Questions & Answers on National Report of India for 8th Review Cycle of CNS

Question Id	Ref. in National Report	Question / Comment	Answer
26114	P97, 13.2.8 the last sentence	Are the QA group staff qualified for inspections and testing as well as audit? How many staff are qualified at NPP in India? It is appreciate if you give us average number of qualified staff.	All personnel engaged by Utilities in India for carrying out Quality Assurance (QA) functions are qualified in their respective area of works. Some of the personnel from QA carry out audits and they are all certified auditors. About 80 percent of personnel in QA are qualified in special processes like Non-Destructive Examinations (NDEs).
28899	Chapter 16.2.6	Emergency training and exercise: Some of the NPP sites are close to big cities, for example Tarapur NPP. What is the evacuation plan for such big cities?	In the existing emergency response framework, Emergency Planning Zones are identified around each NPP site including Tarapur site. Details of the population and infrastructure available are maintained and emergency plan for each sector in the emergency planning zone is clearly identified.
24008	Section 11.1.1, page 78	Could you tell us more about the formation of the nuclear damage liability Fund?	The maximum amount of liability in respect of each nuclear incident shall be the rupees equivalent to 300 million SDRs. The liability of an operator for each incident shall be INR 15 billion. To cover the gap between 300 SDRs and INR 15 billion, Government of India has established Nuclear Liability Fund in 2016.
28898	Chapter 15.1	Radiation protection: This chapter does not contain the dose limits in case of emergency events and life rescue situations. It is recommended to supplement it.	IAEA GSR Part-3 specifies only guidance values for restricting exposure of emergency workers. The same have been adopted in Indian regulations and are reproduced below: Plant operating organisation and response organisation should ensure that emergency worker is not subjected to exposure in excess of 50 mSv except under following conditions:- 1. Life saving actions: Effective Dose <500 mSv This value may be exceeded under circumstances in which (a) the expected benefits to others clearly outweigh the emergency worker's own health risks, and (b) the emergency worker volunteers to take the action and understands and accepts this health risk 2. Actions to prevent severe deterministic effects and actions to prevent the development of catastrophic conditions that could significantly affect people and the environment: Effective Dose <500 mSv 3. Actions to avert a large collective dose: Effective Dose <100 mSv
28347	Article 15	How often is the training of workers involved in radiation hazardous work?	Training of radiation workers employed at Indian Nuclear Power Plants is done initially at the time of employment and subsequently re-training is given once in a year.
28492	2	What constitutes pre-consenting review by AERB, is	Please refer response to QuestionId-23759 (Sequence-12) from Pakistan.

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		the design review in relation to a particular site in the case of a design pre-consenting review? / India discusses what it terms a pre-consenting review by AERB for their nuclear power plant licensing process.	
28302	Page 137	With regard to emergency preparedness exercises, has India considered conducting joint-exercises or trainings with neighbouring countries to prepare for transboundary radiological incidents?	The neighbouring countries are at large distances from the location of operating NPPs and projects under construction and no transboundary implications are expected. India is signatory under the 'Convention on Early Notification of Nuclear Accidents' and 'Convention on Assistance in case of Nuclear Accident or Radiological Emergency'. Under these Conventions, India actively participates in the emergency exercises through CMG-DAE, the national contact point. In the last three years (April 2016 to March 2019), India participated in ConvEx exercises which includes ConvEx-1, ConvEx-2a, ConvEx-2b, ConvEx-2c and ConvEx-3 exercises.
28311	Page 23	Have there been regulatory reviews on the subject and assessment of the effectiveness of measures implemented at nuclear installations to prevent cyber intrusions? / We understand that there was a cybersecurity incident reported at India's Kudankulam Nuclear Power Plant in September 2019. Even though nuclear facilities may be air-gapped, they can still be vulnerable to targeted attacks (e.g. insider).	Yes, through regulatory reviews and inspections, effectiveness of measures implemented at nuclear installations to prevent cyber intrusions is ensured.
27890	Page 174	The report states that additional facilities for spent fuel storage are in the form of Away From Reactor-Spent Fuel Storage Bays and Dry Storage Facilities. Canada has the following questions regarding the Away From Reactor-Spent Fuel Storage Bays: 1. Please provide a few examples of when the Away	1. As per the current practice, the Away From Reactor-Spent Fuel Storage Bays (AFR-SFSB) are used for storage of spent fuel shifted from Spent Fuel Storage Bays (SFSBs) of NPPs, if required. The practice of transferring the spent fuel to dry storage facility was followed in the earlier days for two NPPs. 2. As mentioned in section 19.8.1 under article-19 of the national report, the storage bays at PHWRs are typically designed to accommodate spent fuel accumulated during 10 reactor years of full power operation. In addition, space is also reserved for storing one full core inventory of spent fuel. In VVER

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		From Reactor-Spent Fuel Storage Bays are used instead of Dry Storage. 2. What age of spent fuel is able to be transferred to the Away From Reactor-Spent Fuel Storage Bays? 3. How is fuel transferred from the primary Spent Fuel Storage Bays to the Away From Reactor-Spent Fuel Storage Bays?	type LWRs at KKNPP-1&2, the storage bays are designed to store spent fuel accumulated during ~7 reactor years of full power operation as well as reserved space for one full core inventory of spent fuel. Subsequently, the spent fuel can be transferred to Away From Reactor-Spent Fuel Storage Bays. 3. Spent fuel transfer from the primary Spent Fuel Storage Bays to the Away From Reactor-Spent Fuel Storage Bays is governed by AERB regulations on transport of radioactive material.
28215	1.8	When do you plan to operate KKNPP 3,4 and 5,6	Commercial operation of KKNPP-3,4 and KKNPP-5,6 is planned in the years 2023 and 2025 respectively.
27888	Page 79	The report discusses the decommissioning levy collected as part of tariff. What would happen if a plant had to unexpectantly decommission ahead of schedule, due to an accident or other reason, and there were not enough funds collected to successfully complete decommissioning? Where would the extra needed funds come from?	As per the directive of Department of Atomic Energy (DAE), NPCIL is collecting decommissioning levy from consumers for decommissioning of nuclear power plants on behalf of DAE, Government of India (GOI). This fund take will take care of de-commissioning expenses of any reactor as and when requirement arises.
27889	Page 109	The report states that management of radioactive waste authorizations are valid for five years and are renewed based on reviews and assessments. What would happen to the waste on site if an authorization was not renewed?	Authorizations for safe disposal /transfer of radioactive wastes from NPPs are issued by AERB under the provisions of Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987. If the authorization for waste disposal for any NPP is not renewed then facility will not be able to discharge/transfer the waste. In such a case, AERB is empowered to give directions for safe storage of the radioactive waste at the site and curtail operation of the facility in order to prevent further generation of waste. As per the licensing condition, the responsibility for safe custody of radioactive waste as part of source control regime lies with operator even after suspension of licence of operation.
27886	Page 49	The report discusses training programs for AERB employees, is there a training program specific to inspectors?	Subsequent to recruitment , AERB officers undergo on-the-job training and field training in various facilities under the purview of AERB. These officers after successful completion of their training undergo orientation course organized by AERB for familiarization of regulatory processes including regulatory inspection.

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			Subsequently, these officers are deputed as a part of regulatory inspection team as a trainee inspector under the mentorship of qualified inspector (s) for a pre-defined number of inspections. Finally, AERB conducts a formal assessment for the suitability of the officer, after which he/she is authorised as an inspector.
27887	Page 79	The report states that the oldest reactors are the two boiling water reactors at Tarapur that have completed 50 years of operation. What is the design life of these reactors and when do you intend to shut them down?	TAPS-1&2 reactors were designed for 40 Effective Full Power Years (EFPYs), and so far 28 EFPYs have been completed. SSCs of these reactors are generally in sound condition. These units undergo PSR for their continued operation. Subsequent to completing 30 years of operation, these units had undergone comprehensive safety assessment for their continued long-term operation, and identified safety upgrades were implemented in both the units during November-2005 to January-2006. Based on the comprehensive safety assessments carried out for TAPS-1&2 subsequent to the accident at Fukushima Daiichi NPP, a number of safety upgrades have been implemented in these units, which include hookup points for external water injection, strengthening of resilience to external events, installation of CFVS and enhancement of accident management programme (please refer section 18.1 under Article-18 of the National Report). Also, please refer answer to QuestionId-23899 (Sequence-13) posted by Ukraine.
27885	Page 48	The report states that AERB has a staff strength of 339. How many TSO employees does AERB have access to?	The technical support to AERB from BARC is provided on the basis of the safety issues under consideration. Depending on the issue, AERB seeks the technical support and expert advice from the TSO. Apart from this, the identified expert from the TSO serves as member in AERB's safety review committees, which are providing inputs for safety reviews.
27883	Page 16	The report discusses Safety Culture, is Security Culture embedded in Safety Culture?	All observations (including security related) that affect safety are considered as input for independent assessment and fostering. However, confidential security related observations are dealt separately.
27884	Page 48	The report states that another important resource for AERB's safety review and safety documents development work is the large pool of retired senior experts. Does AERB have a knowledge management plan so that you can transition away from relying on retired	Yes. As explained in Page 17 (Summary) and Page 49 (section 8.1.2.5 under Article-8) of the National Report, AERB has a strategy in place to enhance the knowledge & competence of its existing staff and to retain the knowledge & experience of the limited number of personnel who are leaving the organisation on superannuation. One element of this strategy is also to enhance the reliance on in-house expertise in the regulatory review activities as articulated in the integrated management system of AERB. In

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		employees for their knowledge and expertise?	accordance with this, AERB is pursuing many activities. AERB engages the experienced personnel as consultants who have retired from AERB as well as from TSOs, to support in the safety review activities. This was primarily in the form of members of some of the committees of AERB, wherein the younger staff of AERB could undergo on-job training/mentoring in the review activities, apart from the experienced regulators. Recently, AERB has taken steps to further reinforce the in-house R&D and analytical competences by engaging the domain experts who have retired from AERB and its TSOs. These experts are engaged to mentor and guide the younger AERB staff in identifying & managing safety related R&D projects & experimentation and enhance the in-house analytical capabilities & infrastructure. This programme has provided an added impetus to the competence development programme of AERB. It is also worthwhile to mention that while AERB engages the retired experts in some of the review activities, the regulatory assessment and decision making is entirely based on its in-house expertise and AERB has the necessary technical and regulatory competence for the same.
27609	page 129	The report notes that AERB is developing new guidelines for emergency preparedness and response. How is AERB concurrently considering what drills and exercises will need to accompany this new guidance?	AERB is considering the following types of off-site emergency exercises to assess the preparedness considering the new guidelines: 1) Table Top exercise with emphasis on decision making on classification of emergency and identification of protection strategy. 2) Integrated Command Control and Response exercise to test the command control functions, response timeline, initial response and communication & co-ordination among various response agencies 3) Field exercise to test the resources and field actions. The above thematic aspects are also covered during the Plant and Site Emergency exercise. The section 16.2.6-ii under Article-16 of the National Report may also be referred.
27882	Page 3	Canada recommends that India ratify to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.	It is noted that the comment from Canada is not related to any of the obligations under the Convention on Nuclear Safety (CNS). With respect to safe management of spent fuel and radioactive wastes, detailed account on how India ensures safety and fulfills the obligations under the CNS is given in section 1.3 in 'Introduction' on Page 3 and section 19.8 under Article-19 on Pages 174-176 of the National Report.

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27092	10.5, p. 75	According to the National Report safety culture process inputs by SCAP members are evaluated against set criteria on safety culture. Which are the main issues in the set of criteria? Are the criteria based on technical issues and knowhow only?	The criteria are prepared based on the "Principles for a Strong Nuclear Safety Culture" issued by INPO in November 2004. It was modified to cover radiation safety, industrial safety / occupational safety and environmental safety in addition to nuclear safety, as applicable to NPCIL. Criteria are mainly based on behavioural aspects.
27608	page 24	Have there been follow-up inspections of KAPS-1 subsequent to the corrective actions from the pressure tube leaks? Please share the regulatory findings.	Yes. There have been follow-up inspections of KAPS-1 subsequent to the corrective actions from the pressure tube leaks as per the inspection plan. Further, AERB Site Observer Teams (SOTs) are continuously posted at the site and witness day-to-day activities including surveillance tests. In line with the methodology described in section 14.1.2.5.iii under Article-14 of the National Report, the En-Masse Coolant Channel Replacement (EMCCR) activities and return to service of KAPS-1 were subject to stage wise clearances by AERB. After EMCCR, pre-service inspection of newly installed pressure tubes was carried out, the results of which were reviewed in AERB and found to be satisfactory. The pre-service tests of AGMS at KAPS-1 in modified operational mode (i.e. in line with new PHWRs) were also satisfactory. Strengthened specifications of AGMS, quality checks and surveillances are being followed at the station. Performance of all the safety systems has been observed to be satisfactory. The scope of in-service inspection programme of coolant channels has been strengthened for all operating PHWRs by including a requirement of periodic inspection for localized corrosion on outer surface of pressure tubes.
27090	p. 56	It is stated in the National Report that AERB is administratively and financially independent. Could India please explain in more detail, how independency is ensured?	Please refer answers to QuestionId-25025 (Sequence-81) posed by Belgium and QuestionId-26393 (Sequence-85) posed by France.
27091	10.5, p. 75	It is stated in the National Report that AERB has developed indicators for assessing the safety culture of NPPs. Are the indicators common for all NPP types or specific for each NPP type?	The indicators developed by AERB for assessing safety culture of NPPs are common for all NPP types in India.

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27089	General	Does India have separate Safety Guidelines of NPP with different types of reactors?	Currently, safety requirements in India are of generic nature with respect to site evaluation, construction, quality assurance, operation, radiation protection, radioactive waste management, emergency preparedness and response. With respect to design, currently, separate set of requirements are stipulated for PHWR based NPPs, LWR based NPPs and a separate safety criteria for sodium cooled fast reactor based NPPs. An exercise of harmonization of design safety requirements of different reactor types is currently in hand, which will eventually lead to a set of generic criteria as well as certain technology-specific safety requirements corresponding to the specific reactor type.
26501	summary	In his report, the President of the 7th review meeting had recommended that Contracting Parties consider the implementation of the good practices that where identified during the meeting. Could your country provide information on the actions carried out with regards to the implementation of those good practices in your country ?	India has a robust operating experience feedback system. Since India started participating in the Review Meetings of CNS in 2008, the inputs from CNS are also considered in the Operating Experience Feedback (OEF) system. One of the important aspects considered for inclusion in the OEF process is the Good Practices (GPs) of other Contracting Parties (CPs), as well as those identified in the review meetings. These are considered appropriately for adoption of improvements in the Indian systems. During the 7th Review Meeting, the GPs identified were with respect to proactive topical safety reviews , nuclear safety co-operation with other countries, enhancing transparency in the regulatory process and outreach to members of the public. India already has a number of existing programmes covering the areas identified as good practices during the 7th Review Meeting. To name a few, the regulatory system incorporates a system of proactive 'special safety reviews' as mentioned in the National Report for 8th Review Meeting (Page 15 of Summary and section 6.5 under Article-6). In the area of nuclear safety cooperation, AERB has a bilateral agreement with regulators of many countries as listed in the National Report. Recently, AERB has entered into bilateral cooperation with BAERA and is providing support as sought (refer Article-8 of the National Report). With respect to enhancing transparency in the regulatory processes, AERB has taken new initiatives such as conducting National Conference on Regulatory Interface (NCRI), an updated website with interactive features (refer section 8.5 under Article-8 of the

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			National Report). AERB also provides funds to independent researchers and institutes for taking up research on topics of regulatory interest (section 8.1.2.7 under Article-8 of the National Report). India has legal provisions in place requiring the industrial ventures to engage with the local communities. Under this programme, utility carries out a number of Corporate Social Responsibility (CSR) activities around NPP sites including public outreach activities. (refer section 9.4 under Article-9 of the National Report).
27088	General	India operates many different types of NPP. Could India please inform whether there are differences by the licensing procedures for each separate types of reactors? Are the same teams of experts of the Regulator involved in the licensing procedure for NPPs different reactor type?	The legal requirements as well as approach with respect to licensing of NPPs and review of licensing documentation for all types of reactors are essentially the same. However, some enhancements with respect to scope and detailing of the reviews can be expected depending on the use of specific standards used in design / construction, use of First Of A Kind (FOAK) systems, etc. AERB has regulatory staff trained in different types of reactor technologies, hence, their involvement in safety review and assessment for licensing of NPPs of various technologies is accordingly decided. However, domain experts available in AERB such as for radiation protection, in-service inspections, quality assurance, computer based systems, etc. are utilized in safety review and assessment activities for all NPP types.
26398	Summary p.13	Could India indicate how the rapid expansion of the nuclear power programme affects the emergency preparedness regulation and especially any harmonization with neighbouring countries about planning zones?	For the purposes of harmonising the emergency arrangements at an international level, India participates in IAEA technical meetings on emergency preparedness & response standards, IAEA ConvEx exercises periodically. India has also participated in IAEA IRRS mission which helped to harmonize Indian EPR plans with international standards. The neighbouring countries are at large distances from the location of operating NPPs and projects under construction and trans boundary implications are not expected.
26396	§ 13 p.93 to 98	Could India precise procedures and guidance to manage detection of non-conforming, counterfeit, suspect or fraudulent items received from suppliers before they are installed in the plant? Could India precise the inspection program focusing on preventing and detecting the incorporation	Measures for prevention, detection, control and disposal of CFSI exists. These involve prevention at source by inspection of items at source by qualified QA personnel. All items inspected are positively identified. Items are checked on receipt at Nuclear Power Plant (NPP) sites including verification of identification as per source inspection records. Items and equipment are again checked before installation/erection in the plant.

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		of non-conforming, counterfeit, suspicious and fraudulent items?	
26397	§ 14.1.2.4 p.105 and 106	Could India indicate how the results of the Periodical Safety Review of old Nuclear Power Plants are integrated in the review of Nuclear Power Plants under construction?	The regulatory system in India incorporates the necessary mechanisms which ensure that the review processes for new and existing NPPs take account of evolution in technology, regulatory practices and lessons learned from operating experience. For NPPs under construction, the Operating Experience Feedback (OEF) system takes into account the results of regular safety reviews and Periodic Safety Reviews (PSRs) of operating NPPs. The management systems in the utility as well as AERB have mechanisms built-in for this purpose. Some of the important areas in which this feedback is utilized is ageing management, quality assurance, safety related equipment/ system design, etc.
26394	§ 8.5 p.55 and 56	Could India describe more precisely the way of involving the comments or views from the public in the process of regulatory requirement documents?	As per the established process for revision/development of regulatory requirement documents, the draft requirements are shared with experts and institutions (including TSO and stakeholders) for their review and comments. The comments are addressed appropriately while finalising the documents. The final draft of the requirement documents before approval are placed in the website of AERB for a specified period for obtaining public comments. The comments received are appropriately addressed in the final version before approval. Apart from this, AERB has provided a mechanism, wherein the members of public can provide comments on any of the published regulatory documents through e-mail. The comments obtained are reviewed from time to time and addressed appropriately during the revision along with feedback from the users.
26395	§ 10.5 p.75	Could India provide more information on the outcomes issued from the safety culture survey carried out for the Atomic Energy Regulatory Board AERB staff, in particular if an action plan for improvement of the safety culture has been prepared and implemented?	Results of the safety culture survey conducted for the AERB employees was analysed and mapped to the established safety culture attributes. Based on the survey result, it was found that there was a scope for further improvement in the safety culture attribute related to transparency between the management and the staff. Subsequently, management action was initiated and transparency was increased by establishing a clearer reporting structure and the job allocation of the employees.
26392	Summary p.17	Could India explain how the knowledge required for the activities is effectively formalized and mobilized when the time comes	As explained in Article 11, section 11.2, Availability of qualified and trained manpower for the nuclear power programme has been one of the strengths in India. The core of the manpower for the nuclear power programme comes through established BARC training

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		(identification of critical knowledge, capitalization, transfer, applicability)?	schools and NPCIL's Nuclear Training Centres. Dedicated Knowledge Management groups have been set up in all organisations of DAE to pool and disseminate the available knowledge base and further augment it to meet the challenges of the future. The knowledge management programmes include identification of functional areas requiring improvement, incorporation of knowledge management systems to promote capturing of implicit knowledge, supporting the effective dissemination of knowledge and its preservation. Engineers and scientists of AERB, BARC and NPCIL participate in several international training programmes conducted by the IAEA and other organisations to further enrich their capabilities. In addition to the above, the country also has a large pool of retired experts in nuclear science & technology, whose services are utilised for specific areas of the nuclear power programme. With regard to regulators' knowledge management aspects, please refer sections 8.1.2.4 and 8.1.2.5 under Article-8 of the National Report.
26393	§ 8.1.2.6 p.49	Could India precise what provisions for adequate financial resources are made to enable the Atomic Energy Regulatory Board AERB to recruit and retain personnel with the necessary competencies?	AERB prepares its annual budget and the same is placed in the Parliament thorough the AEC. After passing of the finance bill, the funds are appropriated to AERB and it has full powers to operate its budget. The proposals for augmentation of human resource of AERB are worked out within AERB and recruitment is made through governmental mechanisms. AERB has multiple ways of induction of its human resource. Fresh technical & scientific staff are inducted from various BARC training schools and Nuclear Training Centres as well as from Indian Institutes of Technology. Direct recruitment of experienced professionals is also done through open advertisements. To retain the personnel, AERB provides conducive work environment, challenging assignments, performance based career progression, opportunities for higher education and other avenues for competence enhancement. The above enables AERB to recruit and retain personnel with the necessary competencies.
26112	Article 8.5 P55	I think it's "good practice" if regulatory body receives the comments from the users and stakeholders (TSO, public, etc), every time the regulatory documents is revised.	India thankfully acknowledges the comment from Japan. With respect to the time for obtaining comments, kindly refer to answer of QuestionId-26394 (Sequence-86) from France.

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		Could you tell me how long is an application period of the comments. (If this application period of the comments is too long , the regulatory body can't implement measures promptly, while too short, can't do the enough discussion.)	
26113	Article 8.5 P 56	Could you describe more about "the major regulatory decisions" which regulatory body issues on AERB website. Does the regulatory body issue all "decisions" to public ? If the answer is "no", please tell me the reason and what kind of "decisions" which regulatory body doesn't issue ?	Yes, all regulatory decisions of AERB are made public. The major regulatory decisions which AERB uploads on its websites pertain to grant of licenses for important milestones of nuclear power projects such as siting, first pour of concrete, initial fuel loading, first approach to criticality, regular operation, etc. Regulatory decisions related to any enforcement actions such as suspension of operations or withdrawal of licenses / authorizations are also uploaded on website. Besides, as part of public information, Press Releases on major safety related events are issued as and when required. Apart from these, all other regulatory decisions and activities are summarized and published in annual report and newsletters, copies of which are made available on AERB's website.
25024	§8.1.2.5, pzge 48	The human resources as of March 2019 are indicated. However, what was the trend of the human resources over the last three years?	The trend of human resources over the last three years is as follows: December 31, 2017 – 340 December 31, 2018- 340 As of November, 2019, the staff strength of AERB is 343.
25025	§ 1.0 and 1.1, page 1	Besides the regulatory body AERB (of which we suppose that it is a government "owned" organisation), we understand that also the Nuclear Power Corporation of India Limited is a Government owned company, reponsible for design, construction and operation of the NPPs (thus being the main Licensee for the NPPs). From which ministries are both state "owned" organisations (AERB and NPCIL) depending? What measures are taken to ensure	Atomic Energy Regulatory Board (AERB) was established in 1983 through a notification by the President of India under the provisions of the Atomic Energy Act, 1962. With the statutory and legal provisions of the Act and various rules framed thereunder and the powers conferred by its constitution, AERB has the necessary legal authority for its regulatory activities. The mandate of AERB doesn't include any functions other than regulation of safety of nuclear and radiation facilities. AERB is responsible to the Atomic Energy Commission (AEC) and its responsibility to AEC is limited to presenting its Annual Report and budget proposals once in a year. Nuclear Power Corporation of India Limited (NPCIL) reports to DAE and DAE reports to AEC. AEC reports to Prime Minister of India.

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		adequate independence between the two organisations?	These provide functional independence for the AERB as a regulator.
25022	§ 16.2.5.4 (page 135) & 16.2.6 (page 138)	Nuclear or radiological emergency is declared as terminated through a formal decision taken after prior consultation of all stakeholders, as appropriate. Could the consultation process and the identification of the stakeholders be elaborated? Have these arrangements (stakeholders consultation, formal decision...) already been tested during nuclear/radiological response exercises? If yes, what are the main lessons learned? According to the understanding of the §16, there is no tranisition phase between the urgent response phase and this formal declaration of the nuclear or radiological emergency. Why not considering such transition phase (in accordance with IAEA GSG-11 publication)?	Decision on Termination of emergency is made by the Local authorities based on the recommendation from DAE, which is the nodal department for technical support, primarily based on the identified criteria for termination of emergency. Based on this recommendation, after consultation with the stakeholders, including response agencies (national, state and local authorities identified for emergency management) the decision on termination of emergency is taken. During emergency exercises, the termination of the emergency is based on the advice of CMG-DAE and in consultation with local authorities and these arrangements are found to be satisfactory. The response to emergency is carried out in accordance with the various phases of emergencies viz. early phase, intermediate phase and late phase. Conceptually, early and intermediate phase can be considered similar to emergency response phase (urgent & early) and transition phase as identified in IAEA GSG-11.
25023	§ 7.2.1.1 (page 34) and Annex 7-2 (page 42)	From the description in § 7.2.1.1 and from Annex 7-2, it seems that there is no specific Rule applicable to NPPs. In particular, in the figure of Annex 7-2, we would expect to find a Rule on NPP, that acts as a higher level document for the Safety Codes and Safety Guides. Does such a Rule for the NPPs exist or are NPPs covered under "Factories"?	The Rules described in Section 7.2.1.1 under Article-7 of the National Report are applicable to all the nuclear facilities which include NPPs. For NPPs, Atomic Energy (Radiation Protection) Rules, 2004, specify the high level requirements as well as empowers AERB for establishing regulatory requirements in the form of safety codes and standards. Definition of 'Factories' under Atomic Energy (Factories) Rules, 1996 also cover NPPs, hence these Rules are also applicable to all Indian NPPs.
25020	§ 10.3.3 (page 74)	In this article, it is mentionned that event based EOPs and AMG are implemented/available at all NPPs whereas additional	Indian NPPs rely on event based EOPs to handle plant transients and events. Such EOPs require identification of the event, which is carried out with the set of parameters (as expected in the event). Therefore, existing EOPs take full cognizance of Plant response

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		symptom based EOPs are under implementation. Why such symptom based EOPs have not being developed and implemented earlier (in many countries, such developments have been initiated after TMI) ? How are this new symptom based EOPs articulated with the event-based EOPs and the AMG?	(parameters or symptoms) for event identification and therefore are symptom oriented - event based. These procedures are supplemented by symptom based. During an event handling, event based procedures are used and in parallel, symptom based scheme (a computer based system) confirms that plant is returned to a safe state. In case event based procedures are not successful; actions, as recommended by symptom based procedures, are to be taken. Both event and symptom based EOPs are for the design basis domain. Accident Management Guidelines (AMGs) is a separate set of guidelines/procedures for handling beyond design basis scenario.
25021	§ 10.5 (page 75)	AERB is in the process of developing mechanism for safety culture assesment of the NPPs based on in-house developed indicators. Could India give more precise information on these developed/used indicators?	The indicators selected for assessment of safety culture of operating NPPs are based on various international practices and guidance including OECD-NEA document titled 'Improving nuclear regulation', IAEA Guide on 'Management of Nuclear Installations' GS-G-3.5, etc. The attributes against which safety culture of an operating NPP is assessed include, among others, the following: 1. Frequent deferral of needed improvements 2. Long delays to meet regulatory commitments 3. Failure to follow procedures
24971	Page 142	The report stated "Decision Support System (DSS) for nuclear emergencies is intended to provide comprehensive and timely information to emergency managers on an emergency situation arising from a nuclear accident", Does India Regulatory Body acquire real-time data from NPP e.g power reactor, in and out temperature cooling system, flow rate of primary system etc?	AERB's role during emergency is to monitor and keep itself informed about the emergency situation. Hence, AERB does not require real time online plant data. During emergency situations, AERB is updated on the situation periodically by the utility as per the reporting requirements. This facilitates assessment and monitoring of the situation. In addition, DSS inputs are also made available in NREMC of AERB for monitoring purposes. Real time plant data is available online at NPCIL headquarters, which is made available to AERB on demand.
24972	Page 82	The report stated "Simulator training mainly provides experiential learning of control room operation. Training is based on the approved guidelines for normal operations i.e. start-ups / shutdowns, handling of anticipated operational	Emergency Operating Procedures (EOPs) are used for handling anticipated operational transients as well as accident conditions (i.e. DBA). Details are included in section 19.4 under Article-19 of the National Report. These EOPs are part of control room operator licensing curriculum which also includes simulator training. The control room operator licensing curriculum is prepared based on requirements/ recommendations in relevant AERB Safety Codes and Guides and is approved by

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		occurrences (AOOs) and use of emergency operating procedures (EOPs) related to main plant". The IAEA has published Specific Safety Requirements /SSR-2/1 rev 1. Safety of Nuclear Power Plant Design, Plant state shall typically cover normal operation, AOO and DBA. How AERB ensures the skill of operator and supervisor reactor to manage the DBA situation?	AERB. Candidates have to complete the licensing curriculum including simulator training before appearing for final assessment interview (kindly refer section 11.2.3.2 (iv) in the National Report). The final assessment committee is constituted by AERB and consists of a senior official from AERB as a member. The candidate is considered for a licensed position (control room operator) only after his/her satisfactory performance in the licensing process. Through the above methodology, AERB verifies the skill / knowledge of control room operator for managing DBA situations. The same is also verified during the re-licensing process for control room operators, which is every three years.
24892	18.1/P157	Question: In case of design extension condition with core melt, what measures do you have taken in design to make sure that there isn't any situation which call for permanent relocation of the public?	AERB Safety Code on Site Evaluation of Nuclear Facilities (AERB/NF/ SC/S (Rev.1), 2014) requires for design extension conditions with core melt, the release of radioactive materials should cause no permanent relocation of population. To ensure compliance to this requirement, additional safety systems and complementary safety features are introduced. These measures include post accident hydrogen management systems, containment filtered venting system, provision of core catcher /in-vessel retention as applicable, etc. These are elaborated in section 18.1 under Article-18 on page no. 158 of the National Report.
24893	19.1/P167	It is stated that:" In the light of lessons learned from the accident at Fukushima Daiichi NPPs, following aspects are given special attention:- Implementation of safety upgrades in reactors as well as spent fuel storage pool." Question: What are the specific measures or requirements about the safety upgrades in reactors as well as spent fuel storage pool.	Specific safety upgrades in reactor as well as spent fuel storage pool include hook-up points for injection of water externally, installation of hydrogen management measures, containment filtered venting system, backup power supply, water storage provisions and monitoring instrumentation for design extension conditions. AERB has specified the requirements for these safety upgrades in the Safety Code for design of NPPs (AERB/NPP-LWR/SC/D) which includes seismic qualification, equipment qualification etc. as necessary. Details on the above are included in section 18.1 under Article-18 of the National Report.
24890	16.4.1/P141	It is stated that:" AERB has established a Nuclear and Radiological Emergency Monitoring Centre (NREMC). " Question: What's the role of	During emergency the role of NREMC are: (a) To monitor the emergency condition and the on-site actions taken by Licensee. (b) To monitor that appropriate measures are taken by Utilities to reduce the risk during an emergency. (c) To keep AERB informed on the evolving conditions and conduct independent assessment of the

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		NREMC in normal condition and in emergency case？	emergency situation. (d) To provide appropriate regulatory support and technical advice to the relevant response agencies, as necessary; (e) To collect/record information on the actions/decisions/ feedback required to assess the overall adequacy of the regulatory requirement/guidance that are established through AERB Safety Codes and Guides and other oversight activities carried out in the preparedness domain of emergency. During normal condition, NREMC is involved in emergency preparedness tasks vis-à-vis monitoring of periodic exercises, evaluations of overall arrangements for emergency response and capacity enhancement for effective monitoring during emergencies.
24891	17.3/P152	It is stated that:" Re-assessments related to flood hazard have been completed for NAPS–1&2 & KAPS–1&2." Question: What is the conclusion of the re-assessments related to flood hazard for NAPS–1&2 & KAPS–1&2? Is it necessary to revise the basis parameters or add other supplementary measures?	Flood hazard re-assessment results of NAPS-1&2 indicate that plant site remains unaffected. Therefore, no additional measures were needed. Based on flood hazard reassessment studies for KAPS-1&2, certain mitigating measures are recommended to restrict the water level in the intake pond. Around 80 % of the work has been completed and the remaining work is expected to be completed shortly. As an interim provision, supplementary measures have been implemented.
24888	9.4.1/P63	It is stated that:" Right to Information Act, 2005 was enacted by the Parliament of Government of India for setting out the practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority." Question: Whether all information needs to be reviewed by AERB before it spread to public? How to choose if there is a contradiction between NPCIL and AERB in transparency and accountability? Like the case	The Right To Information Act, 2005 is a legislation that allows the general public to seek information from Public Authorities. The Act allows that if any information pertains to another public authority, to be transferred to the concerned public authority within stipulated timeframe. Under the Act, each Public Authority is required to designate a Public Information Officer and Appellate Authority. Any information to be disclosed under the Act, is through the designated Public Information Officer. If the applicant seeking the information is not satisfied with the response, he can prefer an appeal to the Appellate Authority and in case is not satisfied with the reply from Appellate Authority can further appeal to Chief Information Commissioner. Both, AERB and NPCIL have their own designated Public Information Officers and Appellate Authorities. AERB replies to queries under RTI based on the documented information available with it. NPCIL answers queries under RTI based on information available with NPCIL. Under the RTI Act, 2005, AERB is not required to check

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		of Fukushima nuclear power plant, they did not stop injection as required by the public authorities, how to tell the public?	the correctness or consistency of the information provided by NPCIL. It will only disclose information, which are within the purview of AERB and permitted under the RTI Act, 2005.
24889	14.1.3.2/P107	It is stated that:" Apart from this, Periodic Safety Reviews (described earlier) and special safety reviews are also used for safety assessments. Significant emphasis is placed on utilising feedbacks from experience in identifying and implementing safety enhancements." Question: What's the initiation criteria for special safety reviews?	The special safety reviews are in addition to the well-established processes of operating experience feedback, continual safety reviews and the periodic safety reviews. As practiced so far, the events / developments / new findings, etc. having significant or generic concern for safety or significant potential for safety improvements / lessons are selected. The examples could include major incidents, international or domestic, findings from inspections, safety reviews or research, for Indian plants or findings from the safety reviews done elsewhere could initiate such special safety reviews. A few examples of past instances of such special reviews undertaken for Indian NPPs are listed in Section 6.5 under Article-6 of the National Report. These include the Three Mile Island accident of 1979, the Chernobyl accident of 1986, the fire incident at Narora Atomic Power Station (NAPS) in 1993, the flood incident at the Kakrapar Atomic Power Station (KAPS) in 1994, the tsunami at the Madras Atomic Power Station (MAPS) in 2004, the Fukushima Daiichi NPP accident in 2011, and the pressure tube leaks at KAPS in 2015-16. There have been numerous other examples including review of IGSCC vulnerabilities, 1983 incident of pressure tube failure in Pickering NGS, the Bhuj earthquake of 2001, thinning of elbows in PHT system feeders in CANDU reactors, etc.
24886	7.2.2.1/P37	It is stated that:" After the issuance of licence for operation, renewal of licence is based on limited scope safety review once in five years and conduct of PSR, once in 10 years." Question: Please provide the main contents of limited scope safety review once in five years and PSR once in 10 years. What is the main difference?	As per the current practice followed in India, license of operating NPPs is granted for a maximum period of five years. These license renewals are based on a safety review. The scope of two consecutive safety reviews are different i.e. one is a comprehensive PSR whereas the other one is limited scope. License renewal for operation of NPP in every 5 years is a regulatory requirement wherein utility is required to submit application in a prescribed format, covering details on safety factors such as operational safety performance, operational experience feedback, actual physical conditions and public concern. PSR is more comprehensive review during which, in addition to the above safety factors, improvement in safety standards and operating practices, cumulative effects of plant ageing, plant modifications, safety analysis, etc. are also considered. The key aspect of the

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			PSR is that it involves assessment of the safety factors of the NPP in comparison with the current safety requirements and practices. Based on this assessment, strengths of the NPP and need for safety enhancements are identified. The contents of limited scope safety review and PSR are described in detail in section 14.1.2.5.ii under Article-14 of the National Report.
24887	9.3/P62	It is stated that:" AERB takes initiatives to positively influence the safety culture of licensees so that licensees act voluntarily to comply with the regulatory requirements and need for enforcement actions are minimised ." Question: What enforcement actions have been taken by AERB? Please provide some specific cases about the events and the enforcement actions.	There was no instance related to nuclear safety which necessitated major enforcement action by AERB. During safety review of nuclear power projects and related construction activities, few written directives for improvement of construction safety practices within a reasonable time frame were given. All these requirements were complied with by the utility to the satisfaction of AERB. There were a few instances in which AERB had put a hold on construction related activities at the under construction NPPs due to shortcomings noticed in the construction safety aspects. Details on enforcement actions taken by AERB in the past years are included in respective annual reports which are available on the AERB website under the following link. https://www.aerb.gov.in/english/publications/annual-report
24884	Summary/P19	It is stated that:" The increasing use of digital technologies in the design of I&C systems in nuclear applications with growing reliance on software has brought in certain challenges from regulatory perspective. New issues are emerging such as aspects related to Common Cause Failure (CCF) due to use of software in these systems, evidences to support safety demonstration of these systems and their regulatory acceptance especially with respect to commercially available digital I&C systems. Interface between safety and security aspects with respect to digital I&C systems is an additional area of focus. In order to	AERB Safety Codes on design of NPPs require that the potential for common cause failures in items important to safety shall be considered to determine where the principles of diversity, redundancy, independence and physical separation should be applied to achieve the required reliability. The common cause failure vulnerabilities are addressed through assessment of diversity (through CCF analysis for safety systems). Additionally, it is required that the computer based systems are designed, developed and qualified through a rigorous process to minimize chances of software errors in the systems. AERB Safety Code on design of NPPs also requires that computer based systems shall be protected from accidental disruption of, or deliberate interference with system operation. Further, a security plan that specifies the procedural and technical measures is also to be prepared for each system important to safety to ensure that the system is designed, developed, delivered and operated with adequate security measures.

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		address these issues, it is important to keep the regulatory requirements and guidance up-to-date for acceptance of these systems." Question: How do you prevent the common cause failure of software? What is the latest regulatory requirement on the prevention of CCF and security?	
24885	6.2.2/P23	It is stated that:" On September 16, 2016, there was an event of complete loss of Class-IV power supply in NAPS-2 resulting in reactor trip." Question: The two DGs failed to connect to their respective buses due to malfunctioning of relays of circuit breakers, are there common causes(for example quality problem) about the relays of circuit breakers?	On September 16, 2016, in NAPS Unit-2, two DGs could not connect to the respective bus due to malfunctioning of relays. Malfunctioning of relays was due to independent reasons/ causes and was not due to common cause.
24643	Unique	What is the reason for AERB preparing and approving budgets based on collective doses?	The collective dose budget is prepared annually by all NPPs and is reviewed and approved by AERB. The aim of this practice is to minimize the collective dose in line with ALARA principle. The same is also mentioned in section 15.6 under Article-15 of the National Report.
24712	91	With reference to Article 12, page 91 of the Indian national report, it is stated that NPCIL has prepared a list of safety culture indicators applicable to all the NPPs. And NPP management carries out periodic self-assessment of safety culture through written questionnaire, interviews and audit activities. With respect to the information provided in the article in question, Korea would like to inquire the following questions:	1) Based on safety culture questionnaire survey results, percentage satisfaction of each safety culture principle is marked. Principles with relatively low percentage satisfaction are considered for improvement with appropriate corrective actions. These are compared with the past data of the same station. The reference document used is “Principles for a Strong Nuclear Safety Culture” issued by INPO in November 2004. 2) As stated in Article-12, page 91 of the National Report, self-assessment includes work space inspections, job observations, analysis and trending of important operating parameters, review of deficiency reports and low level event reports, etc. It is part of day to day monitoring and review activity to identify areas for improvement. Its evaluation is based on trend of various observations like non-adherence to

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		1) Would it be possible to provide the information about the safety culture indicators, and what was referred to for deriving and establishing the indicators (e.g., literature, other country's regulatory documents, regulatory experience, plant performance indicators, etc.)? 2) What is the difference between self-assessment, Corporate Peer Review (CPR), and WANO Peer Review in aspect of period, evaluation indicators, method, and those who are evaluated?	procedures etc. In this, various station programmes are evaluated. Corporate Peer Review (CPR) is carried out based on a document called CPR Performance Objectives and Criteria (PO&C) which is developed on similar lines as WANO Peer Review PO&C. The duration of CPR is nine working days and is carried out every three years by a team constituted by Corporate Office. For CPR evaluation, indicators are material deficiency, White Cards and Observation Reports. Under CPR, Areas for Improvements (AFIs) are not developed. For WANO Peer Review, the frequency is once in four years and duration is about three weeks. Evaluation indicators are AFIs. Thus, CPR differs from WANO Peer Review in respect of duration, periodicity/ frequency and development of AFIs. In the case of CPR and WANO Peer Reviews, stations are evaluated, whereas in the case of self-assessment, station programmes and practices are evaluated.
24883	Summary/P17	It is stated that:" Obsolescence is mainly faced in electronics items (shorter usable life) as the field is fast changing with respect to technology. The issue is addressed by advance planning and maintaining adequate spares and by redesigning the cards with latest components (Integrated Circuit) to meet same input and output." Question: Could you provide the spare parts management strategy of electronics items	In developing the strategy for spare parts management of electronic I&C items, a life of specified duration is pre-decided. In project phase, spares recommended by supplier are procured. Upgradation/replacement is planned in advance in such a way that minimum changes are made in the existing system. Replacement of such systems in plant is done in a phased manner.
24641	8.2	Does AERB report to AEC in the same way as other promotional organizations under charge of AEC? does this fact decrease the importance that regulatory matters need?	No. AERB is functionally independent and its responsibility to AEC is limited to presenting its Annual Report and budget proposals only once in a year. AERB has been established using the legal provisions of the Atomic Energy Act, 1962. With the statutory and legal provisions of the Act and various rules framed there-under and the powers conferred by its constitution, AERB has the necessary legal authority for its regulatory activities. The mandate of AERB doesn't include any functions other than regulation of safety of nuclear and radiation facilities.
24642	Unique	In the Culture Safety matters, has the AERB issued some	The regulatory requirement for establishing safety culture within utility is included in the AERB Safety

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		provisions or recomendations on this subject? which elements of safety culture have been defined by AERB for being developed?	Code,' Quality Assurance in Nuclear Power Plants', AERB/NPP/SC/QA (Rev.1), 'AERB Safety Code on NPP Operation' AERB/NPP/SC/O (Rev.1) and related guides. AERB/NPP/SC/O (Rev.1) requires that the plant management shall inculcate safety culture in plant personnel. A policy which gives safety the utmost priority at the plant overriding the demands of production and plant schedules shall be developed and adhered to by all plant personnel. It prescribes that training shall be oriented to develop safety consciousness and safety culture at all levels of the plant organisation structure. It also spells requirements for licence renewal, where safety culture is considered as one of the key issues. AERB Safety Code for Quality Assurance in Nuclear Power Plants, AERB/NPP/SC/QA (Rev.1) requires that utility management shall promote and support a strong safety culture.
24639	7.2.iii)	What is the approach for programming and performing the inspections? and are there so much findings because of more frequency of performed inspections?	The regulatory inspection programme is prepared and performed based on guidelines given AERB Safety Guide on 'Regulatory Inspection and Enforcement in Nuclear and Radiation Facilities', AERB/SG/G-4 and as per procedures developed under Integrated Management System (IMS) of AERB. AERB adopts a graded approach in conducting regulatory inspections of the nuclear and radiation facilities. AERB prepares a consolidated plan for inspection of all the facilities under its purview by considering the following: • potential magnitude and nature of the hazard associated with the facility or activity • outcome of safety review • progress of activities at the facilities • experience of previous inspections • guidelines provided in regulatory and IMS documents. The increase in the frequency of the inspection was with the intent of increasing on-site presence of the regulatory staff. This was also one of the suggestions from IRRS mission to India in 2015. The increased frequency of inspections has not resulted in significant change in number or nature of inspection findings.
24640	7.1	Is the physical protection included in the regulations to be verified by AERB? how is the verification of accomplishment?	Yes, physical protection is included in the regulations by AERB. Verification of the same is ensured through periodic regulatory inspections.
24379	Section 16.1.2	In this section you describe you national arrangements for EPR: How do you ensure	The agencies for response in public domain are local, state and national authorities. Their line of command and communication is as per the established Incident

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		the lines of command and the lines of communication during an emergency? Does the lead body in an Emergency vary according to the nature of the emergency i.e on-site, off-site, cross boundary?	Response System (IRS) of National Disaster Management Authority (NDMA). DAE is the nodal department for providing the technical support during preparedness and response for Nuclear and radiological emergencies. DAE coordinates its actions through the Crisis Management Group-DAE (CMG-DAE) at the national level. As brought out in section 16.1.1 underArticle-16 of the national report, AERB has approved the template for preparation of off-site EPR plans of NPPs. The template incorporates the current national framework and command & control for emergency response. The template has been prepared in consultation with all the relevant national agencies. The arrangements and interfaces are tested during emergency exercises conducted for the NPPs periodically. Yes, the lead body in an Emergency varies according to the nature of the emergency e.g. for on-site it is Plant management, for off-site it is Local Authority. On receipt of a notification from another state or information from the IAEA regarding actual or potential emergency which may affect India, CMG-DAE co-ordinates with respective national agencies.
24638	Unique	In the report is mentioned that AERB prepares and approves the Budget according the collective doses, may be so kind to clarify how this is done and if this is made for all NPPs?	The collective dose budget is prepared annually by all NPPs and is reviewed and approved by AERB. The aim of this practice is to minimize the collective dose in line with ALARA principle. The collective dose budget is prepared based on the jobs likely to be executed during the year. The collective dose budget for each activity is allocated based on the collective dose consumed in the similar activity in the previous years, operating experience and radiological conditions in the plant. Utilities have enormous information on the experience of dose consumption in different type of activities, which makes them capable of preparing a realistic collective dose budget. During review in AERB, it is further verified that the collective dose assigned to each activity in the budget is ALARA. The collective dose consumed in various activities against the budgeted dose is reviewed by AERB on quarterly basis for all NPPs. Details are also covered in Article-15 of the National Report.
24186	Section 17.1.1	Para. 17.1.1 states that the site is evaluated by phenomena or a combination of phenomena which are of	Yes, the probability is same (10 E-7) for all phenomena, both natural and man-made.

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		annual probability of more than 10^-7 a year. Is this probability the same for all phenomena or there are differences for natural and man-made phenomena?	
24378	Section 10.5	India outlines its program within Safety Culture: What are the greatest challenges to the deterioration of safety culture in India? How do you assess and utilise the results of your reviews on safety culture?	The assessments done so far have brought out that in general, safety culture of all NPPs are healthy and are in continuous improvement. The rigorous orientation programme for the new entrants in DAE & AERB and continual training programmes helps to ensure a common understanding on the aspects of safety culture. Further, constant engagement between utility and AERB re-emphasizes the understanding of safety culture. In view of above, India does not face any challenge to the deterioration of safety culture. Some of the elements identified for improvements pertain to following principles of safety culture: i) Leaders demonstrate commitment for safety. ii) A questioning attitude is cultivated.
24182	Section 17.1	Could you give more detailed information about the criteria that prohibit siting NPP on the site?	In general, the site assessment criteria related to rejection of a site could be related to aspects resulting in direct rejection or could be related to aspects resulting in rejection of site due to absence of reliable engineering solutions. Table – 5 of Article 17 of the National Report lists the issues that constitute the rejection criteria.
24184	Section 17.0	Do Indian regulations and rules contain classification of sites for placing NPPs by potential impacts and degree of hazard from external natural and man-made processes, phenomena and factors?	Current regulations in India do not require classification of NPP sites based on the potential impact and degree of hazard from external natural and man-made processes, phenomena and factors. Once the site has been identified, it is evaluated against the specified requirements.
24178	Section 16.2	How does emergency response carry out after receipt of a notification from another state or information from the IAEA regarding actual or potential emergency which may affect the given state (India)?	CMG-DAE is identified as the national contact point for receipt of notification on Emergency Condition from other States or IAEA. CMG-DAE, in turn, notifies the response agencies at National level. DAE as a nodal department has established Emergency Response Centres across the country. These are alerted to support the response agencies (local, state and national authorities) for emergencies or potential emergencies of this type.
24180	Section 16.2	Could you specify information on emergency preparedness assurance and response given	Additional measures and studies carried out post accident at Fukushima Daiichi NPP, has concluded that design of the NPP possesses sufficient safety margin against site specific external natural events beyond the

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		events at multi-unit NPP sites initiated by external perils?	design basis and to avoid cliff-edge effects. In view of the non-sharing of safety systems among the multiple stations at a site and ability to implement accident management guidelines for each unit, the safety concern related to multi-unit/multi-facility sites, as appropriate, are addressed. Further, On-site Emergency support Centre (OESC) being implemented at each site has capability to remain functional under radiological conditions following a severe accident and is capable of withstanding extreme external events (flood, cyclone, earthquake, etc.) Site-specific procedures are available for conducting site-emergency exercises involving multiple units/ facilities at the site including event arising from external hazards.
24153	Section 16.5.2	Are there plans and programs of emergency measures as part of international arrangements with neighboring states?	As brought out in Section 16.5.2 under Article 16 of the National report, neighbouring countries are at large distances from the location of operating NPPs and projects under construction in India. Although no trans boundary implications are expected, India being a contracting party to 'Convention on Early Notification of a Nuclear Accident' and 'Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency', CMG-DAE, the national contact point will notify to IAEA in case of any accident at Indian NPP. Under these Conventions, India actively participates in the Emergency exercises through CMG-DAE. In the last three years (April 2016 to March 2019), India participated in ConvEx exercises which includes ConvEx-1, ConvEx-2a, ConvEx-2b ,ConvEx-2c and ConvEx-3 exercises. In view of above, India has not considered plans and programmes of emergency measures as part of international arrangement with neighbouring states.
24174	Section 16.1.2	What is meant by "District"? What is the procedure of informing the population on emergency planning and emergences?	India comprises of 28 states and 9 union territories. The states and union territories are further sub-divided into districts and smaller administrative divisions. A district is an administrative division of an Indian state or union territory. A district comprises of several towns, villages, etc., under its administrative control. District administration have their organization structure through which administration has reach up to the last man in the society. This system is also used for informing public during emergencies. Public is also informed of an emergency by the district administration through various means such as TV, Radio, etc. Information on planning and preparedness on emergency to public in and around the NPP sites is

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			being disseminated through public awareness programmes and emergency exercises.
24147	Section 13.2.5	Section 13.2.5 says: "Manufacturers supplying SSCs for the Nuclear Power Plants are responsible for the Quality Management processes at their premises. The utility monitors the adequacy and effectiveness of supplier's Quality Management System through the established verification processes like surveillance and audits." What surveillance is? How the enterprises are selected for an audit?	All the outsourced manufacturing and supply of items are governed by a formally agreed contract document. All the Quality Assurance activities are performed as per approved Quality Assurance Plan (QAP) and approved Procedures. Utilities or their authorised representative(s), have access to relevant areas for carrying out inspection of contractors' facilities, inspection of components and for verification of implementation of the Quality Management System (QMS). Findings of these inspections and required corrective actions (if any) are documented. All of the above functions are collectively categorised as "Surveillance". A system of planned audits of suppliers/manufactures is established and documented in QMS of Utilities. Audit Schedule is finalised on yearly basis for the audits of Suppliers/Manufacturers. Whenever there is specific feedback about the supplier or component, additional audits are also taken up during the year. Suppliers are selected for audits on the basis of safety class of items/equipment (safety class-1 is given priority) being manufactured by them and performance feedback with respect to quality of output in the recent past.
24149	Section 13.3	How the self-assessment results are used?	Self-assessment results are trended and are used for investigating their causes and developing appropriate corrective action programmes.
24144	Section 13.2.1	What personnel are subject to certification?	All Technical personnel of Quality Assurance (QA) group, involved in quality assurance and quality surveillance activities are qualified and trained in relevant fields. Personnel engaged in specialised activities like Non-Destructive Examinations (NDEs) are trained and certified. Most of the QA personnel are certified for different levels of NDE methods.
24146	Section 13.2.4	What is the principle for selection of suppliers?	Suppliers are selected on the basis of public tenders with well-defined pre-qualification criteria and based on competitive bidding.
24081	pages 35 and 39	It is said that Indian Boilers Act, 1923, is in force. Does the regulator oversee manufacturing, installation and commissioning of pressure equipment, especially primary circuit components? How has the	Yes. AERB is responsible for the regulatory oversight of manufacturing, installation and commissioning of pressure equipment, especially the primary circuit components. AERB's oversight during manufacturing and installation focuses on implementation of the approved design and adherence to appropriate Quality Assurance aspects. During commissioning, the objective of regulatory oversight is to verify that the

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		co-operation with other regulators been managed? What is the regular interval to perform inspections at the construction sites?	systems' functionality is as per design. AERB conducts on-site regulatory inspections at construction sites, frequency of which depends on the progress of activities at the site. The frequency of routine inspections may vary from twice in a year to four times in a year depending on the consenting stage of the project. In addition to routine regulatory inspections, AERB also identifies certain critical activities during construction as hold points for conducting Special Inspections or for deputing additional experts in the respective areas to observe these activities. The detailed account of the inspection practices and regulatory reviews is brought out in Article-14 and Section 18.1.1 under Article-18 of the National Report.
24082	page 47	What kind of arrangements are there to avoid BARC's conflicts of interest (BARC works for licensees as well)?	The technical support from BARC to AERB is governed by an agreement. The agreement addresses the issues related to conflicts of interest. Further, answer to QuestionId-24000 (Sequence-27) from Russian Federation may also be referred.
24083	page 51	There is noted that the statutory strength of AERB's position (independence) has been under consideration. The issues is also noted in IRRS mission 2015. Plase explain in details what kind of measures are currently going on to change the situation?	Atomic Energy Regulatory Board (AERB) was established in 1983 under the provisions of the Atomic Energy Act, 1962. AERB is the national regulatory body having powers to frame safety policies, lay down safety standards & requirements and powers to monitor & enforce provisions under the Act and rules thereof, in nuclear and radiation installations and practices. The IRRS mission to India in the year 2015 noted the professionalism and integrity of the Atomic Energy Commission (AEC), NPCIL and AERB senior staff towards ensuring the regulatory decision-making processes/arrangements were completed independently and did not notice instances, in which de-facto AERB independence was compromised. IRRS mission recommendation for further strengthening of legal status of AERB for de-jure independence is being looked into.
24079	page 21	Colective doses of "old" NPP's are much higher than newer ones. Have any goals been set for inplementation of ALARA principle and continuous improvement? Are there any results of lowering the collective doses?	Yes, there are goals for continual improvements in the reduction of collective dose for old as well as new NPPs. When the annual collective dose budget is prepared, the areas of improvement are identified along with the five year plan for improvement in ALARA exposure. With this, over the years collective dose of the older NPPs is gradually reducing.
24080	page 26	Are probabilistic methods (PSA/PRA) used to indentify possible safety enhancements?	Yes. For operating NPPs, during the process of periodic safety review, PSA/PRA is used to identify possible safety enhancements. Further information on use of PSA/PRA on design and

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			procedural improvements is given in Sections 12.2 under Article 12 and Section 14.2.2 under Article 14 of the National Report. Also, during design phase, both deterministic and probabilistic assessments are carried out to obtain a balanced design (Refer Section 18.1 under Article 18 of the National Report).
24077	page 1	BHAVINI is currently constructing and commissioning the first 500 MWe Fast Breeder Reactor. How does the regulator oversee the FOAK project (safety reguirements set, safety reviews performed, special inspections of the first of-the-kind etc.) and ensures it's own compenetence building for new kind of technology?	AERB Safety Codes contain both general requirements which are technology neutral like implementation of defence in depth, safety analysis, concept of single failure, management of safety etc., as well as specific requirements which are technology specific like systems specific requirements of shutdown system, ventilation system, etc. The general requirements are utilized for review of different technology based NPPs , including PFBR. In addition to this, AERB has used a document titled 'Safety Criteria for Design of Fast Breeder Reactors' specifically developed for this purpose. AERB is currently developing a Safety Code on Design of Sodium Cooled Fast Reactor based NPPs. The above has been brought out in Section 18.0 under Article-18 of the National Report. PFBR incorporates many FOAK systems for which utility is required to submit necessary technical documents, experimental / analytical verification substantiating the intent of the design. It is also required that performance of the system is demonstrated through analysis and experimentation. In addition, during commissioning, all these systems are verified for their expected functionality as per design. Further, enhanced surveillance and tests are specified for monitoring and performance checks. AERB has been involved in safety review and regulatory oversight of fast breeder reactor technologies for a significant duration now. This has helped in building up the competence for taking up safety review and assessment of PFBR. AERB is continually enhancing its in-house competence on regulatory activities related to fast breeder reactor technology. As part of competence management programme, relevant areas are identified for knowledge up-gradation. Towards this, AERB officials are deputed for training in the specific areas related to the ongoing commissioning activities. Further, AERB is also inducting fresh graduates who are specifically trained in the fast reactor technology.
24078	page 15	On page 15 it is stated that periodic renewal of operating licences for the Indian NPPs facilitate regular safety	The governing legislation for licensing of nuclear power plant from radiological safety considerations is the Atomic Energy (Radiation Protection) Rules, 2004 and the Competent Authority for these Rules is Chairman,

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		evaluations against the current requirements and timely implementation of practicable safety enhancements. How does the legislation support the continuous improvement principle?	AERB. As per clause d of sub-rule 2 of Rule 7, license is to be granted only if the applicant has demonstrated satisfactory compliance with the provisions of the relevant safety codes and safety standards specified by the competent authority. Further, Rule 8 of the said legislation provides that license is to be issued on the condition that all the requirements for issuance of the licence have been duly fulfilled. Rule 16 further makes it compulsory on the part of licensee to comply with the safety codes and standards specified by competent authority. AERB has specified the requirements for PSR in its Safety Code AERB/SC/O (Rev 1) and AERB Safety Guide AERB/SG/O-12 as per which safety assessment is carried out. Further, linking of the PSRs with renewal of operating license helps in ensuring that the identified safety enhancements are implemented timely.
24016	Section 13.2.1	Section 13.2.1 says: "The Functional Heads are assisted by qualified personnel to perform the assigned functions, activities and applicable processes, for establishing, implementing and maintaining the Quality Management System elements in their respective areas of responsibilities." Is quality assurance service meant under the qualified personnel? Could you describe tasks and functions of the quality assurance service and identify its subordination?	All Technical personnel of Quality Assurance (QA) group, involved in Quality Assurance and Quality Surveillance activities are qualified and trained in relevant fields. Apex Quality Management System (QMS) document of utilities describes the functions and responsibilities of QA groups. Some of the major functions of QA groups are: a. Preparation, Review, Revision, Issue and Control of Apex Quality Management System Document b. Quality Surveillance of materials, equipment and items c. Pre/In-Service activities at Nuclear Power Plant sites d. Review of Quality Management System document(s) of vendors e. Review of Quality Management System Document(s) of Projects/Stations f. QA audits of vendors and projects QA group is an independent group. Head of QA group reports to head of the utility.
24076	Section 18.1 page 158	It is stated in Section 18.1 p. 158: As a design improvement, seismic trip is implemented in all power plants where earlier it was not available. Seismic trip is usually implemented only in nuclear power plants in regions with very high seismic activity. What is the rationale in India for implementing seismic trip?	For NPPs in a high seismic zone, the seismic trip was already in existence earlier. Subsequent to the accident at Fukushima Daiichi NPP, seismic trip has been introduced at all NPPs as an abundant precautionary measure.

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24012	Section 11.1	Could you provide information about minimum and maximum limits of the financial liability for nuclear damage established by the state for the licensee?	The information about limits of the financial liability for nuclear damage established by the state for the licensee are provided in Section 6 of the Civil Liability for Nuclear Damage Act, 2010. As per Section 6 of the Act, the maximum amount of liability in respect of each nuclear incident shall be the rupee equivalent of three hundred million Special Drawing Rights (SDRs) or such higher amount as the Central Government may specify by notification. Further, as per the Act, the liability of an operator of NPP for each nuclear incident shall be rupees one thousand five hundred crores. For provisions of the Act, including the limits on liability, kindly see the Act at the following link, http://www.dae.gov.in/node/60.
24014	Section 13.1.5	Section 13.1.5 says: "It is recognised that SSCs, processes and services are required to be of specified quality consistent with their importance to safety and use to which they are to be put, and accordingly classified and graded. Management System Programme has provision for such graded approach indifferent processes, items and services." Could you give more detail information regarding the graded approach? What regulatory requirements do support it?	AERB Safety Code, 'Quality Assurance in NPPs', (AERB/NPP/SC/QA, Rev.1) specifies Quality Assurance (QA) requirements. As per this Safety Code, the extent to which QA requirements are to be applied are required to be consistent with the importance to nuclear safety of the item, service, or process. A graded approach is to be used to satisfy the necessary requirements and ensure the required quality and safety. Considerations for the graded approach include but not limited to: (a) the consequences of malfunction or failure of the items, (b) the design and fabrication complexity or uniqueness of the items, (c) the need for special controls and verification over processes and equipment, (d) the degree to which functional compliance can be demonstrated by inspection or test, (e) quality history and degree of standardisation of the items, and (f) the difficulty of repair or replacement.
24007	Section 10.5	The body text of the Report says that at the present time Safety Culture assessment is carried out at operating NPPs annually. This assessment is based on indicators which have been developed in the country in AERB to identify early symptoms/signs of decrease in safety culture. What are these indicators	The indicators selected for assessment of safety culture of operating NPPs are based on various international practices and guidance including OECD-NEA document titled 'Improving nuclear regulation', IAEA Guide on 'Management of Nuclear Installations' GS-G-3.5, etc. The attributes against which safety culture of an operating NPP is assessed, among others, are following: 1. Frequent deferral of needed improvements 2. Long delays to meet regulatory commitments 3. Failure to follow procedures These are assessed based on the inputs from various

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		and how they are calculated? Are there target levels for these indicators?	regulatory processes, such as regulatory inspections, safety reviews. As per the present assessment strategy, there is no absolute target level defined for the indicators. However, the trend of these indicators over the years is assessed to identify decline, if any.
24010	Section 11.1	Could you provide more detailed information on the requirements which are set by the state to the licensee as regards availability of the financial coverage of civil liability for nuclear damage at a nuclear facility and beyond?	As per the Civil Liability for Nuclear Damage Act, 2010, the operator (licensee) shall, before beginning of operation of nuclear installation, take out insurance policy or such other financial security or combination of both, covering his liability.
24000	Article 8	In Article 8 the Indian side names a number of research centers which render assistance to the Regulatory Body of the country, AERB: Safety Research Institute (SRI) at Kalpakkam, Bhabha Atomic Research Centre (BARC), Indira Gandhi Centre for Atomic Research (IGCAR) and a number of other research centers. At this, in Section 8.1.2.4 the role of the scientific and technical support organization of the regulatory body is affixed to BARC explicitly. The same section says that in cooperation of BARC AERB considers the conflict of interest aspect. How does this aspect consider, especially in the light of that BARC, as per Section 1.1, acts as the developer of the IPWR reactor concept? Is the technical support organization's role of the regulatory body affixed at the country level in India? How does the regulator AERB avoid conflict of interests with NPP operators when using services of such number	The technical support from BARC to AERB is governed by an agreement. The agreement addresses the issues related to conflicts of interest. As brought out in section 8.1.2.4 of the National Report, AERB also utilises the experts from other national institutes such as Indira Gandhi Centre for Atomic Research (IGCAR), Council for Scientific & Industrial Research (CSIR) and various Indian Institutes of Technology (IITs) to support its safety review activities. The technical support from BARC, IGCAR, national laboratories, industrial and academic institutions in the country to AERB comes primarily in the form of providing experts as members for its advisory committees and safety review committees. The review findings from these experts are used as one of the inputs for the safety assessment. The regulatory assessment and decision making is entirely with AERB for which it has necessary technical and regulatory competence.

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		of scientific institutes and research centers?	
24002	Introduction, para. 1.1	Section 1.1 gives information about availability if the research reactor KAMINI in India. Does Indian have any other research reactors?	Yes, India does have a few other research reactors besides KAMINI.
24004	General	In August 1983, pipe G-16 broke at Unit 2 of Pickering NPP with CANDU reactors in Canada. The defect formation was associated with hydrogen effect on properties and decrease in performance of zirconium components of the reactor. What approaches are used to inspections and justification of performance of zirconium components of Indian heavy-water reactors in terms of hydrogenation?	Following measures are implemented in Indian Pressurized Heavy Water Reactors to avoid degradation of Pressure Tubes (PTs) and subsequent failure: PT material has been changed to superior Zr-2.5%Nb alloy from earlier Zircaloy-2. The Zr-2.5%Nb PT material absorbs smaller amount of hydrogen during service and precipitates less deleterious hydrides. Initial hydrogen content in the PT material is further restricted by improving the manufacturing process. Hydrogen content in the PTs is measured through in-reactor sampling and surveillance examination. Appropriate procedures are followed during operation to ensure that the PTs are operated within the conditions envisaged in design.
23911	Section 6.3, page 25	What document regulates the procedure and requirements for the periodic safety review of NPP units with WWER reactors? Is this document publicly available?	Periodic Safety Reviews (PSRs) of all NPPs are conducted as per the requirements given in AERB Safety Code, 'Nuclear Power Plant Operation' (AERB/NPP/SC/O) and in accordance with the guidelines given in AERB Safety Guide, 'Renewal of Authorization of Nuclear Power Plants' (AERB/SG/O-12). AERB/SG/O-12 is in line with IAEA SSG-25 and is publicly available on the website of AERB.
23998	Introduction, para. 1.1	Para. 1.1 states that the Bhabha Atomic Research Centre (BARC) develops a project of own Indian pressurized water reactor (IPWR). The same paragraph says that the Indian regulatory body (AERB) has organized a preliminary safety assessment of this project. What are the final results and conclusions of this preliminary assessment?	As per the AERB regulations, AERB may consider the safety review of design of NPP for its consentability even prior to siting, based on applicant's request. BARC had submitted a conceptual design of IPWR for pre-consenting review by AERB. The objective of the review was to evaluate compatibility of submitted conceptual design with respect to regulations and identify requirements which need to be addressed further for compliance when the project application is submitted.
23909	Section 6.1.6, page 23	What organization develops the safety justification for regular fuel loadings? What computer codes are used to justify the safety of regular fuel loadings?	NPCIL is involved in the development of safety justification of regular fuel loadings for KKNPP-1&2. Based on the proposed fuel loadings, a Reload Safety Evaluation Report (RSER) is prepared. Licensed Computer Codes are used for in-core fuel management of KKNPP-1&2 by trained and licensed specialists for

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			developing the core loading pattern and its operational and safety justification.
23910	Section 6.1.6, page 23	What codes are used by the regulator for safety assessment of regular fuel loadings?	AERB Safety Guides on Core Management and Fuel Handling Operation (AERB/SG/O-10A and AERB/SG/O-10B) provide necessary guidance to achieve the required fuel loading safety goals. Utility estimated core neutron physical characteristics for a given fuel loading are verified independently at AERB. For this, in-house computer codes based on neutron transport and diffusion theory for core-lattice level and full-core modelling are being used. These codes are used to assess criticality safety and neutron detectors' response during fuel loadings. Transient response of the core is evaluated using an in-house developed coupled neutronics and core thermal hydraulics code.
23907	Section 15.3 i), page 124	What radionuclides, other than tritium, are monitored in discharges?	Radionuclides measured in atmospheric discharge of NPPs in India include Ar-41, FPNG, Particulate and I-131 in addition to tritium. Monitoring has been established for gross alpha, beta, gamma emitters, tritium, particulates, with regard to releases through the aquatic route from NPP, before their discharge to environment.
23908	Page 175	What procedure for the treatment of liquid and solid radioactive waste is used at the Indian NPPs?	Liquid wastes generated from Indian NPPs are of low level, and are segregated at source based on specific activity and chemical nature for ease of appropriate treatment. Specific or combination of treatments such as filtration, ion exchange process, chemical treatment and evaporation are provided followed by monitoring, dilution and discharge. Solid wastes are segregated at source based on physical nature and surface dose rate. Treatments provided include immobilisation with polymer/cement, shredding, compaction and incineration. Suitably designed engineered modules like trenches, vaults and tile holes are provided in Near Surface Disposal Facility (NSDF) for the disposal of conditioned solid wastes. The information on treatment processes of liquid and solid radioactive wastes is given in the Section 19.8.2 under Article 19 of the National Report.
23905	Page 120	According to the subsection "Dose Limits for Occupational Workers", the effective dose in any year is 30 mSv and the limit of equivalent dose for eye lens is 150 mSv per year. Question: Has there been a plan/program developed to reduce the effective dose in any year to 20 mSv and the	Regulatory limit of radiation dose in India is 30 mSv in a year and 20 mSv/yr averaged over five consecutive years (calculated on a sliding scale of five years). Though annual dose limit specified by the regulator is 30 mSv in a year, a lower threshold limit of 20 mSv in a year is followed in NPCIL. AERB is in the process of collecting inputs from NPPs on eye lens dose during various activities for revising and implementing the regulatory dose limits for eye lens. Currently, eye lens dosimeters have been

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		limit of equivalent dose for eye lens to 20 mSv per year in compliance with GSR Part 3?	deployed in NPPs in activities having potential for eye lens exposure on trial basis for collecting data.
23906	Para 15.2.2, page 123	Subsection "Observance of dose limits" iv) states that the average annual dose of the observed persons is 1.32 mSv, and in the last three years any radiation worker has received a radiation dose above the annual dose rate of 30 mSv / year. Question: What maximum individual annual doses have been recorded in the last three years?	No radiation worker received the radiation dose above the annual regulatory dose limit of 30 mSv/year in the last three years. The maximum annual individual dose received in the last three years is 24.43 mSv. In last 3 years, around 92% of workers received dose in the range of 0-5.0 mSv/year.
23904	Section 10.3 (ii), page 74	According to the report, EOPs were developed and implemented for Indian NPPs considering potential internal and external initiating events. These EOPs are based on both event-based and symptom-based approaches. Please provide more detailed information on the application of emergency procedures in case of accidents since there are two individual packages of EOPs (symptom-based and event-based): procedure for their use, criteria of transfer from event-based to symptom-based EOPs. Do EOPs contain clear and justified criteria/points of transfer to severe accident management guides?	Indian NPPs rely on event based EOPs to handle plant transients and events. Such EOPs require identification of the event, which is carried out with the set of parameters (as expected in the event). Therefore, existing EOPs take full cognizance of plant response (parameters or symptoms) for event identification and therefore are symptom oriented - event based. These procedures are supplemented by symptom based procedures. During an event handling, event based procedures are used and in parallel, symptom based scheme (a computer based system) confirms that plant is returned to a safe state. In case, event based procedures are not successful; actions, as recommended by symptom based procedures are to be taken. Guidelines are developed to exit from the EOPs and enter into accident management domain.
23902	Section 6.5 page 27	It is pointed in the report that "Onsite storage of fuel for Emergency DG and water for 7 days of reactor core cooling requirement". What scope of analyses was the basis for justifying the necessary time for operation of equipment and systems in case of an	The time period of 7 days of on-site storage of fuel for emergency DG and water for reactor core cooling has been considered adequate to make alternate provisions or restoration of off-site power supply. The amount of on-site storage of fuel has been considered sufficient for operation of design DGs at an NPP site including diesel operated fire water pumps for duration of 7 days. AERB regulations require that the equipment that is

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		accident? The total fuel amount was calculated for the performance of "design" DGs or in "new mobile" DGs? What qualification requirements are imposed on new equipment (such as mobile pumps and DGs) in view of extreme on-site conditions?	credited to operate during design extension conditions as well as during and after severe accident scenarios shall be shown, with reasonable confidence, to be capable of achieving the intended function under the expected environmental conditions. Severe accident management guidelines should address uncertainties arising from any shortfalls in such qualification of specific equipment/instrument.
23903	Section 6.5 page 27	According to report "the post Fukushima Daiichi NPP accident strengthening measures identified and being implemented for the Indian NPPs are associated mainly with enhancing the resilience of the plants to cope with extreme external events exceeding the design bases and to strengthen the provisions for mitigation of severe accidents. The identified safety enhancements were classified as short term, medium term and long-term measures". In frame of safety improvement activity, that connected with analyses of severe accidents, does the additional equipment qualification considered or planned to perform for heavy conditions in Unit's compartments that could cause effect on such equipment due to severe accident propagation?	Yes. As per AERB regulations, equipment that is credited to operate during design extension conditions should be capable of achieving their intended function under the expected environmental conditions. Severe accident management guidelines should address uncertainties arising from any shortfalls in such qualification of specific equipment/instrument.
23900	Section 8.1.2.8 page 50	As pointed in the report, "AERB has developed and implemented an Integrated Management System, which is in line with IAEA Safety Standards: Leadership and Management for Safety". Does the Integrated Management System include specific performance	AERB has recently introduced Integrated Management System (IMS). Currently, the IMS does not include specific performance indicators. To analyze the effectiveness of AERB activities, presently, annual targets are given to each organisational unit of AERB which are based on AERB's objectives and current strategies. The progress with respect to achievement of these targets is reviewed periodically by AERB management.

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		indicators? Can examples be provided of performance indicators used to analyze the effectiveness of AERB activities?	
23901	Section 8.3 i, page 52	As pointed in report "AERB is the national coordinator for IAEA–International Nuclear and Radiological Event Scale (INES) and IAEA-Incident Reporting System (IRS)". Can India provide information on the number of operational events that were classified according INES scale since the Seventh Review Meeting of Contracting Parties?	Number of significant events at operating NPPs during the reporting period are as follows: • In 2016: 39 (36 nos. of events below INES rating scale, 2 nos. of events of INES rating 1 & 1 event of INES rating 2) • In 2017: 37 (36 nos. of events below INES rating scale, 1 event of INES rating 1) • In 2018: 32 (all events were below INES rating scale) The above information is also included in Section 19.6 under Article 19 of the National Report. Further, the information on events rated at Level – 1&2 on INES is included in Article – 6 of the National Report.
23759	18.2.2	Reference section 18.2.2, India may like to share the scope of pre consenting review performed as part of licensing process of NPPs.	Pre-consenting review looks at the suitability of proposed design from safety considerations and regulatory requirements. Pre-consenting review can be for an indicated site or without a site also. In case of the latter, aspects related to effect of site on the plant and plant on the site would not be getting checked and safety review would be limited to the technological aspects.
23899	Section 1.3 page 4, Article 14, Section 14.1.1.1, page 99, Article 18, Section 19.9 page 176.	According to the report, AERB issues licence for operation of NPP for a specified period of 5 years based on safety review and assessment of the application for renewal of licence. In addition, every 10 years, Periodic Safety Review (PSR) is carried out by licensee and the PSR report is submitted to AERB for review. Is the design lifetime (for example, 30 years) established for nuclear units in India? If yes, from what time this lifetime starts (date of first criticality, date of introduction into commercial operation…)? Are there any differences in the licensing process in case of making decision for long-term operation (beyond the design lifetime)?	As per the regulatory requirements in India, NPPs are required to undergo Periodic Safety Reviews (PSRs) once in ten years. The PSRs involve comparison with current safety requirements and practices as well as assessment of health and ageing aspects of important SSCs. During this exercise, strengths & shortcomings and required safety enhancements are identified. The NPPs are required to develop and implement systematic ageing management programmes, for ensuring health and reliable functioning of the important SSCs. As the plants get older, the ageing aspects receive increased attention during various safety reviews including PSRs. A plant can continue operation as long as it satisfies the laid down regulatory requirements and demonstrates availability of adequate safety margins.

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23084	Pages 163-164/Section 18.3	How were the human factors and human-machine interface considered in the designs of nuclear installations in India to allow for reliable, stable and easily manageable operation?	As per AERB Safety Code on Design of NPP, systematic consideration of human factors, including the human–machine interface, are to be included in the design process at an early stage of design development and continued throughout the entire process. The human-machine interface are to be designed to provide the operators with comprehensive and easily manageable information, in accordance with the time necessary for decision making and initiating actions. The information necessary for the operator to make a decision to act are to be simply and unambiguously presented. In Indian NPPs, Human Factors Engineering (HFE) and human–machine interface issues have been adequately taken into consideration in the development of the design, in order to facilitate interaction between the operating personnel and the plant. The specific design features of systems and equipment that are intended to promote successful operator actions are also considered based on operating experience review with respect to HFE related safety issues. Human Reliability Analysis (HRA)/Probabilistic Safety Assessment (PSA) results are utilized in HFE so as to address risk important human actions in the NPP design. Various human factor engineering principles are applied to the selection of alarms, controls and displays along with environmental factors viz. illumination, temperature and noise.
23758	8.1.1(xi)	Reference article 8.1.1(xi), India may elaborate the main elements of review of 'Nuclear Security affecting Safety' at Nuclear installations.	The main elements of review are in line with the IAEA Nuclear Security Series No. 13,'Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities'.
22994	All	The report is detailed with regard to Article 16. In particular, the tiers of responsibility at different levels from site through to the national level. However, there are a lot of different bodies and groups and it is not clear in the report how they are linked or work together systematically during an event. Please provide further	During an event, the agencies for response in public domain are local, state and national authorities. Their line of command and communication is as per the established Incident Response System (IRS) of National Disaster Management Authority (NDMA) which lays down policies, plans and guidelines to be followed by the different Central Ministries, Departments and the State Governments. National Disaster Response Force (NDRF) assists the relevant State Government/District Administration in the event of an imminent hazard or in its aftermath. National Crisis Management Committee (NCMC) oversees the command, control and coordination for response and gives direction on specific actions as deemed necessary. Please also refer answer to QuestionId-24379 (Sequence-55) posted by Norway on similar subject.

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		information on the interfaces and lines of responsibility between these different bodies and groups to aid explanation of the function of the Emergency Response Plan.	
23083	Pages 155-159/Section 18.1	In the "18.1 Implementation of defence in depth" a very thorough description is provided of the regulatory requirements concerning the design and construction of nuclear installations, namely regarding implementation of defence-in-depth concept. Yet, there is no information given regarding the status and extent of actual implementation of these regulatory requirements in the NPPs operating in India. Is it to be understood that the Indian regulator considers all its requirements implemented in full and to a sufficient extent? Even then, some elaboration on this ruling would be welcome.	Yes. During design safety reviews for consenting of NPPs, conformance to all the AERB regulatory requirements are evaluated. AERB Safety Guides on design provide detailed guidance towards meeting the requirements brought out in AERB Safety Codes on design of NPPs. Demonstration of compliance to all regulatory requirements, including defence-in-depth, as described in section 18.1 under Article 18 of the national report, is mandatory for any NPP to obtain consent for construction from AERB. During Periodic Safety Reviews (PSRs), strengths and shortcomings of the operating NPPs against the requirements of current safety standards are identified. Outcome of PSR is reviewed by AERB for renewing license for operation of NPPs. During this exercise, safety enhancements are identified to further strengthen the safety of NPPs and plan for implementation of the same is worked out.
22993	11.1.3	Section 11.1.3 mentions the refitting of the older NPPs and the relicensing as well as the need for financing of decommissioning. However, no details are provided of the envisaged post operational phases anticipated. What are the plans for decommissioning of the older power stations and how will this take cognisance of international experience?	Conceptual decommissioning plans are prepared for all NPPs based on national and international experience. These plans are included in the Final Safety Analysis Reports (FSARs) of the respective NPPs. Presently, all NPPs are in operation except RAPS Unit-1, which is under shutdown state since October 2004. In immediate future, there is no plan for decommissioning of any older NPP.
22991	All	The article primarily focuses on the requirements for training and staffing for operations and management	NPCIL's technical manpower includes engineering graduates and post-graduates from prestigious engineering colleges/universities in the country. Freshly recruited engineers go through one year of

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		of NPPs. 11.2.9 states that AERB's assessment of humans resources is conducted against LCOs and during PSR. What baseline level of staffing is required for designers and safety engineers, either at the NPP or at an engineering headquarters?	training in DAE/BARC Training School or in Nuclear Training Centres of NPCIL. After such training, they are placed at NPCIL Corporate Office for functions like design, Safety, QA, procurement etc., or construction sites or operating units based on the needs and suitability for the job. The Atomic Energy (Radiation Protection) Rules, 2004 and AERB regulatory documents give the requirements regarding the qualification, training and re-training of personnel working in the radiation areas. The regulatory requirements for staffing, qualification, training and re-training of staff for NPPs are given in AERB Safety Code, ' Nuclear Power Plant Operation' (AERB/SC/O, Rev.1, 2008) and AERB Safety Guide, 'Staffing, Recruitment, Training, Qualification & Certification of Operating Personnel of NPPs' (AERB/SG/O-1).
22992	All	Article 13 outlines the arrangements and expectations for Quality Assurance including the supply chain. However, no specific examples of issues, challenges or developments since the last CNS report are given despite international concerns over CSFI and Le Creusot Forge quality issues. What was the response to the issues at Le Creusot? What was the outcome of follow up investigation to the extent that Indian NPP may be affected? How has the learning from this event been used to improve safety in the supply chain of Indian NPPs?	Quality Assurance groups of utilities or their authorized representatives participate in inspection of control points identified in Quality Assurance Plan (QAP) for the important activities during manufacturing of all items. The results of inspections and tests are evaluated for their acceptance as per the specification requirements. Deviations (if any) observed are reviewed by design groups before acceptance of item/equipment. The incident similar to M/s Le Creusot is unlikely to take place in supply chain of Indian NPPs because of the stringent Quality System followed by Indian Utilities as detailed above. Additionally, for the Nuclear System Components, before erection at site, all quality documents are again reviewed by utilities and by regulator as part of "Basis of Acceptance (BOA)".
22989	6.5.1	Section 6.5.1 describes improvements in equipment used in response to severe accidents including hydrogen mitigation and containment venting systems. What technology has been	1) Containment Filtered Venting System is based on filtration of aerosol particles and gaseous fission products by wet scrubbing processes such as sparging aerosol-iodine species laden gas through alkaline water pool. 2) In KKNPP, due to provisions of core catcher and diverse cooling, the amount of non-condensable gas release is insignificant and does not pose any threat to

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		selected for the Containment Filtered Venting System (CFVS)? What is the safety justification for not installing CFVS on the PWR units at KKNPP-1&2?	the containment. During the severe accident event progression, the containment pressure can be brought down by various containment cooling provisions such as re-establishing the existing safety systems or connecting the additional diverse accident management systems. Therefore, containment venting provision is not envisaged. Please refer Section 18.1 under Article 18, page 158 of the National Report for details.
22990	10.5	Section 10.5 outlines the AERB approach to encouraging a strong safety culture in the nuclear industry. However, the response to the article does not provide a critique of the results of the approach. The text states that NPCIL has established a system for safety culture assessment of operating NPPs. The text also states that the review and assessment of safety culture is part of AERBs continual safety review process. What are the results of these safety culture reviews and how have these results been used to improve the safety culture?	AERB encourages every utility to institute a good safety culture during all the stages including design, construction, as well as operation of an NPP. The regulatory requirement for establishing safety culture within utility is delineated in the AERB Safety Code 'Quality Assurance in Nuclear Power Plants', AERB/SC/QA (Rev.1) and related guides. Please refer answer to QuestionId-24378 (sequence-54) posted by Norway and answer to QuestionId-26395 (sequence-87) posted by France for details on results of assessments done so far.
22987	15.2	The report explains the limits and average annual dose per worker in the period 2016-2018. It is also stated that the regulatory limit of 30mSv/yr was not exceeded. For normal operational activities, what (if any) lower threshold limit below that of the legal exposure limit does the operating company of	Though annual dose limit specified by the regulator is 30 mSv in a year, a lower threshold limit of 20 mSv in a year is followed in NPCIL. Further, as a matter of ALARA practice, stations also set specific dose restrictions (Monthly, Quarterly and Yearly).

Question Id	Ref. in National Report	Question / Comment	Answer
		NPPs use? This would drive to push doses down (ALARA) rather than to simply comply with the legal limit.	
22988	6.1.4	Section 6.1.4 briefly describes the BARCIS in-service inspection tool used on the coolant channels of the PHWRs. Please provide any further information available that may help the UK understand this in further detail.	In-Service Inspection of coolant channels of PHWRs is essential to provide assurance of continued structural integrity of pressure tubes over reactor lifetime. A semi-automated remotised channel inspection system known as BARCIS (BARC Channel Inspection System) has been developed for this purpose. It has various NDE capabilities like ultrasonic measurement of pressure tube wall thickness & internal diameter, ultrasonic and eddy current detection of flaws in pressure tube and eddy current detection of garter spring location. The system is designed with the objectives of minimizing radiation exposure to inspection personnel and completion of inspection with minimum reactor down time. The inspection is carried out from one end of the channel with the reactor in shutdown condition and shutdown cooling pumps in operation. The channel to be inspected is defueled and the fuel bundles are temporarily stored in the fuelling machine at the other end of the channel. Isolation of the channel from the primary heat transport system is not needed and after the inspection, fuel bundles are put back in the channel to occupy the same old positions. BARCIS has the following salient features: • An inspection head containing Ultrasonic and Eddy Current based NDE sensors • A remotely operated mechanism for driving the inspection head in the desired test sequence and positioning it inside the coolant channel • A special sealing plug • A drive tube attached to the inspection head, which carries the sensor cables and passes through seals in the special sealing plug • Operator friendly computerised control system with the control station located outside containment • NDE instrumentation to record and analyse the data acquired during inspection