.

Battery isolation switch between battery bank and UPS is needed to be provided.

LED based exit and fire signage to be installed as per location.

Air-conditioning: The complete area should be centrally air-conditioned as per norms. Additional AC other than the centralized AC if required to be maintained by vendor during duration of warranty and CMC period.

It shall be equipped with synthetic filters of suitable capacity complete with ducting work, grill work, drain Work, insulation, work including providing and fixing of electrical panel for HVAC system.

The temperature range should be between  $22 \pm 2$  degree Celsius. The variation in temperature should not exceed one degree Celsius per hour. The humidity should be less than 50%.

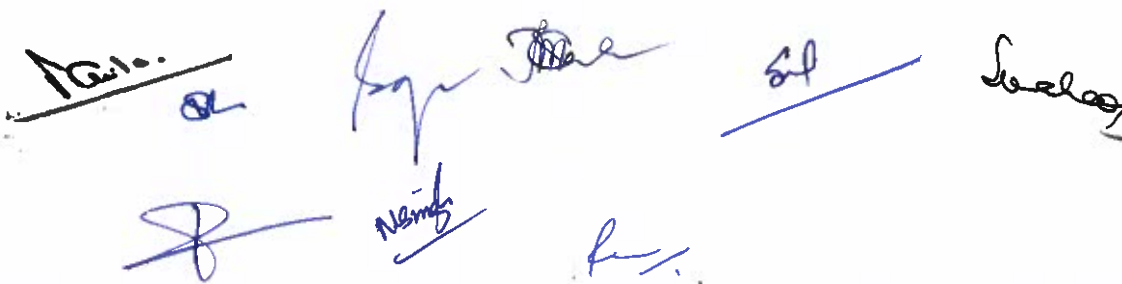
Control and power cables should be provided and fixed in all respect. An electrical cable if required from / to the AC panel will be supplied and fixed by the vendor.

Proper Ventilation along with necessary inline fan shall be provided for toilets and UPS room.

Warranty: 05 years and CMC of 05 Years after the expiry of warranty period shall be part of the tender.

Others: The successful vendor should also include following in the scope of work:

Lead Glass of required size and thickness should be fixed in the console room.

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Control console and computer platform should include Table with Keyboard drawers as per the requirement.

Music and Public Address System for calling / information the patients.

Furniture and fixtures for all the area should be provided as per requirement.

Proper signage, both external and internal.

Aesthetic Interiors, Landscaping

Any other required work but not mentioned in the turnkey specifications.

Dismantling of the existing structure and clearance of all the material will be done by the vendor.

Whole turnkey work including commissioning should be completed within 90 days from the date of receiving AERB clearance for the layout plan to be prepared by vendor in consultation with the department.

**Defect Liability:** The works to be executed shall be guaranteed for a period of 5 years from the date of commissioning against any defective material / workmanship. The warranty and CMC of the Air Conditioning units will from the part of main equipment.

Certification to the effect that all civil/electrical/AC the work has been executed as per the specifications incorporated in the above document will be by the Engineering Department of the Institute.

All dispute will be in jurisdiction of Lucknow courts.



Dr. Pankaj Tandon,  
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