Questions & Answers on National Report of India for 9th Review Meeting of CNS

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33856	Section 15.3.2	Dose modelling can yield different results depending on the methodology and the assumptions used as inputs to the model. Is there a standardized methodology that is used to calculate the regulatory dose limits?	An effective dose limit of 1 mSv per year to the public arising from nuclear facilities at a site due to normal operation (including anticipated operational occurrences) is prescribed. AERB has published a Safety Guide on 'Methodologies for Environmental Radiation Dose Assessment' (AERB/NF/SG/S-5). Taking account of this document, a standardized methodology has been evolved to calculate the public dose to demonstrate the compliance with regulatory limits. This methodology was standardised through iterative round robin exercise with experts from TSO, Utilities and AERB. This methodology was accepted by AERB and is being published as a regulatory document.
33854	Section 17.2.2	Are soil, air, vegetation, and fish samples collected? During the operation of the nuclear facility, what is the frequency of collecting the environmental samples?	Soil, air, vegetation, and fish samples are collected during the operation of the nuclear facility. The samples are collected by Environmental Survey Laboratory, which is a unit of BARC. The frequency of collecting environmental samples is site specific as per the approved schedule. Generally, more samples are taken close to the site or wherever population cluster exists and sampling frequency gets reduced with distance from the site. Samples are generally collected from the area covering 30 km from the site. The total numbers of samples collected and analysed vary from about 600 to 1400 per year, depending on various site related factors. Refer AERB Safety Guide on 'Methodologies for Environmental Radiation Dose Assessment' (AERB/NF/SG/S-5).
33855	Section 15.5	It is stated that the annual effective dose to the representative person in public domain at various distances is assessed by using radioactive liquid and gaseous discharges as well as radioactivity concentration in various environmental matrices. How are the contributions from the sources other than the	Approved methodology and standard models are used for public dose assessment. A dose of 50 µSv from regional sources is reserved for each site. Facilities other than NPP also provide their discharge data and their contribution is taken into account for public dose assessment. Environmental monitoring and surveillance programme considers the dose contribution from all sources at site and demonstrates

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		discharges from nuclear power plants determined?	compliance with the annual dose limit specified by AERB.
33853	Section 17.2.2.4	How are the milk and food consumption rates determined?	The data is collected by carrying out dietary surveys around the NPPs for generating this information. Refer AERB Safety Guide on 'Methodologies for Environmental Radiation Dose Assessment' (AERB/NF/SG/S-5).
33851	Section 16.2.7	Is there a specific legal requirement on the periodicity for updating of the EPR (i.e. every 5 years)?	Rule 33 of Atomic Energy (Radiation Protection) Rules, 2004 specifies the requirement for preparation of emergency plans as specified in the AERB safety codes. AERB Safety Code on 'Nuclear Power Plant Operation' (AERB/NPP/SC/O, Rev.1) specifies requirement for 'periodic review, updating and improving of emergency plans and procedures in the light of actual experience and results of exercises'. Technical specifications for operation of NPPs, which is one of the licensing basis documents of the NPP approved by AERB, specifies a frequency of 5 years for revising the emergency preparedness & response manuals.
33852	Section 17.2.2	Does the dose criteria consider the potential dose and their potential impacts to local biota?	The dose criteria does not specifically consider the potential dose and their potential impacts to local biota. As per AERB Safety Code on 'Site Evaluation of Nuclear Facilities' (AERB/NF/SC/S, Rev.1), the annual release limits for all the facilities within a particular site (taken together) shall ensure that the effective dose limit for any individual at off-site, due to normal operation (including anticipated operational occurrences) is less than 1.0 mSv/year. [ICRP 103, Clause (W), states that, 'the Commission continues to believe that the standards of environmental control needed to protect the general public would ensure that other species are not placed at risk']
33850	Section 15.4	Dose to the public at the Rawatbhata site (~22µSv) and Kaalpakkam site (~15µSv) are above what would be considered de minimis (10µSv) and also much higher than other NPP sites in India. What are the main drivers for the higher doses to the public at these sites?	The higher doses to the public at these sites compared to other NPPs is due to higher emission of Argon-41 from older generation PHWRs. The older generation PHWRs (i.e. RAPS-1&2 and MAPS-1&2) at these sites have air filled calandria vault. It may be noted that the annual doses to public due to the releases from the NPP sites are much less than the authorized annual public dose limit of 1000 µSv.

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33848	Sections 10.2 & 12.3.4	At what frequency do operators (NPCIL and BHAVINI) carry out assessments of safety culture?	The safety culture assessment evaluates all the available information (e.g. Event Reports (ER) /Significant Event Reports (SER) / Root Cause Analysis (RCA) Reports, Regulatory Aspects, ISO Audit Observations, abstracts from CPR & WANO peer reviews, WANO Performance Indicators (WPI), Operations & Maintenance work practices, Low Level Events, Job Observations, Exposure Events, RP Observations, Safety Related Deficiencies (SRD), Near miss accidents, Fire safety observations, Safety Culture Survey) against safety culture principles and attributes to provide an early indication of potential problems, develop effective corrective actions and monitor the effectiveness of the actions. In addition, safety culture survey is carried out to gather opinion of the staff regarding the state of organizational safety culture using questionnaire survey. This survey is carried out on yearly basis. The data from the process inputs and questionnaire survey are evaluated by members of Safety Culture Assessment Panel (SCAP) in every quarter. SCAP submits its report once in six months to Station Management Team (SMT). This process is covered in NPCIL Head Quarter Instructions (HQI) on 'Assessment and Fostering of Safety Culture at Nuclear Power Stations', which is revised based on WANO MSMs on Safety Culture and its Assessment and is in line with the approach envisaged in NEI-09-07, R-1 (Fostering a Healthy Nuclear Safety Culture, March-2014). Also refer section 10.5 of the national report.
33849	Section 13.2.4	Given problems encountered within the supply chain in many countries, it is good to see that there are programs to deal with counterfeit, fraudulent or suspect items (CSFI).	India thankfully acknowledges the comment from Canada
33846	Section 6.3	What is the rationale for conducting a PSR after the first 5 years of operation of a new NPP design? In most countries this would just follow the typical 10 year periodicity.	For new NPP design, conduct of PSR after first five years of operation provides feedback on the performance of systems, structures and components and First of A Kind (FoAK) systems. This includes the safety factors considered for PSR following graded approach. Subsequent to this exercise, all

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			further PSRs are carried out every 10 years in accordance with the guidelines given in AERB safety guide on 'Periodic Safety Review of Nuclear Power Plants' (AERB/NPP/SG/O-12, Rev.1).
33847	Section 8.1.2.2	Clarification: Does the AERB Directorate of Regulatory Inspections have inspectors deployed full time at NPP sites, both operational and under construction? It appears from the report that inspectors are only at sites where construction of new NPPs is in progress.	AERB has deployed resident Site Observer Team (SOT) at sites (Kakrapar, Rawatbhata, Kudankulam and Kalpakkam) which have under construction as well as operational NPPs. Further, AERB personnel posted at Regional Regulatory Centres (RRCs) also participate in the regulatory inspections of NPPs. Also refer section 14.1.3.2 of the national report.
33845	Section 6.2.2	In regards to the IGSCC in the main reactor coolant system piping, what type of material is used for the piping? Is it stainless steel or carbon steel?	Stainless steel is used in the main coolant system piping of TAPS-1&2.
33843	General Comment	The report from India was comprehensive, very well written and informative.	India thankfully acknowledges the comment from Canada
33844	Section 2.2.3	Understanding that it was hydrocarbon contamination of the AGMS that was the primary cause of the pressure tube leaks, has India determined which specific hydrocarbon(s) was responsible for the accelerated corrosion and hydrogen pickup in the pressure tubes?	The specific hydrocarbon that was responsible for the accelerated corrosion and hydrogen pickup in the pressure tubes was established to be Ethylene. The event has been shared with international community through Incident Reporting System (IRS) wherein the details regarding hydrocarbons was also shared. Kindly refer IRS report nos. 8742 & 8743 for details.
33643	Art. 15 / 15.3	"The regulatory limits (authorized limits) of radioactive effluents are based on the apportionment of effective dose limit of 1 mSv per year to the public arising from nuclear facilities" Q: What is the general authorized limit for the members of the public from all sources? How does this relate to the partial limit for nuclear facilities?	Authorized dose limit for the members of the public from all sources is 1mSv/year. A dose of 50 µSv from regional sources is reserved for each site. Partial limit for nuclear facilities is enforced by apportioning a fraction of 1 mSv/year, typically from 10-300 µSv, to a particular nuclear facility within the site. Refer AERB Safety Guide on 'Regulatory Control of Radioactive Discharges to the Environment and Disposal of Solid Waste' (AERB/NRF/SG/RW-10).
33792	19.2 Operational limits and conditions	Please provide information on whether Technical Specifications have been developed also for the plant equipment credited in the	Yes. The technical specifications for operation of NPPs also addresses systems / components / equipment required for

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		response to design extension conditions, including severe accident management (permanently installed, portable and mobile equipment used for accident management).	handling of design extension conditions, including severe accident management.
33169	AREA OF GOOD PERFORMANCE	Practice of Remote regulatory inspection during Covid restrictions (§14.4, p127)	India thankfully acknowledges the comment from France.
33170	AREA OF GOOD PERFORMANCE	Availability of a training simulator is a mandatory regulatory requirement for licensing of NPP (§12.2.2, p98). Training for normal and off-normal operating conditions on full scope simulator is a mandatory regulatory requirement for licensing of staff (§12.2.4, p98)	India thankfully acknowledges the comment from France.
33168	AREA OF GOOD PERFORMANCE	Presence of site observer teams (SOT) on certain nuclear sites (§7.2.3.2, p44)	India thankfully acknowledges the comment from France.
33166	AREA OF GOOD PERFORMANCE	Multi-tier system of safety review and assessment implemented at the Regulatory Body (§8.1.2.3, p53; 14.1.1.2, p113)	India thankfully acknowledges the comment from France.
33167	AREA OF GOOD PERFORMANCE	Use of management by exception (§14.1.1.2, p115)	India thankfully acknowledges the comment from France.
33164	CHALLENGE	Completing the remaining activities related to the long term safety enhancements identified subsequent to the accident at Fukushima Daiichi NPP and the on-going action for issuance of the remaining regulatory documents	As mentioned in the national report, the safety enhancements identified for Indian NPPs subsequent to the accident at Fukushima Daiichi NPPs were classified as short term, medium term and long term. Implementation of the short term and medium term safety enhancements have been completed as reported during the 7th review meeting and 8th review cycle of CNS. The development, qualification and regulatory review for implementation of long term safety enhancements identified subsequent to the accident at Fukushima Daiichi NPP has been completed. Implementation of these enhancements is already in progress as planned. Some of the long term safety enhancements such as Passive Catalytic Recombiner Devices (PCRDs) and enhancement of severe accident management programme have already been completed. Containment Filtered Venting System (CFVS) has been

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			implemented at one of the NPPs. Similar CFVS are being implemented at other identified NPPs. Construction of On-Site Emergency Support Centres (OESCs) are also in progress at the NPP sites. AERB has already incorporated the lessons learned from Fukushima Daiichi NPP accident in its regulatory requirements (safety codes) and in most of the identified safety guides. Incorporation of these lessons in the remaining safety guides is in progress based on the regulatory document revision schedule / priorities of AERB. Hence, these are not envisaged as challenges for India.
33165	AREA OF GOOD PERFORMANCE	Development and use of a comprehensive set of safety codes and guidelines (§7.2.1.2, p40 ; annex 7-2, p47)	India thankfully acknowledges the comment from France.
33163	CHALLENGE	Conducting successfully the construction and commissioning of the new 700 MWe PHWR NPPs	The first 700 MWe PHWR NPP at Kakrapar has already been constructed and the plant operation has been demonstrated up to 50% Full Power (FP) as per Phase-C commissioning stage. Further, construction of three more 700 MWe PHWRs is nearing completion. In view of this, India does not envisage challenge in construction and commissioning of 700 MWe PHWRs.
33161	Article 17	Are the hot water discharges into the environment (river, lake or sea) from nuclear power plants regulated? If yes, by which body? possible, give examples of limit values, specifying whether or not the nuclear power plant has cooling towers and the kind of the receiving environment (river, large lake or sea)	The Pollution Control Board is the agency for regulation of discharges to air and water (other than radioactive substances). The Environment (Protection) Rules, 1986 specify that for plants in coastal areas using sea water, “resultant rise in the temperature of receiving water does not exceed 7 degree Celsius over and above the ambient temperature of the receiving water bodies.” All new NPPs located inland are required to have cooling towers. Depending on location, Indian NPPs have receiving bodies of all three categories i.e. river, large lake and sea. Also refer section 7.2.1.1 of the national report.
33162	Article 19	Has India already taken into account the French feedback on stress corrosion discovered on safety injection circuits of	Yes. India is aware of the IRS report no. 9063. India appreciates France for sharing information on the event with international community. The review of IRS reports is a

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		pressurised water reactors (IRS number 9063)? If yes, how?	part of operating experience feedback program of regulatory body as well as the Utility. The methodology for detection of IGSCC type of flaws during in-service inspection is under development.
33159	16.2.1	What is your country's policy regarding potassium iodide tablets? Are they distributed to the public in advance or are they stored in specific places (pharmacies, city halls, etc.)?	The Iodine Thyroid Blocking (ITB) tablets are stored at identified off-site locations for distribution to the public during potential off-site emergency situation. These are not distributed to the public in advance.
33160	16.4, p161	Are there inspections with simulation of an emergency situation on the nuclear installation? If yes, how often?	Off site emergency exercises (simulation of accident conditions) are carried out once in two years. The accident scenarios for simulation of the emergency exercises are disclosed progressively to the plant personnel on the spot through sealed envelopes at the time of exercise. As mentioned in Section 16.4 of the National Report, AERB observes these emergency exercises. In addition, plant emergency exercises and site emergency exercises are also conducted quarterly and yearly respectively. AERB resident Site Observer Teams (SOTs) observe these exercises. The reports on emergency exercises are submitted to AERB for review and acceptance. The aspects related to emergency preparedness are checked during regulatory inspection of NPPs.
33157	15.3.2, p 141	Are there any regulatory criteria (e.g. minimum river flow) to be checked before discharging liquid radioactive effluents in order to limit the impact on the natural environment and if yes, what are these criteria?	The regulatory criteria for radioactive liquid effluent discharges are the activity concentration and total activity limit specified in the technical specification for operation approved by AERB. The liquid effluent discharge is carried out in batch process after ensuring compliance with the concentration limit at discharge point, considering the engineered dilution. Engineered dilution ensures minimum flow rate in the aquatic media and adequate dilution of discharged radionuclides. The restriction on discharges in absence of dilution water flow is specified in Technical Specification for Operation. Periodic samples from the discharge point, and various locations including down flow direction of the aquatic media is collected, monitored and analysed to assess the

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			dilution of discharged radionuclides and the radiological impact due to discharge process.
33158	15.3.2, p141	Are there requirements on a minimal storage capacity that must be available at any time to deal with possible accidental conditions? In particular, for nuclear power plants located along a river, which specific conditions are planned about liquid radioactive discharges management if the river flow becomes very low?	AERB Safety Code on Management of Radioactive Waste (AERB/NRF/SC/RW) specifies the requirements for storage capacity for liquid waste. As per this code, "The capacity of the radioactive waste storage facility shall be designed on the basis of normal operation and anticipated operational occurrences." Further, requirements are given in technical specifications for operation which calls for storage of liquid radioactive waste up to 70% of storage capacity during reactor operation. The liquid waste discharges are generally carried out in batch process. Sufficient storage capacity is available for on-site storage of liquid waste. If the aquatic media / river flow becomes very low, the discharge from the facility is controlled by restricting the activity limit as per the engineered dilution.
33155	14.1.3.2, p121	Does it happen that licensees modify their safety cases in the absence of design modifications, for instance to obtain greater flexibility in operation? If yes, are these modifications subject to assessment and consent by AERB?	The design modifications are implemented in NPPs mainly on the basis of operating experience feedback, new regulatory requirements and special safety reviews undertaken following any major event. Safety and safety related modifications are implemented only after review and acceptance by AERB. Modifications in safety cases without implementation of design modifications based on technical justification are subject to review and acceptance by AERB. For example, any change in technical specifications for operations requirements or safety analysis require AERB review & acceptance.
33156	Article 15	Do operators rely on Best Available Techniques to respect the exposure thresholds? (if yes, please give examples)	Exposure thresholds (dose constraints) are respected by application of optimisation to the best available techniques. As mentioned in the national report, in India, annual collective dose budget proposals of NPPs are reviewed and approved by AERB and any improvements identified for reduction of

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			collective dose are recommended for implementation. During this review, actual exposure vis-à-vis budgeted collective dose of previous years in an NPP and also performance of other similar NPPs in this respect are considered. NPPs carry out job specific assessments for dose intensive jobs in order to optimise the collective dose in accordance with ALARA. Some of the examples for use of methods to optimise the collective dose / individual dose include training of personnel in radiation protection & maintenance practices, use of remote tools for in-service inspections, proper pre-job briefing, mock-up with best available techniques, execution of job through work permit system, rotation of available staff, improvement in procedures, etc.
33153	14.1.1.2, p114	The Unit safety committees and the SARCOP committee include some members from the Utility. How does AERB manage to avoid any loss of independence in its decision making process?	The role of the committees is that of supporting the safety review process and providing recommendations to AERB. The representation from Utility headquarters is normally restricted to 20% of the committee strength (i.e. 1-2 members), mainly for coordination purpose and to take care of Utility's views. The authority for decision lies solely with AERB. This mechanism ensures that there is no undue influence of the Utility in the decision making process of AERB. An IMS document of AERB provides guidelines on formation & functioning of the safety committees of AERB.
33154	14.1.2.5, p119	A six months period appears rather short to assess all the aspects mentionned for a PSR ("improvements in safety standards and operating practices, cumulative effects of plant ageing, modifications, feedback of operating experience, deterministic & probabilistic safety analysis and development in science and technology"). Are there some mechanisms in place to anticipate some of the review and assessment effort?	As per AERB Safety Guide AERB/NPP/SG/O-12 (Rev.1) on 'Periodic Safety Review of NPPs', NPPs are required to submit PSR basis document eighteen months prior to the end of PSR period. The PSR basis document is an agreement of NPP with AERB on the PSR scope, requirements, assessments, expected outcomes, etc. Utility conducts the safety assessment needed for PSR program and submits its report to AERB, after multi-tier review within the Utility organisation, at least six months prior to the expiry of license. In the period of six months, AERB conducts its regulatory review of Utility's submissions with respect to PSR.

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			As mentioned in the national report, license for operation of an NPP in India is issued for maximum period of five years, either based on review of Periodic Safety Review (PSR) or Limited Scope Safety Review (LSSR). Outcomes of PSR of one NPP, including additional requirements emanating from revision of AERB safety standards & codes, cumulative effects of ageing, modifications, feedback of operating experience, safety analysis, development in science & technology, etc. are assessed for other NPPs of similar design / vintage. The site related re-evaluations carried out during PSR of an NPP or while setting up a new NPP are also applied for other NPPs at the site. It may be noted that at most of the NPP sites, new NPP projects are being set up, for which site related evaluations have been carried out following the latest requirements. These evaluations are also made applicable to the existing NPPs at the site. During LSSR of NPP which is carried out once in 5 years and during PSR which is carried out once in 10 year, all the issues identified earlier, which includes routine safety reviews, are revisited and a collective stock on its status is taken. In addition to the above, the routine safety review and assessment of operating NPPs is carried out by AERB on a continual basis by monitoring and assessment of operational and safety performance, radiological safety, maintenance activities, ISI results etc. During this review, important issues specific to the NPPs are identified and the progress on their corrective measures are also monitored. During license renewal of NPP which is carried out once in 5 years and during PSR which is carried out once in 10 year, all the issues identified earlier are revisited and a collective stock on its status is taken. Dedicated staff of AERB are identified for regulatory oversight activities of each NPP. This staff also participates in the review of PSR. The review of PSR safety factors is carried out by expert groups. This

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			also helps in completing the review of PSR in six months. In view of above, the lead time of 6 months for review of PSR is adequate.
33152	Article 14	What safety improvements have been (or are planned to be) implemented in the spent fuel storage pools of nuclear power plants with regard to the application of the IAEA concept of practical elimination of certain accident sequences?	Accident sequences having potential for high radiation doses or radioactive releases to the environment are avoided with provision of following safety features in Spent Fuel Storage Bay (SFSB) i) SFSBs are designed for SSE and there are margins over SSE ii) Provision of siphon breaker avoiding siphoning of water out of the fuel pool iii) Design ensures travel of the single failure proof crane limited to reach the loading position, which is away from the area of the bay where spent fuel trays are located iv) Design provision for addition of make-up water in bay to compensate for loss of water inventory
33150	10.4	Considering the "licensee as a partner in safety" is not usual and can be viewed as limiting the independence of ther regulatory body. Can you elaborate this a little and give examples?	AERB follows multi-tier system for its safety review process as per the IMS Level-I document. The multi-tier system provides for representation of the stakeholders. The criteria for formation of multi-tier safety review committees is such that the decision making is inclusive, participative yet not intrusive, taking into account conflict of interest. This multi-tier safety review ensures independence and graded approach in decision making. It provides checks and balances to minimise subjectivity in regulatory decisions, and provides for taking into account the collective wisdom of the members for impartial, unbiased, consistent, transparent, fair, just and reasonable decisions, taking all aspects into consideration. The role of the safety review committees is that of supporting the safety review process and providing recommendations to AERB. The representation from Utility is restricted to 20% of the committee strength (i.e. 1-2 members), mainly for coordination purpose and to take care of Utility's views. An IMS document of AERB provides guidelines on formation & functioning of the safety

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			committees of AERB. This system provides for taking a regulatory decision by AERB on the basis of recommendations which have emerged out of the culmination of multi-tier safety review process. In all cases of decision making, the ultimate responsibility and accountability lies with AERB.
33151	13.2.4, p106	What are the specific measures taken to address CFSI issues?	i) The approved Procurement procedure provides guidelines to all concerned personnel of NPCIL on the issue of Counterfeit, Fraudulent, Suspect Items (CFSI) and to communicate measures that can be implemented to prevent CFSI from being introduced into NPCIL plants. This procedure describes the process for the identification, prevention, evaluation, notification and disposition of CFSI in NPCIL. It also provides detection/ reporting and disposal of such items including record keeping. ii) NPCIL always ensures that items/ equipment are procured from approved vendors after due process of evaluation. During manufacturing stage, regular visits by NPCIL QA is being carried out to witness/ review as per approved Quality Assurance Plan (QAP) for all critical stages of manufacturing, including the quality of Bought Out Items (BOIs) to ensure that the finished products supplied are as per the technical specifications.
33148	9.1 "the Licensee shall ensure compliance with the Safety Codes and Safety Standards issued by the competent authority"	Is there in India laws or regulations a more general provision assigning the global responsibility for safety to the licensee? If yes, could you please quote it?	Yes. The AERB Safety Code for 'Regulation of Nuclear and Radiation Facilities' (AERB/SC/G), which is the governing requirements for regulation for nuclear and radiation safety in the country provides that the prime responsibility for safety rests with the licensee. Section 2.1.1 of AERB/SC/G specifies "The consentee is solely responsible for ensuring the safety in siting, design, construction, commissioning, operation and decommissioning of a Nuclear Power Plant (NPP)/Research Reactor (RR) and shall demonstrate to the Regulatory Body that safety is ensured at all times."

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33149	10.2, p79	The report mentions that safety culture is assesed and enhanced. How is safety culture assessed?	AERB has developed safety culture indicators for assessing safety culture of NPPs. These indicators cover various areas like management aspects, operational aspects, plant documentation, radiological protection, events and analysis, regulatory compliance, etc. Also, licensee ensures that safety culture is assessed periodically and corrective actions are taken. The adherence to this process is checked by AERB.
33146	8.1.2.3, p53	Can you give some examples of questions of problems submitted to the ACNRS?	The Advisory Committee for Nuclear and Radiation Safety (ACNRS) advises AERB on generic safety issues affecting the safety of nuclear installations. It is also mandated to conduct the final review of draft regulatory documents. The committee advises and provides guidance towards development & revision of regulatory documents put up to the committee by AERB. Examples of issues that came up for consideration in ACNRS, include application of single failure criteria for DEC provisions, credit of non-permanent equipment for severe accident analysis, introduction of formal step for release from regulatory control after decommissioning, etc.
33147	9.0, p67	Can you indicate which texts (law, regulation, etc.) assign the responsibility for safety to the licensee?	The AERB Safety Code for 'Regulation of Nuclear and Radiation Facilities' (AERB/SC/G), which is the governing requirements for regulation for nuclear and radiation safety in the country provides that the prime responsibility for safety rests with the licensee. Please refer response to Question ID 33148 from France on the same subject.
33144	Annex 7.2, p47	The table of Annex 7.2 shows inter alia a list of safety codes and safety standards covering many aspects but not construction or fabrication. Are there other codes or standards covering these two aspects?	AERB has published regulatory documents for construction and fabrication on the subjects such as design of concrete structures, material of construction of civil structures, design & fabrication of steel structures and embedded parts, quality assurance during construction, etc. These documents are referred in Annex 7-2 of the national report (Safety Standards on Civil engineering structures important to safety of NPPs, Safety Codes & Safety Guides on Quality Assurance in NPPs) and available on AERB website

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			(https://aerb.gov.in/english/publications/codes-guides)
33145	7.2.1.3, p41	« Regulations and guides shall be reviewed and revised as necessary to keep them up to date, with due consideration of relevant international safety standards and technical standards and of relevant experience gained. » (IAEA, GSR part 1, requirement 33). Is there in India a required frequency for reviewing and revising regulations or guides?	The safety documents are presently being reviewed and updated based on experience and scientific developments and to harmonize these with the current safety standards of IAEA. Recently, AERB has introduced a provision for periodic review and revision, as necessary, of various regulatory documents for their continued applicability and adequacy. This exercise of review / revision is in progress for a number of regulatory documents. AERB also has a mechanism for obtaining feedback on the regulatory documents from other regulatory processes, for their continual improvement.
33142	Article 6	Is there a difference between licensee and "responsible organization"? If yes, please explain.	The lifetime of an NPP consists of Siting, Construction, Commissioning, Operation and Decommissioning. Licensee is a holder of the Licence for Operation of Nuclear Power Plants in the stage of operation. For the purpose of regulatory licensing process, the persons or organizations holding current 'Authorisation', 'Registration', 'Approval' or 'Consent' granted by the competent authority are also considered as 'Licensee'. Responsible Organization is an organisation having overall responsibility for siting, design, construction, commissioning, operation and decommissioning of a facility. In view of the above, for NPPs in India, the licensee organization and Responsible Organization are the same.
33143	7.2.3, p45	Does AERB have the powers to conduct regulatory inspections at the manufacturers' workshops and factories in order to check conformity of products and not only QA provisions?	AERB is empowered to inspect the nuclear and radiation facilities. The conformity of the products is checked by the licensee as part of its QA programme, which is approved by AERB. For verification of implementation of approved QA programme, AERB carries out inspections at vendor's premises. These inspections are arranged through the licensees. Refer section 14.2.3.2 of the national report.
32301	Pg 141	In ensuring transparency and public confidence, are the results of the periodic environmental	Environmental Survey Laboratories (ESLs) established at nuclear power plant site carry out the monitoring and surveillance of

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		monitoring and surveys, as well as the dose assessment methodology in estimating the dose to the population, around each NPP site made available to the public?	radiation dose to the public residing near the NPP site. The public dose data of each NPP site are available to public through AERB annual reports. The methodology of dose assessment is available in AERB Regulatory Documents which are available on its website for easy access.
32428	HUMAN RESOURCES, page 88	Can foreign engineers be employed at NPP and do you carry out security checks for employees at NPP? If you carry out security checks, how often do you renew them?	Foreign engineers cannot be employed in Indian NPPs. However, they may be allowed to work for specific activities under contract agreements with vendors, suppliers, manufacturers, etc. Security checks of the employees of NPPs are carried out.
32299	Pg 20 / 42 / 64	Can the country elaborate on the mechanisms for providing opportunities to the public to examine and offer comments in the development of regulatory/safety requirements?	There is a mechanism for obtaining and addressing comments from members of public on the Safety Codes and Safety standards under development. The draft Safety Codes & Standards (Specifying Regulatory Requirements) are made available for public comments for a specified period through AERB website. In addition, members of public are free to post their comments and suggestions on any regulatory safety document at any time.
32300	Pg 35	Are existing legislations and regulations enhanced or modified for fast breeder reactors? If so, how is this done?	National laws, regulations and requirements for setting up a NPP are summarised in Article 7 of the report. These provisions are applicable for all types of NPPs. Regulatory documents pursuant to primary legislation pertaining to nuclear energy are brought out in Annex 7-2 of the report. Under this, some of Regulatory documents are technology neutral whereas specific safety codes/safety guides are prepared wherever required. The regulatory requirements, specific to fast reactor based NPPs, were issued by AERB as 'Safety Criteria for Design of Fast Breeder Reactors'. Taking account of latest international standards including that of IAEA as well as national and international experience, development of Safety Code on 'Design of Sodium Cooled Fast Reactors (SFRs) based NPPs' (AERB/NPP-SFR/SC/D) is undertaken which is in advance stage.
32297	Pg 4	What are the surveillance/monitoring measures put in place at the Vitrified Waste Storage Facility?	The Vitrified Waste Storage Facility (VWSF), designed and set up in India, is based on passive natural air draft cooling with provision of forced cooling to take care of

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			any eventuality. Along with continuous monitoring of the radiological status of the facility, some of the important parameters, being monitored, are stack monitoring, temperature monitoring at earmarked locations and ventilation patterns. In line with international practices the facilities are equipped with appropriate surveillance systems including fire detection & mitigation system, physical protection systems and environmental monitoring including sampling sumps and boreholes provided in and around the facility.
32298	Pg 4	Are there identified/shortlisted potential sites for a Geological Disposal Facility? If not, is there a target year for such site to be identified?	India is pursuing a closed fuel cycle, where the quantity of radioactive waste generated is very less. Further, technologies for separation, partitioning and burning of wastes are being developed in the country, which will further bring down the quantity of radioactive waste. Considering the small quantity of radioactive waste, there is no need of Geological Disposal Facility (GDF) in near future. GDF will be built when found viable considering the built up of waste volume which may take decades. However, R&D works in this regard are being undertaken.
30070	para.6.5, p. 31	What criteria were specified for necessary strengthening of old plants? / It is written in the report that an example of the safety enhancement at Indian NPPs on the basis of the aforementioned assessments is the seismic re-evaluation of old plants and consequent strengthening of SSCs, where necessary.	As mentioned in the National Report, safety enhancements are identified in the reviews carried out during i) Periodic Safety Reviews (PSR) ii) Specific reviews following major international/national events During PSRs, reasonable and practicable safety improvements (in line with current safety standards) are identified and implemented, as per agreed time frame. Applicability of the major international/national events for individual NPPs is evaluated and accordingly, safety enhancements are finalized. Criteria for seismic re-evaluation for old NPPs were derived based on international literature including that from IAEA safety series 28 and DoE-GIP and relevant AERB Regulatory Documents. Based on the

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			outcome of assessment, the suitable strengthening measures are recommended.
30071	para.9.4.2, p. 72	What kind of information is available to the public? / It is written in the report that NPCIL has web-based information system, where the information about NPPs is available.	On the web page of the NPCIL, Operational performance of the operating units and progress of the projects are available. Also, Corporate Social Responsibility (CSR) policy, CSR reports, annual reports and environment policy is available. Apart from these, various information are available for public awareness about nuclear power plants in the form of articles, presentations, videos and comic books.
30786	para.6.5.1	Are there computational (technical) substantiations for severe accident management guidelines? Are the computation software tools for severe accident analysis certified?	Computational (analytical) basis of accident management guidelines is available and documented in the Technical Basis Document. Analysis for severe accident scenario is carried out using verified and benchmarked computational software tools.
30863	p. 166	Are there any guidelines, rules, guides for uncertainty analysis within the deterministic safety analysis in India? / India's National Report gives information on the use of uncertainty analysis within the deterministic safety analysis.	Guidance regarding approach to conduct deterministic safety analysis, including guidance for best estimate analysis with uncertainty analysis, is provided in AERB Safety Guide on 'Deterministic Safety Analysis for Pressurized Heavy Water Reactors' (AERB/NPP-PHWR/SG/D-19). The safety guide is available on AERB website at https://aerb.gov.in/english/publications/codes-guides The guidance includes approach to address different types of uncertainties (viz. plant uncertainty, simulation uncertainty, model uncertainty) while using the best estimate analysis. The guidance given for uncertainty analysis in this document is mostly technology neutral. This safety guide is currently undergoing revision to make it applicable to water cooled reactors.
31765	N/A	Is all spent fuel transferred to dry storage after 10 years, or only if space is needed in the bay? (19.8: Management of spent fuel and radioactive waste; pg. 195 – 196)	Spent fuel is stored in a water filled storage bay provided at each NPP. These storage bays are typically designed to accommodate spent fuel accumulated during 10 reactor years of operation. In addition, space is also reserved for storing one full core inventory of fuel in case of exigencies. Depending upon the requirement, spent fuel

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			may be transferred from the spent fuel storage bay to Away From Reactor- spent fuel wet storage facility or for reprocessing. However, a minimum cooling period of 5 years is ensured before transfer of spent fuel to any of these facilities.
31766	N/A	What is the management strategy for spent fuel beyond the storage at reactor and away from reactor? (19.8: Management of spent fuel and radioactive waste; pg. 195 – 196)	Spent fuel generated from operation of nuclear reactor is considered as resource for future energy needs. A closed nuclear fuel cycle program is followed for recovery and recycle of fissile / fertile materials.
31763	N/A	In the case of accidents, how is engineering and technical support provided to NPPs? (19.5: Engineering and technical support; pg. 191 – 192)	The engineering and technical support to NPPs in case of accident have been identified in the station specific documents on accident management guidelines. In the case of accident, initial response is from NPP personnel, for which training programme exists covering accident conditions. Technical support to the affected station is also provided from utility design and safety analysis office, for which a control room is established. From this control room, required technical support can be provided as utility has personnel having experience in design, operation and safety analysis. In addition, the Department of Atomic Energy will provide support as required by the NPP in managing the accident.
31764	N/A	Could India briefly describe the manner used to share OPEX from its NPPs with the international nuclear community? (19.7: Operating experience feedback system; pg. 193 – 195)	India shares OE of Indian NPPs through various international platforms like IAEA-IRS, WANO, COG, IAEA-INES, NEA-CNRA, CNS and various regulator and operator forums. The utility, NPCIL shares the operating experience with WANO by forwarding WANO Event Reports (WERs) regularly which are posted on its website. AERB shares the events of Indian NPPs in IAEA-IRS. In addition, AERB shares the operating experience through the regulators forums (VVER Regulator's Forum, IAEA Annual Meetings of Senior Regulators of Countries Operating CANDU Type Reactors, and other multilateral and Bilateral meetings).

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31761	N/A	How many deviations from the Technical Specifications are typically detected per year, from experience with Indian NPPs, by the Technical Audit Engineer? Is the Technical Audit Engineer empowered to order measures to restore compliance with the Technical Specification? Is she or he empowered to order a temporary shutdown of the plant? (19.2: Operational limits and conditions; pg. 189)	As mentioned in the national report, the role of Technical Audit Engineer at the Station is to independently verify compliance with all the clauses of Technical Specifications for Operation and report to station management. Based on inputs from the Technical Audit Engineer, station management can order measures to restore compliance with technical specifications or order shutdown of the plant if necessary. However, experience has shown that the licensed operating manpower in the control room themselves ensure compliance with the technical specifications clauses and initiate reporting of the deviations from technical specifications, if any. Thus, reporting of deviations by Technical Audit Engineer have been rare. Shift Charge Engineer has the authority to shutdown the plant if required. Moreover, during regulatory inspections, report of Technical Audit Engineer and disposition of his / her findings are checked by AERB.
31762	N/A	Do the licensees perform periodic plant drills simulating the response to transients and accidents and exercising the emergency operating procedures and severe accident guidelines? If yes, what is the periodicity of such exercises and how are they conducted? Do such exercises include the simulation of actions in the installations and on site? (19.3: Procedures for operation, maintenance, inspection and testing; pg. 189-190)	Yes. Handling of Transients/Infrequent events and accidents is through emergency operating procedures (EOPs) and these EOPs are rehearsed in plant simulators. The frequency of this exercise is once in a year for each operating crew. The exercises on severe accident management provisions are conducted in the field to demonstrate their functionality in accordance to Accident Management Guidelines. These drills are categorized based on the severity of simulated scenario and are conducted at defined periodicity – half yearly, yearly and once in five years.
31760	N/A	What consideration was taken in the verification and validation process that led to the implementation of qualified technologies for use in NPPs? (18.2: Incorporation of proven technology; pg. 180 – 184)	Computer Based Systems (CBS) are developed following a systematic development life cycle approach, which consists entire stretch from defining the system requirements through design and development to the installation and commissioning of the system. In this process, activities at each stage of the development life cycle from system

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			requirement to design and development are verified and final product is validated by independent verification and Validation (IV&V) team from utility to ensure consistency and correctness of the products of this development process. This process is carried out in graded manner commensurate with safety class of the system. Every verification step produces a report of the analysis performed, compliance of the outputs of the phase with the inputs requirements, resolution of anomalies and the conclusions reached. At the end of system development, the overall functional and performance requirements of the integrated system is validated. Based on satisfactory resolution of issues observed during verification and validation, system is considered suitable for use in intended application by utility. System life cycle documents and verification and validation reports are submitted by Utility to Regulatory Body as part of a safety case for individual system. Safety case along with all the evidences is scrutinized by Regulatory Body to confirm that system is designed and developed following high quality and safety principles as per guidance provided in AERB safety guide (AERB/NPP-PHWR/SG/D-25) on Computer based Systems of Pressurized Heavy Water Reactors.
31758	N/A	Could India explain the reasons for which NPCIL permitted exemption of specific PHWR from installation of a CFVS? (18.1: Implementation of defence-in-depth; pg. 175 – 180)	From the accident analysis carried out for PHWRs of lower capacity and large containment volume, it is seen that the containment pressure remains within its design pressure for 7 days into the accident. This time is considered adequate to make alternate provisions for containment cooling. This information is given in the national report in section 18.1 of Article-18.
31759	N/A	What is the retention rate and design principles of the filters? Are there also provisions to remove organic iodine? (18.1:	CFVS design of Indian PHWR is based on wet scrubbing using venturi scrubbers. Decontamination Factors (DF) have been established for large range of flows through CFVS by using air/steam through the system.

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		Implementation of defence-in-depth; pg. 175 – 180)	Observed DFs on experimental set ups for elemental iodine, CsI aerosol and methyl iodide are much higher than the values used in radiological release assessment.
31756	N/A	In consideration of the potential impact of flooding on the NPP, is the potential for bio-fouling of the cooling water intake taken into consideration? (17.1: Evaluation of site related factors; pg. 166 – 169)	AERB Safety Code on 'Site Evaluation of Nuclear Facilities' (AERB/NF/SC/S) includes requirements regarding loss of ultimate heat sink, including by bio-fouling & marine organisms growth. During normal operation, the chlorination (dosing) is done in the intake of cooling water system to control/ reduce bio-fouling. In case of flooding, the intake and outfall design of coastal NPPs have adequate design measures to control & stop the progression of bio-fouling mass from reaching and adversely affecting the cooling water pumps. These include special design measures to control/ divert the marine bio organisms, margins in the sizes of the intake system, and use of screens & gates to hinder ingress of large floating bodies. The design of the NPP takes care of maximum flood level with sufficient margin. The equipment related to safety-related cooling water system and emergency make-up provisions are located above the postulated flood level, which also addresses effect of choking of intake due to bio-fouling. Further all NPPs have on-site storage of make-up water for the important systems for ensuring safe shutdown and decay heat removal for a minimum period of seven days.
31757	N/A	Could the contracting party explain if the stipulated 16km EPZ distance is with or without consideration for the type of technology in use? (17.4: Consultation with other contracting [parties; pg. 173)	The 16 km Emergency Planning Zone (EPZ) is irrespective of the type of technology used.
31748	N/A	What is the basis of the assessment of flooding potential due to run-off from precipitation considering measured flow/flood height data, measured precipitation data for a specified	Guidelines on flood hazard assessment at NPP sites are given in AERB safety guides, 'Design Basis Flood For Nuclear Power Plants On Inland Sites' (AERB/SG/6-A) and 'Design Basis Floods for Nuclear Power Plants at Coastal Sites' (AERB/SG/6-B)

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		heavy rain duration converted to flooding data via hydrological modelling of run-off or other? (17.1: Evaluation of site related factors; pg. 166 – 169)	For flooding potential due to run-off from precipitation, generally methodology based on convolution of heavy rainfall/storm via hydrological modelling is adopted.
31755	N/A	What are the characteristics of the dam / barrage failure (e. g. partial or complete failure, instantaneous or progressive break) assessed? (17.1: Evaluation of site related factors; pg. 166 – 169)	As a practice based on observed data of past failures of dams, following guidance is provided in AERB Safety Guide on "Design Basis Flood For Nuclear Power Plants On Inland Sites" (AERB/SG/S-6A): "• In case of rock or earth filled dams, the failure is not instantaneous and it develops slowly. Periods for total failures can be as large as several hours also. • Arch dam failure due to flooding is likely to be instantaneous and the destruction is complete. In case non-failure cannot be demonstrated then total failure is to be considered • Concrete gravity dams are to be analysed for overturning and sliding. Size of breached section and its location should be computed consistent with the type of dam and other relevant parameters. If not, the opening shape and size of failure should be limited by a rectangular shape with the full height as one side and the bottom width of the dam structure as the other side."
31746	N/A	Could India indicate action(s) taken to provide information for EPR to competent authority of neighbouring countries that are likely to be affected by a nuclear accident? (16.9: Compliance with obligations of the convention; pg. 163)	Neighbouring countries are at large distances from the location of Indian NPPs. No trans- boundary implications are expected. India being a Contracting Party to 'Convention on Early Notification of a Nuclear Accident' will notify IAEA in case of any accident at Indian NPP. India also participates in ConvEx exercises conducted by IAEA.
31747	N/A	Could India provide the list of event combinations usually considered? (17.1: Evaluation of site related factors; pg. 166 – 169)	Certain guidance in respect of combinations of hazards are specified in AERB safety guide on 'Design Basis Flood For Nuclear Power Plants On Inland Sites' (AERB/SG/S-6A) Some of these include Dam failure caused by an earthquake equivalent to SSE coincident with peak of 25 years flood; Inadvertent opening of all gates on an

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			upstream dam coincident with peak of flood caused by one half probable maximum precipitation (PMP), etc. The potential for internal hazards such as flooding, missile generation, pipe whip, jet impingement, and fluid release from failed systems or other plant on the site is taken into account in the design of the plant. Some external events may initiate internal fires or floods and may cause the generation of missiles. Such interaction of external and internal events is also considered in the design, wherever appropriate. While conducting safety assessment post Fukushima, it was also brought out that for inland sites, scenario involving combination of flood due to dam break and earthquake should be considered whereas NPPs along Indian coast would only be subjected to either a local earthquake or a tsunami caused by a far away earthquake.
31744	N/A	Could India share lessons learnt and challenges faced with the conduct of table-top off-site EPR exercises during covid-19 lockdown period? (16.8: Emergency preparedness during covid-19 pandemic; pg. 163)	During Covid-19 lockdown, only table top exercises were conducted in place of Integrated Command & Control Response (ICCR) exercises wherever these had become due, with prior permission from AERB. There was no challenge in conducting the table top exercises as these were conducted by plant / site personnel following Covid-19 related protocols.
31745	N/A	Has India conducted an assessment of which States in the vicinity of power plants could be affected in the event of occurrence of a highest scale accident (INES scale 7) at any of the NPPs? (16.9: Compliance with obligations of the convention; pg. 163	Neighbouring countries are at large distances from the location of Indian NPPs. No trans- boundary implications are expected.
31742	N/A	Plants are not mentioned in the list of those to be protected. Are there any special reasons for the omission and what influenced such a decision? (16.3: Implementation of off-site	The intent of the question is not evident. However, presuming that the question refers to the 'plant personnel', it may be noted that they are part of the 'site personnel' which is mentioned in the report.

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		emergency measures; pg. 158 – 160)	
31743	N/A	Are Decision Support System (DSS) tools used in other facilities and on higher levels (district, state, national)? Are such tools checked and approved by AERB? (16.5: Enhancement of infrastructure for EPR; pg. 161 – 162)	The Decision Support System (DSS) for emergency management and estimation of projected dose has been implemented at NPP sites. DSS for NPPs are reviewed and accepted by AERB. DSS helps in taking early decision regarding protective actions in public domain. Taking inputs from DSS, identified experts advise the district authorities for taking protective actions during different phases of accident.
31740	N/A	What are the criteria used to determine precautionary action zone (PAZ) and urgent protective action planning zone (UPZ) boundary distances? (16.2: Emergency preparedness and response laws; pg. 151 – 158)	At preparedness stage, the criteria used to determine precautionary action zone (PAZ) and urgent protective action planning zone (UPZ) boundary distances are based on hazard analysis (for all facilities in a site) carried out for wide range of accident scenarios (design basis accident, design extension condition without core melt down and design extension condition with core melt down) to meet the requirement of protective actions during emergency. In practice identical distances for these zones have been specified for all plants. During an actual emergency situation, for implementation of specific protective measures, the size of PAZ and UPZ will vary based on observed Emergency Action Levels (EALs)/Operational Intervention Levels (OILs) during emergency. The criteria to determine PAZ are based on the prevailing emergency conditions at the facility and also on meteorological conditions. UPZ boundary distances are based on environmental monitoring or, as appropriate, prevailing conditions at the facility.
31741	N/A	Is there any cooperation between India and neighbouring countries regarding EPRs? (16.2: Emergency preparedness and response laws; pg. 151 – 158)	Neighbouring countries are at large distances from the location of Indian NPPs. No trans- boundary implications are expected. India being a contracting party to 'Convention on Early Notification of a Nuclear Accident' will notify to IAEA in case of any accident at Indian NPP. India also participates in ConvEx exercises conducted by IAEA.

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31738	N/A	On what basis does AERB approve an NPPs collective radiation dose budget? Is it enshrined in the Atomic Energy Act? (15.6: Regulatory review and control activities; pg. 142 – 143)	Collective radiation dose budget for a particular facility or activity is approved considering the principle of ALARA. Annual collective dose budget proposals of NPPs are reviewed and approved by AERB and any improvements identified for reduction of collective dose are recommended for implementation. During this review, actual exposure vis-à-vis budgeted collective dose of previous years in an NPP and also performance of other similar NPPs in this respect are considered. Section 17 of the Atomic Energy Act, 1962 provides for radiation protection. Atomic Energy (Radiation Protection) Rules, 2004 promulgated under the Atomic Energy Act, 1962 stipulates, “Every licensee shall establish written procedures and plans for controlling, monitoring and assessment of exposure for ensuring adequate protection of workers, members of the public and the environment and patients, wherever applicable.” Further, AERB Safety Guide on 'Radiation Protection during Operation of NPPs' (AERB/SG/O-5) specifies that ‘The plant management shall in consultation with health physics unit prepare a Collective Dose Estimate for the year including that for special jobs as per approved procedures. The actual collective dose expenditure should be reviewed by the plant management towards achieving exposures ALARA.’ [Refer https://aerb.gov.in/storage/uploads/documents/regdoceuHER.pdf]
31739	N/A	How will communication be ensured in case of an TSBO and/or natural disaster (e.g., earthquakes) which largely destroy infrastructure? Are all emergency response key actors equipped with satellite communication means? Ground stations possibly used for satellite communications may be damaged and unavailable in the event of an earthquake or	In case of TSBO (total Station Black Out), provisions are available in the form of extended battery based back up and portable chargers which can provide power to various communication means. Stations are equipped with multiple and diverse communication systems including satellite and radio based communications systems. There are also multiple locations at each site where diverse communication systems are available (like Plant Emergency Control Centre, Site Emergency Control Centre, Off-

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		tsunami. What are the requirements on fall-back communication means with regards to the transmittal of information, data and voice? (16.2: Emergency preparedness and response laws; pg. 151 – 158)	site Emergency Control Centre) which will enable prompt communication. AERB Safety Code on 'Management of Nuclear and Radiation Emergencies' (under publication) specifies "The licensee shall ensure that appropriate reliable and diverse means of communication are available at all times, under the full range of emergency conditions, for use in taking protective actions and other response actions on the site and for communication with off-site officials responsible for taking protective actions and other response actions off the site."
31736	N/A	The report suggests that environmental monitoring focuses on dietary intake of human population. Are there considerations for flora and fauna? (15.4: Environmental monitoring; pg. 141 – 142)	Atomic Energy Regulatory Board of India considers ICRP recommendations issued from time to time, and issues national directives. The environmental monitoring and surveillance programme include dietary intake of human population and flora and fauna as trend indicators to ascertain the build-up of radionuclides if any. [ICRP 103, Clause (W), states that, 'the Commission continues to believe that the standards of environmental control needed to protect the general public would ensure that other species are not placed at risk']
31737	N/A	Could India consider lifecycle analysis (LCA) of radioactive wastes as minimization of waste at source is only a single step in LCA applications? (15.5: Radiological protection of the public; pg. 142)	Yes, the management of radioactive waste takes into account minimization of waste at source in design, construction and operation of facilities and minimisation of secondary waste generation. Refer section 19.8.2 of the national report.
31734	N/A	Is/are there radiation protection requirements for activities during decommissioning in place? (15.1: Regulatory requirements related to radiation protection; pg. 135 – 137)	The radiation protection requirements during decommissioning of the facilities are covered in the AERB safety code on 'Radiation Protection for Nuclear Fuel Cycle Facilities' (AERB/NRF/SC/RP). The guidance regarding the decommissioning activities including radiation protection aspects are covered in AERB Safety Guide on 'Decommissioning of Nuclear Power Plants and Research Reactors' (AERB/NPP&RR/SG/RW-8).
31735	N/A	How does the AERB ensure that radiation in effluent discharges do not reach the stated values?	AERB specifies the requirement for monitoring & control of radioactive effluent by the licensee. In accordance with this

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		Has the AERB installed dosimeters at vantage intervals within a certain radius of the effluent discharges? (15.1: Regulatory requirements related to radiation protection; pg. 135 – 137)	requirement, the radioactive discharges from the facilities are continuously monitored through installed radiation monitors on the stack / effluent discharge point by the licensee. This data is provided to AERB on regular basis. The off-site environment is monitored by Environmental Survey Laboratories (ESLs) of BARC, which includes sampling of environmental matrices, monitoring by established environmental monitoring instruments / setup and the installed TLDs at designated locations. Refer 6.1.2 of the national report.
31733	N/A	Could AERB share experiences, challenges and lessons learnt regarding the conduct of regulatory inspections of NPPs via virtual and hybrid modes in the wake of the covid-19 pandemic? (14.4: Assessment and verification of safety during Covid-19 pandemic; pg. 127)	Following were the experiences, challenges and lessons learned in conduct of remote & hybrid regulatory inspections: 1. Development of comprehensive self-assessment checklists to cover several inspection areas, while working from home. 2. Development of infrastructure for remote regulatory inspections when the country was under lockdown. 3. Preparing the Utility for remote regulatory inspections. 4. Limitation in covering all areas for verification by Inspectors through videoconference / photographic evidence. 5. Extensive dependence on the assessment & data provided by plant personnel. Although there were certain limitations, the remote & hybrid regulatory inspection process could achieve the overall regulatory inspection objectives. The developed infrastructure & checklists can be used immediately if in case similar situation arises in future.
31731	N/A	How are the AERB in-house codes verified and validated? Which institution(s) was/were responsible for such activity? Are the processes of the Management System categorized according to their safety relevance? (14.1: Assessment of safety; pg. 111 – 122)	AERB in-house developed computer codes are validated through inter-code comparison with validated codes and analysing the significant events. AERB also participates in benchmark exercises nationally and internationally using the in-house developed codes as required. AERB has developed an IMS document on 'Guidance on application of Graded approach in regulation of facilities and activities'. Graded approach is followed in all

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			the regulatory processes i.e. safety review, licensing, regulatory inspections, enforcement, etc.
31732	N/A	Can India elaborate on the Screening Guidelines for ensuring graded approach? (14.3: Operational experience feedback; pg. 126 – 127)	Screening of the events (including internal and external experiences) for operational experience feedback is carried out to identify the events for further analysis. AERB regulatory guide on 'Operational safety experience feedback system in Nuclear Power Plants' (AERB/SG/O-13) recommends screening of the events based on safety implication, potential consequences, probability of occurrence and organizational/human deficiencies. The applicability of the external information is determined based on factors such as generic implications, similar equipment and system design, similar practices, occurrence of a similar event earlier, lessons learnt and applicable corrective actions. AERB has issued IMS documents on 'Guidance for application of graded approach in regulation of facilities and activities' and 'Management of Operating Experience Activities', which provide guidance on screening of events.
31728	N/A	Does AERB and NPCIL have oversight responsibility on utilities' assurance of supplier's quality management systems? (13.2: Quality assurance programs; pg. 105 – 107)	AERB Safety Code on Quality Assurance in Nuclear Power Plants (AERB/NPP/SC/QA, Rev. 1) requires the licensee organisation to establish, implement, assess and continually improve a detailed QA programme, to demonstrate that the programme is consistent with the regulatory requirements, for the life cycle of NPP. The programme outlines the special requirements necessary to effectively manage the processes carried out in multiple organisational arrangements such as contractors, sub-contractors and functional units within an organisation. This QA programme is reviewed and approved by AERB as part of the application for license. The licensee has the responsibility to make proper arrangements with vendor(s) and/or contractor(s) availability of all the required information and also keep the regulatory body constantly informed of all relevant additional information or changes in the information submitted earlier. The licensee

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			is also required to ensure that the consultants and contractors that carry out assignments and activities also follow the safety and quality assurance norms of the licensee. The Contractors are evaluated through a Vendor Evaluation Criterion established by the licensee. In the field before undertaking actual work, contractor personnel are given appropriate training, briefing and are provided with approved work procedure. The work is carried out by the contractor, under the supervision of licensee's personnel. QA checks and critical checks are done by the licensee. AERB verifies the aspects related to adherence to the QA programme including related documentation, as part of the inspections, safety assessments and verification of the licensees.
31729	N/A	Could the India give details of NPCIL's system of planned and documented audits/reviews? What is meant by similar audits are in place? (13.4: Review sand audit program; pg. 108)	NPCIL has an established program for QA audits at operating NPPs, NPPs under construction and at Corporate level. Details are included in sections 13.2.2 to 13.2.8 of the national report. In case of suppliers and sub-suppliers, assessments are carried out following a graded approach depending on safety significance of items manufactured by supplier and Sub-Suppliers. Starting from verification of QA Program for sufficiency and implementation for Safety class 1 equipment by way of regular audits and additionally in conjunction with surveillance activities followed by verification of QA Program in conjunction with Quality Surveillance by independent QA personnel for safety class 2 and 3, is carried out.
31730	N/A	Explain the graded approach mechanism employed by the AERB in the review process. (13.5: Regulatory review and control activities; pg. 109)	AERB has developed an IMS document on 'Guidance on application of Graded approach in regulation of facilities and activities'. The graded approach mechanism is employed by AERB in its regulatory review process by considering the factors like radiation risk/hazard potential of the facility, novelty and complexity of the facility etc. Based on these factors, the scope and depth of review, Tiers of review, selection of review methodology, extent of independent

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			assessment, identification of review basis documents, tools for review & assessment and allocation of resources etc. are determined.
31726	N/A	Clarify the impact of the multi-tier review system of the regulatory framework of AERB. (12.5: Regulatory review and control activities; pg. 102)	The multi-tier review system provides checks and balances in the regulatory review process of AERB and takes into account the collective wisdom of the members/experts in different tiers of review. It provides assurance that review outcome is unbiased and consistent.
31727	N/A	Could the contracting party be specific with the ISO standards and other relevant documents under consideration? How does NPCIL enforce that NPPs adhere to the directives on management systems? Is the India inferring by that NPCIL ensures vendors and contractors are ISO 9001:2015 compliant? (13.1: Quality assurance policies and management systems; pg. 103 – 105)	In the referred section, ISO standard implies ISO 9001 on Quality Management Systems of the organisation, ISO-14001 on Environmental Management System and ISO-18001 on Occupational Health and Safety Management System. Refer section 10.2 of the national report. NPCIL ensures compliance to directives on management system by NPPs through audit programs. Quality Assurance Management Requirements are enforced on contractors through appropriate contract conditions during manufacturing/supply process. Quality Management System requirements issued by regulators in the form of codes/guides are enforced on suppliers as part of contract. ISO 9001 certifications are taken as one of the first building block and as a minimum requirement for identification of potential suppliers at the time of start of Procurement process.
31725	N/A	Which HRA method is used to support the PSA model? (Article 12.2: Human factors considerations; pg. 97 – 99)	Technique for human error rate prediction (THERP) is used to model latent human actions. Dynamic human actions are modelled by using Human Cognitive Reliability (HCR) model for diagnosis error and accident sequence evaluation program (ASEP) for execution error.
31722	N/A	How is human factors consideration accounted for in decommissioning activities? (Article 12: Human Factors (General); pg. 97)	At present, none of the NPPs in India is under decommissioning. Human factors are required to be considered during all stages and activities of NPPs, including decommissioning. The requirements related to human factors are brought in the AERB Safety Code on 'Quality Assurance in Nuclear Power Plants' (AERB/NPP/SC/QA).

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31723	N/A	Could India precisely state how many human factor specialists are working in AERB in charge of all issues related to human factors? What are the requirements (such as background, competencies, experience and others) expected from a human factors' specialist? How are their roles and responsibilities defined? Does AERB rely on support from external human factors specialists (contractors, academics, etc.)? (Article 12.1: Regulatory requirements; pg. 97)	The three major nuclear accidents have highlighted the importance of considering the entire system (Human, Organisational and Technical factors) that contribute to safety. Therefore, instead of separating human & organization factor from the technical aspects, AERB considers an integrated perspective with an effective and systemic approach, rather than human specific factors, which needs specialized experts in human factors. In view of this, basic level training on HOF has been imparted to 70 technical personnel and advanced level training has been imparted to 22 technical personnel of AERB. AERB plans to continue with such training programmes in future to cover all its technical staff. The above approach ensures holistic consideration of human, organization and technical factors for use during day to day regulatory reviews. Review experience in AERB also shows that organizational factors have been the root cause of most of the events. AERB can also employ services of already identified external specialists in human factors for advise in case of requirement.
31724	N/A	Maintenance is often the grey area where events and incidents with human factors implications occur. During maintenance activities, what human factors processes are used to ensure that human errors are kept low? How does the AERB ensure the analysis, prevention, detection and correction of human error in the operation and maintenance of NPPs in India? (Article 12.2: Human factors considerations; pg. 97 – 99)	AERB Safety Code on 'Nuclear Power Plant Operation' (AERB/NPP/SC/O, Rev.1, 2008) gives requirements to reduce the human errors. AERB technical document on 'Human reliability analysis (methods, data and event studies) for NPPs' (AERB/NPP/TD/O-2) provides various methods and illustrative examples for estimation of human error probabilities. Maintenance activities are carried out by trained and qualified staff following the approved maintenance procedure & checklists. Maintenance activities are carried out through the established work permit system. During performance of maintenance activities, human error prevention tools like pre-job briefing, adherence to procedures &

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			checklists, job-site review, hold points, independent verification, Foreign Material Exclusion , peer review, Just-In-Time (JIT) briefing are used. Also regular training on mock-up facilities for critical activities is imparted to maintenance personnel to preclude human errors. Additionally, in all the stations, Job Observation programme has been implemented. Job observation team observe the conduct of maintenance activity with respect to pre-job briefing, adherence to maintenance procedure, job-site review, flagging, post job debriefs, etc. For gaps observed, if any, with respect to desired behaviour, the concerned job performers are coached accordingly. The NPPs are operated within the limits specified in the technical specifications for operation, reviewed and approved by AERB. All activities including surveillance testing are performed using approved procedures to minimize errors due to human factors. All operations in the control room as well as in the field are carried out only after adequate pre-job briefing and planning. Post-job debriefing is done for certain types of jobs to identify the areas of improvement with respect to best practices and taking appropriate actions for enhancing human performance. These areas are verified during regulatory inspections. An event reporting system is adopted and maintained to report events of varied significance to bring out underlying weaknesses in the system. While all the events including low-level events are reported and analysed at various levels by licensees, the Significant Event Reports (SERs) are reviewed in AERB. During these reviews, due consideration is given to aspects related to human performance. The lessons learned and corrective actions taken are disseminated through an operating experience feedback system of licensee as well as AERB. The contribution of human related aspects to the events & corrective

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			actions taken by licensee are also checked during Periodic Safety Review (PSR) of NPPs.
31720	N/A	What are the safety principles, practices and procedures India adheres to regarding decommissioning of NPPs and RRs? (10.3: General safety principles; pg. 79 – 82)	Presently, no NPP is under decommissioning stage in India. AERB has published a Safety Guide on "Decommissioning of Nuclear Power Plants & Research Reactors" (AERB/NPP&RR/SG/RW-8), which states the regulatory requirements as well as technical and safety considerations in the decommissioning of NPPs and Research Reactors.
31721	N/A	Based on INFCIRC/572/Rev.5 Article 11 (2) bullet 11 could India please describe which methods India uses to analyses the competence, availability and sufficiency of the additional staff that is required for severe accident management, including contracted personnel or personnel from other nuclear installations? (11.2: Human resources; pg. 88 – 96)	Subsequent to preparation of accident management guidelines at NPPs, all licensed and qualified personnel undergo periodic training on accident management. Periodic drills are also carried out in which usage of accident management measures are rehearsed, which involve assessment of competence and sufficiency of additional staff required. Requirement of contractor personnel is not envisaged in accident management guidelines. Immediate actions are envisaged to be taken by the staff of the affected NPP. As accident management philosophy is same across the fleet of reactors, personnel from other NPPs can also provide help in case such a need arises. In this context it is worthwhile to mention that all NPPs in India are operated by the same utility and therefore getting help from other NPPs is easily manageable.
31719	N/A	Can India share the procedure for issuing licence to operating personnel? (10.3: General safety principles; pg. 79 – 82)	The procedure for issuing license to operating personnel involves induction / initial training, authorisation based training, on-the job training, simulator training, walkthrough, written examinations, medical fitness tests and final assessment interviews. Sufficient details are included in section 11.2.3 of the national report.
31717	N/A	Can India throw light on ‘proper controls’ in place? (10.3: General safety principles; pg. 79 – 82)	‘Proper control' here means the administrative and management system controls, with provisions for periodic audits, for implementing design changes. Design changes are implemented by following the approved procedures which include adherence to the configuration control norms of the plant, reviews at various levels, implementation as per the design, third

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			party checks, commissioning and update of plant documents.
31718	N/A	Does it imply all other plants in India do not have internal review mechanisms? What is the scope of this internal review mechanism? (10.3: General safety principles; pg. 79 – 82)	All Nuclear Power Plants (NPPs) under construction, commissioning or operation in India have internal review mechanisms. The scope of internal review by utility is elaborated under sections 10.3.2, 10.3.3 and 14.1.1.2 of the national report.
31715	N/A	How does India implement the Vienna Declaration on Nuclear Safety principle that stipulates that national requirements and regulations on safety culture should take into account relevant IAEA Safety Standards? (10.0: General (Priority to safety); pg. 77)	All the national safety requirements / regulations for Indian NPPs take account of the relevant IAEA standards, including for safety culture. The AERB Safety Code (AERB/NPP/SC/QA, Rev.1) spells out national requirements on safety culture. This safety code is under revision, which will take into account the requirements of IAEA GSR Part-2. In addition to the above, AERB safety guide on 'Periodic Safety Review of NPPs' (AERB/NPP/SG/O-12, Rev.1), which is in line with IAEA SSG-25, specifies the requirements for assessment of safety culture under the safety factor-10 (Leadership and management for safety). All NPPs undergo Periodic Safety Review every 10 years.
31716	N/A	What goes into the rigorous assessment of the design basis? (10.3: General safety principles; pg. 79 – 82)	Main aspects of interest for regulatory review and assessment of the adequacy of the design basis for a nuclear power plant are brought out in AERB Safety Codes such as AERB/SC/G, AERB/NF/SC/S (Rev. 1) and the Safety Guides published thereunder. The compliance to the requirements of these safety codes is to be demonstrated by utility in the form of Safety Analysis Reports. The utility submissions are reviewed following graded approach based on detailed review plan which involves Multi-Tier review process before taking regulatory decisions.
31713	N/A	Why would the AERB channel its budget proposal to the government through AEC? How does the AERB ensure avoidance of conflict of interest with the AEC? (8.1 and 8.2: Establishment of AERB; pg. 49 – 58)	Various functions of the Government are entrusted to various Ministries/Departments as per the 'Government of India (Allocation of Business) Rules, 1961'. For all matters related to atomic energy, Department of Atomic Energy is the nodal agency of the Government. Accordingly, the budget proposals of AERB are forwarded to the Government through Department of Atomic

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			Energy. The budget proposal so presented forms part of the finance bill of the central government that is tabled in the parliament. After the finance bill is passed by the parliament, the funds as per the budget allocation are made available to AERB. As explained in the national report, AEC is the high level body dealing with policy matters concerning nuclear energy in the country. All the regulatory decisions on the safety of nuclear facilities lie entirely with AERB. AEC does not interfere in the regulatory decision of AERB. The IRRS mission conducted in 2015, noted the professionalism and integrity of the AEC and AERB and did not notice instances, in which de-facto independence of AERB was compromised.
31714	N/A	How does the AERB ensure the licensee complies with activities within the scope of license issued to the licensee at all times? (9.2: Responsibilities of licensee and means to fulfil obligations; pg. 68 – 69)	The regulatory processes of continual safety review and regulatory inspection, which complement each other, are carried out throughout the lifetime of the facility for ensuring licensee's compliance to regulatory & licensing requirements and to ensure safety at all times.
31711	N/A	Regarding the independence of AERB: Does AEC have to approve the reports on safety status including observance of safety regulations, standards and implementation of the recommendations in all DAE units that the AERB submits? (8.1: Establishment of AERB; pg. 49 – 56)	No. The annual report of AERB is approved by the Board of AERB. The report is presented to AEC for information. AEC does not interfere in the regulatory decision of AERB. The IRRS mission conducted in 2015, noted the professionalism and integrity of the AEC and AERB and did not notice instances, in which de-facto independence of AERB was compromised.
31712	N/A	Can the contracting party assist with the motivation for setting up ERSD and Legal and Security Cell? (8.1: Establishment of AERB; pg. 49 – 56)	ERSD was constituted for development of regulatory strategies for the new and emerging technologies and regulatory issues. For more details, kindly refer AERB website https://aerb.gov.in/english/about-us/divisions The Legal and Security cell was constituted to provide need based legal support for various regulatory processes as part of safety regulation of nuclear and radiation facilities and for effective and efficient

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			security regulation of nuclear and radiation facilities including computer security in NPPs.
31708	N/A	What are the identified safety improvements and how is the implementation being carried out? (6.3: Periodic safety review; pg. 29)	Based on these PSRs, action plans were developed for various areas, viz. additional studies for site related parameters, measures to address obsolescence, revision of safety analysis reports as per latest Safety Guides, etc. The major safety improvements include upgradation of SSCs (such as I&C systems, computer based systems, components where OEM support is not available, etc.) to address obsolescence issues foreseen by NPPs in future. Also refer Section 14.1.2.5 of the national report.
31709	N/A	"The 'Nuclear Safety Regulatory Authority (NSRA) Bill 2011', which expired, aimed at establishing the regulatory body under the new legislation. A similar bill is being processed." What will the significant changes be and how will the new bill strengthen the legal framework for safety regulation of safety in nuclear facilities as well as radiation facilities and associated activities? (7.2: Provisions of legislative and regulatory framework; pg. 38 – 45)	It appears that the reference in the question is made to the India's national report to the 7th RM of CNS. However, the current status is as below and included in the section 7.2.1.1 of the India's national report to the Joint 8th and 9th RM of CNS: To strengthen statutory status of AERB, the proposal for setting up a Nuclear Safety Regulatory Authority (NSRA) was considered by Government of India. Accordingly, Government of India had introduced the Nuclear Safety Regulatory Authority Bill, 2011 in the parliament in the year 2011. The Bill could not be taken up for consideration before the dissolution of 15th Lok Sabha (Lower House of the Parliament). Subsequently, Government proposed to move NSRA Bill, 2015 in the Parliament. However, since the Bill needed re-examination of certain aspects, the proposal was withdrawn. The matter is under review as advised by the Government.
31710	N/A	Could India explain what necessitated the modification of regulatory document development process in the IMS Manual of the AERB? What rules govern modification or revision of the IMS document? (7.2: Provisions of legislative and regulatory framework; pg. 38 – 45)	The Integrated Management System (IMS) of AERB establishes the policies and strategies, thereby enabling the objectives of AERB to be achieved in an effective and efficient manner. The IMS of AERB is in line with IAEA GSR Part-2. The regulatory document development process was revised to bring it in line with the latest policies and strategies provided in the revised IMS level-I document of AERB.

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			This has also taken account of the feedback from assessment of the process. The revisions effected in this regard include application of the graded approach in regulatory document development process and steps to make the process more efficient. The IMS level-I document of AERB provides detailed rules for control of modification or revision of various IMS processes, including the review level and approval level. For example, any change in IMS level-I document requires approval from the Board of AERB.
31706	N/A	Does the in-service inspection program cater for stress corrosion cracking?	As brought out in section 6.2.2 of the national report, the seepage from one of the circumferential welds of main reactor coolant system piping of TAPS-1 was observed during inspection. Detailed investigations revealed that the crack had occurred due to Inter-Granular Stress Corrosion Cracking (IGSCC). Methodology for detection of such type of flaws during in-service inspection is under development.
31707	N/A	Are there timelines for leak investigation for MAPS-1 and repair/replacement of the vulnerable reactor coolant piping of TAPS-1&2 and TAPS-1&2 that experienced inter-granular stress corrosion piping (IGSCC)?	Investigations to establish the root cause of end-shield leak at MAPS-1 is under progress. Preparatory activities for replacement of the vulnerable piping due to Inter-Granular Stress Corrosion Cracking (IGSCC) is under progress at TAPS-1&2. It is expected that replacement of vulnerable piping will be completed by 2024.
31704	N/A	The National Nuclear Power programme indicated that Kudankulam reactors in Tamil Nadu incorporated many advanced passive and active safety features. Could India clarify what these advanced passive and active safety features were?	The design of KKNPP, in addition to the safety features provided in earlier versions of VVER reactors, incorporates additional engineered safety features (ESFs) for catering to design basis accidents (DBAs), Design Extension Conditions (including Severe Accidents), as per regulations and practices adopted in India. For example, the regulatory practice in India assumes that the off-site power supply may remain unavailable for significant periods and there is further possibility of unavailability of on-site power supply under some conditions. Therefore, the plant needed to incorporate passive and active safety features as part of

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			design, to ensure that the safety functions, including decay heat removal, for extended duration under situations involving unavailability of off-site and onsite power. The plant also have design provisions for ensuring sufficient on-site stock of makeup cooling water and diesel oil for ensuring site autonomy for seven days.
31705	N/A	2. With the 30km radius under the environmental survey program, is there a pattern of how surveillance equipment is positioned and at what distances are these equipment's positioned from each other? Are these surveillance equipment's reporting data instantaneously in real time?	The Environmental Survey Laboratory (ESL) carries out periodic surveillance of the areas around NPPs, based on which the radiological impact of NPP operation on the environment and public around the NPP is assessed annually. Areas up to a distance of 30 km are covered under the environmental surveillance programme. From the radioactivity level in the environmental matrices, intake parameters and dose conversion factors, the population dose is evaluated. Kindly refer Article-15.4 of the national report.
31702	N/A	Ghana commends India for its comprehensive national report which is structured in accordance with the Convention articles. India operates twenty-two (22) nuclear power plant units with an installed capacity of 6780 MWe. Eleven (11) more units with capacity 8700 MWe are under construction and ten (10) prospective projects are underway. India identifies nuclear power as a safe, environmentally benign and economically viable source to meet the increasing electricity needs of the country The report mentions India's commitments to the following conventions (UNFC on Climate Change, COP26 UN Climate Change Conference) as additional efforts to the CNS which is commendable. Ghana is very hopeful that India will address the 4 recommendations in the	India appreciates the comment from Ghana.

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		2022 report of the IRRS before the next invitation and visit of the IRRS. The conduct of AERB's National Conference on Regulatory Interface (NCRI) is commendable. Ghana commends NPCIL in its innovative efforts in establishing the state-of-art ''hall of nuclear power'' gallery in Mumbai, New Delhi and Chennai in seeking to create public awareness and educating interested parties in nuclear technologies.	
31703	N/A	India has provided references to requirements which meet cross-cutting issues identified at the 7th Review Meeting. The report provides an overview of the efforts of India to ensure nuclear safety. Indigenisation of the nuclear power projects allow India to effectively ensure safe application of nuclear technology. Suggestion: Given the status of its NPP program, it is recommended that India become a Contracting Party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.	This suggestion does not pertain to the obligations under the Convention on Nuclear Safety or improve the implementation of the obligations of the Convention of Nuclear Safety [Refer Annex-IV of INFCIRC 571 Rev.7; A Suggestion is an area for improvement. It is an action needed to improve the implementation of the obligations of the Convention.]. Hence, this does not qualify as suggestion under the ambit of Convention on Nuclear Safety.
31259	§8.1	Could you describe if and how international exchange is used to further enhance the capacity building of both AERB and BARC.	AERB and BARC have their own programmes for capacity building. India has arrangements for participation of its experts in various international forums (both bilateral & multi-lateral) for experience sharing. This exposure aids in the competence enhancement of participating experts.
31265	§11.2.7 (page 94-95)	In addition to human resources needs for current (ongoing) activities, how is it verified that sufficient staff will be available	Directorates of Coorporate Planning and Human Resource of NPCIL reviews annually the requirement of technical and scientific staff based on the approved plans, periodic

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		for future activities? Is a multi-annual plan in place that takes into consideration those future needs and the time required to train sufficient staff in a timely manner?	progress reports, status of existing staff etc and accordingly recruitment & training of new personnel is being done to ensure sufficient trained staff in a timely manner.
30871	para.15.2.2.4.	Why are lower maximum permissible exposure rates (15 mSv) set for temporary employees of NPPs than for regular employees? Why is this restriction not set forth for all individuals performing works at NPPs?	Maximum permissible exposure limit for radiation workers (which includes temporary workers also) in India is 30 mSv/year. In addition, the occupational exposures of any worker shall be so controlled that the effective dose of 20 mSv/yr averaged over five consecutive years (calculated on a sliding scale of five years) is not exceeded. The dose constraint for temporary worker is 15 mSv/year compared to 20 mSv/year for regular worker considering their short-term association with NPPs. National Occupational Dose Registry System (NODRS) is used in NPPs for effective dose monitoring and dose control of all radiation workers.
31253	§ 7.2	§ 7.2 of the Indian National Report suggests at several places (in particular in § 7.2.2.2) that research reactors are submitted to the same regulations as power plants. Is there any graded approach applied in the safety evaluation of research reactors? If yes, what are the underlying criteria to apply a graded approach?	In section 7.2.2.2 of the national report, AERB safety guide on consenting process (AERB/NPP&RR/SG/G-1) is referred. This safety guide is applicable for consenting of NPPs and research reactors. This document provides guidance on application of graded approach in safety evaluation of various types of research reactors. Graded approach is applied in safety review & assessment, application of regulatory requirements and regulatory inspections of research reactors. IMS document of AERB on 'Guidance for application of Graded approach in regulation of facilities and activities' provides criteria for application of graded approach for various facilities and activities regulated by AERB. The underlying criteria for application of graded approach is based on power level and hazard potential. Based on graded approach, the siting, design and emergency preparedness & response planning related evaluations are carried out. The outcome of invoking graded approach includes the following viz., identifying the need & preparation of review plan, determination of scope and depth of review,

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			effort to be devoted, number of consenting stages for any licensing application, selection of review methodology, extent of independent assessment, stringency of applicable/identified regulatory requirements, tools for review & assessment and allocation of resources etc. As such, the research reactors are not in the scope of CNS.
30868	para.15.6.5.	When was the last time, and under what circumstances, the main exposure limits were exceeded? / The exposure cases exceeding the regulatory constraints/ limits are primarily investigated by the exposure investigation committee at each NPP and subsequently reviewed by AERB.	On May 30, 2011, three workers in KAPS received doses above annual regulatory dose limit (30 mSv). Refer India's national report to 6th Review Meeting of CNS for details.
30869	para.15.2.2.3.	Periodic ALARA reviews are conducted at the NPPs to identify areas for dose reduction and to implement corrective actions. Are these ALARA analyses carried out by in-house NPP personnel or the involvement of representatives from off-site specialized organizations?	ALARA analyses are carried out by in-house NPP personnel, with active participation of Radiation Safety Officer of the NPP and work executing agencies.
30866	Para. 1.2	Does India have plans for development of own small modular reactors and a legislative and regulatory framework to support their development?	To fullfil its commitment to clean energy transition, India is taking steps for development of SMR. India is also observing the world-wide developments in the area of SMRs, for which a group has been constituted on the lines of Nuclear Harmonization and Standardisation Initiative of IAEA.
30867	Section 15.1	It is noted that eye lens dosimeters are deployed at NPPs in activities having potential for eye lens exposure. When performing what types of work at the NPP, is it possible or takes place significant irradiation of the eye lens?	Works involving beaming inhomogeneous field are considered having potential for eye lens exposure, such as cutting, removal and installation of pressure tube in PHWRs. As brought out in the national report, 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.
30789	p. 16	Are any substantive changes in a NPP design (for example, modernization) possible in India and corresponding changes in	Yes. Major safety modifications can also be taken up between the two assessment periods (i.e. PSR or LSSR). However, these

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		the license during operation beyond 5 and 10 years (for example, in the second or seventh year)? / India's National Report provides information about a limited periodic safety assessment of Indian NPPs once in 5 years and about a complete periodic safety assessment of Indian NPPs once in 10 years.	safety modifications are subject to review and acceptance by AERB.
30864	p. 54	Is independence of decision-making by the Regulatory Body provided? / India's National Report says BARC is the only technical support organization of the Regulatory Body. However, it also says that AERB uses services of other TSOs – IGCAR, CSIR, IITs.	Yes, AERB is an independent body for regulation of NPPs. The responsibility for safety assessment and regulatory decision making are solely with AERB. The TSO's support is used in conduct of the safety reviews and inputs from the TSO forms one of the inputs for the safety assessment. As brought out in the national report, BARC is the TSO for AERB. However, AERB may seek technical support for safety review from other organizations (i.e. IGCAR, CSIR, IITs) on case by case basis, after ensuring that there is no conflict of interest.
30865	Section 7	Does India have regulatory documents which in detail provide format and content of safety analysis reports of power units, and, if they are available, do these guidelines cover all types of power units or there is a document that covers each type of power units?	The format and contents of safety analysis reports of all types of NPPs are brought out in AERB Safety Guide on 'Standard Format and Contents of Safety Analysis Report for Nuclear Power Plants' (AERB/NPP/SG/G-9, published in 2017) which is available on AERB website (https://aerb.gov.in/english/publications/codes-guides)
30787	para.19.2	How do nuclear power plants document information on control over the limits and conditions of safe operation, are there appropriate procedures in place? How do nuclear power plants control compliance with safe operation limits and conditions established in technical specifications and safety reviews (SRR), are there appropriate procedures available?	All the NPPs in India are operated within the operational limits and conditions as specified in the technical specifications for operation, which is reviewed and approved by AERB. Appropriate procedures are available in NPPs to record the compliance with technical specifications. These records are regularly filled by control room operators. A Technical Audit Engineer at the Station independently verifies compliance with all the clauses of Technical Specifications for Operation and reports to station management. AERB has specified the format for periodic reports (monthly, quarterly and annual) to be submitted by licensees. These reports contain information on compliance with the

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			technical specifications for operation. AERB verifies compliance with the requirements specified in Technical Specifications for Operation through regulatory inspections, direct observations by resident Site Observers of AERB and during safety reviews. Any deviation from the approved Operating Limits & Conditions are required to be reported to AERB as per the event reporting criteria.
30788	para. 19.6, p. 193	Could India explain what are the criteria applied for classifying an event as an Extraordinary Nuclear Event? What are the main ele-ments of the related reporting system? / According to the National Report, “A system for reporting Extraordinary Nuclear Events has been established in order to meet the re-quirements under the Civil Liability for Nuclear Damage (CLND) Act, 2010.”	The criteria for classifying an event as an Extraordinary Nuclear Event and elements of reporting system is available in Gazette Notification. Please refer the following link: https://egazette.nic.in/WriteReadData/2013/E_2239_2013_003.pdf
30784	n/a	Is there any plan on certification of the quality management system for compliance with standard ISO 19443:2018 «Quality management systems - Specific requirements for the application of ISO 9001:2015 by organizations in the supply chain of the nuclear energy sector supplying products and services important to nuclear safety (ITNS)»?	Yes, ISO 19443:2018 certification is under consideration.
30785	para.6.5	Are emergency I&C systems implemented at nuclear power plants to monitor the reactor plant parameters in case of a severe accident?	Provision for monitoring selected critical plant parameters under prolonged SBO have been implemented at all NPPs subsequent to Fukushima Daiichi NPP accident. However, a dedicated system to monitor selected plant parameters during severe accident conditions is being implemented in NPPs.
30782	n/a	Could you please describe in more details the criteria for selecting suppliers of products for NPP during procurement?	Suppliers’ evaluation is carried out by Utility and also by the contractor. Evaluation criteria are defined for selection of suppliers.

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30783	n/a	What measures are undertaken by NPP operating personnel to ensure the quality in performance of their job duties?	NPPs have comprehensive training and qualification program for operating personnel. Refer section 11.2 of the national report. Operation & maintenance activities are carried out through approved procedures & checklists, which have QA check points and independent verification. During performance of O&M activities, human error prevention tools like pre-job briefing, adherence to procedures & checklists, job-site review, hold points, independent verification, Just-In-Time (JIT) briefing are used. Periodic training on simulator is also imparted to the operating personnel. Additionally, at all the stations Job Observation programme has been implemented. Job observation team observes the conduct of O&M activities with respect to pre-job briefing, adherence to procedures, job-site review, flagging, post job debriefs, etc. For gaps observed, if any, with respect to desired behaviour, the concerned job performers are coached accordingly.
30589	p. 142; p. 162	Could your country please clarify if there are any efforts to establish an online exchange of data from the Decision Support System or Indian Environmental Radiation Monitoring Network with India's neighbouring countries?	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 Crisis Management Group of Department of Atomic Energy, the national contact point.
30590	p. 29; p.178	The 9th National Report states that the "access road to Kaiga generating station site from the residential complex had experienced water logging during monsoons". Could your country please clarify if the implementation of defence in depth includes the accessibility of off-site emergency services during floods and how accessibility to the site was improved?	Yes, implementation of level-5 of defense-in-depth includes implementability of emergency response plans, including accessibility of offsite emergency services during floods. As per the requirements of AERB Safety Code on 'Site Evaluation of Nuclear Facilities' (AERB/NF/SC/S, Rev. 1), the site and surrounding areas should be suitable for implementation of emergency plans. This safety code also requires identification of alternate access routes to the sites. During the event at Kaiga wherein normal access route to the plant was affected, the longer alternate access route

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			was available. As mentioned in the national report, plant authorities are constructing one more access route to the site which will circumvent the low lying areas on the normal access route.
30587	p. 107	The 9th National Report states that the 'utility monitors the adequacy and effectiveness of supplier's Quality Management System through the established verification processes like surveillance and audits' and that 'the overall responsibility for effectiveness of the Quality Assurance Programme remains with Utility'. Could your country please clarify what this implies for the liability of the suppliers?	As brought out in the national report, it is the responsibility of each organisation participating in the manufacture and supply of SSCs to establish and implement Quality Management System Programme so that the product meets the design requirements. However, the overall responsibility for effectiveness of the Quality Assurance Programme remains with Utility. The suppliers' liability for Quality will be as per the contract.
30588	p. 119	Canada (which also runs CANDU reactors) requires a pressure tube to be removed every three years from the unit with the highest integrated fast neutron fluence (lead unit), for evaluation of fracture properties. Could your country please elaborate if there is a periodic removal of pressure tubes to evaluate their fracture properties in your country as well, and if so, what the time frame is?	Yes, in-service inspection requirements include removal of a pressure tube from each Pressurized Heavy Water Reactor (PHWR) between 12-14 full power years of operation and subsequent removal after every 6 years, for detailed examinations such as fracture properties, DHC velocity, mechanical properties, microstructure examination, hydrogen isotope analysis, etc. CAN-285.4 also prescribes the similar approach.
30584	p. 69	The Civil Nuclear Liability law (CLNDA), 2010, provides the Clause 17(b), which states that operators could under circumstances seek recourse against suppliers. Could your country please clarify how the clause is effectively implemented?	Rule 24 of the CLND Rules, 2011 states that 'supplier' shall include a person who: (i) manufactures and supplies, either directly or through an agent, a system, equipment or component or builds a structure on the basis of functional specification; or (ii) provides build to print or detailed design specifications to a vendor for manufacturing a system, equipment or component or building a structure and is responsible to the operator for design and quality assurance; or (iii) provides quality assurance or design services. A detailed examination of the above formulation indicates that 'the system designer and technology owner' is the supplier. Accordingly, NPCIL has taken the

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			role of supplier for PHWRs being set up by it and this is clearly indicated in the General Conditions of Contract. However, the projects for which NPCIL is not the system designer, integrator and technology owner, the role of supplier will be assumed by the system designer, integrator and technology owner for such projects. Financial security option, in the form of Insurance is available in India for suppliers. Refer FAQ 2.0 issued by Department of Atomic Energy, Government of India (https://dae.gov.in/writereaddata/CLND_FAQ_v2_2020.pdf) for more details.
30585	p. 85	The 9th National Report states that "expenditure towards safety improvements in the NPPs throughout its lifetime are met through internal resources generated by NPCIL". Could your country please clarify what 'generated' does mean in this context, i.e. if safety improvements are bound to the sale of electricity/profits?	Safety improvements are implemented from time to time based on the reviews and operating experience feedback. Once a decision for safety improvement is taken, then NPCIL utilizes own funds to implement identified safety improvements. These safety improvements are not linked to the sale of electricity /profit. Moreover, NPCIL is a Public Limited Government company, under the Companies Act, 1956, fully owned by the Government of India.
30586	p. 87	The 9th National Report mentions "a Nuclear Liability Fund, which comprises the levy collected from operators of nuclear installations". Could your country please clarify if there is also a possibility for suppliers to take part in the fund/insurance?	The maximum amount of liability in respect of each nuclear incident shall be the rupees equivalent to 300 million SDRs. The maximum liability of an operator/supplier 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.
30582	p. 39	Could your country please elaborate on the developments regarding the NSRA bill? Are there further steps taken or plans to strengthen AERBs position as an independent regulatory body?	As mentioned in the section 7.2.1.1 of the national report, to strengthen statutory status of AERB, the proposal for setting up a Nuclear Safety Regulatory Authority (NSRA) was considered by Government of India. Accordingly, Government of India had introduced the Nuclear Safety Regulatory Authority Bill, 2011 in the parliament in the year 2011. The Bill could not be taken up for consideration before the dissolution of 15th Lok Sabha (Lower House of the Parliament). Subsequently, Government proposed to move NSRA Bill, 2015 in the Parliament.

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			However, the Bill needed re-examination and the proposal is under review as advised by the Government.
30583	p. 43	Could your country please clarify if the provisions of the "Atomic Energy (Working of the Mines, Minerals and Handling of Prescribed Substances) Rules, 1984" are enforced by AERB?	The safety provisions of the "Atomic Energy (Working of the Mines, Minerals and Handling of Prescribed Substances) Rules, 1984" are enforced by AERB. Chairman, AERB is designated as the Competent Authority under these Rules.
30580	p. 28f	Both NAPS-2 (September 16, 2016) and NAPS-1 (April 12, 2020) experienced loss of Class-IV power supply and struggled to successfully connect to diesel generators due to deficiencies in maintenance procedures. Could your country please elaborate what exact measures have been taken and why they weren't successful after their first implementation in NAPS-2 - especially regarding safety culture?	The event involving failure of DG to connect to class-III bus on September 16, 2016 in NAPS-2 had occurred due to malfunctioning of a relay. The event on April 12, 2020 in NAPS-1 had occurred due to ageing of a component of incomer breaker which was not covered under preventive maintenance program. Both the events had occurred due to different reasons and corrective actions have been taken accordingly.
30581	p. 22	The 9th National report states that, due to COVID-restrictions, a remote regulatory inspection process had to be established and e.g. the PSR for license-renewal for operation of RAPS-5&6 was partially carried out remotely. Could your country please elaborate on methods/improvements that have been developed from this that will also be used in the future?	To overcome the challenges posed by Covid-19 pandemic, AERB developed infrastructure & methodology for conducting safety reviews in virtual / hybrid manner and regulatory inspections in remote / hybrid manner. At the time of nationwide lockdown, regulatory review of RAPS-5&6 PSR was in progress and hence, the review meetings were conducted in virtual / hybrid mode. While the normal working methods i.e. physical inspections and meetings are preferred, the implemented infrastructure facilitates an additional option of virtual participation in review activities in case such requirement arise. Also, in case of requirement in future, AERB will be in a position to easily transit into remote mode of working for carrying out its regulatory business.
30203	2.5, 7.2.3.2, 14.1.3.2 iii., 14.2.3.2, 14.4	(1) How do you determine when to deploy an AERB Site Observer Team (SOT) to an NPP? (2) Is this Team assigned continuously to be on-site? or are they deployed on a case-by-case	AERB has deployed resident Site Observer Team (SOT) at four sites (Kakrapar, Rawatbhata, Kudankulam and Kalpakkam) which have under construction as well as operational NPPs. The SOT are deployed at these sites on continuous basis. In addition,

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		(for example, when there is the need for increased oversight or when there are higher risk job evolutions)?	AERB deploys special teams at site to cover activities of high significance or activities of special nature.
30578	p. 27	In the 9th National Report it is stated that additional inspections were introduced to detect corrosion spots similar to these, detected in KAPS 1&2 in 2015-2016, which were traced back to the presence of unlisted hydrocarbon impurities in the annulus gas monitoring system (cf. 8th National Report, section 6.2.4, p. 24). Could your country please clarify, if there were any gas contamination detected in other plants and if additional cooling channel replacements were necessary?	Presence of unlisted hydrocarbon impurity was not detected in Annulus Gas Monitoring System (AGMS) of any other NPP. Inspections of pressure tubes for localized corrosion spots were carried out in all NPPs and no such phenomena, as observed in KAPS-1&2, was seen. Hence, no coolant channel replacements were necessary. Also refer India's national report to the 7th Review Meeting of CNS.
30579	p. 27	In the 9th National Report it is stated 'Inspections on the reactor pressure vessels of TAPS-1&2 and KKNPP-1&2 are carried out as part of ISI programme.' Could your country please clarify, if the inspections were limited to only these reactors?	India operates two Boiling Water Reactors (TAPS-1&2) and two Pressurized Water Reactors (KKNPP-1&2). The Reactor Pressure Vessel inspections at these NPPs are carried out as per established In-service inspection (ISI) program. All other operating reactors in India are Pressurized Heavy Water Reactors containing pressure tubes, where the inspections are carried out as per the established ISI program. Details of ISI coverage for these reactors are covered in Section 6.1.4 of the national report.
30069	para.1.4, p. 27	What are the results of monitoring for identification of corrosion spots at new pressure tubes? / It is written in the report that based on the experience from the events of leaks from pressure tubes in KAPS units-1&2 (2015-16) and the observation of localized corrosion spots on the outer surface of pressure tubes, additional inspections were introduced for detection of such corrosion spots It is also indicated in the report that pressure tubes were replaced with improved ones.	Inspections of pressure tubes for localized corrosion spots were carried out in all NPPs and no such phenomena, as observed in KAPS-1&2, was seen. New pressure tubes of KAPS-1&2 have also been inspected and no such localized corrosion spots were observed. Also refer India's national report to the 7th Review Meeting of CNS.

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30202	6.5.1.1	You mention in your report that you conducted multi-unit accident exercises. (1) Can you please describe some of the lessons learned that were unique in these exercises as compared to single-unit accidents? (2) Were any staffing or other resource challenges identified?	In India, each nuclear power station (NPS) has two similar units (NPPs). Safety systems are not shared among two units. Human resources are assigned on per NPS basis. Similarly, accident management measures are also implemented per NPS basis. With this, handling of accident in a single unit or both units of a NPS is possible with the provided resources. In this way, in a multi-unit accident scenario, each NPS can safely handle both the NPP Units. In case of simultaneous accident at all NPPs at a site, some NPP units may need assistance from fire station to inject water through fire tenders. As accident progression in all units may not be exactly the same, this requirement of fire tenders will also be staggered and can be handled by the fire station at the site. In extreme case, help from external agencies for fire tenders etc. may be required. Accident management guidelines include provisions for seeking such help.
30049	para.10.2.	Is the International Standard ISO 45001:2018 "Occupation health and safety management systems - Requirements with guidance for use" applied for certification in the safety area?	Yes, some NPPs have got certified and others are in the process of getting certified for ISO-45001:2018
30068	Introduction para.1.3, p. 53	How this closed nuclear fuel cycle is currently implemented? / This Section states that the Indian nuclear power programme is based on closed fuel cycle.	India is pursuing a closed fuel cycle, where spent fuel is considered as a resource, with the aim of utilizing full energy potential of nuclear materials. This approach not only ensures sustainability of fuel resources but also leads to credible radioactive waste management in a manner that takes care of concern for future generations. Spent fuel is stored for a requisite period in dedicated spent fuel storage facilities for cooling and to ensure the decay of short-lived radionuclides prior to reprocessing. The material recovered after reprocessing is targeted for use in future fast breeder reactors. The High-Level Waste generated from reprocessing operations are vitrified in borosilicate matrices and are stored in interim storage facilities called, Vitrified Waste Storage Facilities.

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29748	12.3.4. Assessment of Safety Culture	Are these indicators the same that regulatory body set up for safety culture assessment? / In the report is mentioned that NPCIL has prepared a list of safety culture indicators for application to all NPPs.	Safety culture assessment of NPPs by AERB has been carried out to establish the methodology for checking convergence with the approach followed by the Utility and for benchmarking. The Utility (NPCIL) has been carrying out self-assessment of safety culture regularly for a long time. The approach and methodology for safety culture assessment by regulatory body and Utility are not same.
29749	Radiological protection of the public.	Has not been considered leaving some portion of the annual dose for doses coming from other contributions? / The effluent discharge limits for NPPs are based on the apportionment of effective dose limit of 1 mSv per year to the public.	Yes, these aspects are considered in dose apportionment process at Indian NPPs. A margin of 50 µSv is kept for contribution of radiation dose to the public due to regional sources. Margin is also kept for future facilities at a site. The process of dose apportionment is elaborated in AERB Safety Guide on 'Regulatory Control of Radioactive Discharges to the Environment and Disposal of Solid Waste' (AERB/NRF/SG/RW-10).
30048	para.15.2.2.4.	What is the procedure for obtaining permission to perform works associated with the potential for an employee to receive an excessive irradiation exposure exceeding the maximum permissible value?	If a situation arises in which a worker is required to carry out a special operation wherein dose to the worker may exceed dose constraints (monthly, quarterly or annual), such planned exposures are allowed only for regular employee with proper justification and approval from Station Management, with intimation to AERB, through a procedure called Notification of Planned Exposure (NOPE). Such operations are well planned to keep the exposures to as low as reasonably achievable within the annual dose limit.
29746	8.1.5. Financial resources.	Is it the budget for regulatory body previously approved by AEC? / The budget for AERB is provided by Central Government but routed through AEC. This could cause some problems in the prioritization of resources assignment for regulatory matters.	Various functions of the Government are entrusted to various Ministries/Departments as per the 'Government of India (Allocation of Business) Rules, 1961'. For all matters related to atomic energy, Department of Atomic Energy is the nodal agency of the Government. Accordingly, the budget proposals of AERB are forwarded to the Government through Department of Atomic Energy. The budget proposal so presented forms part of the finance bill of the central government that is tabled in the parliament. After the finance bill is passed by the parliament, the funds as per the budget allocation are made available to AERB. The

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			existing mechanism in no way impacts the availability of funds to AERB. The IRRS mission conducted in 2015, noted the professionalism and integrity of the AEC and AERB and did not notice instances, in which de-facto independence of AERB was compromised.
29747	10.1. Regulatory Requirements to prioritize safety	Which are the indicators set by AERB that a strong safety culture is kept as requested? How is the encouraging of safety culture as developed by AERB? / The AERB have policies which emphasize priority to safety in all activities by which the safety culture which was developed over the years is maintained.	AERB has developed safety culture indicators for assessing safety culture of NPPs. These indicators cover various areas like management aspects, operational aspects, plant documentation, radiological protection, events and analysis, regulatory compliance, etc. Also, licensee ensures that safety culture is assessed periodically and corrective actions are taken. The adherence to this process is checked by AERB.
29744	7.2.1.1. Subordinate Legislation for Nuclear Safety	Under which governmental organization is in charge of the reviewing? Is there some foreseen date for being newly discussed in the Parliament? / The project for setting up the Nuclear Safety Regulatory Authority has been withdrawn and it is under review as advised by Government. It is deemed important this step to better fulfil the regulatory duties.	Various functions of the Government are entrusted to various Ministries/Departments as per the 'Government of India (Allocation of Business) Rules, 1961'. For all matters related to atomic energy, DAE is the nodal agency of the Government. Executive Instructions/procedures are in place for dealing with legislative processes.
29745	Subordinate Legislation for Nuclear Safety.	Has AERB had opportunity for issuing any enforcement order for some non-compliances of a NPP or any other radioactive facility? / The AERB is empowered to inspect and enforcing the regulations in nuclear and radiation facilities. The regulatory body need to be strong enough for enforcing the safety regulations	AERB prioritises an approach of positively influencing the licensees than taking the enforcement actions so that licensees act voluntarily to comply with the regulatory requirements. There have been many instances where licensee, on its own, has taken the actions to correct the deficiencies, including shutting down the reactor when necessary. As a result, instances of taking regulatory enforcement actions are rare. In the reporting period, there was no instance related to nuclear safety which necessitated major enforcement action by AERB for nuclear power plants. 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

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			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 During safety review and regulatory inspections of operating NPPs and nuclear power projects, Utilities were asked to correct the observed deviations in a time bound manner. Few written directives for improvement of construction safety practices within a reasonable time frame in nuclear power projects were also given. All these requirements were complied with by the utility to the satisfaction of AERB.
29643	16.4/P161	It's stated that "Periodic off-site emergency exercises are carried out as per the regulatory requirements and are witnessed by AERB observers to ensure that the emergency planning is adequate and its implementation is effective." Question1: Could you introduce the period of off-site emergency exercises? Question2: Could you introduce how can AERB observers be sure that the emergency planning is adequate and its implementation is effective?	1) Off-Site emergency exercise is carried out once every two years for a NPP site. Plant personnel, CMG-DAE, NDMA and District Authorities participate in this exercise and AERB observers witness the exercise. 2) Among others, AERB observers are deputed in various emergency centres/facilities where they observe the conduct of exercise, functioning of centers and implementation of response actions and note down their observations on the basis of checklist provided. All off-site emergency exercises are also monitored from NREMC, AERB based on analysis and independent assessment of response actions. The observation includes finding on key areas of strengths and areas for improvement which are presented in form of AERB observer report. Based on the observation, an evaluation of emergency exercise is carried out. Follow-up of implementation of recommendations and suggestions for the improvement are carried out.
29644	18.1/P181	It's stated that" For qualification of digital technology for use in NPPs, an elaborate software development lifecycle process and Independent Verification & Validation process (IV&V) has been implemented." Question: Could you introduce the independent verification &	Computer Based Systems (CBS) in Indian NPPs are developed following a systematic development life cycle approach, which consists of the entire stretch from defining the system requirements through design and development to the installation and commissioning of the system. In this process, activities at each stage of the

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		validation of the software development lifecycle process?	development life cycle from system requirements to design and development are verified and final product is validated by Independent Verification and Validation (IV&V) team from utility to ensure consistency and correctness of the products of this development process. This process is carried out in a graded manner based on safety classification of the system. Every verification step produces a report of the analysis performed, compliance of the outputs of the phase with the inputs requirements, resolution of anomalies and the conclusions reached. At the end of system development, the overall functional and performance requirements of the integrated system is validated. Based on satisfactory resolution of issues observed during verification and validation, system is considered suitable for use in intended application by utility. System life cycle documents and verification and validation reports are submitted by Utility to Regulatory Body as part of a safety case for individual system. Safety case along with all the evidences is scrutinized by Regulatory Body to confirm that system is designed and developed following high quality and safety principles as per guidance provided in AERB safety guide (AERB/NPP-PHWR/SG/D-25) on 'Computer based Systems of Pressurized Heavy Water Reactors'.
29645	18.3/P185	It's stated that" Configuration control mechanism is established to record all necessary changes made in the plant during operation." Question: Could you introduce whether there is a comprehensive evaluation for all necessary changes made by plant?	NPCIL has an established mechanism for configuration control for all operating stations. The modifications are subjected to multistage reviews & documentation. During these reviews, comprehensive evaluation for all necessary changes is done. All safety related modifications are implemented only after regulatory review and approval. Requirements for implementation of safety related modifications are given in AERB Safety Code on 'Nuclear Power Plant Operation' (AERB/NPP/SC/O, Rev.1). Modifications in plant are communicated to AERB through an

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			established mechanism which includes technical bulletins, Station Operation Review Committee (SORC) minutes, Monthly performance reports, etc.
29641	15.2.2.4/P140	It's stated that" In areas of high or non-uniform radiation fields, additional dosimetry devices such as extremity badges (for hands or fingers) and head badges are used for exposure monitoring purpose." Question1: Could you introduce what type of dosimetry devices extremity badges (for hands or fingers) and head badges are? Question2: Could you introduce how extremity badges (for hands or fingers) and head badges measure the extra dose in area of high or non-uniform radiation field?	i) Thermoluminesence Dosimeters (TLD) are used as extremity badge or head badge to assess the dose. ii) The extremity badge or head badge measure the dose received to extremity or head and same is assigned to that organ whereas dose recorded by Chest TLD is assigned to whole body dose. Algorithms are developed and used for assessment of extremity dose and skin doses.
29642	15.6.2/P143	It's stated that" The unplanned activities, which were not part of the collective dose budget, are carried out based on the principles of ALARA." Question1: Could you give some examples about unplanned activities that are not part of the collective dose budget? Question2: Could you explain whether the increased collective dose caused by defects of treatment equipment of the plant is treated as unplanned activities?	During the course of operation of NPPs, there may be requirement of carrying out additional activities which were not considered during preparation of dose budget proposals. These activities are termed as unplanned activities. An example of such activities could be additional maintenance work due to breakdown of an equipment or additional inspection work taken up based on operating experience. All the unplanned activities, are carried out based on the principles of ALARA.
29639	14.1.3.2/P122	It's stated that "Similarly, AERB evaluates the personnel in the management positions through a Committee constituted by AERB for Licensing of the Station Management Personnel." Question: Could you elaborate on how the AERB Committee evaluates the personnel in management positions at a NPP？	AERB safety guide on 'Staffing, Recruitment, Training, Qualification and Certification of Operating Personnel of NPPs' (AERB/SG/O-1) specifies in detail the qualification and certification requirements for all Station personnel including plant managers. Based on these guidelines, NPCIL has established a procedure for certification of Plant Managers (Senior Station Management Personnel), concurred by AERB. The senior management certification process involves assessment of candidates

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			through written examinations and interview of the candidate by a AERB constituted committee. The committee has members from NPCIL, BARC and AERB. The committee evaluates the candidates based on their technical knowledge, overview of safety management, safety attitude, etc. AERB certifies the successful candidate after a final assessment interview conducted by the committee. Also refer section 11.2.3.2 of the national report.
29640	14.2.2.6/P124	It's stated that" The proposals for design modifications or revision in technical specifications for operation are supported by the results of PSA studies, whenever required." Question1: Could you elaborate on whether there are any cases of design modifications or revision in technical specifications that were rejected by PSA studies? Question2: Could you introduce what is the modeling range of PSA model?	AERB follows a risk informed approach. The proposals for design modifications or revision in technical specifications for operation are based on the deterministic analysis and complemented by PSA findings, wherever required. As a practice, Utility ensures that these requirements are fulfilled before submission is made to AERB. Hence, there have been no cases of design modifications or revision in technical specifications that were rejected by PSA studies. In India PSA Level-1 and Level-2 are modelled. The Level-1 PSA includes full power, low power and shut down for internal events and internal & external hazards.
29584	18.1.1 Page 180	India may like to elaborate the implementation of event reporting system viz. Significant Event/Change Reporting Criteria (SECRC) during construction and commissioning of NPP by AERB.	AERB has established a reporting mechanism which requires utility to report any Significant Event/Change observed during different stages viz. design, siting, manufacturing, construction and commissioning of NPPs. The SECRC provides guidelines and stage-wise reporting criteria to the utility on what, when and how to report an event / change in safety related SSCs during pre-operational stages of an NPP. The SECRC includes reporting of Event or Change that has caused damage to/deficiency in SSCs important to safety, or having potential for damage or latent failures, or it is a deviation/modification from approved design or design basis or specification. The mechanism envisages an early notification of the event/change based on reporting criteria laid out in SECRC document, followed by the significant

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			event/change report which includes details of the event and subsequently, an Event Closure report after completion of corrective action. These submissions after internal review by utility, undergoes multi-tier review at AERB and appropriate regulatory decisions are taken following graded approach. Also refer 14.1.3.1 of the report.
29585	19.8.2 Page 196	India may like to share the major actions taken or planned to achieve the objective of near-zero discharges in the latest NPPs.	Discharge of liquid waste to the water body is reduced by introducing liquid waste evaporation system in KKNPP. Additionally, liquid waste generation is reduced by reusing of water to the extent possible. For e.g. Liquid waste generation in decontamination system is reduced by reusing water with the help of filtration and ion exchange system.
29638	10.3.3/P81	It's stated that "For non-standard jobs involving safety, special procedures are made and regulatory approval is obtained." Question: Could you elaborate on what are safety-related non-standard jobs that require special procedures and regulatory approval?	As required by AERB Safety Code on 'Nuclear Power Plant Operation' (AERB/NPP/SC/O, Rev.1), all the activities in the NPPs are carried out as per the established procedures. Non-standards jobs are the jobs which are not part of regular plant operation or the jobs which are being carried out very infrequently or the jobs for which no experience is available. All such non-standard jobs on safety systems need regulatory reviews. For example, boiler replacements in RAPS-2, deployment of any new inspection tool / technique for inspection of reactor / primary systems, etc.
29477	p. 68-72	In relation to the strengthening of the licence holders capabilities to ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence, could you, please, explain how is the adequacy of financial resources of licence holders evaluated? Are there any defined criteria?	As per The Atomic Energy Act, 1962, “Central Government shall have power to produce, develop, use and dispose of atomic energy either by itself or through any authority or Corporation established by it or a Government company and carry out research into any matters connected therewith.“ In accordance with the above, all operating NPPs in India are owned by Nuclear Power Corporation of India Ltd. (NPCIL) which is wholly owned company of Government of India. The financial resources of NPCIL come from budgetary support from Government of India, borrowings from capital market and internal

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			surpluses. NPCIL raises finances for the construction of new projects through a combination of Government budgetary support, market borrowings and internally generated resources by sale of electricity. It is ensured that budget for a particular project has been sanctioned and is available before commencing the construction work. Please refer section 11.1 for details.
29478	p. 68-72	Concerning the strengthening of the licence holders capabilities to ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence, could you, please, clarify whether you have established any special provisions/rules/procedures for the licensees´ responsibility for activities of their related contractors and subcontractors involved in activities with an impact on nuclear safety? If yes, please, specify.	Section 3.2 of AERB Safety Code on 'Quality Assurance in Nuclear Power Plants' (AERB/NPP/SC/QA, Rev.1) specifies, 'The organisation shall retain overall responsibility when contracting any process'. AERB requires the licensee organisation to establish, implement, assess and continually improve a detailed QA programme, to demonstrate that the programme is consistent with the regulatory requirements, for the life cycle of NPP. The programme outlines the special requirements necessary to effectively manage the processes carried out in multiple organisational arrangements such as contractors, sub-contractors and functional units within an organisation. This QA programme is reviewed and approved by AERB as part of the application for license. AERB verifies the aspects related to adherence to the QA programme including related documentation, as part of the regulatory inspections and safety assessments.
29056	11.1.1	The Indian Nuclear Liability Fund to provide for prompt compensation to the victims of nuclear incident. "The Civil Liability for Nuclear Damage Act enacted in the year 2010 provides for prompt compensation to the victims of nuclear incident through a no fault liability regime channelling liability to the operator. Pursuant to the Civil Liability for Nuclear Damage Act, 2010, the Nuclear Liability Fund Rules, 2015 have been promulgated. The Rules	India thankfully acknowledges the comment from Brazil

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		establish a Nuclear Liability Fund, which comprises the levy collected from operators of nuclear installations. This component is charged at present, at 5 paise/kWh and collection is deposited with Government of India." This Initiatives can be seen as area of good performance for India.	
29476	p. 49 - 56	Are there any extra tools in your legislation for prevention and resolution of conflicts of interest to ensure the independence of competent regulatory authority? If yes, please specify. If not, please, clarify way how is this issue solved, especially in case of rotating staff with executive responsibilities between the licence holders/nuclear industry and regulatory body (both directions).	The personnel working in AERB are permanent staff of AERB and there is no rotation of staff among licensee and regulatory body. Therefore, there is no issue of conflict of interest for the AERB staff. Please refer section 8.1.4 of the national report.
29053	12.6	3) In the Article 12 of India report, specifically in the item 12.6 is stated that: "Human factors are given adequate consideration during all stages of NPPs. Systems for training and retraining of operating personnel including use of simulators, operational feedback including lessons learned from the events and regulatory control are well established. …" In this context, is there in AERB a specific system or program to collect, store, classify and analyse information related to human performance from the event	AERB has a database to store the information related to reportable events from NPPs and inspection findings. The root causes of reportable events, including those related to human performance, are reviewed & analysed in AERB and published in AERB annual reports. These annual reports are available at AERB website. During Periodic Safety Review, the contribution of human performance related aspects to the events and inspection findings during the 10 year period is reviewed.

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		report or inspection report? If yes, please comment a little about this system?	
29054	13.2.5	4) It's mentioned in section 13.2.5 Quality assurance in manufacturing" that: "… All the outsourced activities (such as manufacturing/ supply of items) are governed by a formally agreed contract document. All the activities are performed according to approved QA programme, plan and procedures. The utilities or their authorised representative(s) have access to relevant areas, where work involving the concerned Contract/ Purchase Order is being carried out, for the purpose of quality surveillance. This includes access necessary for inspections of contractors' facilities/ activities to verify implementation of all aspects of the Quality Management System / Quality Assurance Programme, products and to their supplier's premises. Findings of these inspections and required corrective actions are documented." Could you inform if the AERB performs any type of inspection or audit on manufacturers and suppliers?	AERB approves the QA programme of licensee. For verification of implementation of approved QA programme, AERB carries out inspections at vendor's premises. These inspections are arranged through the licensees. Refer section 14.2.3.2 of the national report.
29055	10.5	It's mentioned in section 10.5 "Safety Culture, its development and assessment": "NPCIL has established a system for safety culture assessment of operating NPPs. This is in accordance with the	India thankfully acknowledges the comment from Brazil

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		requirements of NPCIL HQI titled 'Assessment and Fostering of Safety Culture at Nuclear Power Stations'. The system involves both safety culture assessment based on documented data in the station and safety culture survey. As a part of this system, each station carries out following activities. - Evaluation of various safety culture process inputs by Safety Culture Assessment Panel (SCAP) members independently against the set criterion. - Conducting quarterly review of outcome of the said evaluation process by SCAP members jointly to identify significant safety culture issues and corrective actions to address them. - Conducting annual safety culture survey - Review of safety culture survey results by SCAP - Overall assessment of safety culture annually by station management and issuing corrective action programme. The above process is supported by training and effective top down and bottom-up communication at the station" This process can be seen as area of good performance for India.	
29051	7.2.3.2	In subsection 7.2.3.2 of Article 7 is mentioned that; "The observations made during regulatory inspections are categorized according to their safety significance. Inspection findings and utility response are reviewed in AERB, and enforcement actions as deemed necessary are taken. " In that case, How is the significance determining process of the inspections fidings?	AERB has an IMS document for categorisation of regulatory inspection findings based on graded approach. Based on this document, inspection findings are categorised considering the potential of the deviation to impact the safety on its own or in combination with other failures.

Question Id	Ref. in National Report	Question / Comment	Answer
29052	10.1 and 10.2	It's mentioned in section 10.2 – "Safety policies and programmes": "… Utilities ensure that the consultants and contractors, for carrying out assignments and activities, also follow the safety and quality assurance norms of the Utility. Utilities have management systems in place to ensure that safety is accorded priority in its activities. …" And It's mentioned in section 10.1 – "Regulatory requirements to prioritize say" that: "… AERB Safety Code on 'Quality Assurance in Nuclear Power Plants' (AERB/NPP/SC/QA, Rev.1, 2009) provides basic requirements to be adopted for establishing and implementing quality assurance programme for assuring safety. It specifies that utility management shall determine their effectiveness in establishing, promoting and achieving objectives of nuclear safety. …" Is the Utility QAP reviewed and approved by AERB? Is the implementation of QAP by utility audited by AERB? Are the QAP of main contractors reviewed and approved by AERB? How the AERB proceed in relation to QAP of other contractors?	Quality Assurance Manuals (Siting, Design, Construction, Commissioning and Operation) of Licensees are reviewed by AERB with respect to requirements of AERB Safety Code on 'Quality Assurance at Nuclear Power Plants' (AERB/NPP/SC/QA, Rev.1), being one of the mandated submissions for identified major stages of licensing of NPP. Licensees are required to have management systems in place to ensure that contractors have QA programmes in-line with QA manuals of licensee. The QAPs of main contractors and sub-contractors are reviewed and approved by licensee. Section 3.2 of AERB Safety Code on 'Quality Assurance in Nuclear Power Plants' (AERB/NPP/SC/QA, Rev.1) specifies, 'The organisation shall retain overall responsibility when contracting any process'. During regulatory inspections, AERB verifies the mechanism of licensee for ensuring implementation of the approved QAPs by main contractors and other contractors.

Question Id	Ref. in National Report	Question / Comment	Answer
29047	14.2	On page 119 of the report, item (iii), is presented information about to “Em-mass coolant channel replacement” (EMCCR) in PHWR. Wouldn't it be interesting to present some safety criteria, such as the useful safe lifetime of the tubes?	As mentioned in the national report, the pressure tubes of PHWRs are covered by extensive life management programme involving in-service inspections, material surveillance and measures for optimizing their operational lifetime. Based on these assessments, decision is taken for en-masse coolant channel replacement. Presently, all Indian PHWRs are fitted with Zr-2.5%Nb pressure tubes with four numbers of tight fit garter springs. As seen from the experience, the life of pressure tubes in Indian PHWRs is governed by dimensional changes during operation (such as axial elongation or increase in diameter).