



Quality Management System (QMS) and Regulatory oversight during Manufacturing stages of Nuclear (NPP) Components

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11/19/24



QA Directorate-NPCIL



A. Ramu, Executive Director(QA), NPCIL

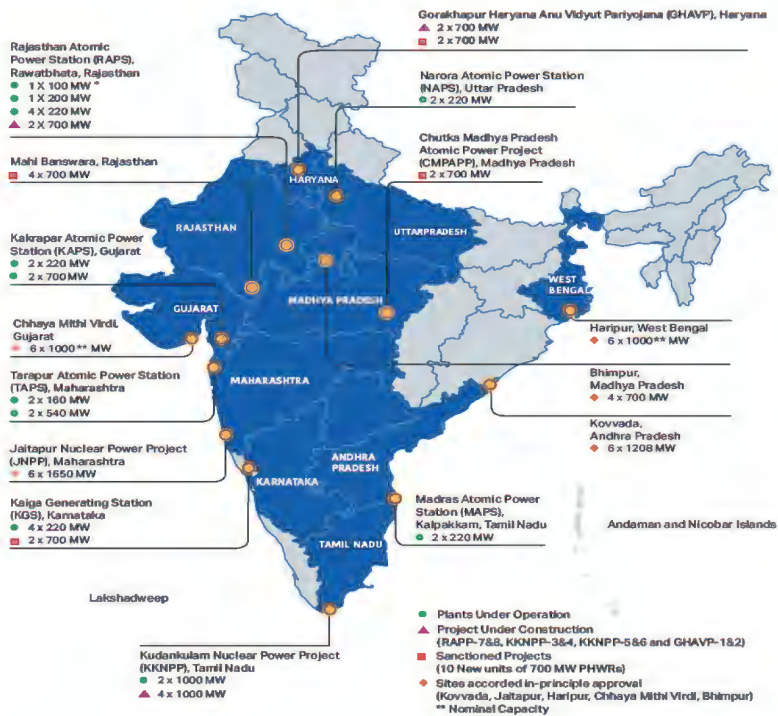


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OUR PRESENCE NUCLEAR POWER PLANT & SITES IN INDIA



Map for representation only, Not to scale

* RAPS-1 (100 MW PHWR), owned by DAE and managed by NPCIL, is under long shutdown since October 2004

- **Reactors in Operation**
 - 24 reactors 8180 MW
- **Reactors under Construction**
 - 8 reactors 6800 MW
- **Reactors at Pre-project activities stage (under implementation)**
 - 10 reactors 7000 MW

On progressive completion of these projects, nuclear power capacity in the country will reach 22480 MW by 2031-32

- **Sites approved for future reactors**
 - 5 sites (28 reactors)
 - More sites being explored

Courtesy : CP&CC-NPCIL

We are "Many Companies in One."



- Formed on September 17, 1987 as a PSE of DAE, fully owned by the Government of India
- Expertise in multiple reactor technologies - PHWR, BWR & PWR (VVER)
- AAA rated, Profit making, dividend paying company.
- Assets of over US 20 Billion, Networth of crore.
- Large expansion plans based on indigenous PHWRs and LWRs with foreign co-operation.

Courtesy : CP&CC-NPCIL



Reactors in Operation – 8180 MWe



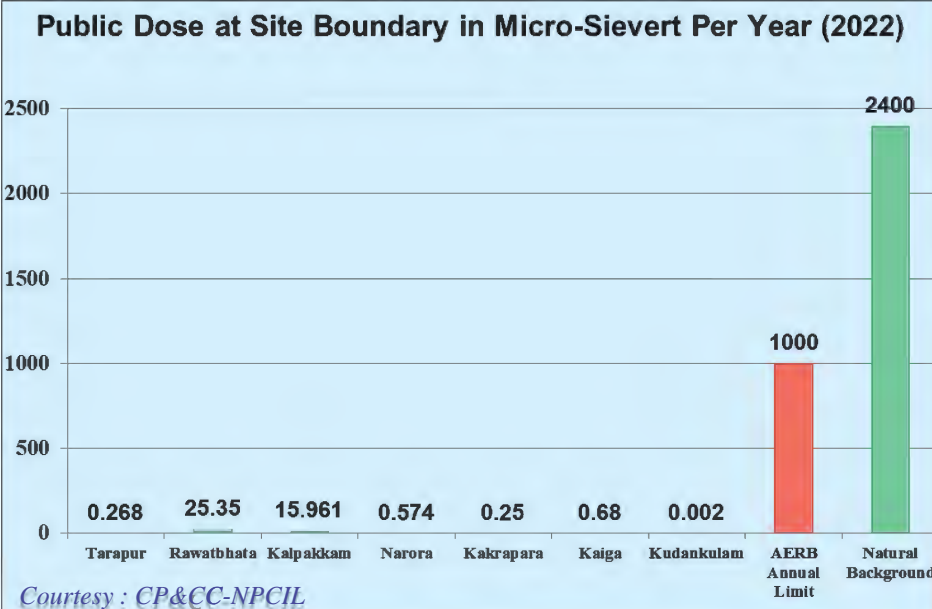
Courtesy : CP&CC-NPCIL



Impeccable Safety Record



- No incident of release of radioactivity beyond stipulated limits in public domain in over 55 years (more than 625 reactor-years) of operation.
- Public dose insignificant fraction of AERB limit & Natural Background
- Excellent Safety Culture



Impressions

"Open communication, enthusiasm, motivation and sense of ownership were observed at all levels during the OSART Mission. These attributes have cultivated an environment of strong safety culture at RAPS-3&4."

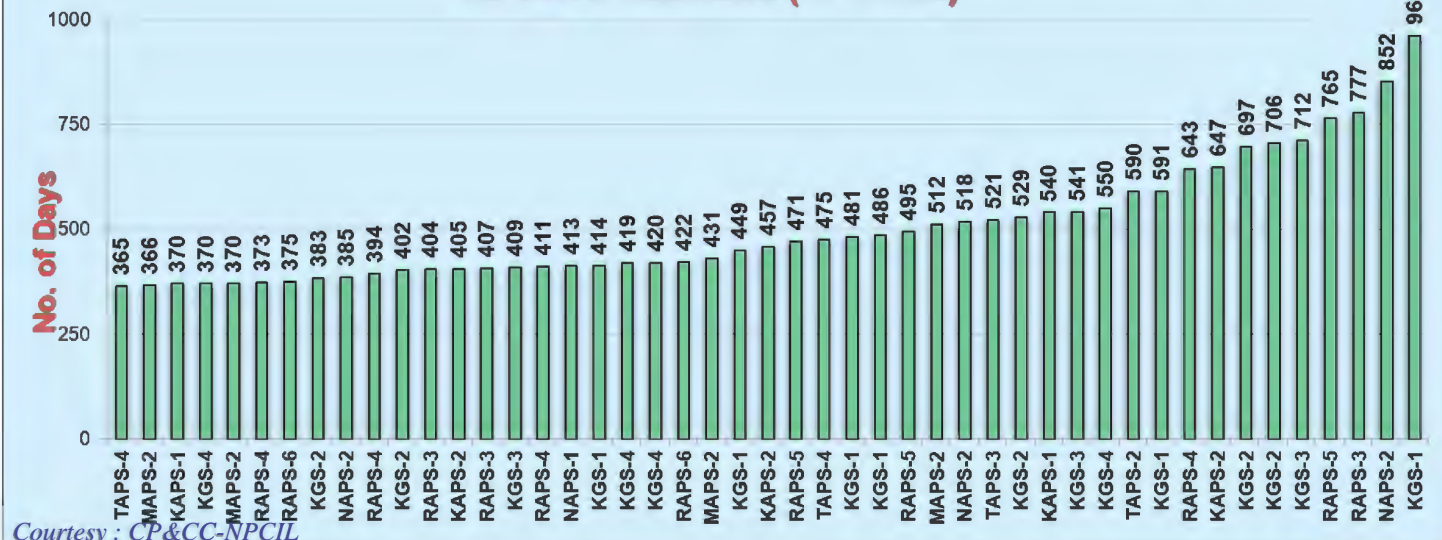
Mark Kearney
Deputy Team Leader

Miroslav Lipar
Team Leader

Landmark Achievements in Operation

- Completion of over 50 years of operation of TAPS-1&2, oldest reactors in operation in the world today.
- World record of continuous operation of 962 days by KGS-1 in 2018 (presently second highest, behind Darlington-1)
- Continuous Operation of more than a year (365 days) 47 times so far.

Continuous operation for more than a year registered by NPCIL's Reactors (47 times)



Courtesy : CP&CC-NPCIL

INTRODUCTION

- Corporate Management System Document (CMSD) defines the overall Quality Assurance System of NPCIL.
- NPCIL issued a statement of policy that mentions overriding priority to nuclear safety at all phases i.e. **Design, Procurement, Manufacturing, Construction, Commissioning and Operation** of Nuclear Power Plants (NPPs).
- QA Programs for all phases are developed, implemented and maintained by respective units/Directorates of NPCIL.
- Quality Assurance Directorate (QAD) is assigned the over all responsibility of implementation of QA (**QMS**) System of NPCIL.
- CMSD is developed and issued by QAD.
- As per CMSD, respective units have responsibility to develop, implement and maintain the Quality Assurance System of their respective areas.



INTRODUCTION OF QA DIRECTORATE



- Presently, QAD of NPCIL is headed by Executive Director who is independent of any direct production responsibility and reports directly to CMD.
- Quality Assurance group/Directorate of NPCIL, from the days of PPED, is following a systematic approach as per National/International standards like AERB, IAEA, ASME etc. during all activities for Quality Assurance purposes.
- QAD is certified as per ISO 9001 in the Year 1996. It was the first directorate in NPCIL to be certified based on ISO 9001:1994.
- QAD is presently certified for ISO 9001: 2015.



Introduction of QA Directorate



- QAD has its Offices at different locations all over India for providing prompt and effective Quality Assurance services.
- All Nuclear Power Plant Projects and Stations are having their own separate QA groups. QA Heads at NPP Projects and Stations technically report to ED(QA) for quality related aspects.
- QAD also provide QS services in foreign countries i.e., in Russian Federation (RF) for KKNPP-1 to 6 and other countries worldwide for KKNPP and PHWR projects.
- Sr. Executives/Executives monitor the performance of the QA units at all offices for continual improvement.
- QA Engineers (Task performers) are responsible for ensuring quality in their area of work. They shall maintain vigil in following the QMS and have the responsibility to report non-conformances, and the authority to control further processing.
- All functionaries are committed for Implementation of QMS so that the Quality Policy and objectives of Company are achieved.

Various QA offices and other QA functional Locations

- HQ + 12 Regional Quality Assurance Centers (RQACs) in India to provide region wise QA coverage – Some offices are in manufacture’s premises.
- QA team at Operating Stations & Projects.
- QA team on deputation at Russian Federation(RF)- Availability of about 18 (at times - 26) officials ensured at RF always on rotation (minimum 3 months deputation at a time).
- Senior Quality Assurance Engineer (SQAE) is posted at RF for one year.
- Deputation of QA officials to Europe & other Third Countries (Asian) as and when required.



1. RQAC-Trichy (Mnfr.)
2. RQAC-Bengaluru
3. RQAC-Chennai
4. RQAC-Hyderabad
5. RQAC-Pune
6. RQAC-Baroda
7. RQAC-Bhopal (Mnfr.)
8. RQAC-Hazira (Mnfr.)
9. RQAC-Dahej (Mnfr.)
10. RQAC-Kolkota
11. RQAC-Noida
12. RQAC-Haridwar (Mnfr.)

Regional Quality Assurance Centres (RQACs)

NPCIL in India



Manufacturing Facilities in Russian Federation (RF) & Ukraine - Third Countries



Country	Facility Name	Count
Finland	Finland	16
Russia	Petrozavodsk	275
Russia	Saint-Petersburg	11 782
Russia	Novouralsk	45
Russia	Izhevsk	78
Russia	Ekaterinburg	2 130
Russia	Ozyorsk	340
Russia	Chelyabinsk	1 412
Russia	Kurgan	269
Russia	Novosibirsk	140
Russia	Ufa	110
Russia	Penza	2 732
Russia	Togliatti	220
Russia	Saratov	161
Russia	Tambov	1 350
Russia	Suzran	3 944
Russia	Sverdlovsk	2 893
Russia	Belgorod	2 893
Russia	Volgograd	-
Russia	Kramatorsk	1 020
Russia	Krasnodar	2 320
Russia	Volgogradsk	11 271
Russia	Kramatorsk	1 020
Ukraine	Khar'kov	593
Ukraine	Dnipro	233
Ukraine	Kiev	518
Czech Republic	Czech Republic	5 845
Slovakia	Slovakia	1 374
Austria	Austria	91
Slovenia	Slovenia	827
Croatia	Croatia	91
Germany	Germany	705
Germany	Mulheim, Germany	705
Spain	Salzburg, Spain	5 113
Italy	Italy	-
France	France	-
UK	UK	-



FUNCTIONS & PROCESSES QMS



- Quality Assurance (QA) activities
- Quality Surveillance (QS) activities
- Pre-service and In-service Inspection Processes (PSI-ISI).
- Software Quality Assurance (SQA)
- Project/Station Coordination for QA activities
- Other Functions: Assessments (Vendor Audits, Projects Audits, Station Audit and independent oversights at Projects/Stations/Manufacturing), Vendor evaluation, QMS preparation and monitoring for implementation etc.

Quality Surveillance process of QA Directorate is ensured through documented procedures, covers following features:

- Ensuring of the Inputs required for effective and efficient QS activities.
- Various administrative steps and controls (such as **identification of individuals, assigning of the QS jobs to individuals depending upon the authorization**).
- Preparation for QS (i.e., study of requirements and discussions as needed).
- Steps to be followed for carrying out QS activities.
- Monitoring of QA-QS activities.
- Conclusion of QA-QS activities

INPUTS - QS:

QS Requisition from PROC. in specified form is received online in QAD along with **documents listed below (uploaded on the online system)**. This form is to be filled by indenter giving all the information specified therein. This forms to be filled for all POs for which QS is required.

- Purchase Order (PO may be Main Order or Sub-Order)
- Specification.
- Approved Drawings
- Approved QAP
- Approved Procedures
- Catalogue as applicable
- Any other specific instruction, if any



Quality Surveillance Processes



- Availability of the documents, if applicable is essential for providing QS service for any QS engineer.
- Details of tests to be carried are clearly defined in the requisition form.
- For materials such as plates, bars etc., **if purchased from traders, where availability of correct material TCs** and its correlation is always not possible, acceptance criteria are clearly stated in the form.
- If inspection is to be carried out on **sample basis** then applicable **sampling methodology** is defined in the form.



Quality Surveillance Processes



ADMINISTRATIVE STEPS AFTER RECEIPTS OF QS REQUISITION

- QS Requisition along with relevant documents are received at office of ED(QA). The requisition along with documents is forwarded to concern Group Head.
- For every QS Requisition a QA Reference Number is allotted by system. **QA Reference Number is a unique seven-digit number** for each PO.
- Job is then assigned to Section Heads by Group Heads who intern assign the same to QS Engineers.

- An Intimation letter (generated online) is sent it to supplier with copies to indenter on assignment of Requisition by Section Head to QS engineers .
- Job is then **assigned to QS engineers** on-the-basis of his **competence and his authorization**.
- Section Head may assign the job to himself also.
- Competence of personnel is taken care by providing on **job training** or training through internal/external agencies.

PREPARATION FOR QS

- On receipts of documents, QS Engineers review the documents available with requisition.
- Additional information/documents if required are obtained from indenter for providing effective and efficient QS service.



Quality Surveillance Processes



STEPS FOLLOWED FOR CARRYING OUT QS ACTIVITIES

- Only **authorized QS Engineers** are deployed for carrying out QS activities.
- QS Engineer **ensures that all relevant documents** is received/uploaded.
- All information received is **reviewed for completeness** and action is initiated for obtaining any **additional information/input** required.
- Documents such as PO, QAP, Specification, Drawings, codes and standards specification are **studied and understood** before starting the QS work.
- Need for special equipment, special tools, processes, qualified personnel etc. to achieve required quality level is identified and necessary action is initiated.



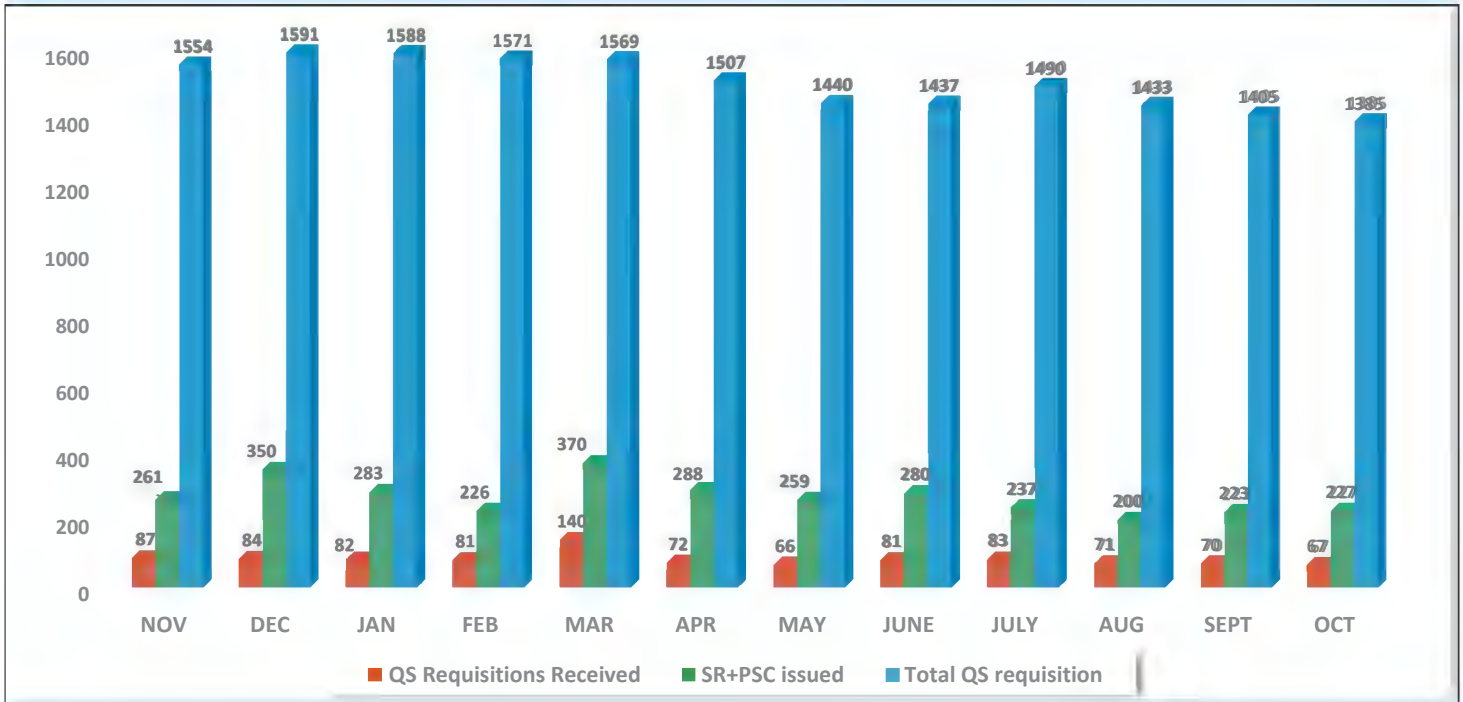
Quality Surveillance Processes



- Communication is established with supplier for status of job and expected dates for QS.
- Telephone, E-mail etc. methods of communication are utilized for faster communication with vendor, indenter and other concern agencies.
- Inspection visits are planned to provide adequate coverage.
- Response to inspection call is made keeping the delivery schedule in mind.
- **NDT procedures and QAPs developed by Vendor** are **reviewed** by QS Engineer before acceptance.



KPI-QS Requisitions & SRs (Past 12-Months) October - 2024

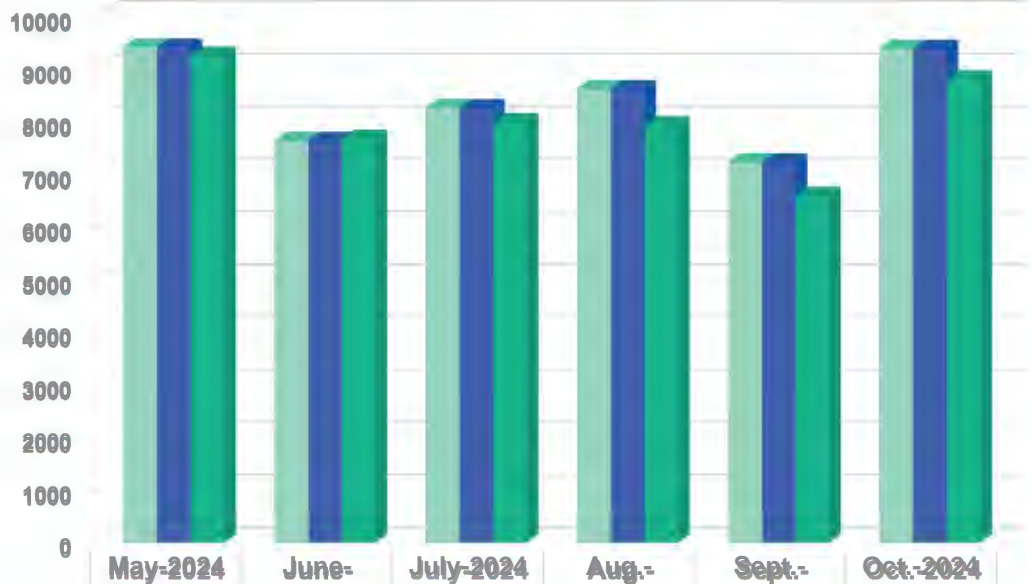


KPIs at RF-TC : KKNPP 3-6



KPIs at RF-TC KKNPP 3-6

No. of Notifications/
Control Points (CPs)



■ Inspection Notifications Offered	9408	7634	8256	8618	7229	9385
■ Inspection Notifications Completed	9408	7634	8256	8618	7229	9385
■ CPs Completed for KK#3-6	9255	7672	7990	7934	6588	8804



Quality Surveillance Processes



- Inspection during visit is carried out as per approved QAP, Drawings, PO specification and other approved documents.
- All the stages as per the approved QAP are strictly followed by QS Engineer.
- QS Reports are issued/submitted online periodically giving details of status, inspection activities performed, discrepancies noticed and suggestion.
- Action required to be taken by Indenter/customer is clearly indicated.
- Status of job after every visit is also updated online.
- It is ensured by QS engineer that only calibrated instruments are used for inspection.



Quality Surveillance Processes



- It is also ensured that for NDT only appropriately qualified persons are employed by Vendor.
- QS Engineer follows latest revision of all the documents for implementation during manufacture.
- Any deviation in product with respects to PO, specification, drawings etc. is reported to indenter (after confirmation from QS Engineer) in the specified format (DCR, NCR etc.) for final acceptance of job.
- After completion of QS activities on a PO, a check list “Self Inspection by QS Engineer” is prepared by QS Engineer.
- End Documents (History Dockets) for the job prepared by vendor are reviewed and certified by QS engineer.
- Clearance for dispatch is given in the form of Shipping Release (SR) on completion and acceptance of job/PO.
- Requisition is closed. However, all documentation/records are maintained online. These documents are removed/destroyed after specified period as per NPCIL policy.

MONITORING OF QS ACTIVITIES

- QS Engineer **monitor fulfillment of his objectives** as defined in the document in his respective areas of work.
- Section Heads provide guidance to QS Engineer and carry out periodical review of QS activities and ensure adequate coverage, effective implementation of processes and procedures.
- **Feedback from indenting groups is obtained** by Group Heads from all concerns, analyzed and communicated to all engineers.

MONITORING OF QS ACTIVITIES

- Section heads and group heads **monitor fulfillment of their objectives** as defined in the document in their respective areas of work.
- **Internal Audits are conducted** on regular basis for implementation check of QMS at all levels.
- **NCRs are issued for any Non-Conformances** observed during audits. Disposition of NCRs by implementing corrective and preventive actions is ensured by various mechanism including Management reviews.

Quality Assurance Processes



ASSESSMENT FUNCTIONS

(Independent assessment of Performance – Oversight)

- **Assessments planned** & carried out as part of QA Process
- **Internal Audits** as part of self assessment at group/unit levels.
- **External Assessments:** carried out by independent teams which are external to groups/units which include:
 - ❖ **Corporate QA Audits** by Teams constituted by ED(QA) at Projects (Twice in a year) and Corporate Audit of Stations for In-service (ISI) and Pre Service Inspection activities.
 - ❖ **Independent verifications/oversight activities** for specific activities at projects and stations (during shutdowns).
 - ❖ **Independent verification** of QS activities at manufacturing locations.
- ❑ Third party assessments: This includes assessment by Certification Bodies (CBs), WANO reviews, Regulator etc.
- ❑ Outcome of all these assessments are reviewed, deliberated and implemented as part for Corrective And Preventive Actions (**CAPA**).

Quality Assurance Process



VENDOR EVALUATION

- Competency check of vendor for executing an assignment is carried out by NPCIL Team with participation from Quality Assurance Directorate.
- A competent person is assigned this job for execution.
- Visit is made by NPCIL Team to vendor's place for the purpose of evaluation.
- All the details are collected by interviewing the concern persons at vendor's place.
- Physical verification of various facilities and equipment is also carried out during the visit.



Quality Assurance Process



VENDOR EVALUATION

- **Availability of qualified & certified personnel required for execution of Contract is also verified at vendors place.**
- **Existence of QMS/QA programme and record for their implementation are also verified.**
- **A pre defined Check List for evaluation of vendors is followed for evaluation and report is prepared.**
- **Evaluation report is issued and distributed to all concern.**



Quality Assurance Process



Manufacturing process control

- **The component to be manufactured are clearly defined by drawings and specifications to the extent necessary.**
- **Some of the stages (but not limited to) involved in manufacturing process planning and control are:**
 - Pre-planning**
 - Process Qualification**
 - Process control planning**
 - Control of Equipment/Machine/measuring tool**
 - Quality planning**



QA - QS : Manufacturing at RF & TC



- Equipment are being manufactured as per RF Codes and Standards and approved Quality Assurance Plans for QA1,QA2, QA3 and selected QNC category equipment.
- Equipment are under manufacturing in 10 different zones of RF, Ukraine and TCs.
- NPCIL QA Coverage is being provided by deputation of QA persons to RF and TCs.
- Senior QA Engineer (SQAE) is posted at Moscow on long term basis to guide, monitor and co-ordinate the QA activities.
- Weekly review meeting with JSC-ASE is conducted on QA matters.



QA - QS : Manufacturing at RF & TC



- Weekly Quality Surveillance Reports are generated, and Weekly Executive Summary Report is issued by SQAE.
- Quality Systems are in place and being followed during manufacturing of equipment as per QMS agreed by the sides.
- Quality Audits are performed on the major suppliers.
- Equipment at KKNPP site are subjected to joint inspection during receipt and storage.
- Vendor Evaluation(s) are carried out.
- Equipment in Indian scope of supplies - manufactured as per approved QPs.
- QA Coverage is being provided by NPCIL QA Engineers from QAD HQ and RQACs for the equipment under manufacture.
- Third Party Inspectors (VPO-ZAES) deployed by suppliers are assessed before authorising for inspection.

- **Software Quality Assurance Group is responsible to ensure that all the safety and safety related Digital I&C systems (DICS) have been designed, developed, manufactured and deployed correctly and completely as per desired H/W configuration and S/W customization to meet the indented safety, security, functional and performance requirements for safety of the respective systems.**
- **It is an independent review process i.e. IV&V (follows AERB/SG/D-25) to review independently and concurrently along with the system development life cycle of the digital I&C systems.**
- **Independent Verification and Validation (IV&V) improves the reliability of the system and ensures that the delivered product satisfy the user's operational & maintenance requirements.**
- **The rigor of the IV&V review process depends on the safety class (IA, IB & IC) of each function being catered by Digital I&C systems and overall safety class of the system.**

Independent Verification and Validation (IV&V) : for Projects (700MWe, 1000MWe) and Operating Stations

Verification : It is a review process at various phases of development life cycle.

Validation : Performs at Factory, Lab and Site to demonstrate the compliance with the functional, performance and interface requirements.

Newly Developed Systems (NDS):

These are designed, developed & manufactured from the scratch: Ex. **DNM, TMS-1, ETF, CMS, TMS-2, RRS, FMS, SRDCS, CTMS, TPMS, RPCMS** (Adjuster Rod Cooling, PDHRS, PHT, End Shield Cooling System, AGMS, ECC Sump Recirculation, FM Vault Leakage Collection, Liquid Zone Control System, SGLC, Spent Fuel Bay Cooling and Purification, Calandria Vault Cooling System, MLPAS, Moderator Cover Gas, SDS#2 Process Instrumentation etc.) **CVCS** (Active Process Water, Service Water, Fire Water, Chilled Water, DM Water, SSCP, PCCD, AIRLOCK etc.).

Pre-Developed Systems (PDS) :

These are previously designed and developed systems. Further classified as: **Certified PDS & Commercial PDS** Ex.: WMP PLC, SFC, FHC Controller, FHCS-MSL, FAS, ICS, Smart Transmitters, Numeric Relay 6.6 KV, Numeric Relay- 415 V, 220VDC MBC, 40KVA INV, 5KVA INV, Power UPS, GFDS Inst, GFDS-Elec, EDG-AVR, Seismic Inst, EAM, VVVF Starter etc.

Standalone (NDS/PDS): HSCMS, SIGMAS, DSS, SAPMS, RADAS, BMS, EMTR, ICS, MAS etc.,

- **QA Support**
 - ✓ Providing Technical (NDE) support.
 - ✓ Uniform guidelines for Inspection & Testing of SSCs (NNPV/Fuel SAs)
 - ✓ Approved NDE Procedures (Advanced NDE)
 - ✓ Development of NDE Techniques
- Independent review of Inspection & Test results of SSCs during BSDs/RSDs.
- Developmental activities with the support of other DAE units (BARC/IGCAR).
- Preparation/Revision of Plant PSI-ISI Programme documents of Operating Stations.
- Conduct of Corporate QA Audit of PSI-ISI implementation; Project QA Implementation/Verification.
- Ensures equipment PSI is completed before its dispatch.
- Regulatory interface w.r.t QA at Operating Stations/Projects

- Qualification of raw material & its sources such as aggregate, cement, water, chemical and mineral admixture.
- Qualification of Vendors, subcontractor and third-party laboratory.
- Design of various grade of concrete, mortar, masonry block and grouts.
- Production of concrete, transportation, placement and post care.
- Pre-Pour and Post-Pour Inspection of concreting activity.
- Pre-Stressing of Containment.



Regulatory Oversight



As part of regulation activities, Regulatory oversight during manufacturing is carried out by AERB for following TWO main function/activities of QAD:

1. **Quality Surveillance (QS) Activities**
2. **Independent assessment (Corporate QA Audit of Vendors by QAD) of vendors.**

- ✓ For Corporate QA Audits, schedules are shared with regulator.
- ✓ Required inputs/documents as desired by regulators are shared for planned oversight of audits.
- ✓ Oversight during QS function is planned by Regulator in consultation with NPCIL.
- ✓ Outcome of these Regulators oversights are issued as reports and actions are initiated by NPCIL for observations/suggestions in timely manner.

Both these oversight activities by regulator are creating positive awareness among manufacturers and helping for further enhancement of understanding the requirements of Nuclear Equipment.

Also, it helps us in gap analysis and experience sharing with respect to international regulatory requirements/ practices.



Quality Surveillance : Indian/RF/TC Manufacturing facilities

- **Mechanical Equipment (Nuclear)**
- **Electrical – C&I Equipment (Safety/Non-Safety)**
- **Mechanical Equipment (Non-Nuclear)**

Critical operation : SG Tubes insertion at the Facility

SG Tubes removed from box



After insertion of partial Rows of SG tubes

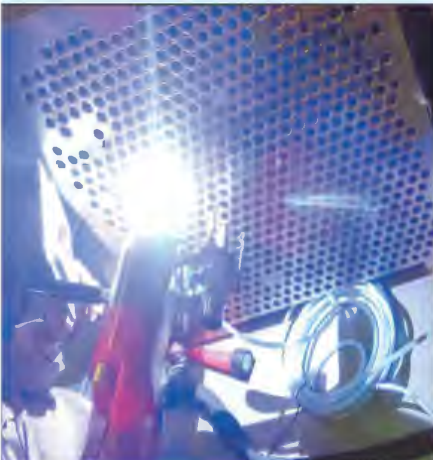


After complete insertion of all rows along with Anti-vibration U - tube supports and strips

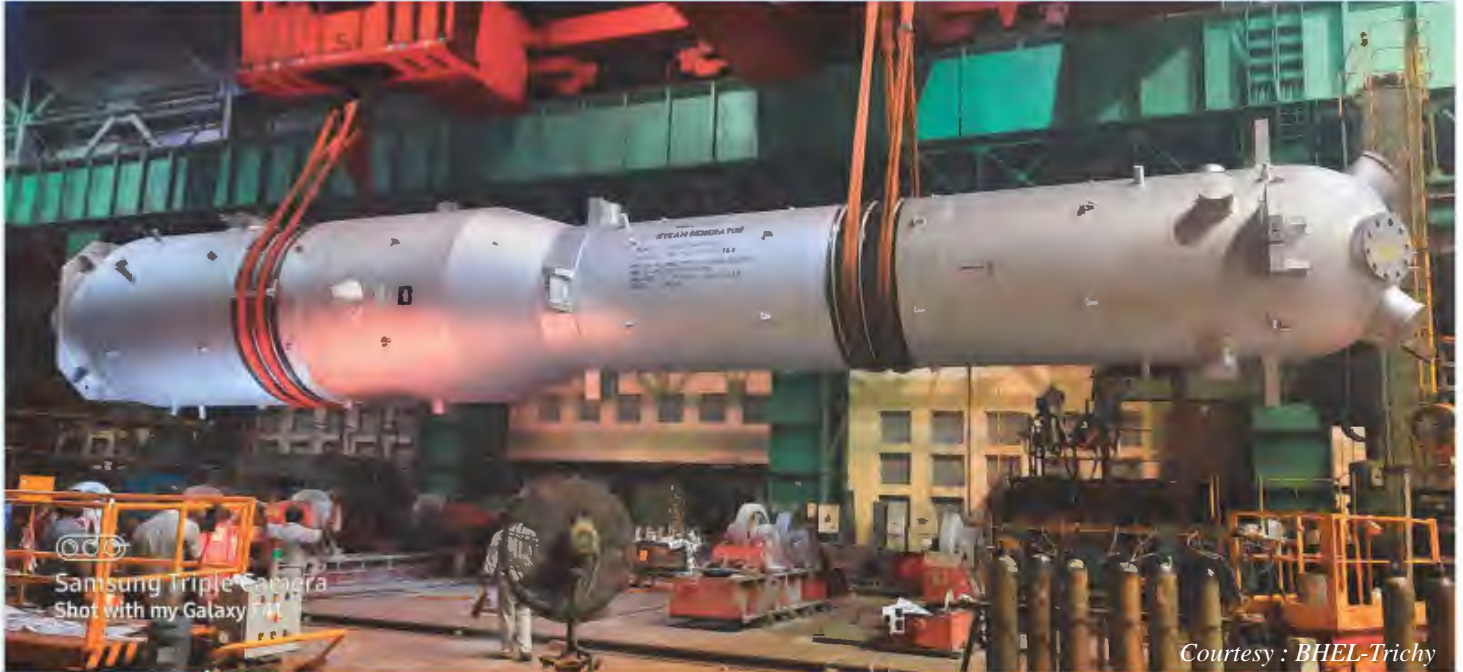


Courtesy : BHEL-Trichy

TTS welding of Steam Generator - PHWRs



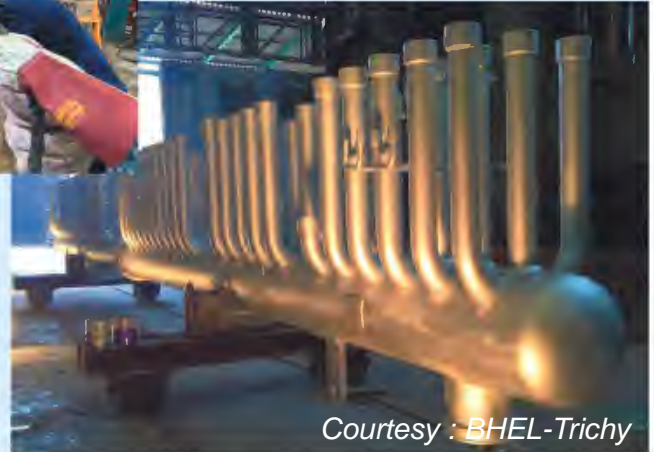
Courtesy : L&T, Hazira



**Critical
components
(PCP Fly-
wheels) :
Manufacturing
for Fleet mode
700MWe units**



Reactor Header(s) Manufacturing for 700MWe



Courtesy : BHEL-Trichy



Electrical Equipment : NNIS QS

SF6 Gas filled
420KV
transformer
for KGS 3&4

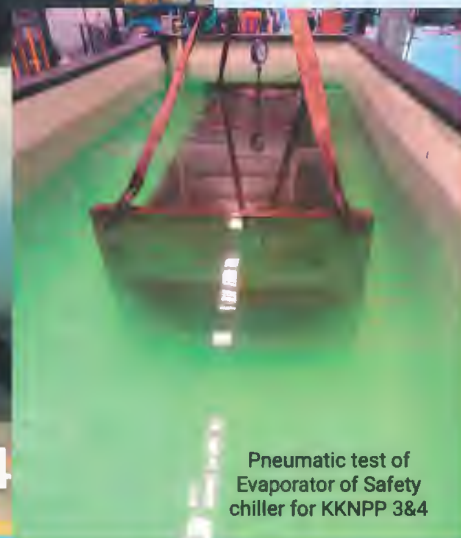


Courtesy : RQAC-Pune

Other Safety related Equipment : KKNPP#3&4



Safety chiller of KKNPP 3&4



Pneumatic test of Evaporator of Safety chiller for KKNPP 3&4

PHT Header(s) Pipes : Manufacturing for 220MWe as part of EMFR activities (RAPS#3)



PHT Feeder pipes of RAPS 3

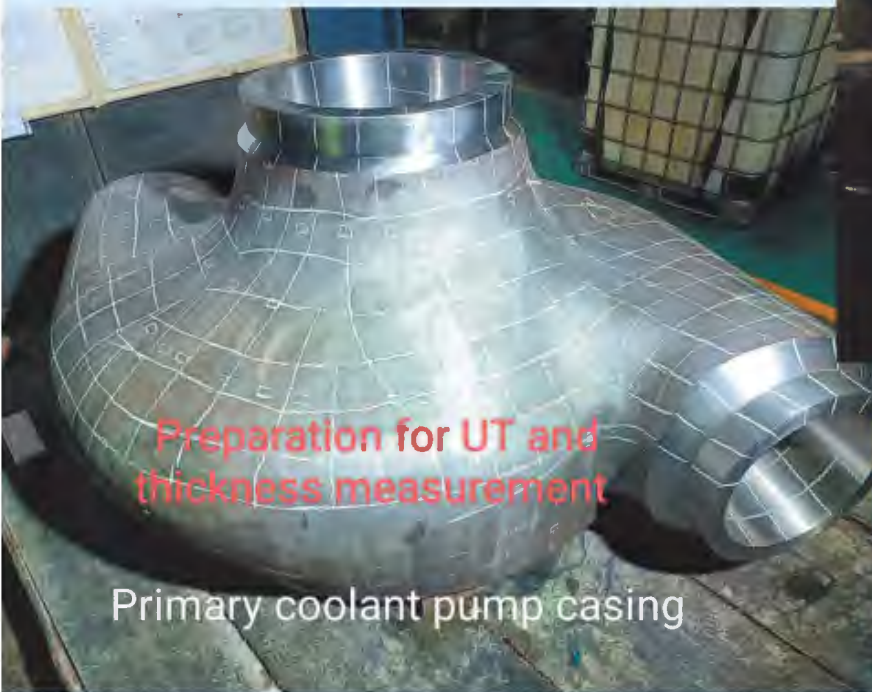
Other Equipment : Manufacturing for 700MWe New Projects



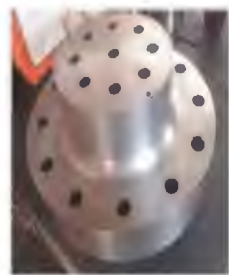
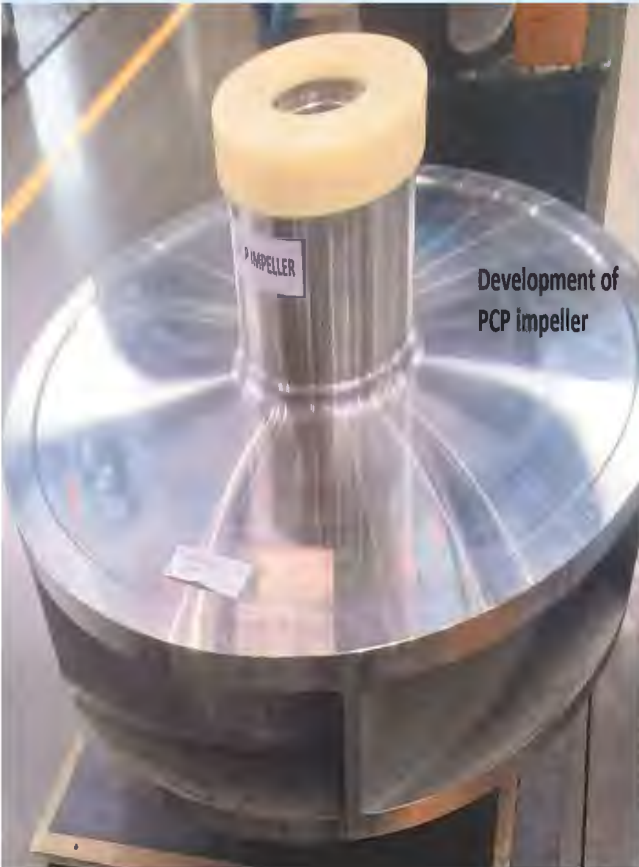
QS : EDGs for OESCs – for all Stations



QS : Primary Coolant Pump (PCP) – Casing under NDE



QS : PCP – Components Development



QS : Reactivity and Core components



CRD Mechanisms & Sealing Plugs



QS : Electrical and C&I



Diaphragm Actuator = Life Cycle Test



HT Meter = Hot Spot test



Transferring to Water bath for Quenching



Quenching in Water Bath

After Quenching

Courtesy : M/s Techtubi, Italy

Courtesy : Techtubi, Italy

Key Performance Indicators (KPIs)

Some of the Key Performance Indicators (KPIs) monitored on monthly basis and continuously improved :

- Response time for Issue of Intimation letter
- Numbers of inspection calls received
- Response time for QS visits
- Response time for Issue of QS Reports
- Response time for Issue of Shipping Release after completion of QS activities
- Response time for responding to customer feedbacks and complains.
- No. of NCR (System)
- Reduction in customer complaints
- Response time for Solving of technical issues



Yearly Magnitude of QA-QS activities



- QS requests ~1450 purchase orders are received every year
- ~ 3000 Inspection Clearances (SRs & PSCs) issued in a year
- ~ 3500 QS reports issued in a year
- ~ 50+ Corporate QA audits are conducted every year.
- ~ 20+ Independent Oversight activities in every year.
- Many Training program are conducted per year.
- ~ 20 Internal audits conducted yearly.
- Assistance provided to all Stations (28) for PSI-ISI.
- Assistance is provided for PSI of projects
- PSI/ISI program development for all projects and stations
- Vendor evaluations (~ 25-30 per year)
- SQA of Operating Stations & projects (Computer Based Systems – CBS)
- Many other...



Strength of Quality Assurance at NPCIL



- First Directorate/Department in DAE to be certified as **ISO-9001 in 1997.**
- **First inspection agency** to achieve ISO-9001 certification.
- Re-certified to ISO-9001:2015.
- Maximum nos. of certified lead auditors in a single organization.
- Well structured organizational setup.
- Qualified and authorized manpower.
- Well developed communication infrastructure.
- Online information system.
- Excellent work environment.
- QA Directorate also provides services to external customers and earns revenue for NPCIL.



Conclusion

- ❑ QA Directorate of NPCIL is ensuring that the required quality of products is achieved during manufacture by following a **well-established Quality Management System (QMS)** for all Nuclear (SSCs-NPP) components.
- ❑ The Directorate is playing an active role in providing assurance that the requirements of **safety, reliability and quality are met** at manufacturing stage for the components.
- ❑ **Oversight functions** are playing very important role in **achieving overall goal about Quality & Safety of NPPs.**
- ❑ NPCIL is committed to the **Quality : From Compliance to Performance (Excellence)** in all its activities.



Discussions – Q&A

Shri Akkala Ramu, presently holding a position as Executive Director (Quality Assurance), NPCIL since June 2024. He belongs to 2nd batch of NPC-training school engineer (equivalent to 34th Batch of BARC), joined TAPS-1&2, Tarapur Maharashtra Site, NPCIL in the year 1990. He has contributed significantly in Light Water Reactors (Tarapur-BWRs) for about 20 years (1991-2010) in various critical activities in the field of Welding Technology, Condition Monitoring, Import Substitution of Reactor core components, Reverse Engineering as part of plant ageing management, Condition assessment of SSCs using various NDE techniques, Engineering modifications, Development of special welding mock-ups for Austenitic Stainless Steel BWR-Reactor coolant piping repairs/replacements and developing unique NDE facility to support the O&M activities at TAPS-1&2.



He has also worked as Superintendent (QA) at BHAVINI-Kalpakkam on deputation for a period of 4 Years and contributed during project QA activities and established various inspection methodologies (PSI/ISI) for O&M(QA) activities. He introduced many special welding procedures and streamlined various inspection systems/methodologies. In view of his significant contribution & achievements in the field of engineering, welding technology development he is in receipt of the following awards.

1. Unit Recognition Award in the Year 2000 – Engineering of Chemical Decontamination system at TAPS#1&2.
2. NPCIL Excellence Award-2006 - Recognizing the efforts made in successful completion of various developmental at TAPS-1&2.
3. INS Medal-2007 - Recognizing excellent contribution to the various aspects of nuclear power plant engineering.
4. NDT-National Award (2010) by ISNT: Recognizing the efforts made implementing NDE techniques in Industrial sector activities.
5. Group Achievement Award for the year 2015” for the Group’s significant contribution for SG & BCD Forgings Development
6. Two (02) Group Achievement Awards for the year 2018 in recognizing the efforts made during the RCA of KAPS#1&2 coolant channels failure in analyzing the UT acquired data and Installation of PCRDS.
7. Group Achievement Awards for the year 2020 - One of the Team Member associated with QA-QS of Bleed Condenser (BCD) forgings at the manufacturing facility (L&T-SSSF Hazira Works), for the first time developed and manufactured within India, for which National Technology Award-2020 from Technology Development Board, Department of Science and Technology has been given to NPCIL.

He authored/co-authored & contributed/presented 53 technical papers /articles in the field of Condition monitoring, QA, QCI, Welding Engineering & Technology and In-Service Inspection & Testing.

Thank you...