

सी एस. वर्गीज
उत्कृष्ट वैज्ञानिक एवं
निदेशक, एन एफ आर जी



नियामक भवन/NIYAMAK BHAVAN,
अणुशक्तिनगर/ANUSHAKTINAGAR,
मुंबई/MUMBAI-400 094

C. S.Varghese
Outstanding Scientist and
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भारत सरकार
GOVERNMENT OF INDIA
परमाणु ऊर्जा नियामक परिषद
ATOMIC ENERGY REGULATORY BOARD
Nuclear Facilities Regulation Group

No. AERB/NPSD/USC/CN/SR/233314/2018/00629

November 14, 2018

Clearance for Excavation of KKNPP-5&6

References:

1. No. NPCIL/Engg-LWR/KK/2018/M/08 dtd. 08.01.2018.
2. No. NPCIL/Engg-LWR/KK-5&6/2018/M/161, dtd. 16.10.2018.

Consent Number	KKNPP-5&6/21000
Stage of Consent	Excavation
Applicant	Nuclear Power Corporation of India Ltd (NPCIL) (Application for Excavation of KKNPP-5&6 was submitted by NPCIL [1]. NPCIL progressively made various submissions required for Excavation. Subsequently NPCIL submitted revised request with updated status on submissions and compliance to recommendations [2]).
Brief Description of Nuclear Power Project	Kudankulam Nuclear Power Project, KKNPP-5&6 Type: 1000 MWe VVER, PWR type reactor (Repeat Design of KKNPP-1&2 with technological updates and modifications incorporated in the design of KKNPP-3&4). Located at: Kudankulam Nuclear Power Project (Existing Site), Kudankulam P.O., Radhapuram Taluk, Tirunelveli District, Tamil Nadu -627 106.

	<u>Present status:</u> Preparatory works for start of excavation of main plant area is completed.
Basis for issuing the Consent	AERB regulatory requirements as per AERB Safety Code on Design of Light water reactor based NPPs (AERB/LWR-SC/D), AERB Safety Code on Site Evaluation of Nuclear Facilities (AERB/SC/S) Revision-1, AERB Safety Code on Quality Assurance in Nuclear Power Plants (AERB/SC/QA) and AERB Safety Guide on Consenting process for Nuclear Power Plants & Research Reactors (AERB/NPP&RR/SG/G-1).
Safety Review	Detailed review carried out prior to grant of excavation consent including verification of compliance to regulatory submissions is briefly given in Annexure-1. The proposed activities of excavation can be carried out without undue risk to workers, the public or the environment.
Responsibility of Safety	It is the responsibility of Applicant to comply with safety requirements as specified in Regulations.
Other statutory requirements	The status of compliance to MoEF & CC stipulations by Applicant as relevant to AERB are brought in Annexure-1. Applicant shall ensure that all necessary statutory clearances are obtained and are valid for present stage of consent i.e., excavation.
AERB Stipulations and Conditions	AERB stipulations and conditions for excavation of KKNPP-5&6 to enable effective regulatory control is brought in Annexure-2.

Based on satisfactory review as brought out above, clearance is hereby granted for Excavation of KKNPP-5&6, subject to satisfactory compliance to the stipulations and conditions as brought in Annexure-2. The clearance will be subjected to re-review for any non-compliance to the stipulations and conditions.

This clearance is valid till November 30, 2021. The excavation activity of main plant area shall be completed within the validity period, else extension shall be sought with justification.

This is issued with the Approval from Chairman, AERB

Encl.: Annexure-1&2


(C. S. Varghese)

To,
Chairman and Managing Director,
Nuclear Power Corporation of India Ltd.,
Nabhikiya Urja Bhavan,
Anushaktinagar, Mumbai-400 094

Copy to:

AERB

Chairman, AERB
Executive Director, AERB
Head, NPSD
Head, LWR&FCF-PS, NPSD

AERB Committees

Chairman and Member-Secretaries, ACPSR-NPP
Chairman and Member-Secretary, ACS
Chairman and Member-Secretaries, PDSC-LWR
Chairman and Member-Secretary, CRSA

NPCIL

Director (T-LWR)
Director (P)
ED (Engg.-LWR)
Regulatory Interface

KKNPP Site

Site Director
PD, KKNPP-5&6
CCE, KKNPP-5&6

SAFETY REVIEW FOR EXCAVATION OF KKNPP-5&6

1.0 Safety Review

Siting Clearance for locating 4 x 1000 MWe VVERs (KKNPP – 3 to 6) was granted by AERB on February 9, 2011. Subsequently, NPCIL submitted an application seeking revalidation / extension of Siting Consent of KKNPP-5&6 for a period of 5 years along with an Addendum to SER for KKNPP-3 to 6 (Rev-1) elaborating details of updated data on applicable Site related parameters. Based on satisfactory review of the details submitted by NPCIL, AERB has granted revalidation of the Siting Consent of KKNPP-5&6 for another 5 years (i.e., up to February 8, 2021) on March 3, 2016. NPCIL submitted application seeking AERB Consent for Excavation of KKNPP Unit-5&6 along with supporting documents on January 8, 2018. The adequacy of documents submitted by NPCIL as part of excavation consent for KKNPP-5&6 was checked against the requirements spelt out in AERB/SG/G-1 by Light Water Reactors & Fuel Cycle Facilities Project Section (LWR&FCF-PS) of Nuclear Projects Safety Division (NPSD), AERB. Based on review it is noted that few submissions are required to be made for considering review towards excavation consent. Consequently, NPCIL progressively made various submissions required for excavation.

On May 4, 2018; NPCIL has requested for an early clearance for excavation in pump house area of KKNPP-5&6 along with KKNPP-3&4 pump house excavation citing the construction constraint. The report on applicability of ground motion parameters derived for KKNPP-3&4 to KKNPP-5&6 and the report on geotechnical investigations for the pump house area of KKNPP-5&6 were submitted along with the request. Further, NPCIL resubmitted application to AERB seeking the clearance for excavation of pump house area of KKNPP-5&6 on July 19, 2018. These submissions were reviewed by In-House Review Groups of NPSD. Based on satisfactory review and considering similar layout, design and site parameters of pump house area of KKNPP-5&6 as that of KKNPP-3&4, clearance was granted for excavation of pump house area of KKNPP-5&6 by AERB on July 23, 2018 .

NPCIL submitted revised request with updated status on submissions and compliance to earlier recommendations on October 16, 2018 and same is considered as date of admittance of application.

KKNPP Unit-1&2 Design has already been extensively reviewed in AERB. Since KKNPP Unit-5&6 plant design is a repeat design of KKNPP Unit-1&2 with technological updates and modifications incorporated in the design of KKNPP-3&4, the review process was optimized to detailed review of design differences impacting safety and compliance to AERB safety code on Design of LWRs. The AERB safety code on Design of LWRs and AERB Safety Guide on Consenting Process for NPPs formed the main review basis document for review of Application for Consent of Excavation of KKNPP Unit-5&6. Review was focused towards the requirements related to excavation.

Compliance to relevant Regulatory Codes and Guides were used for checking design changes meets the regulatory requirements vis-à-vis KKNPP-1&2 as already design compliance to requirements specified in these documents have been ensured during the detailed review of KKNPP-1&2. Feedback from commissioning and operational experience of KKNPP-1&2 and associated changes in KKNPP-3&4 were followed up during the review process. Also aspects of Nuclear Security for KKNPP-5&6 have been reviewed.

The application and associated documents viz., Job Hazard Analysis Report, Construction Safety Management Manual, Preliminary Safety Analysis Reports (PSAR) Chapters (Chapter-1 on Introduction and General Description of NPP, Chapter 2 on Site Characteristics & Chapters 3 on Design of Structures, Components, Equipment & Systems), excavation drawings & procedures, excavation schedule, details of construction labor colony roads with respect to construction labor colony and Emergency Preparedness Plan (EPP) were reviewed by Project Design Safety Committee for Light Water Reactors (PDSC-LWR), Nuclear Projects Safety Division (NPSD) of AERB and its Review Groups (NPSD RGs).

Nuclear Security aspects have been reviewed by Committee for Reviewing Security Aspects of Nuclear and Radiation Facilities and Transport of Radioactive Material (CRSA) and its recommendations were taken into account while verifying requirement related to excavation consent.

NPSD reviewed the recommendations of PDSC-LWR & CRSA and verified compliance to regulatory requirements related to excavation and also compliance to MoEF & CC recommendations with regard to AERB. Section-2 and 3 below gives the compliance status with respect to regulatory submission requirements for excavation and

compliance status to MoEF & CC stipulations which are relevant to AERB respectively. NPSD submitted its report for consideration for consideration by Chairman, AERB.

2.0 Compliance to Regulatory Submissions for Excavation

KKNPP-5&6 is a repeat design of KKNPP Unit-1&2 with technological updates & modifications incorporated in the design of KKNPP-3&4 and in general meets the regulatory requirements. Compliance with requirements of AERB/NPP&RR/SG/G-1 in terms of submissions and essential review required for consenting stage of excavation was verified. After submission of application for excavation consent, NPCIL submitted the various documents supporting its application as required by consenting process of AERB for NPPs. Review of all required chapters of PSAR for excavation stage, has been completed with specific attention on experience feedback of KKNPP-1&2 & KKNPP-3&4. Compliance with requirements of AERB/NPP&RR/SG/G-1 for excavation stage of KKNPP-5&6 are given below:

- 2.1 Review of Relevant Safety Analysis Reports (Preliminary):** As required by AERB/SG/G-1, PSAR chapters (Introduction and General Description of NPP, Site Characteristics and Design of Structures, Components, Equipment & Systems) and associated documents were progressively submitted for KKNPP-5&6 along with application for excavation. Review of these PSAR chapters is completed with main focus of review was on design differences with respect to KKNPP-1&2 & KKNPP-3&4 and compliance to AERB safety code on Design of LWRs (AERB/NPP-LWR/SC/D).
- 2.2 Design Basis Ground Motion (DBGM):** NPCIL has proposed to adopt design basis ground motion of KKNPP-3&4 for KKNPP-5&6. The average shear wave velocity of founding strata is a major input for DBGM study. Considering the small reduction (~7%) in average shear-wave velocity between that considered for KKNPP-3&4 and that of KKNPP-5&6 and negligible non-linearity effect of surficial layers, the effect of marginal difference in average shear wave velocity at KKNPP-5&6 on DBGM was considered to be negligible. Hence DBGM developed for KKNPP-3&4 was found acceptable for KKNPP-5&6 also.
- 2.3 Industrial and Fire Safety:** NPCIL submissions related to I&FS of KKNPP-5&6 were reviewed w.r.t. requirements for the consenting stage of Excavation, including compliances w.r.t safety and regulatory requirements specified in Atomic Energy (Factories) Rules, 1996, relevant AERB Safety Codes/Standards/ Guides. NPCIL also

submitted a request to exempt the minor deviations in KKNPP-5&6 buildings related to fire escape doors & fire exits from 100% compliance of provisions of AE(F)R as exempted earlier for KKNPP-3&4 since there are no changes in internal layout of main plant buildings as it is a repeat design of KKNPP-3&4. Considering that KKNPP-5&6 layout is same as KKNPP-3&4 and noting the low occupancy of the buildings during all operating states of the NPP and the cascading impact of modifying the supplier design, condonation to the deviations as requested by NPCIL was granted to KKNPP-5&6 by Competent Authority under Rule 42(15) of the Atomic Energy (Factories) Rules, 1996 subject to stipulations (similar to KKNPP-3&4).

In general, AERB has been reviewing the industrial safety aspects by safety review and by conducting regular regulatory inspections to check the compliance to the Atomic Energy (Factories) Rules, 1996. The observation/deficiencies noted during the safety review/inspections have been regularly brought to the notice of the project management for implementation.

2.4 Excavation Procedure: NPCIL submitted documents covering brief statements on excavation procedure, quality assurance plan, dewatering system, in line with the documents approved for Units-3&4. It was also informed that, the final work procedures and QAP will be prepared by the contractor, once contract for the excavation job is awarded, and the same will be submitted for review.

NPCIL to submit to AERB all related documents prepared by contractor including excavation & dewatering procedure, QAP, confirmatory investigations & consolidation grouting procedure. The review by AERB should be satisfactorily completed before start of respective works.

2.5 Meteorology: Kudankulam site is a coastal site, and experiences a tropical climate. The meteorological parameters from the nearby meteorological station at Kanyakumari (for year 1970 to 2008) and recorded data from met station at KKNPP site (for year 2003 to 2017) were used to arrive at the design basis parameters corresponding to wind, temperature and rainfall, taking into account latest AERB regulations. The latest recorded data have been cross-verified with respect to the approved design basis values of corresponding parameters, and it was confirmed that, none of the latest recorded data exceed design basis values. After satisfactory review of data, it is

concluded that design basis parameters derived for KKNPP-3&4 may be used for KKNPP-5&6.

- 2.6 Hydrologic Engineering:** Kudankulam site is a coastal site on the shores of Gulf of Mannar located on the South-Eastern tip of India near Kanyakumari. The DBFL and BDBFL estimated for KKNPP site, are +5.56 m MSL and +6.16m MSL respectively (due to cyclonic storm), which were already reviewed and approved by AERB during consenting review of KK Units 3&4, and is based on latest AERB regulations. NPCIL informed that no flooding event has been witnessed/recorded since the approval, which could potentially impact or change the design basis values. Hence, the same design basis and beyond design basis values, as already approved, will be adopted for design of KKNPP-5&6, which was found acceptable.
- 2.7 Emergency Preparedness Plan:** Emergency Preparedness Plan (EPP) Manual covers three parts i.e. (1) Plant emergency (2) Site Emergency and (3) Off-Site emergency. Emergency Preparedness Plan (EPP) manual for KKNPP was reviewed by AERB and was subsequently issued by NPCIL in June, 2011. Due to construction activities at KKNPP-3&4, Site EPP manual was updated. Further, NPCIL has now revised Site EPP manual including the personnel involved in construction activities and any other specified requirements of KKNPP-3&4 and KKNPP-5&6 along with identification of the assembly areas for employees and workers of KKNPP Units 3 to 6. After satisfactory review, the document on Site Emergency Preparedness & Response Manual of KKNPP Site (Vol-II, Rev-1) was approved for use by SARCOP on September 19, 2018.
- 2.8 QAP for Excavation:** Quality Assurance Plan (QAP) for pit excavation, confirmatory geotechnical investigation and consolidation grouting has been submitted and reviewed satisfactorily by AERB. NPCIL was asked to include the limiting value of PPV for green concrete and actions to be taken if limiting value of PPV is exceeded during actual blasting in QA plan. NPCIL informed that this aspect is taken care by specifying safe charges for various ages of concrete in the Work procedure of excavation.
- 2.9 Construction Colony:** NPCIL submitted a drawing on overall Site layout indicating the construction labour colony roads and labour colony, which was found acceptable.

2.10 Nuclear Security: Site submitted compliance to recommendations made during siting clearance on nuclear security aspects along with a status of complying the requirements related with excavation. Site is complying with earlier recommendations made during siting consent. In case of excavation, Site has complied with certain recommendations and for others, has made commitment to comply with prior to appropriate stage of the project. Compliance of the relevant points/issues will also be checked during regulatory inspections. NPCIL should comply with all the Nuclear Security related recommendations.

2.11 General: Submissions such as Construction schedule (from ground breaking to scheduled criticality) and Excavation drawings (general arrangement showing all safety aspects, slopes and approaches) were submitted and satisfactorily reviewed by AERB.

3.0 Compliance to MoEF & CC stipulations relevant to AERB by Applicant

The Ministry of Environment & Forests and Climate Change (MoEF & CC) had issued Environmental Clearance for KKNPP-3&4 on December 31, 2009 with validity period of 5 years. Subsequently, the validity has been extended upto December 30, 2019. In the Environmental Clearance Letter issued for KKNPP-5&6, for certain stipulations, AERB was referred. The status of compliance to MoEF & CC stipulations for KKNPP-5&6 by Applicant as relevant to AERB is brought out below:-

3.1 AERB clearance for Site: AERB clearance for Site shall be obtained before starting any construction work and a copy of same shall be provided to MoEF & CC.

Compliance Status: AERB granted Siting Clearance for KKNPP Units 3 to 6 (vide Ref. CH/AERB/199/KKNPP-3 to 6/2011/506) on February 9, 2011. AERB has granted revalidation of the Siting Consent of KKNPP-5&6 for another 5 years (i.e., up to February 8, 2021) on March 3, 2016 after satisfactory review of submissions made by NPCIL in this regard. It is noted that NPCIL has been submitting half yearly compliance status reports to MoEF & CC.

3.2 Monitoring of Radioactivity Releases: Regular monitoring of conventional gaseous pollutants, radioactive pollutants in air as well as in discharged water shall be monitored regularly as per AERB standards. During plant operation, regular monitoring of radioactive pollutants in air through stacks will be carried out.

Compliance Status: Plant design ensures that radioactive gaseous discharges do not exceed the limits prescribed by AERB. The design features for assuring the above requirements will be submitted in PSAR on “Radioactive Waste management” along with Application for Consent of First Pour of Concrete. The requirements on monitoring as well as limiting values will be translated into Technical Specification for Operation and same will be reviewed by AERB prior to issuing clearance for Initial Fuel Loading of KKNPP-5&6. During plant operation, radioactivity of sea water at main outfall point and other discharges will be regularly monitored.

3.3 Emergency preparedness Plan: A disaster management plan and Emergency Preparedness Plan shall be prepared and put in place as per norms of AERB.

Compliance Status: Emergency Preparedness Plan (EPP) Manual covers three parts i.e. (1) Plant emergency (2) Site Emergency and (3) Off-Site emergency. Emergency Preparedness Plan (EPP) manual of KKNPP-1&2 was reviewed by AERB and was subsequently issued by NPCIL in June, 2011. Due to construction activities at KKNPP-3&4, Site EPP manual was updated. Further, NPCIL has now revised Site EPP manual including the personnel involved in construction activities and any other specified requirements of KKNPP-3&4 and KKNPP-5&6 along with identification of the assembly areas for employees and workers of KKNPP Units 3 to 6. After satisfactory review, the document on Site Emergency Preparedness & Response Manual of KKNPP Site (Vol-II, Rev-1) was approved for use by SARCOP on September 19, 2018.

Plant Emergency EPP manual of KKNPP-5&6 will be prepared and issued by NPCIL prior to start of operation of KKNPP-5&6. AERB ensures the availability of EPP manual and implementation of its requirement prior to issuing clearance for initial fuel loading.

3.4 Treatment & Management of Radioactive of Radioactive Wastes: Radioactive waste shall be managed as per norms prescribed by AERB.

Compliance Status: Details on design features of solid, liquid and gaseous waste management system of KKNPP-5&6 will be submitted in PSAR on “Radioactive Waste management” along with Application for Consent of First Pour of Concrete. AERB through its regulatory inspections will also ensure compliance with these requirements once plant is made operational. Please see 3.2 above

AERB Stipulations and Conditions for Excavation of KKNPP-5&6

- S.1 All the requirements mentioned in QAP for Excavation should be implemented including provision of organizational set-up with sufficient manpower and appropriate experience for safety supervision for all activities etc.
- S.2 NPCIL to submit all identified documents prepared by contractor for satisfactorily review prior to start of respective works.
- S.3 The system of regulating traffic with help of marshals/stewards should be implemented at Site in the excavation and dumping areas.
- S.4 Trial blast vibration studies to confirm the safe charge per delay should be carried out through an authorized agency and report submitted.
- S.5 In addition, the following stipulations shall always be adhered to:
- Safety requirements of the Atomic Energy (Factories) Rules 1996 and relevant AERB Directives/Notifications;
 - Adequate QA shall be effectively implemented to ensure compliance to AERB Safety Code on 'Quality Assurance in NPPs'; AERB/SC/QA (2009);
 - Regulatory requirements related radiation protection and emergency preparedness;
 - Significant Event or Change should be reported as per ECRP guidelines; and
 - All applicable Statutory Clearances should be available before start of Excavation and their stipulations complied with.
