

GOVERNMENT OF INDIA

अध्यक्ष  
CHAIRMAN

No. CH/AERB/GHAVP-1&2/2020/38

November 18, 2020

CONSENT FOR FIRST POUR OF CONCRETE OF GHAVP-1&2

References

1. NPCIL Application for FPC Consent for GHAVP-1,2  
[NPCIL/GHAVP/PD/2018/S/39 dated July 4, 2018]
2. Safety Review Plan for FPC for GHAVP-1,2  
[AERB/NPSD/LRB/CN/SR/513214/2019/254, dtd. April 11, 2019]

<b>Consent No.</b>	GHAVP-1,2/CN/FPC/0/18112020
<b>Stage of Consent</b>	First Pour of Concrete (FPC) of GHAVP-1&2
<b>Applicant</b>	Nuclear Power Corporation of India Limited (NPCIL) Project Director, GHAVP-1&2, the person authorised by CMD, NPCIL, (Application – Ref.1)
<b>Brief description of Nuclear Power Project</b>	<b>Name:</b> Gorakhpur Haryana Anu Vidyut Pariyojna Units 1&2 <b>Type:</b> 700 MWe Pressurized Heavy Water Reactor based Nuclear Power Plant (Repeat Design of KAPP-3&4) <b>Site: New Site</b> <b>Location:</b> Village & Post - Gorakhpur, Tehsil – Bhuna, District – Fatehabad, Haryana -125047 <b>Present Status:</b> At GHAVP1&2, Site Excavation and ground improvement activities are completed. For the Combined Pile Raft Foundation (CPRF), logistics have been arranged for casting of the construction piles as well as confirmatory piles. Concrete batching plant and concrete testing laboratory are established. Construction power and water supply are available. Site Organisation has been established.
<b>Basis of issuing the Consent</b>	Regulatory requirement as per AERB Codes/Guides, AERB/SC/G (Regulation of Nuclear & radiation facilities), AERB/NPP&RR/SG/G-1 (consenting process for NPP), AERB/NPP-PHWR/SC/D (Rev-1) (Design of PHWR based NPPs). Also satisfactory compliance to the Safety Review Plan for FPC of GHAVP-1&2 (Ref.2).
<b>Safety Review</b>	Safety review by NPSD Review Groups and Working Groups / Specialist groups, multi-tier safety reviews, viz.: 1 <sup>st</sup> tier review by the Project Design safety Committee (PDSC-PHWR) & Civil Engineering Safety Committee (CESC), 2 <sup>nd</sup> tier review by the Advisory Committee for Project Safety Review (ACPSR-NPP), and final 3 <sup>rd</sup> tier review by the Board of AERB in its Meeting # 131. Review carried out towards the grant of Consent is briefly given in Annexure-1.

**परमाणु ऊर्जा नियामक परिषद**  
**Atomic Energy Regulatory Board**

	Salient details of (1) review methodology and (2) regulatory processes and compliance to regulatory requirements are included in Annexure-1.
<b>Responsibility of Safety</b>	The Prime responsibility for safety of the facility or activity lies with the Consentee. It is the responsibility of Consentee to comply with safety requirements as specified in Regulations.
<b>Other Statutory requirements</b>	Consentee shall ensure that all other necessary statutory clearances are obtained and valid for present stage of Consent, i.e. FPC of GHAVP-1&2.
<b>AERB Stipulations and Conditions</b>	AERB Stipulations and conditions for FPC to enable effective regulatory control are appended as Annexure-2

Based on satisfactory review as brought out above, Consent is hereby granted for First Pour of Concrete of GHAVP-1,2, subject to satisfactory compliance to the Stipulations and Conditions, as brought out in Annexure-2. The Consent will be subject to review for any non-compliance to the Stipulations and Conditions.

This Consent is valid till November 30, 2030. The construction work shall be completed within the validity period, else extension shall be sought with justification.

Encl.: Annexures-1 & 2

  
18-11-2020  
(G. Nageswara Rao)

**Chairman & Managing Director**  
**Nuclear Power Corporation of India Limited**  
**NUB, Anushakti Nagar**  
**Mumbai – 400 094.**

**Copy to:**

**AERB**

Executive Director  
Director, NFRG  
Director, NSARG  
Head, NPSD  
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Head, OPSD  
Head, NSAD  
Head, DRPE  
Head, PHWR-PS  
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Director (T)  
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Director (O)

**AERB Committees**

Chairman & Member Secretary, ACPSR-NPP  
Chairman & Member Secretaries, PDSC-PHWR  
Chairman & Member Secretary, CESC  
Chairman & Member Secretary, CRSA

**GHAVP Site**

Project Director  
Chief Construction Engineer

**Safety Review for  
First Pour of Concrete Permission for  
Gorakhpur Haryana Anu Vidyut Pariyojna Units -1,2**

**1.0 Review Methodology**

The 700 MWe PHWR based NPPs at GHAVP Unit-1&2 (Haryana) are similar to the 700 MWe PHWR projects KAPP-3&4 (under construction / commissioning at Kakrapar, Gujarat) and RAPP-7&8 (under construction at Rawatbhata, Rajasthan), except for certain site specific changes, and certain design improvements based on feedbacks from earlier NPPs.

Following Regulatory Consents have been issued for GHAVP till date:

Regulatory Consents	Date of Issue
<b>SITING STAGE</b>	
Siting Consent for GHAVP-1 to 4	July 8, 2015
<b>CONSTRUCTION STAGE</b>	
Site Excavation Consent for GHAVP-1,2	January 17, 2018

NPCIL submitted the application (Ref.1) for the consent for First Pour of Concrete (FPC) of GHAVP-1,2 following the guidance as given in the guide 'Safety guide on consenting process for Nuclear Power Plants and Research Reactors' AERB-NPP&RR/SG/G-1, and the balance supporting submissions progressively over a period till October, 2020.

The application was reviewed by AERB staff, Working Groups/Review Groups, and the Safety Review Committees (PDSC-PHWR, CESC & ACPSR-NPP). Review of nuclear security aspects was carried out by AERB Committee for Review of Security Aspects (CRSA). Thereafter, final review was carried out by the Board of AERB in its Meeting # 131 held on 13.11.2020.

The review was carried out in accordance with the NPSD's General Review Plan and the Safety Review Plan for FPC of GHAVP-1&2 (Ref-2) in line with the AERB Safety Guide on 'Consenting Process for Nuclear Power Plants and Research Reactors' AERB/NPP&RR/SG/G-1. Compliance to the requirements of regulatory codes/guides as relevant to FPC stage was ensured during the review. The stipulations / recommendations of earlier consents were also followed up for compliance & resolution.

Based on the satisfactory review of Nuclear & Radiological Safety, Industrial & Fire Safety and Civil Engineering aspects as required for the current stage of GHAVP-1&2 as per AERB/NPP&RR/SG/G-1, it was decided to grant Consent for First Pour of Concrete of GHAVP-1&2, subject to compliance with the review recommendations, and the progressive resolution of the Regulatory Hold Points identified for various stages within the FPC Consent.

**2.0 GHAVP-1,2 Compliance to AERB/NPP&RR/SG/G-1 Regulatory Requirements w.r.t. FPC**

- 1. Construction Schedule** - Construction schedule showing network of activities from Excavation to Synchronization is submitted. FPC activity would commence with pile construction activity.



2. **Preliminary Safety Analysis Report (PSAR)** - All Sections of the PSAR Part-A (Design Description) of GHAVP-1&2 have been submitted by NPCIL. PSAR Sections 1, 2 & 3 were earlier reviewed at the time of Excavation Consent. The GHAVP-1,2 PSAR Part-A Sections relevant for the FPC stage were reviewed with a focus on changes/differences w.r.t. earlier projects and found acceptable. Review recommendations made for earlier 700 MWe NPP Projects (KAPP-3,4/RAPP-7,8) in respect of design & analysis are also applicable to GHAVP-1&2, and they are being progressively responded by NPCIL and resolved for 700 MWe PHWR design as a whole.
3. **Status of pending issues based on earlier stage reviews** - NPCIL submitted response to the stipulations / recommendations of earlier consents of GHAVP (Siting & Excavation) which were taken cognizance of during the safety review.
4. **QA Manuals for Design & Construction** - QA Manuals for Design & Construction were earlier reviewed at the time of Excavation Consent. For FPC stage, QA Manual for Procurement was also reviewed and accepted.
5. **Civil Engineering submissions** - Various submissions as identified in AERB/NPP&RR/SG/G-1 were reviewed, viz.: Design Basis Reports (DBRs) on surface drainage, confirmatory geo-technical investigation report, geological mapping of the excavated foundation pits, DBRs (including dynamic analysis methodology), Dynamic analysis reports and selected design reports of civil engineering structures important to safety, Report on Concrete Mix Design, Construction Methodology Document, Contractors QA Document, pile-test results, settlement monitoring provision, etc.
6. **Details of Construction Labour Colony** - The Colony is established at Gorakhpur Village outside the Exclusion Zone boundary.
7. **Emergency Preparedness Plan** - GHAVP-1,2 is a new site. Approved EPP will be available before Initial Fuel Loading (IFL) to carry out off-site emergency exercise before FAC of GHAVP-1/2 addressing EPP aspects of GHAVP - 3 & 4 construction staff, handling of transient population from Agroha Dham in Off-site Emergency, emergency escape routes, etc.
8. **Location and Approach / Exit Roads** - Details were covered in Site Evaluation Report and PSAR Sections 1, 2 & 3 which were reviewed at the time of Excavation Consent.
9. **Industrial & Fire Safety** - Construction Safety Manual, Job Hazard Analysis and Safe Work Procedures were reviewed earlier at the time of Excavation Clearance. For FPC, salient submissions were reviewed and accepted, viz.: Amenability of Pipe & Cable Tunnels/Trenches to emergency rescue, Test certificates for lifting machinery, lifting tools and tackles, Fire order, I&FS Organisation at Site as per AE(F)R-1996, etc.
10. **Nuclear Security** - Review was carried out by Committee For the Review of Security Aspects (CRSA) and it was confirmed that the security requirements relevant to this stage is complied with .
11. **Statutory Clearances** - GHAVP has been granted Environmental Clearance (EC) by MOEF&CC, Wildlife Clearance by Haryana Forest Dept. and 'Consent to Establish' by Haryana State Pollution Control Board. GHAVP Site has been regularly submitting half-yearly compliance report to MOEF&CC, as mandated by the EC. Further, the Notifications for 'Natural Growth Zone' & 'No Fly Zone' are being taken up by NPCIL with appropriate authorities so as to be available before Criticality of First Unit.



**AERB STIPULATIONS AND CONDITIONS FOR FIRST POUR OF CONCRETE OF  
GHAVP-1,2**

- S.1. All safety review recommendations of PDSC-PHWR, CESC & ACPSR shall be strictly adhered to, including the Regulatory Hold Point (RHPs) indicated therein [Refer Annexure-2A]
- S.2. Stipulations related to Nuclear Security shall be adhered to.
- S.3. The facility shall be designed and constructed in accordance with design basis review by AERB for relevant site parameters provided in safety analysis reports. The Consentee shall not deviate from design as provided in safety analysis reports in any way that might affect safety, without prior approval of AERB.
- S.4. Activities under First Pour of Concrete Consent shall be carried out as per the approved construction procedures. Deviation, if any, shall be promptly informed to AERB. No changes shall be made to the programs & procedures, which have been approved by AERB, without prior intimation and review of AERB.
- S.5. Consentee shall implement the Quality Assurance Program laid down as per requirements of the safety code on "Quality Assurance in Nuclear Power Plants" AERB/NPP/SC/QA (R1) and any other requirements stipulated by the Regulatory Body in this regard from time to time. During pile-testing, casting of working piles, & subsequent construction of raft & superstructure, strict adherence to QA shall be ensured.
- S.6. The Consentee shall appoint authorised persons who are qualified to perform functions under the Consent.
- S.7. All Industrial & Fire Safety requirements including prompt reporting of industrial accidents or fatalities as per the Atomic Energy (Factories) Rules, 1996/AERB notifications and Control of Works shall be strictly adhered to.
- S.8. Any abnormal occurrence, significant events, industrial accidents or fatalities during the activity shall be promptly reported to AERB. Significant Event or Change shall be reported as per SECRC (Significant Event/Change Reporting Criteria).
- S.9. The Consentee shall complete collection of a pre-operational radiological study of the region for establishing base-line radiological data before start of commissioning activities.
- S.10. Compliance to the Stipulations of the Statutory Clearances shall be ensured.
- S.11. This Consent 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 the application is not complied with.



**1.0 REGULATORY HOLD POINTS WITHIN FPC PERMISSION**

Following sub-stages during construction of GHAVP-1,2 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) Commencement of Raft Construction of Nuclear Building (NB)-1&2
- (2) Commencement of Construction in Control Building (CB) including Piling
- (3) Commencement of Construction of Safety Related Structures [other than NB, CB, and Induced Draft Cooling Tower (IDCT)]
- (4) Commencement of Construction of IDCT

*To ensure effective, time-bound & focussed follow-up of various recommendations & submissions associated with the above RHPs in the safety review process, NPCIL shall submit action plan so that the RHPs are scrupulously followed without any deviations, and no mid-course concessions are needed.*

*Note: The compliance w.r.t. RHP of 'Commencement of Pile Construction in Nuclear Buildings of Units 1&2 (NB-1&2)' is already checked.*

**2.0 SAFETY REVIEW RECOMMENDATIONS RELEVANT TO THE FPC STAGE OF GHAVP-1,2**

**Regulatory Hold Points (RHPs) and Timeline agreed by NPCIL as a condition for FPC Consent for GHAVP 1&2**

Sl. No.	Activity*	Target date/ milestone
<b>RHP: Commencement of raft construction of NB1&amp;2</b>		
[1]	Submission of revised analysis/ Design reports of NB for following cases: a) Single building analysis b) Multi building analysis c) Analysis for reduced end bearing d) Factored load analysis e) Analysis for Range of soil E value f) Construction sequence analysis g) Validation of MSM approach for seismic analysis in SASSI for NB h) MSM based seismic analysis with pile as solid elements in SASSI i) Submission of revised seismic analysis reports of NB j) Submission of revised design reports of NB Raft addressing above analyses cases	Item a) to j), at least 3 months before Start of NB raft construction.  Item k) to n), at least 1 month before Start of NB raft construction.

	<p>k) Submission of seismic analysis and design reports for OBE based on appropriate soil properties</p> <p>l) Submission of design reports of, ICW, OCW, RB internal structures, and RAB addressing above analyses cases</p> <p>m) Outcome of HSDT and implications on NB design</p> <p>n) Analysis/ design for as built configuration after casting of all the piles (if required).</p> <p>All the recommendations as brought out in CESC report shall be addressed while undertaking the above analyses/ design.</p>	
[2]	Proof check analysis report for NB addressing the review recommendations and design report based on the same.	At least 3 months before start of NB raft construction.
[3]	Submission of data from confirmatory vertical pile load tests in NB area, review and further course of action as decided by AERB after review	Before January 31 <sup>st</sup> , 2021 or before the casting of raft whichever is earlier.
[4]	Submission of applicable soil properties for OBE analysis	3 months before start of NB raft construction.
[5]	<p>1. The estimated tilt/differential settlement in NB towards design of systems and components inside RB (and any sensitive items outside RB)</p> <p>2. The estimated/ predicted settlement and soil pressure at measurement locations and pile forces (for applicable buildings, including load transfer behaviour for instrumented piles) (as per geotechnical monitoring scheme).</p> <p>a. From SSI analysis used in final design (construction sequence analysis considering multi-building)</p> <p>b. From As-built analysis model (construction sequence analysis considering multi-building).</p>	Before start of NB raft construction.
[6]	Adequacy assessment of multi building analysis with linear soil properties.	Before start of Raft construction of NB-1.
[7]	Final report for geotechnical monitoring including scheme for settlement plates for safety related structures.	Prior to NB raft construction.
[8]	Report on long term structural monitoring.	Prior to NB raft construction.
[9]	Mix design report for M35 and M45 grade concrete addressing review recommendations.	Prior to NB raft construction.
[10]	Updated calculations of seismic gap within NB as well as NB and surrounding structures and gap between SAB & DG foundation using finalized numerical model and for all the three cases of soil properties (UB, LB and BE).	Prior to raft construction of respective building.



[11]	Action plan for seismic instrumentation including that in deep borehole.	Before start of raft construction of NB.
[12]	Tests reports for friction co-efficient of PVC water proofing layer following ASTM D 1894.	At least 1 month before start of raft construction.
[13]	Study report on revised configuration of calandria end shield anchor bolt addressing following items i) concept used in earlier PHWRs including multi step configuration ii) use of alternate configurations of bolts/scheme, ii) explore the scheme used in CANDU reactors iv) considering certain drawbacks seen in previous tests, testing of the considered anchor configuration along with concrete embedment configuration to estimate its capacity in applicable loading scenario, v) constructability aspects.	Prior to NB raft construction.
<b>RHP: Commencement of construction in CB including piling</b>		
[1]	<p>Submission of revised analysis/ Design reports of CB for following cases:</p> <ul style="list-style-type: none"> <li>a) Single building analysis</li> <li>b) Multi building analysis</li> <li>c) Analysis for reduced end bearing (as applicable)</li> <li>d) Factored load analysis</li> <li>e) Construction sequence analysis</li> <li>f) Validation of MSM approach for seismic analysis in SASSI for CB</li> <li>g) MSM based seismic analysis with pile as solid elements</li> <li>h) Submission of revised seismic analysis reports including that for OBE</li> <li>i) Submission of revised design reports addressing above analyses cases for raft and super structure</li> <li>j) Outcome of HSDT and implications on CB design</li> <li>k) Analysis/ design for as built configuration after casting of all the piles (if required).</li> </ul> <p>Analyses to consider outcome of confirmatory geotechnical investigations and calibrated numerical model. All the recommendations as brought out in CESC report shall be addressed while undertaking the above analyses/ design.</p>	<p>Item a) to i) before start of piling activity in CB.</p> <p>Item j) to k), before start of CB raft construction.</p>
Change in the layout of Main Control Centre including the modifications in MCR panels and OWS should be satisfactorily reviewed before taking up construction of 106 m EL floor of Control Building.		
<b>RHP: Commencement of construction of safety related structures other than NB, CB, and IDCT</b>		
[1]	1. Submission of revised static analysis reports of SAB (addressing single and multi building (including location & orientation effects), factored load, confirmatory geotechnical parameters, calibrated numerical model etc.).	At least 3 months before start of raft construction.

	<p>2. Submission revised seismic analysis reports of SAB for all the soil properties (UB, LB, &amp; BE) including that for OBE.</p> <p>3. Submission of revised design reports of SAB covering above analysis cases.</p> <p>All the applicable recommendations as brought out in CESC report shall be addressed while undertaking the above analyses/ design.</p>	
[2]	<p>1. Submission of revised static analysis reports of other safety related structures, WMP/STACK/ SRPH/SREH/FWPH/FOSA, (addressing single and multi building, location &amp; orientation effects, factored load, confirmatory geotechnical parameters, calibrated numerical model etc.).</p> <p>2. Submission of revised seismic analysis reports of above buildings for all the soil properties (UB, LB, &amp; BE) including that for OBE.</p> <p>All the applicable recommendations as brought out in CESC report shall be addressed while undertaking the above analyses.</p>	At least 3 months before start of raft construction of respective structure.
[3]	Seismic margins for SREH-Annex and non-collapse of SREH on SREH-Annex during DBBE should be demonstrated before taking up construction of SREH, SRHE Annex.	Before start of construction of SREH, SREH Annex.
[4]	Repeat PMT in GI area of WMP; evaluation of results w.r.t implications in other areas including NB; repeat PMT in NB and other areas, if necessary	Before start of raft construction of WMP, NB, CB, SAB
<b>RHP: Commencement of construction in IDCT</b>		
[1]	Analysis and design reports of IDCT structures.	At least three months before start of construction of IDCT structures.
<b>RHP: Submission of data from Geotechnical monitoring</b>		
[1]	<p>All data from Geotechnical monitoring shall be submitted at the following intervals.</p> <p>1. On monthly basis till completion of raft construction for both NBs.</p> <p>2. On quarterly basis afterwards.</p>	As per the mentioned schedule.

\* Each activity/submission should address the related review recommendations brought out in the review report.

### 3.0 OTHER SALIENT RECOMMENDATIONS OF PDSC-PHWR, CESC & ACPSR-NPP RELEVANT TO THE FPC STAGE OF GHAVP-1,2

- i) *With respect to the design provision for measurement of absolute and differential settlement, & tilt during lifetime of the plant, all efforts should be made to ensure life-*

*time monitoring of geo-tech parameters. All precautions should be taken at various stages to ensure that instruments perform well during the lifetime of the structures and reliable data is obtained. Work procedure for installation, commissioning & operation of the settlement monitoring instrumentation should be well established.*

- ii) Settlement data should be recorded as per approved procedure and submitted to AERB for review periodically.*
- iii) Functionality of the settlement monitoring provision for the intended service life should be ensured by deploying the redundant & reliable instrumentation, and by surveillance on the same as committed.*
- iv) Sequence of construction / installation of SSCs, & time-gaps therein should be adhered to with that considered in analysis to allow realisation of the expected deformation / settlement. During assessment of deformations / settlements in a structures, any effect of settlement of nearby structures should also be considered. Any change in construction sequence from approved sequence (refer RHPs) should be informed to AERB sufficiently in advance prior to taking up subsequent activities.*
- v) NPCIL to ensure collection / confirmation of necessary inputs for the design of SSCs from the pile testing & construction data before taking up the NB raft construction and data on settlement during raft & superstructure construction. As part of this, all basic parameters for design, like Seismic Anchor Movement, differential settlements (from all possible phenomenon) should be made available before NB raft casting. Before start of raft construction, NPCIL should submit information on schedule of erection of these critical equipment vis-a-vis total construction schedule.*
- vi) NPCIL to submit information on estimated differential movement and tilt in the areas of the critical equipment due to construction activities subsequent to their erection. Design of these equipment shall account for the estimated differential movement and tilt. A submission on observed settlement characteristics vis-a-vis corresponding estimates should be submitted when Calandria Vault construction reaches 95 m EL. Corrective measures, if any, required based on the above study should also be implemented in design & erection of these critical equipment, as appropriate.*
- vii) NPCIL to submit a note on the effect on the settlement of SSCs due to ground water table changes.*
- viii) During execution and measurement of settlement, the predicted settlement should be verified and corrective action taken, if required.*

*If any unexpected revelations are encountered during construction, like higher than expected settlement, loss of settlement readings from certain locations, etc., then NPCIL should approach AERB with relevant details, before proceeding further.*

- ix) The differential settlement data monitoring should be included as one of the safety factors during the Periodic Safety Review of the plants located at this site.*
- x) Revised report on slope stability addressing review recommendations should be submitted within the identified time frame.*

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