

गुंटूर नागेश्वर राव
G. NAGESWARA RAO
अध्यक्ष
CHAIRMAN

No. AERB/CH/KAPP-3&4/2020/ 71

November 02, 2020

Permission for Phase-C Commissioning of KAPP-3

Reference: Application for Authorization of KAPP Unit-3 for Phase-C Commissioning Stage: Initial system performance tests as determined by the stable operation by the Turbine: C-1 (Consent to Raise Nuclear Steam by increasing Reactor Power up to 50% FP of the unit), C-2 (Consent to Raise Nuclear Steam by increasing Reactor Power up to 90% FP of the unit), C-3 (Consent to operate up to rated Power, 100% FP); No. KAPP-3&4/SD/2020/S/116 dated Sept 25, 2020; and revised application dated Oct 21, 2020

Consent No.	KAPP-3/CM/PH-C/0/01112020
Stage of Consent	Phase-C Commissioning Stage of KAPP-3
Person authorized by CMD NPCIL for applying	Shri M. Venkatachalam Station Director, KAPP-3&4
Brief description of Nuclear Power Project	Name: Kakrapar Atomic Power Project Unit 3&4 Type: 700 MWe Pressurized Heavy Water Reactor based Nuclear Power Plant Location: Anumala, Dist. Surat, Gujarat, Pin-394651 Present Status: KAPP-3: First Approach to Criticality and Low Power Physics Experiments have been completed. KAPP-4: Construction and Equipment erection is in progress
Basis of issuing the Consent	AERB regulatory requirements as per the AERB Codes and Guides, mainly AERB/SC/G (Regulation of Nuclear & Radiation Facilities), AERB/SG/O-4 (Commissioning of PHWR based NPPs) and AERB/NPP&RR/SG/G-1 (Consenting Process for NPPs and Research Reactors). Also satisfactory compliance to the Safety Review Plan for Commissioning of KAPP-3&4.

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Safety Review	After review by NPSD Review Groups and Working Groups/ Specialist Groups, Safety review was carried out by the Project Design Safety Committee for Pressurized Heavy Water Reactors (PDSC-PHWR) and Advisory Committee for Project Safety Review of Nuclear Power Plants (ACPSR-NPP) towards Phase-C Commissioning Stage of KAPP-3. Review carried out towards the grant of Permission is briefly given in Annexure-1. The proposed activity of Phase-C Commissioning of KAPP-3 can be carried out without undue risk to the workers, public or the environment.
Responsibility of Safety	The Prime responsibility for safety of the facility or activity lies with the Consentee. It is the responsibility of the Consentee to comply with safety requirements as specified in the Regulations.
Other Statutory requirements	Consentee shall ensure that all other necessary Statutory Clearances are obtained and are valid for the present stage of the Consent, i.e. Phase-C Commissioning.
AERB Stipulations and Conditions	Refer Annexure-2

Based on the satisfactory Safety reviews as brought out above, Permission is hereby granted for the Phase-C Commissioning Stage of KAPP-3 with the Regulatory Hold Points as identified, and subject to satisfactory compliance to the Stipulations and Conditions, as brought out in Annexure-2. The Consent will be subject to re-review for any non-compliance to the Stipulations and Conditions.

This Consent is valid till April 30, 2021. The activity as per AERB/NPP&RR/SG/G-1 shall be completed within the validity period, else extension shall be sought with justification.


(G. Nageswara Rao) 2-11-2020

Encl.: Annexures-1 and 2

**Chairman & Managing Director
Nuclear Power Corporation of India Limited
Nabhikiya Urja Bhavan (NUB)
Anushakti Nagar
Mumbai – 400 094.**

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Kakrapar Site

Site Director
Station Director, KAPP-3&4
Project Director, KAPP-3&4
Chief Superintendent, KAPP-3&4

**SAFETY REVIEW FOR
PHASE-C COMMISSIONING STAGE OF KAPP-3**

1.0 INTRODUCTION

Kakrapar Atomic Power Project Unit-3&4 (KAPP-3&4) is a twin unit 700 MWe Pressurized Heavy Water Reactor (PHWR) based Nuclear Power Project (NPP), currently under construction/ commissioning. Following are the Regulatory Consents/ Clearances/ Permissions issued for KAPP-3&4 till date:

Regulatory Consents/ Clearances/ Permissions issued	Date of Issuance
Siting Consent	May 25, 2009
Clearance for Site Excavation	January 15, 2010
Clearance for First Pour of Concrete	November 20, 2010
Permission to proceed with construction activities beyond 91.7m EL	November 22, 2011
Clearance for Major Equipment Erection	May 26, 2014
Permission for Grouting End-Shields	September 29, 2014
Permission for Construction of ICW-OCW above 133mEL	June 09, 2015
Clearance for Hot Conditioning and associated Hot tests of KAPP-3	August 07, 2019
Clearance for Balance Light Water Commissioning Tests of KAPP-3	November 01, 2019
Permission for Light Water Draining from PHT System of KAPP-3	December 16, 2019
Permission for Draining of Light Water from Moderator System of KAPP-3	January 13, 2020
Provisional Authorization for Disposal/Transfer of Radioactive Waste	January 27, 2020
Clearance for Initial Fuel Loading of KAPP-3	February 28, 2020
Clearance for Addition of 65 Te Heavy Water to Moderator Systems and Addition of Heavy Water to PHT System of KAPP-3	March 18, 2020
Permission for Heavy Water Addition to PHT System of KAPP-3	April 06, 2020
Permission for Bulk Addition of Heavy Water of the Moderator System of KAPP-3	July 07, 2020
Permission for First Approach to Criticality and Low Power Physics Experiments of KAPP-3	July 17, 2020

NPCIL had submitted an application (dated Sept 25, 2020) seeking consent for Phase-C Commissioning Stage (Phase C-1, C-PB, C-2, and C-3) of KAPP-3. Based on the detailed reviews carried out by the Review Groups/ Working Groups and PDSC-PHWR, NPCIL submitted a revised application on October 21, 2020. Later ACPSR-NPP also carried out necessary review related to Phase-C Commissioning stage.



**AERB STIPULATIONS AND CONDITIONS DURING
PHASE-C COMMISSIONING OF KAPP-3**

- S.1.1. All Recommendations of PDSC and ACPSR shall be strictly adhered to, including the Regulatory Hold Points (RHP) indicated therein [*Refer Annexure-2A*].
- S.1.2. Phase-C Commissioning of KAPP-3 shall be carried out in accordance with the programme approved by AERB and as per the approved commissioning procedures (CP) and applicable QA. Deviation from the CPs, if any, shall be promptly informed to AERB.
- S.1.3. Completed components, systems and structures important to safety shall not be put into service unless inspected, tested and approved as being in accordance with design intent and terms of the Permission.
- S.1.4. The Consentee shall not operate the plant in excess of the maximum capacity (thermal power) authorised by AERB.
- S.1.5. The Consentee shall have an approved and periodically updated on-site and off-site emergency preparedness plan.
- S.1.6. The commissioning shall proceed only in accordance with design parameters and operational limits, conditions and procedures as approved by AERB. No changes shall be made to the programmes, procedures or Technical Specifications for Operation, which have been approved by AERB without such changes being given prior approval by AERB.
- S.1.7. The Technical Specifications for Operation of KAPP-3&4 shall be strictly adhered to.
- S.1.8. Any abnormal occurrence, significant event, industrial accident or fatality during the activity shall be promptly reported to AERB.
- S.1.9. The Consentee shall ensure that the plant is operated only under the control and supervision of authorised personnel in adequate numbers acceptable to AERB. Any changes in authorized personnel should be duly notified to AERB.
- S.1.10. Continuous & reliable core neutron monitoring and monitoring of reactivity devices shall be ensured at all times.
- S.1.11. The Consentee shall implement the Quality Assurance Program laid down as per requirements of the Quality Assurance Code AERB/SC/QA and other requirements stipulated by the Regulatory Body in this regard from time to time.
- S.1.12. Radiation protection procedures shall be strictly adhered to.
- S.1.13. Witness points identified by AERB as per the Safety Review Plan for Commissioning Phase of KAPP-3&4, and those communicated during the course of further review, shall be timely informed.



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- S.1.14. Physical separation between Unit-3 and Unit-4 shall be achieved and maintained. All required measures should be in place to prevent unauthorized entry of personnel within the main plant boundary.
- S.1.15. The Consentee shall provide approved storage facility for all nuclear and radioactive materials. Appropriate physical security measures shall be made effective.
- S.1.16. Stipulations related to Nuclear Security shall be adhered to.
- S.1.17. The Consentee may take reasonable action that departs from a consent condition or a technical specification in an emergency, if such action is immediately needed to protect the public health and safety and it is apparent that no action consistent with consent conditions and technical specifications can provide adequate or equivalent protection. Such actions shall be reported to the Regulatory Body within 24 hours, followed by a detailed report within 20 days.
- S.1.18. All the Industrial & Fire Safety Requirements shall be strictly complied.
- S.1.19. This Permission shall be suspended or cancelled, if any declaration made or information given in the application is found to be false or if any undertaking given in such application is not carried out.
- S.1.20. Compliance to the Stipulations of the Statutory Clearances shall be ensured.



1.0 REGULATORY HOLD POINTS

The following sub-stages during Phase-C Commissioning of KAPP-3 shall be taken up only after necessary Permission from AERB, based on the satisfactory compliance to the recommendations given in Section 2.0 below:

- (1) Phase C-1: Raising Nuclear Steam by increasing Reactor Power up to 50% FP of KAPP-3
- (2) Raising Nuclear Steam by increasing Reactor Power up to 60% FP of KAPP-3
- (3) Raising Nuclear Steam by increasing Reactor Power up to 70% FP of KAPP-3
- (4) Raising Nuclear Steam by increasing Reactor Power up to 80% FP of KAPP-3
- (5) Phase C-PB: Partial Boiling stage during Phase-C commissioning of KAPP-3
- (6) Phase C-2: Raising Nuclear Steam by increasing Reactor Power up to 90% FP of KAPP-3
- (7) Phase C-3: Operation up to rated Power, 100% FP of KAPP-3

2.0 RECOMMENDATIONS OF PDSC-PHWR AND ACPSR-NPP PERTAINING TO PHASE-C COMMISSIONING OF KAPP-3

- (1) NPCIL should submit a proposal on disabling of Lin N High trip set point from ion chambers, for AERB's review before Phase-C commissioning.
- (2) Fire protection provisions as per design should be fully in place in all the areas including TB, and fire walk-through report to be submitted confirming compliance before start of power raise in Phase-C.
- (3) Site should resolve/rectify the observed deficiencies as reported in Special Remote RI, and submit response before start of power raise in Phase-C.
- (4) All the identified secondary side systems required for Phase-C1 power raise should be commissioned (except for the functional checks linked with availability of steam, if any) before start of power raise as part of Phase-C.
- (5) NPCIL should submit the revised response regarding measured worth and calculated worth for Shutdown system SDS-2 Liquid Poison Injection LPI-2 and LPI-3 blocked for AERB's review before start of power raise in Phase-C.
- (6) Qualification of Reactor Physicist, Station Chemist and Station Management at KAPP-3&4 should be completed before Nov 15, 2020 or Turbine Generator (TG) synchronization, whichever is earlier.
- (7) TG related commissioning (seal oil, EOP, Turbine trip, generator hydrogen related commissioning) from Backup control room (BCR) / Back up local control panel (BLCP) , and Works/commissioning of Turbine, Generator, LP, HP heaters, drain tanks, hot-well make up, etc. should be completed before TG synchronization.



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- (8) Commissioning of main generator protection and Auto Transfer System (ATS) should be completed. Completion of Construction Completion Certificate (CCC) / System Transfer Document (STD) required up to 50%FP (C1) should be reported before TG synchronization.
- (9) Results of the test at 50% should be submitted to AERB for detailed review. RRS response should be observed during power operation for AR Bank-4 as-well-as for other banks for which the worth is close to that of AR Bank-4.
- (10) NPCIL should ensure that In-service inspection (ISI) Manual is approved along with the Technical Specifications for Operation of KAPP-3&4 before 70% FP level.
- (11) Physics related issues (Trip Set Points in power regime beyond 70 % FP, maximum uncertainty in TRIVENI estimated bundle power & validation of Flux mapping system (FMS) capabilities during steady state operation) should be resolved before raising reactor power beyond 70 % FP.
- (12) A comprehensive review report should be submitted to ACPSR addressing the aspects like assurance that Bundle power is not exceeded, power measurement scheme in partial boiling, hydrodynamic stability and available experience feedback from CANDU reactors etc. This will be reviewed by ACPSR before going ahead to partial boiling stage in KAPP-3.

3.0 OTHER RECOMMENDATIONS OF PDSC-PHWR AND ACPSR-NPP PERTAINING TO PHASE-C COMMISSIONING OF KAPP-3

- (1) NPCIL should ensure that during the Phase-C tests in non-boiling regime, PHT should not enter in partial boiling regime, requisite precautions should be incorporated in all the relevant CPs/TPs. Functionality of 'sub-cooling margin low' alarm should be ensured.
- (2) NPCIL to keep the Trip Set Points (TSP) corresponding to 70 %FP only for those transient experiments which warrant the same, and for remaining transients reduce the TSP corresponding to 50 %FP. Such finalised TSPs should be submitted to standing committee for Reactor Physics (SCRIP). Such settings should be cautiously implemented through critical jumper.
- (3) Only after obtaining adequate confidence on Regional over power protection system (ROPS) response through channel trip tests by lowering trip set point, the Lin-N trip on Ion Chambers may be disabled, under information to SCRIP, and submit also the channel trip test data.
- (4) NPCIL should attempt passive decay heat removal system (PDHRS) test as early as possible subject to satisfying the conditions of availability of 3%FP decay heat.
- (5) NPCIL should validate the measurement of secondary side thermal power vis-à-vis the primary power at power range before boiling regime, during Phase-C power operation.
- (6) All the commissioning tests should be carried out as per the agreed upon schedule, approved Commissioning Procedure / Test Procedure, and Test Reports/Commissioning Reports should be submitted.
- (7) Compliance to Technical Specification (O) shall be ensured during power raising and conducting required tests.



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- (8) Plant performance data at each stage of power operation as per approved format with designer review and acceptance should be submitted for AERB review.
- (9) Radiation Protection Procedures shall be enforced to protect personnel against undue radiation exposure.
- (10) Industrial and fire safety supervision and medical facilities shall be ensured at all time.
- (11) Any deviation from approved procedure and any incident during the test should be informed to AERB before proceeding further.
- (12) Identified actions of Independent Verification & Validation (IV&V) should be completed as per the agreed upon plan.
- (13) NPCIL should continue with the attempts to further improve the zone control compartments (ZCC) level monitoring scheme.
- (14) Lessons learnt from the rate log N trip event should be disseminated to all concerned in NPCIL.
- (15) Site should take appropriate actions to avoid recurrence of events like Primary Circulating Pump PCP-2 Seal leak.
- (16) NPCIL should continue efforts to study Common Cause Failures in Computer Based Systems.
- (17) Review of Partial Boiling aspects should be completed at the earliest and NPCIL should provide necessary supporting documents to enable a comprehensive review.
- (18) NPCIL should complete the activity of procurement and commissioning actions for Online Decision Support System at the earliest.
- (19) Liquid Zone Control level control should be closely monitored.
- (20) NPCIL should complete all the Environmental Qualification (EQ) related pending activities as per committed schedule and submit status of qualification progress periodically.


