RESPONSES TO THE QUESTIONS AND COMMENTS ON THE NATIONAL REPORT OF

GERMANY

(Group 6)

No.	CNS Article, Ref. Nat. Rep.	COMMENT / QUESTION	ANSWER
1		Overall the report is very comprehensive and gives good detail on the activities undergone by the operators to comply with the various Articles of the Convention.	
2	Introduction p. 5	It is stated that risk of radiation was identified to be higher now as previously thought; please explain.	The recommendations of the International Commission on Radiological Protection (ICRP) form the basis of radiological protection in many countries. Basic recommendations were published in Publication 26 (1977) and in Publication 60 (1991). The 1991 recommendations are based on the most recent information from epidemiological studies in the population of Hiroshima and Nagasaki. The new data indicated that the risks of radiation-induced cancer exceeded those assumed in 1977 by a factor of 3 to 4 (4×10^{-2} instead of $1{,}25 \times 10^{-2}$). For more information see ICRP Publication 60.
3	Introduction	Has been any risk-based analysis carried out or consideration made before the decision to prefer interim storage of spent fuel and its transport to the final storage facility afterwards vs. reprocessing it?	It was always possible for licensees to apply for on-site interim storage facilities. In the documentation for such an application the applicant has to demonstrate that the necessary precautions against damage have been taken in accordance with the current state of science and technology. Risk-based analyses are not required. This is in accordance with practices in other countries. Last year, the RSK has issued specific guidelines for interim storage facilities. They give guidance for the applications with regard to necessary protective measures and are the basis for the review of applications by the regulatory body.

4	Introduction p. 1	It is described in the first paragraph of page 1 that the phase-out will be implemented by limiting the standard lifetime of the nuclear power plants to 32 years from the date of commissioning. What is the technical basis of the standard lifetime of 32 years?	The standard lifetime of 32 years has no technical basis. It is the result of a political agreement. This lifetime was defined on the base of a compromise between industry referring to the constitutionally based protection of investments and the government wanting to phase out of nuclear power as soon as possible. On the base of this compromise it was agreed to limit the operational lifetime of each NPP by an individually fixed amount of electricity allowed to be produced after 1 January 2000. These electricity amounts were calculated on the basis of a standard operational lifetime of 32 years. Certain assumptions on the plant availability to be expected in the future were considered. Operation is terminated when the allocated electricity volume has been reached. Table Q4 shows the calendar dates of the end of the 32-years periods. The actual dates for shut down will differ from these data depending on the operational performance. The agreement permits the transfer of the right for electricity output between the NPPs, but in principle only from older to newer plants and from smaller to larger plants. Any decision on exceptions from the principle “old to new” has to be taken by the Federal Government.
5	Introduction	Introduction to the Report says that recently Germany re-evaluated the risks from atomic energy uses. As a result of this re-evaluation and based on the latest data and experience Germany will cease to use atomic energy for commercial electricity generation, and this will be implemented gradually by limiting the standard NPP lifetime to 32 years from the start of unit commissioning. The question is as follows: Please, describe which factors define the standard 32-year lifetime of a NPP unit, and do you perform any research that determines the possibility for NPP operation above the standard lifetime?	As there are no technical factors for limiting the operational lifetime, there is also no research on the possibility to extend the lifetime of the plants. Such research would be in contradiction to the agreed phase out.

6	Introduction	Introduction to the Report notes that the events that occurred since the beginning of atomic energy use demonstrate that new risks always arise that could not be foreseen earlier. Could you please advise what "new risks" have been identified in the course of German NPPs operation?	Operational occurrences have shown that unexpected malfunctions and failure combinations that can make the different levels of defence ineffective can not totally be excluded. Even if the risk of a large release in case of an accident might be low, the consequences are to large to be acceptable in the long run. Such unexpected events have been precursors for interfacing systems LOCA, unexpected failures such as explosions (due to radiolyse gases) of pipes with the potential of consequential failures, deboration, strainer clogging, combinations of technical failures and failures related to the safety management.
7	6	When will the necessary backfitting measures for the Biblis A nuclear power plant be completed?	See question No. 72
8	6, p. 7, para 4	Reporting should be limited to facts; it should not be used to advertise pro or anti nuclear views.	
9	6, p. 9	It is reported that for these measures, applications have been submitted by the plant operator which, however, do not cover the need for backfittings completely, and the Federal Government insists on granting the necessary licenses as soon as possible and implementation of these measures by the plant operator without delay. 1. Is the backfitting required by law or administrative request? 2. What are the problems that do not cover the regulatory need? 3. In the case that the plant operator does not implement the said backfitting as the federal government insist, does the federal government	The backfitting has been requested by the regulatory authority. Relevant backfitting and risk - reduction measures were implemented and realised in particular by backfitting the nuclear service water system in 2000.The remaining urgent backfitting measures will be finished in 2002. For further open improvement measures, e.g. the independent emergency system, the detailed programme still has to be agreed with the regulatory authority. The Federal Government has the right to force the *Länder* government by a federal directive to shut down a nuclear power plant if this is necessary for safety reasons.

		take the enforcement action such as forced shutdown of operation?	
10	6	As mentioned in the Report (Article 6), the share of nuclear electricity in Germany is approximately 30%. Could you please clarify whether the German NPPs operate in the load following regime (daily, weekly, monthly etc.), and if so, how this may affect NPP safety?	The German NPPs are operating in different regimes, some plants are in base load operation all the time and a minor part of plants are operating in a load following regime from time to time depending on the demands of the load dispatcher. The German NPPs are designed for base load and for load following operation. Hence, any influence of load following operation on the safety of the plants has been considered already at the beginning by the regulatory authority. No influence on the safety of NPP has been found so far.
11	6	Operators have carried out or are carrying out detailed assessments of the safety status of their existing nuclear power plants, particularly older plants designed and constructed to earlier standards. Which regulatory actions has the Federal Regulator taken so far to address the fulfilment of high level safety standards?	Since the beginning of the nineties, periodic safety reviews have been performed by licensees. These reviews were partly required by licensing conditions partly they were performed voluntarily. Regulatory guidelines have been developed by a federal states committee for nuclear energy chaired by BMU. In these guidelines, criteria for the necessity and urgency of safety improvements have been defined [3-74-1]. The safety levels of the operating plant have to be compared against current safety standards and practices. According to the latest amendment of the Atomic Energy Act the process of the safety review is now a legally binding obligation of the licensee. Based on the experience so far the guidelines for the safety review will be revised especially with regard to the assessment criteria and applicable standards. With regard to results and improvements see question No. 75.
12	Comment to Art. 7	The nuclear programme has been started some decades ago and it has been stated now that the legislation needs updating. Existing legislation also requires that licences can only be granted if the necessary precautions against damage have been taken according to the state of science and technology. Respective regulations of the regulatory body need updating to the state of science and technology.	

13	7	Which legislation and which legally binding regulations have been updated during the past five or ten years to adapt the legally required precautions against damage to state of S&T? What were the most important improvements that have been achieved?	The Atomic Energy Act has the great advantage that it obliges applicants and the regulator to assure that provisions against hazards and risks are taken in accordance with the state of the art in science and technology. That means, if the operator does not cope with this corresponding requirements, the regulator can oblige him to do so in any single case. The regulator may in such cases refer to any standard, national or international, that reflects the current state of science and technology. On the other hand, the legally binding obligations do not include technically detailed specifications, i.e. they are open for up-to-date interpretations. Recently an amendment to the Atomic Energy Act has been made, obliging the licensee to perform Periodic Safety Reviews. Table Q 13 shows examples of regulations that have been promulgated during the past five years. Most important is the guidance for periodic Safety Reviews especially with regard to the use of PSA and the implementation of accident management measures. See also Appendix 4 of the National Report.
14	7	To what extent have legally not binding regulations been updated that must be followed by the regulator?	Examples for recently updated regulations are shown in table Q 13. The promulgations of the BMU have to be followed by the regulator. The regulator is also involved in the development of KTA standards. KTA standards are adjusted to the state of the art in science and technology on the basis of regular reviews and amendments if necessary at intervals of no more than five years. The regulator only agrees to KTA standards if they reflect the current state of science and technology at the time of decision-making. Following the legal requirements the regulator then must consider these KTA standards in regulatory decision-making. See Chapter 7 (2i) of the National Report and also question No. 22. Other regulatory documents concerning nuclear safety (e. g. regulatory guidelines) are newly drafted, revised, commented or withdrawn as appropriate to the needs for regulatory decisions. For these there is no formal regular process for reviews and updates. An example for a current revision of a regulatory guide is the improvement of the Safety Review Guidelines.
15	7	Have safety improvements or backfitts for operating plants been requested	In the past, when new safety measures were proposed by the RSK e.g. and accepted by the Federal Supervisor, these measures were implemented by the

		from licences due to updated legislation or regulations? What are the legal means to require such improvements or backfitts?	NPP operators on a voluntary basis. Basically this was the case for the on-site accident management measures. All major modifications of the plant or its operation require a license. A license can only be granted if all necessary precautions to prevent danger are taken. These precautions are reviewed in the light of the state of the art in science and technology. Whenever a modification is applied for, new regulations and new requirements are applicable for the modification itself and for the plant to the extent as it will be affected by that modification. In the case of non-compliance with respect to legal provisions or to requirements of the license the competent nuclear licensing supervisory authority is also authorised by section 19 of the atomic energy act to require protective measures. According to section 17 of the atomic energy act amendments to licenses are admissible. In case of a considerable hazard the licensing authority has to revoke the issued license if the hazard cannot be removed within a reasonable time by appropriate measures. A license can also be revoked if licensing prerequisites are not fulfilled any more.
16	7	On page 3 of the report it is stated, that the nuclear safety regulations are in compliance with the internationally accepted safety standards. On p. 112 it is stated that the standards have not been subjected to a general review with regard to differences compared to international standards. What is the current status of this matter? What is foreseen for the future?	The state of the art in science and technology as mentioned in the Atomic Energy Act includes the state of the art in the international regulatory framework. So internationally accepted standards are also basis of backfitting requirements of the nuclear authority. The Federal Government compares specific national regulations during their amendment with the international regulations. A programme for a general review of the existing regulations has been started. In addition current international standards shall be taken into account in the KTA 2000 project.
17	7	Deregulation of electricity markets and associated ownership changes and increased competition together with phasing out nuclear power in Germany are factors and circumstances external to the nuclear safety programme as such, which could have a significant impact on nuclear safety.	Impacts on the safety of the NPPs due to the deregulation of the electricity market if any would be dealt with in the regulatory supervision process. From the point of view of the federal regulator the phasing-out has not a special significant impact on nuclear safety. Furthermore, the Federal Regulator sees a need for actions with regard to safety-related and regulatory issues in order to maintain and improve the safety level of the German NPPs.

		Which concrete actions have been implemented by the Federal Government to counteract these developments and what has been achieved so far? What is planned?	See also Chapter “Planned Activities for Improvement of Safety” of the National Report, e.g. safety management system.
18	7	Which national regulatory strategies will be followed during the phase-out of nuclear power (regulations of detailed prescriptive nature as compared to less prescriptive, goal oriented approaches and the complementary use of risk based assessments.)?	It is not intended to have specific regulations for the phase-out period except those that directly relate to the amendment of the Atomic Energy Act, for example the safety review and the monitoring of the produced amounts of electricity. There is a common understanding that no compromise will be made with respect to safety. On the other hand, there are ongoing regulatory processes that aim for improving safety, for example in the areas of ageing and safety management. In addition, basic KTA guidelines are being developed in which fundamental questions like safety goals and use of probabilistic safety assessments are addressed.
19	7.21, 7 (2i)	Article 7(2i) states that the KTA safety standards are “not legally binding”. Is there a license condition or the like requiring licensees to follow these standards? If not, how are current safety standards enforced in order to maintain the highest possible level of safety?	The licensing authority, the ministry of the *Land*, refers in the licence to certain KTA standards. The authority demands within the licence that the requirements of these specific KTA standards are to be met. This must be done in every single licence.
20	7.21, 7 (2i)	Chapter 7 (2i) “Nuclear Safety Regulations” states that „…the measures regarding precaution against damage must comply with the state-of-the-art in science and technology” How is the requirement of the Atomic Law used in the practice of modification of NPPs?	See question No. 21.
21	7.21, 7 (2ii)	What are the criteria of an actual modification for asking approval of the Regulatory Body and conducting the	Any modification planned and applied for will be checked for safety implications. In case the license basis is affected, i.e. the licensed design of the plant and its operation, a formal licensing procedure for such a "major modification" is required.

		licensing process indicated in details in *Chapter 7 (2ii)?*	"Minor modifications" need approval by the supervisory authority of the *Land*. Modifications to the non-nuclear part of the plant or having no safety implications at all can be performed at the licensee's discretion. All *Länder* authorities have a set of criteria in place to judge on the categorisation of planned modifications. By such a categorisation the "major" modifications are identified and the "minor" modification reviewed to the extent as appropriate. In most cases technical support organisations are involved to review the licensee's application.
22	7.21, 7 (2i), p. 13	It is reported that conventional technical standards, in particular the national standards of the German Institute for Standardisation (DIN) and also the international standards of ISO and IEC, are applied just as they are in the design and operation of all technical installation, as far as the conventional standards correspond to the state of the art in science and technology. 1. How national standards such as DIN are incorporated in German legislative and regulatory framework? 2. How those international standards such as ISO and IEC are incorporated in German legislative and regulatory framework? 3. In case any incompatibility between an authorised national standard and an international standard is found, how is it solved? 4. Are there any ISO and/or IEC standards already adopted?	1. The licensing authority, the ministry of the *Land*, refers in the licence to certain DIN standards. The authority demands within the licence that the requirements of these specific DIN standards are to be met. This must be done in every single licence. The legislative framework does not include an obligation to follow DIN standards, but to apply the standard that represents the current state of science and technology. The decision there about is made on case-by-case basis. 2. There is no difference between national and international technical standards. In both cases the licensing authority must refer within the licence to the standards, which are to be met. 3. See answer 2. 4. A lot of international technical standards are adopted by DIN literally as DIN EN (from CEN/CENELEC) DIN ISO (from ISO) or DIN IEC (from IEC). In the regulatory framework these are binding only, if the licensing authority refers to them.
23	7.24,	What are the procedures to appeal	Action against the ruling of the regulator can be brought before the administrative

	p. 19	against the ruling of the regulator?	courts on *Länder*, or finally on federal level, according to the legal system of Germany.
24	8, p. 12	The relation between the states ("*Länder*") and the federal government is still unclear when it comes to decision-making. E.g., can a licensee lodge an appeal with the federal government in case of unusual (i.e. deviating from general practice) safety demands of a states authority? Can the federal government overrule decisions made by a state, or vice versa?	The *Länder* act on behalf of the Federal Government and in close co-operation when it comes to decision-making. If necessary, the Federal Government can overrule the competent *Länder* authorities. The licensee can appeal informally against a decision at the competent *Länder* authority or bring action against it before the administrative courts of the *Land* or finally on federal level.
25	Comment to Art. 8	According to the first Review Meeting special attention should be given – among others – to the development of assured human resources and competencies. In its second report it has been confirmed that an efficient an well-informed nuclear regulatory supervision will be ensured: the government agencies responsible will guarantee the necessary financial resources, the technical competence of their personnel, the required number of personnel as well as an expedient and effective organisation. It is understood that the related government agencies consist of the Federal Ministry and the Federal State Licensing and Supervisory authorities. The Federal Office for Radiation Protection, the Advisory Committees and the Authorised Experts have only supporting or advising but no	

		regulatory functions.	
26	8.1, p. 23	It is stated that: “The overall cost of the licences for construction and operation are set at 2 per mil of the construction costs.” How is the construction cost estimated? Is there an independent cost estimate by the regulatory body? What is included in the construction cost?	For former construction licenses of new NPPs: In the past the applicant presented to the regulatory licensing authority a realistic cost plan for the project to be licensed broken down into details as appropriate. The construction cost included the nuclear facility as applied for and to be covered by the future license. Also, all other parts of the facility not directly covered by the nuclear licensing procedure but relevant for initially judging on plant safety had been included. The authority, after discussion and review of this plan, had set the license fee according to the Nuclear Cost Ordinance [1A-12] and based on the result of the review of the cost plan. If necessary, technical support organisations had been involved. For modification licenses: The procedure is similar to the above description. In addition, the actual costs of the licensing authority are taken into account.
27	8.1, 8(1)	Article 8(1) describes the regulatory body, specifically identifying the significant role of the regulatory bodies in the various *Länder* in regards to nuclear safety regulation. How does the federal authority ensure consistency between the different regulatory bodies, specifically in regards to day-to-day regulatory activities (e.g. design change requests)?	The *Länder* act on behalf of and in close co-operation with the Federal Government. The Federal Government has the right to issue, if necessary, binding directives on factual and legal issues in each individual case. In the interest of a uniform execution of the Atomic Energy Act and the associated ordinances across the Federation, the federal structure of the Federal Republic of Germany implies a high degree of co-ordination between the Federal and *Länder* governments. In generally, they act by common consent concerning the execution of the Atomic Energy Act. In individual cases, the BMU may use the right to give directives to achieve a level of safety that is as high as possible. For further details see chapter 8 of the National Report (Figure 8-1)
28	8.1, Introduction p. 3 8(1) p. 23	It is reported in Introduction that essential condition for ensuring safe operation of the nuclear power plant is an efficient and well-informed nuclear regulatory supervision and the government agencies responsible in Germany will guarantee the necessary financial resources, the technical competence of their personnel, the required number of personnel as well	The German Government has initiated a "loss of competence analysis“ on the Federal and on the *Länder* level in order to obtain reliable data on the number of trained staff members that will be needed in the future for ensuring and maintaining experienced and efficient regulatory supervision. Through this analysis, the respective areas of competence that need to be staffed with qualified experts in replacement of retiring staff-members will be determined. Appropriate training programmes based on the Systematic Approach to Training (SAT) will be initiated on the Federal and on the *Länder* level. Several *Länder* authorities have already started such recruitment and training programmes, supported by special training courses initiated by the Federal Ministry, the BMU. The Federal Ministry is

		as an expedient and effective organisation. It is also reported in section 8(1) that regulatory supervision requires an annual personnel deployment of 30 to 40 man years for each nuclear power plant unit. 1. How many personnel at present are engaged in current regulatory activities in federal bureaus and local supervisory authorities respectively? 2. Under the circumstance that nuclear industry would become less attractive for people owing to nuclear phase-out policy, how do German government maintain number of personnel with appropriate competence for performing effective regulatory activities?	also assessing the idea of creating a central pool of experts to be trained in all areas of competence needed for an efficient regulatory supervision, from which qualified regulatory staff could be recruited after a training period of about two years. The quoted figure of 30 to 40 man-years for each NPP-unit refers only to the authority staff at the *Länder* level including the staff of support organisations. At the Federal level the legal and technical staff including their experts are approximately: - about 75 persons at BMU and BfS departments of Reactor Safety for reactor safety issues and - about 100 technical experts of GRS engaged in reactor safety issues. Concerning the number of personnel see also question No. 30 and regarding measures to maintain competence see question No. 49.
29	8.1, 8	One of the most difficult challenges in assessing the safety performance at a nuclear power plant is to recognize the early signs of declining safety performance, before conditions become so serious that regulatory sanctions must be imposed or, worse, a serious incident or accident occurs. In this connection, it is widely known that a good approach is to have senior resident inspectors who can observe the day-to-day operations of the plant. 1. What is the role of resident inspectors in the regulatory framework?	In Germany we have no "resident inspector" on site of the NPPs. As mentioned in the National Report chapter 8 (1) and 14 (i), authorised experts are involved in the licensing procedures, thus supporting the decision-making authorities. As well, authorised experts are involved in the review process of the plants, in in-service inspections and assessment of events (see also chapter 14 (i)). Most of the 30-40 man-years of inspection time per plant in Germany are assigned to authorised experts (e.g. from TÜV). These experts are frequently on-site and have detailed knowledge of the plant. Section 12 of the Atomic Energy Act lists the following aspects which must be taken into consideration when engaging experts: - vocational training, - professional knowledge and skills, - trustworthiness and

		2. What is the size(number) of resident inspectors per reactor or site? 3. What are the major activities of resident inspectors? 4. What are the requirements for the qualification of resident inspectors?	- independence. Details regarding these requirements are specified in corresponding regulatory guidelines [3-8, 3-34].
30	8.1, 8.1	How has the number of staff with the necessary regulatory qualifications developed during the past five years within the regulatory body? How will the staff of the Federal and the Federal State regulators develop in the next five years if no recruitment will take place?	In 2000 the staff of the *Länder* authorities and their TSO was in total 1,347 (authorities: 481, TSO: 866). In 2005 it is expected that authorities and TSO need a number of staff of approximately 1,285 with a technical or scientific education (authorities: 466, TSO: 819). Between 117 – 174 persons of the technical staff of the authorities and the TSO will have retired until 2005. It is planned to recruit approximately 55 – 112 during that period. See answers to the questions Nos. 47, 48, 49, 50 and 51, too
31	8.1, 8	Where are the necessary qualifications for the staff of the regulatory body engaged in the main regulatory functions of development of regulations and guides, review and assessment, inspection and enforcement laid down (Are the Guidelines on the Qualification as there are for the operator?)? Which areas of competence have to be covered by what number of qualified regulatory staff to ensure the efficient supervision?	At present, only a few *Länder* authorities have prepared specific requirements in writing for the necessary qualifications for the staff of the regulatory body. There are no federal guidelines yet for regulatory authorities in Germany. However, such guidelines will be prepared as criteria for future recruitment and training activities. The number of regulatory staff that will retire in the next years concerns all areas of competence of the authorities and the technical support organisations (see answer to question No. 30). Therefore to ensure an efficient supervision in future, it is necessary to have a wide-ranging training programme for the new employees. Numbers of regulatory staff necessary for the individual areas of competence are not available. See answers to the questions Nos. 30, 47, 48, 49, 50 and 51.
32	8.1, 8	Are there well defined training programs in order to ensure that adequate levels of competence are achieved and maintained to ensure that staff are aware of technological developments and new safety principles and concepts?	Training programmes for Federal and for *Länder* regulatory personnel are in place and are up-dated as need arises. These training programmes exist on Federal and on *Länder* level and will be supplemented by a more systematic approach to training which focus on the actual near and mid-term needs identified through a “loss of competence analysis” presently under way.

33	8.1, 8	Is there a long term staffing program? How is future staff recruited and prepared for its future responsibilities?	Long-term staffing programmes are not yet in place for the Federal and for several *Länder* regulatory authorities, as the “loss of competence analysis” will have to be completed and evaluated first to serve as a basis for this staffing programme.
34	8.2, 8	What measures have been taken to ensure that the supervision of nuclear power plant operation is fully independent from organisational units promoting the use of nuclear energy in case these units belong to the same Ministry as the organisation responsible for nuclear supervision?	The German parliament has deleted the purpose of the promotion of the peaceful utilisation of nuclear power, originally mentioned in Section 1 of the Atomic Energy Act of 1959, by the amendment of the Act in 2002. On federal level the competence for licensing and supervision lies with the Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU). As the supervisory body for the Länder authorities it guarantees the independence of the regulatory body.
35	8.2, 8.2	Significant attention was directed in Article 8 towards the separation of the regulatory body from the promotional/industry bodies. The report states that certain *Länder* fulfill “the function of nuclear supervision and energy industry promotion” with one single ministry. Although there is a division between organizational units, please describe how impartiality is ensured and maintained.	See answer to question No. 34.
36	9, p. 27	In the case of utilities (with board members) who is the licence applicant, the NPP or the Board? In case the licence holder is the utility (board) who has the primary responsibility for nuclear safety?	License holder is the utility, which operates the NPP (see Appendix 1.1 of the National Report). Responsible for nuclear safety is the station superintendent. He is reported to the authority by name as the ultimately responsible person.
37	10, 10	Which measures have been taken and/or are planned to ensure that safe NPP operation is maintained during the remaining operating lifetimes?	The Federal Regulator has significantly intensified his supervisory activities, in particular to strengthen the safety management of the licensees. It is foreseen to oblige the utilities to establish a transparent overall safety management system, which measures its performance by objective indicators. One specific utility has, after discussions with the regulator, already obliged itself to deliver a first concept for five plants in June 2002. Further measures will concentrate on subjects like

			ageing management, periodic safety reviews and particular safety issues. (For details see "Planned Activities for Improvement of Safety" of the National Report.)
38	10, 10	An ageing workforce is an issue for many nuclear regulatory bodies. What is the plan by the Authority to ensure that new staff and graduates are recruited and retained?	See answer to question No. 28.
39	10, p. 29	It is indicated that the federal government doesn't have concrete solutions for the new challenges facing nuclear industry, such as the decision to phase-out the NPPs or the deregulation of the electricity market. Is it possible to indicate in which direction solutions are sought, or to indicate an outline of the work programme?	The German regulator has concrete strategies to maintain safety of nuclear plants. See answer to question No. 37. Phase-out is not a reason for a special challenge. And even the deregulation of the electricity market has more revealed problems than created them.
40	10	With the agreement between the Federal Government and the power utilities of June 2000, the German industry will terminate the electricity production from nuclear energy in an orderly manner. The operating lives of the NPPs shall be limited to a standard operating life of 32 years, converting the output of the total operating life for each NPP into electricity equivalents. Could you detail the way of transfer of the right for electricity output between the NPPs ?	The transfer of generating rights between the NPPs is specified in the Agreement between the Federal Government of Germany and the utility companies: "The utilities can transfer electricity volumes (generating rights) from one power plant to another if the Federal Office for Radiation Protection is informed by the operators concerned. There is agreement between the negotiating partners that this flexibility will be used to transfer electricity volumes from less economical to more economical plants. Therefore, electricity volumes shall in principle be transferred from older to newer and from smaller to larger plants. If electricity volumes are transferred from newer to older installations, agreement is required between the negotiating partners within the framework of the monitoring group with participation of the utility company concerned; this does not apply in cases where the newer installation is at the same time being decommissioned".
41	10	What safety measures are foreseen for Biblis A NPP backfitting ?	See answer to question No. 72.
42	10	What approach does Germany	The German approach to accident management is treated in chapter 18(i) of the

		Government take to the management of severe accidents?	National Report under “fourth level of safety”. Additional details are given in the answers to question Nos. 102, 103 and 104.
43	10	How does the regulator assess safety culture?	See answer to question No. 55.
44	11.1, p. 30	Government Expenditures: Is there a provision for expenditures related to the continuation of support for technical cooperation with regulatory bodies of countries importing German nuclear technology, even when Germany decides finally to close their nuclear facilities?	The Federal Government of Germany has declared that the cooperation with countries importing German nuclear technology will be continued. Expenditures are still provided for the support of the regulatory bodies in such countries to promote the exchange of technical information and enhance the nuclear safety.
45	11.1, 11(1)	Article 11(1) states that licensees are setting aside decommissioning funds. Is there a regulatory requirement to ensure that adequate funds are available as the plant reaches the end of its life?	Apart from fiscal and commerce regulations on the financial reserves for the follow-up-costs, which are examined by accountants annually, there is no additional regulatory requirement to ensure that adequate funds are available as the plant reaches the end of its life.
46	11.1, p. 30	For building up the financial reserves for decommissioning an interest rate of 5,5% is assumed. Is this percentage a fixed percentage for a longer period of time, or is it fluctuating with the market?	The interest rate of 5.5 % is a fixed percentage based on the fiscal regulations.
47	11.2, Section 11(2) p. 33	As mentioned in the report, the licenses of the operating personnel in Germany NPP will not be expired. How did the Nuclear Safety Authority and NPPs make their operating personnel keep the capabilities required by the licenses?	The necessary competence of the operating personnel in NPPs has been specified in several regulatory guidelines. The requisite number of qualified personnel needed to fulfil core competencies important for ensuring safe operation of the plant has been specified in a recent report. The necessary qualifications and the number of qualified personnel have been documented in the operating licenses of each NPP. In case the operating organisation wants to modify the number of qualified operating personnel available on site, this can only be done after prior assessment and approval by the competent regulatory authority. If the operator cannot prove that the number of qualified personnel is in agreement with the criteria mentioned above and with safety needs, the operating

			license may be revoked. Therefore, it is of vital interest to the operating organisation to meet its primary responsibility for safety of the plant by providing staff, well trained and adequate in number.
48	11.2, 11	Is the development of human resources in the area of nuclear safety monitored? Has the further development during the phase out period been assessed? Are there plans for maintaining adequate human resources to cope with future nuclear safety needs?	The development of human resources in the area of nuclear safety has been subject to several studies and review activities by research institutes, regulatory authorities and utility organisations. The regulatory authority monitors sufficient staffing and competence of NPP personnel. These are licensing prerequisites. Therefore it is the responsibility of the licensee to assure sufficient competent staffing for safe operation. See questions Nos. 32 and 33.
49	11.2, 11	Have special measures been taken to maintain critical competence within the industry due to retirement of many people who contributed to the design and start up of nuclear power plants and the difficulty of attracting young people into the nuclear energy field?	The loss of critical competence within the industry, in particular due to retirement of experts qualified in design and start up of NPPs, has been ongoing for more than a couple of years already. With respect to the operating personnel of NPPs the competence level in general has been maintained at a high level, in spite of early retirement programs of the utilities. Substitution for retiring staff on the engineering, technicians and craftsmen level is generally available from conventional power plants and in future also from nuclear power plants undergoing shut-down. The only remaining major manufacturer for NPPs in Germany has merged with a foreign partner to benefit from the joint expertise and experience. The operating organisations of the NPPs have joined forces and agreed on a specific package of nuclear hardware and service contracts to be made with the major manufacturer mentioned before. This package is meant to serve as a procurement programme to support the maintaining of competence at this designer and manufacturer. After all it is not the task of the regulator to provide nuclear power plants with sufficient staff. The regulators task is to watch whether the staffing and competence of the operators are sufficient to run the plant safely. See also question No. 32.
50	11.2, 11	Have special actions been taken to counteract loss of interest and loss of personnel in the nuclear safety sector?	See also question No. 49.
51	11.2,	The report refers to the power plant school that was set up by the utilities	Up to now the operating organisations of NPPs still get sufficient candidates with an engineering degree to be trained for taking over responsible functions in NPPs,

	p. 32	in 1970 and offers special courses to provide the specific skills required for work at power plants. What has been the recent experience in Germany with regard to the willingness of engineers to enter the nuclear industry, especially now that it has been agreed to phase out nuclear power in Germany?	because electricity supplying companies still offer good career perspectives even during phase-out of the nuclear option. If there is a problem to find engineer replacements, this is regarded as being a general problem of the German job market, as young qualified engineers are difficult to recruit because of a significant drop in the number of engineering students in the past. A particular problem is associated with the knowledge on plant design for NPPs; training is not provided by the manufacturer to the same extent as in previous years. The phase-out decision has no measurable effect on this development. See question No. 49.
52	12, 12	What is the trend regarding safety culture at the individual German NPPs, and what measures will be taken to ensure that safety culture will not be affected by the decision to phase out nuclear energy in Germany?	There are several developments in Germany regarding the improvement of safety culture during the phasing-out period. For details see the answers to the questions Nos. 53, 55, 56, 57, 58 and 59.
53	12, p. 18	Organization and safety culture: Please provide more details and information on the status of the self-assessment program mentioned in the last paragraph.	Self-assessment programme: The Affiliation of Power Companies (VGB PowerTech) is introducing a safety culture assessment system, which is based on various assessment elements. To each element questions are assigned. A group of three assessors (one internal, two external) will interview staff and employees, check the documentation, and inspect the plant. The grade of implementation of each element is checked by using a ranking system which consists of six levels: - the process is not identified, - the process is identified, - the process is known and understood, - the process is well known and well understood, - the process is vivid and continuously improving, - the process is learning and optimising by its own. According to the licensees, the development of the self-assessment program has been completed, it has been presented to some regulatory authorities and it will be used in the plants henceforth. These programmes cover many intend aspects of the operating organisation that are not subject to regulatory review. Independently from industry activities the regulatory body has initiated activities

			with the objective to strengthen the safety management of the licensees. See also question No. 55.
54	12, 12, p. 38	It is reported that each German nuclear power plant has its own HF-officer in charge of the human factors programme. The results of the human factors programme and the measures implemented as a result are summarized by the utilities in an annual report to the regulatory authorities. 1. Are the nomination of HF-officer and establishment and implementation of human factor programme required by regulation? 2. What does a HF-officer do as daily activity? Some examples?	1. HF-officers and HF-programs are not required by regulation. 2. The task of the HF-officer is to analyse, evaluate and to draw conclusions from events, which include HF-aspects. This could result in interviews, discussions, lectures, training, modification of procedures, guidance to shift or maintenance personnel.
55	12, 12, p. 39	It is reported that in 1998 the utilities operating the German nuclear power plants initiated a national peer reviews pilot project, and preparations are now underway to establish such a self-assessment programme on a permanent basis, and one utility is currently also developing a process monitoring system which is to register the quality of safety relevant process on the basis of measurable parameters. How do the Federal government and/or supervisory authority encourage these voluntary activities performed by the utilities?	In 1998 the German utilities started a National Peer Review Program, which contains many elements of the WANO Peer Reviews. Peer review teams visit the different plants (normally for one week) and make reviews on a selection of nine different areas such as shift hand over, radiation protection, in-service testing, quality assurance etc. During the visits, observation reports are written for each area and discussed with the plant staff. The reports contain findings such as good practices, proposals and recommendations. A final report is distributed to all plant managers and the results are presented on the common meeting of the plant managers. It is not delivered to the regulator. The Federal government encourages these voluntary activities. The aim of the regulator is to ensure that all NPPs establish a safety management system that is transparent. For this purpose, a questionnaire has been sent to the *Länder*, which requires each plant to answer on a set of specific questions. Questions and expected answers are related to the following fields: - safety policy, safety goals, - plant organisation, - rules and instruments to plan, control, implement and support safety related

			activities, - audits, reviews, experience backfitting. The questionnaire has the following goals: - to check the status of implementation of a safety management system in German NPPs, - to enable a common understanding between regulators, support organisations and operators on requirements for a practicable and efficient safety management system. See also questions Nos. 37 and 53.
56	12	Article 12, Section "Organization and Safety Culture" states that the utilities have developed principles of safety-conscious thinking which contributed to the common understanding of the "safety culture" notion and also developed a list of characteristic features to conduct safety culture assessments. Would you please advise what are the new elements that have been introduced into the common "safety culture" notion from the German practice?	The Affiliation of Power Companies (VGB PowerTech) has issued a position paper, which describes fundamental principles of safety culture. The purpose of the paper is to provide a general guidance for checking safety culture in their organisations. Three different areas are covered: safety culture in the organisation, commitment of the management and commitment of the staff. There are no real new elements in this concept, but it is a comprehensive approach for the first time. See question No. 53.
57	12	It would be worthwhile to clarify some points related to the self-assessment program in the operational management at German NPPs mentioned in Article 12 of the Report. Could you give a more detailed description of the process monitoring system which is to register the quality of safety-relevant processes on the basis of measurable parameters. Could you please give some major	For the self-assessment programme: See question No. 53. Independent from this self-assessment program, one NPP is developing a method to monitor the basic work processes using specific indicators. The method consists of two parts: firstly, to model the work processes which are necessary for safe plant operation, and secondly, to identify indicators for each of these processes. Modelling of the work processes has been finished, whereas the selection of indicators is not yet completed. (These indicators are not to be mixed up with other performance indicators).

		parameters which characterize the quality of operation processes?	
58	12, 12, p. 39	A self-assessment programme on operational management in the German NPPs, planned to be established on a permanent basis, has been set up. An evaluation system to assess the safety performance and safety culture of the operational management system has been introduced in several plants. Could you elaborated more on this evaluation system and indicate whether these plants introduced it by their own initiative or by any regulatory requirement? If it is a regulatory requirement, could you indicate if it is a federal or state requirement?	For the National Peer Reviews: see answer to question No. 55. For the self-assessment programme: see answer to question No. 53. There are no regulatory requirements; it was a voluntary initiative of the German NPPs, triggered by an INES 2 event and several events with contamination of fuel element transport casks.
59	12, 12	Which regulatory actions has the Federal Regulator taken so far to address safety management issues such as safety culture relevant to nuclear safety?	The Federal Regulator has issued a questionnaire, which recently has been distributed to all utilities via the nuclear licensing and supervisory authorities of the *Länder,* with the aim to check the status of the implementation of the safety management system in German NPPs. See also questions Nos. 53 and 55.
60	13	What are the most important findings regarding the application of Quality Assurance at the German NPPs? Are measures planned to further improve the individual plant's Quality Assurance systems?	The matter of quality assurance is explicitly regulated in KTA 1401 to 1408 and implicitly in many KTA safety standards concerning the safety of components. There have been no findings, which required changes in the KTA safety standards.
61	13	What standards are applied in the scope of QA requirements for foreign	For foreign deliveries the same standards have to be applied as for domestic

		deliveries.	deliveries.
62	13	This chapter describes mainly the technical QA aspects. What is the QA regime for organisational, personnel and administrative matters?	The requirements regarding the quality management system for NPPs is principally based on the provisions specified in the KTA standards 1201, 1202 and 1401 (see Appendix 4 of the National Report) and other nuclear regulations [3-2, 3-4]. The general requirements regarding quality assurance are contained in KTA 1401. On the basis of these requirements the licensees develop a comprehensive QA system. The structure of the QA organisation with its tasks, competencies, responsibilities and personnel qualification as well as the respective work procedures are specified in the operating manual and in the testing manual. These specifications regulate, among others, the performance of internal and external audits, and the QA monitoring. The organisation of a plant and the administrative responsibilities have to be approved by the *Länder* authorities.
63	13, 13	Has the Federal Regulator taken actions to implement modern quality management systems for regulatory activities?	Elements of quality assurances are widely used throughout the German regulatory system. Especially the "decentralised" federal system in Germany has implemented a great deal of quality assurance aspects. Nevertheless, up to now a systematic application of all quality assurance tools is not the common practice of all authorities and organisations involved in the licensing process in Germany. As a first step it is planned to apply the IRRT questionnaire on organisation of the federal regulator.
64	13, 13	How are past quality management practices of the regulatory body and of its supporting organisations and committees assessed?	See question No. 63.
65	13, 13	Are there needs for improvements, e.g. in the field of regulatory effectiveness?	In 2000, a review of the scope of duties was performed and a reorganisation took place to strengthen the effectiveness of the Federal Regulator. Comparable efforts by the *Länder* authorities are under way. Needed and started: - a documentation and knowledge management system - guidelines for the work of TSOs in charge of the Länder authorities as part of an overall quality management system. See also question No. 63.
66	14	To what extent do you use performance indicators to assess the	Performance indicators are not used in the continued supervision process, but to some extent within the periodic safety reviews. Trend analyses are performed for

		safety performance of a licensed reactor? What indicators are used?	some indicators like scram, failure of valves etc. The analysed indicators are plant specific, because the PSR guideline does not define which indicators are to be used. Investigations are ongoing to determine a set of indicators for the supervision. See question No. 53.
67	14	How does the regulator use the risk assessment data; for example in planning inspections, developing inspection procedures, developing technical specifications, and evaluating incidents ? How does the operator of the facility use the risk data?	Every NPP has now plant specific level 1 probabilistic safety assessments (PSA) carried out for the periodic safety review, though not all of the “first round” of reviews have been formally finished. Insights gained from the PSAs are used by the utilities, e.g. in maintenance during operation, in optimisation of procedures and technical specifications. It is emphasised, that PSA is seen as a tool complementary to the deterministic approach. There is a federal regulatory programme on precursor evaluation of events, which is, however, of limited scope (See chapter 19(vii) of the National Report). Primarily, the regulator is interested in identifying potential vulnerabilities, assessing the balance of design, and evaluation of safety improvements.
68	14.1, p. 44	To which extent is the public involved in the licensing procedure? What documentation is made public during the licensing and operation of a NPP? (safety reports etc.)	Participation of the general public is outlined in chapter 7(2ii) of the National Report. The Nuclear Licensing Procedure Ordinance [1A-10] gives detailed regulations on the content of the information to be announced to the public. Among other information, in any case the application, the safety report and a summary of the measures planned must be provided for at a suitable location near the site. If an environmental impact assessment is required, more detailed information must be given, e.g. with regard to the description of the site, the concepts of the basic design, description of the foreseeable environmental impact, and information on additional aspects which may be important for the plant.
69	14.2	What is the rationale for not performing plant specific Probabilistic Safety Assessments Level II in Germany?	In accordance with past international practices the regulatory safety review process in Germany was limited to the first three levels of protection (normal operation, abnormal operation, design base accidents). Beyond design base plant conditions (fourth level of protection) were not treated in the licensing and supervisory procedures and therefore level 2 PSAs have not formally been required from licensees in the past. Nevertheless different level 2 PSAs have been performed by expert organisations under contract of governmental bodies. Based on the results of such studies accident management measures being able to cope with challenges under specified severe accident conditions were implemented by licensees on a voluntary basis in all operating plants. These

			measures have also been treated in the past voluntary safety reviews. In future severe accident management is part of the now legally required safety reviews of the licensees. According to the international state of the art in science and technology, in future safety reviews the PSA shall be extended to level 2 to assess and assure the effectiveness, adequateness and completeness of the accident management measures. The accident management measures (AM) comprise filtered containment venting, primary and secondary bleed and feed, catalytic recombination for hydrogen, additional off-site power supply, enhancement of battery capacity and others. They form the fourth level in the defence-in-depth concept (see chapter 18(i) of the National Report).
70	14.2	What type of probabilistic analysis is prescribed for Periodical Safety Assessment in the PSR guidelines?	In the guideline [3-74-1] a plant specific level 1 PSA is required, including active containment functions. This guideline is presently being revised to include a level 2 PSA. See question No. 69.
71	14.2, Introduction p. 1, 14(ii) p. 48	It is reported that the Federal Government assesses the radiation risk, determined on the basis of the results of a re-evaluation of empirical data by the International Radiation Protection Commission, to be higher as it was supposed at the time of the licensing of the German nuclear power plants in accordance with the Atomic Energy Act of 1959, while new insights concerning the requisite safety level can lead to the supervisory authority demanding a safety review of certain systems, components or circumstances. 1. Does the International Radiation Protection Commission mean ICRP? If so, which ICRP's material is used for re-evaluation?	1. Yes. It is the International Commission on Radiological Protection (ICRP), which in1990 adopted new recommendations, published in 1991 as ICRP Publication 60. The material is given in this publication, especially in Annex B. See answer to question No. 2. 2. The results are significant. The occupational dose limit was reduced from 50 to 20 mSv per year. Adequacy or prerequisite for the licensing of existing plants are not affected. 3. Radiation protection of the personnel of NPPs is under continuous review by the *Länder* authorities, so an additional safety review on this issue was not necessary.

		2. Are the results so significant as to affect adequacy or prerequisite for the licensing of the existing plants? 3. Did the supervisory authority demand a safety review on this issue to the operators?	
72	14.2, Introduction p. 2, 14(ii) p. 54, 56	It is reported in Introduction that for the Biblis A nuclear power plant, which is in particular need of backfitting, an upgrading programme will be established in compliance with the remaining electricity output, and some examples of backfitting in Biblis A are shown. in section 14(ii). 1. Which organization has regulatory responsibility for the backfitting of Biblis A nuclear power plant? 2. Could you explain scope and schedule of the upgrading programme of Biblis A?	1. The Hessian authority has the regulatory responsibility for the backfitting of Biblis A, as long as the Federal Government does not give directives. 2. The goal of the backfitting is the upgrading of the plant to the state of the art in science and technology. The backfitting measures contain: - measures to control the impacts of an earthquake, like backfitting of cable routes, of the residual heat removal system, of the containment isolation valves, of the emergency power system etc., - measures to control the resulting damage of pipe rupture like jet forces on gratings and platforms in the vicinity of measuring transducers, - measures to prevent interfacing LOCA, - measures to control the hydrogen distribution in case of a LOCA, - backfitting of a leak detection system in the reactor building and - measures to control a leak in the safety relevant service water system (to prevent flooding). Urgent backfitting measures will be finished in revision 2002.
73	14.2	Who invites the IAEA to carry out an OSART-mission; is that the federal government, the state, TÜV or the operating organisation? What is the reason that there were only 4 missions in 15 years for all of the 19 NPPs in operation?	The Federal Government invites the IAEA in co-operation with the responsible authority of the *Land* and the operator. The Federal Government will invite the IAEA again for an OSART mission because of the events in the Philippsburg 2 NPP.
74	14.2, 14.ii, p.47	Verification of the licensing provisions is required to prove that the system functions important to safety are executed properly. Does it mean that preventive	Within a frame of specified boundary conditions, preventive maintenance activities on safety systems may be performed during power operation. The procedures for preventive maintenance are plant specifically laid down in the safety specifications within the operating manual. These procedures include specification of the conditions under which preventive maintenance activities during power operation are allowed. The kind of measures is laid down as well as a maximum time

		maintenance of safety systems is allowed without limitations? Is preventive maintenance implemented during power operation? How are these activities performed?	interval for taking individual trains of safety systems out of service, which is typically about 7 days. For all measures beyond these specifications approval by the regulatory authority is necessary. The basis of these procedures is a recommendation of the Reactor Safety Commission dated December 9, 1992 on "Preventive Maintenance Activities at the Safety System during Power Operation" (PMO). Key requirements of this recommendation are: "PMO" is allowed for one train at a time of stand-by systems, which are listed in a special PMO maintenance plan or in the operation manual. The degree of redundancy must be equal or greater than n+2 (n+1 is allowed if the single failure criterion is not required for the system). "PMO" is not allowed during test, start-up, shut-down or other deviations to the normal operation conditions. "PMO" is generally allowed during plant operational states when the system or the components in view are not necessary for the safety actions or if the redundancy is n+2.
75	14.2, 14.ii, p. 49	Periodic safety reviews (PSR) have been carried out to support the continuous review process. PSR have consisted of a deterministic and a probabilistic part. So far, deterministic safety status analyses have been completed for a total of 15 Nuclear Power Plants. Probabilistic safety analyses were performed for all 19 nuclear power plants. Could you indicate what were the main results and the main measures derived and implemented or planned to be implemented? It would be very useful to have an indication of the results of PSA in terms of core damage frequency.	The main measures derived from PSR are listed in attached table Q75.1. Most of these measures are now being implemented in the plants. Table Q75.2 gives an overview about the estimated frequencies of plant hazard states (as defined below) and core damage frequencies (CDF) gained from PSA. Despite the rather broad variety of events considered, the total frequency for plant hazard states is between 2E-6 and 2E-5/reactor-year. The total CDF is between 5E-7 and 4E-6/reactor-year as far as the CDF was evaluated. These frequencies consider only events during power operation. Remark: Different from the international practice, it is common in Germany to display also the frequency for plant hazard states as result of a PSA. Plant hazard states occur if system functions for the cooling of the core, which - according to the safety design - are required to cope with the accident, are not available. In this case, a core meltdown can only be prevented by on-site accident management measures or by repair of the failed components. The frequency of plant hazard states is a measure for the safety level of the plant as realized within the design basis – not taking into account on-site accident management measures.

		Could you provide us a summary table with the core damage frequencies for all the plants?	
76	Comment to 14.2 of Art. 14	It is stated that methods for Level 2 PSA still need to be tested and assessed before plant specific level 2 PSAs should be performed for all plants (report page 113). On the other hand there is a well established level 2 PSA methodology since more than a decade. Level 2 PSAs have already been performed. Procedure guides have been established.	
77	14.2, 14	Why is it necessary to further test and assess level 2 methods before the regulatory body requests level 2 PSAs to be performed by the plant operators?	In the guidelines plant specific level 1 PSAs are required including active containment functions. These guidelines are presently being revised to include level 2 PSAs. Work on level 2 methodology will be used to formulate guidance for the future safety reviews. See question No. 69, too.
78	14.2, 14	Does this justify a further significant delay of state of the art assessments of the severe accident vulnerabilities and accident risks of nuclear power plants especially when «the possible extent of damage in case of an accident» is a key argument to phase out a nuclear power generation?	See questions Nos. 6 and 69. The development of regulatory tools has nothing to do with the phase-out process, which is a social normative decision. Only phase-out can exclude severe accidents.
79	14.2, 14	In the recent years periodic safety reviews (PSRs) have been performed for all operating nuclear power plants. These PSRs encompass a deterministic safety status analysis as well as a level 1 PSA. Does an overall regulatory review guideline of the PSRs including PSA exist?	Regarding the PSR, a guideline [3-74-1] and additional guidance concerning the methodology for performing a deterministic and a probabilistic assessment exist. The review of the PSRs is performed by technical support organisations by order of the *Länder* authorities considering these guidelines.

80	23 14.2, 14	Have licensees proposed safety improvement programs to cope with findings of the PSRs? If yes, what where the most important measures? Which regulatory requirements have been used in assessing plants designed to earlier standards against up to date requirements?	Regarding safety improvement programs and important measures see answer to question No. 75. The general approach and used regulatory requirements in PSR is described in answer to question No. 83. This is also valid for plants designed to earlier standards.
81	14.2, 14	Have there been generic findings and general consequences with regard to the safety of the operating plants?	See question No. 75.
82	14.2, 14	Which limitations of PSR guidance documents and performed PSRs have been found?	The PSR guidelines consist of a deterministic and a probabilistic part. The guidelines will undergo further development to adapt them to the progressing state of the art in science and technology. The deterministic safety assessment is to be based on accidents (see Appendix 2 of the National Report) and on a spectrum of accident management measures to cope with beyond design basis conditions (also Appendix 2 of the National Report). The foreseen amendment of the deterministic part of the PSR guidelines is, to compare the existing nuclear power plant with the recent nuclear regulations to describe the deficiencies between the facility and the state of the art in science and technology in order to get an objective assessment whether the protection goals are achieved. For the PSA part of the PSR see answer to question No. 77.
83	14.2, p. 49	It is noted that Periodic safety reviews will be carried out every ten years. It is not clear what standards are used to determine the adequacy of these reviews. Is the purpose of the PSR to provide reassurance that a plant still complies with the standards in force at the time the plant was built, or, is it to compare the plant with current safety standards in order to determine what upgrading measures are be needed to	The general purpose of PSR is derived from the fact, that in the course of a longer lasting operating period, the range of knowledge to safety is broadened, so the current standards are used; the methods and instruments for safety analyses develop further. This should lead to a continued development of the plant safety status and its operational safety. The deterministic review concentrates on the description how accidents subject to the analysis are controlled by the engineered safety features of the plant. The actual conditions of the systems important to safety are to be examined with regard to availability of required safety functions for accident control with sufficient efficiency and reliability, and if by that the safety criteria for NPPs [3-1] based on the protection goals

		justify continued operation?	- reactivity control, - cooling of fuel elements, - confinement of radioactive material and - limitation of radiation exposure. These criteria have to be met according to the state of the art in science and technology. On safety level 3, the deterministic analyses of systems important to safety are to be based on requirements derived from the protection goals, at the same time considering necessary requirements for safety levels 1 and 2, e.g. on to quality conditions. The protection goal oriented requirements are based on the sublegal nuclear regulations. They also consider more recent, corroborated findings. They ensure a uniform application of general requirements, irrespective of specific technical solution, within the performance of the safety status analysis. The protection goals are taken to be reached if the respective requirements are met. In this respect, technical solutions may not comply literally with the current nuclear regulations. If it turns out that particular safety functions are not at all available or not available with the adequate efficiency and reliability, a final safety assessment considering also results from other parts of the PSR is performed. See also question No. 82.
84	14.2, p. 49	What is the policy on plant upgrading now that a closure programme for all NPPs has been agreed?	Part of the agreement between the Federal Government and the plant operators on terminating the use of nuclear energy is the clear obligation that during the remaining operating lives of the NPPs the dynamic damage precaution according to the state of the art in science and technology required by law has to be maintained.
85	15, p. 61	What is meant by “immission monitoring ”? Is that monitoring of radiation that comes from sources external to the Plant ?	Radioactive consequences in Germany are evaluated and measured in two ways: emission monitoring and immission monitoring. For emission monitoring the discharges from the plant are measured e.g. directly at the stack by direct monitoring or by taking and evaluating reference samples. Examples for the data obtained are presented in tables 15.2 and 15.3 of the

			National Report. The data allow to calculate the doses in the environment by models, taking into account the dispersion due to the prevailing weather conditions and exposure pathways. Immission monitoring measures the impact of the NPP by taking data outside of the plant e.g. by measuring the airborne concentration, the direct radiation or the activity deposited. This measurement mainly aims at excess from normal conditions, say particularly looking at nuclides coming from the plant on top of the natural radiation background [3-23]. So as a consequence this is a redundant and divers mean to identify the impact of the NPP to the environment, which complements (and in case checks) the emission monitoring. Certainly the immission monitoring will also cover the influence of other external sources, if such sources should exist – e.g. immission monitors identified the releases of Chernobyl approaching the German NPPs - but the main intention of the immission monitoring close to NPPs is to identify their radiological impact on the environment. In addition, Germany has an environmental radiation monitoring programme aiming at measuring natural conditions all over the country with more than 2000 measuring points (IMIS). Several institutions take part in the programme - Physikalisch-Technische Bundesanstalt, - Bundesamt für Strahlenschutz/Institut für atmosphärische Radioaktivität, - Deutscher Wetterdienst. Table Q85 shows an example for measurements by DWD. See also p. 61-62 of the National Report and actual data under www.bfs.de/IMIS.
86	15	Is the effect of releases from nuclear facilities under normal operation evaluated as regard the exposure to critical groups of population in their vicinity? If so, specify the models used and how they reflect changes of the actual weather situation throughout the year.	Dose limits for radiation exposure of the general public are laid down in Section 46 and 47 of the Radiation Protection Ordinance. Models and parameters are specified in a general administrative provision [2-1]. Accordingly, the radiation exposure must be calculated for a reference person at the most unfavourable receiving point, taking into account also unfavourable - rather unrealistic high - nutritional habits and durations of stay. In this way the calculated radiation exposure will in by no means be underestimated. Dispersion calculations are based on the Gaussian model and take into account dispersion statistics of at least five years on the particular plant site. Parameters of the statistic are wind direction and velocity, precipitation intensity and diffusion

			categories. For the license application, calculations are made on the basis of the proposed discharges with exhaust air and waste water. Furthermore, calculations on the basis of the real discharges of every single plant are made subsequently and published each year as a parliamentary report (see www.bfs.de/info).
87	15, 15	As regards article 15 of the Convention, the Section of the German national Report titled "Fundamentals" on page 57 specifies that two principles are decisive for any activity involving radiation protection; the principle in the first item states that any unnecessary exposure of man and the environment shall be prevented. While the second principle reported appears to echo the optimisation principle, at least to a certain extent for which see the request for clarification below in 2 and 3, the principle above does not appear to be similar, at least in the wording used, to the justification principle as stated in paragraph 2.20 of the Radiation Protection Requirements for Practices in the IAEA BSS and in article 6(1) of the 96/29/Euratom directive of 13th May 1996. Clarification would be welcomed.	The principle to reduce any radiation exposure or contamination is laid down in the new Radiation Protection Ordinance (RPO). It serves to transfer the principle of optimisation in 96/29/ EURATOM to the German RPO. The aim of reducing radiation exposure or contamination is to achieve what is possible according to the state of the art in science and technology. Deviating from the wording in Art. 6 Sec. 3a in 96/29/EURATOM the principle of reducing radiation exposure or contamination in Sec. 6 Para. 2 RPO is directly linked to the requirement to comply with the dose limits for workers and the public laid down in the RPO. Persons exposed to radiation may demand compliance with the dose limits, but not a further reduction of the exposure. The principle of dose reduction is to be applied together with the constitutional principle of proportionality reflected in the wording "taking into account the conditions of each individual case". Social and economic factors can be taken into account.
88	15, 15	The second principle reported on page 57 lays down the obligation to keep radiation exposures "as low as practicable ... taking due account of ... the conditions of each individual case."	See question No. 87.

		As in the English rendering of the German principle the adjective 'practicable' is used in conjunction with the requirements on 'state of the art' and the conditions prevailing in the specific case, is there any difference in meaning intended in respect of the way the optimisation principle is stated both in paragraph 2.24 of the Radiation Protection Requirements for Practices in the IAEA BSS and in article 6(3).(a) of the 96/29/Euratom directive, given that both IAEA BSS and Euratom BSS refer to economic and social factors?	
89	15, 15	Clarification would also be welcomed with reference to the final statement reported in the Section on page 57; the statement says that the two fundamental principles mentioned lead to an obligation to "minimise radiation exposure" when read in the light of a German constitutional principle (proportionality). If the understanding is correct it would appear that the German radiation protection framework calls for minimisation of radiological risk instead of optimisation. Also, it would seem that implementation of state of the art science and technology, together with consideration of circumstances prevailing in the specific case, appear to be the criteria used to judge whether minimisation of	See question No. 87.

		exposures has been achieved.	
90	15, p. 58, Table 15-1	In Table 15-1 on page 58 (Section 47), limit values for discharges in operating conditions are specified: are these limits proper, in the sense used *e.g.* in directive 96/29/Euratom for dose limits, or dose constraints are meant on the contrary?	Limit values for the public (Section 47) are meant as dose limits. The German Radiation Protection Ordinance does not use dose constraints, instead the concept of optimisation is followed.
91	15, 15	In Table 15-1 on page 58 (Section 55), an effective dose limit of 6 mSv per calendar year is specified *inter alia* for category B workers; is this a dose limit proper or a classification criterion, like *e.g.* in article 21 of the Euratom directive mentioned?	It is a dose limit AND a classification criterion.
92	15	In Table 15-1 on page 58 (Section 55), limits for under age apprentices and students are specified for effective dose; are equivalent dose limits provided for in the German Radiation Protection Ordinance to lens, skin, forearms etc. of trainees and students between 16-18 in case of exposures agreed upon by supervisory authorities, like *e.g.* in article 11(2).(a)(b)(c) of directive 96/29/Euratom?	For under age 18 persons the effective dose limit is 1 mSv per calendar year, organ dose on lens 15 mSv and organ doses on skin, hands, forearms, feet and ankles 50 mSv per calendar year. With consent of the supervisory authority this may be extended for students 16-18, if needed to reach the educational target. Than the effective dose limit is 6 mSv per calendar year, organ dose on lens 45 mSv and organ doses on skin, hands, forearms, feet and ankles 150 mSv per calendar year. The numbers are very similar to 96/29/EURATOM.
93	16	Is the emergency planning zone in the vicinity of nuclear power plants specified as a special area with predefined actions for a severe (beyond design basis) accident? If so, what criteria are used to define this emergency planning zone?.	The emergency planning zone around every NPP is subdivided into central (2 km), medial (10 km) and outer zone (25 km) [3-15]. Here, detailed measuring points and emergency measures are defined as a prerequisite of the license. Moreover, measures further away follow the general disaster control on the *Land* level (chapter 16, p. 70 of the National Report). Depending on the situation (real emission and weather condition), decisions for outside the 25 km zone might be necessary.

94	16, p. 74	The section on training exercises states that "The disaster control authorities at *Land* and regional level perform large-scale emergency exercises at the nuclear power plant sites, albeit at intervals of several years due to the considerable efforts and expenditure required." Could Germany provide more specific information on the scope of these exercises? It is also not absolutely clear that these exercises properly test the various off-site centres.	There are three general objectives of emergency exercises: - to examine the effectiveness and practicability of emergency preparedness plans, - to test the usefulness and the condition of equipment, and - to educate and train the personnel. A large-scale exercise in Germany encompasses all of theses objectives. Furthermore there is a real time information exchange and online co-ordination with other authorities or agencies playing simultaneously in order to test the communication exchange between them. That is the main scope of this kind of exercises. Normally a large-scale exercise includes the test of mobile monitoring equipment and the personnel involved. Besides that the set up and operation of an emergency centre, where information, contamination check, decontamination and medical care are supplied to the affected population, is sometimes tested too. In these large-scale exercises one or more *Länder* with their local (county district, district authorities, regional government) and federal authorities being responsible for emergency response in case of a nuclear accident participate. Sometimes also federal authorities participate in these exercises. Figure 16-1 in the National Report gives an overview of the organisations involved. In general, there is no combination of on-site and off-site authorities acting together in these exercises. Also the licensee is involved in the preparation of the exercise, mainly in the development of the exercise scenario.
95	16.1, p. 68 and 73	Related to Iodine prophylaxis: Who is in charge of keeping the Iodine tablets? Who distributes them to the population. When exactly are they distributed (before a probable release? After a release? After radiation is measured on the field?). What are the Iodine intake doses used?	1. Storage of iodine tablets: Within the 25 km disaster response planning zone the disaster response authorities of the *Länder* are responsible for the storage of the iodine tablets. The BMU recommends the following procedure within the 25 km radius around a NPP [3-15]: Iodine tablets should be stored in such a way that rapid availability is guaranteed. The tablets should be distributed in advance to households within a radius of 0 – 5 km. Within a radius of 5 – 10 km iodine tablets should be in stocks at several points in the communities (e. g. town hall, schools, hospitals, businesses) or distributed in advance to the households. From 10 – 25 km there should be stocks of tablets in communities or in suitable establishments. An advanced distribution to households with a radius of 10 – 25 km in exceptional cases only. Outside the 25 km planning zone the federal government is responsible for the

<table>
<tr><td></td><td></td><td></td><td>storage of the iodine tablets.

2. Distribution of iodine tablets: Iodine tablets will be distributed by the disaster control personnel. In general, the tablets should be distributed before a release. Nevertheless, satisfactory prophylaxis can also be achieved if the intake of the radioactive iodine occurred less than 2 hours after the inhalation of radioactive iodine. Even several hours after the intake of radioactive iodine, the duration of its presence in the body is still reduced by taking iodine tablets. However, the first iodine tablets should be taken not later than one day after intake of radioactive iodine.

3. Iodine prophylaxis: The dosage for iodine prophylaxis depends on the age of persons concerned:
<table>
<tr><td>Group of persons</td><td>Daily dose in mg iodine</td><td>Daily dose in mg potassium iodide</td><td>Tablets of 130 mg potassium iodide</td></tr>
<tr><td>< 1 month</td><td>12.5</td><td>16.25</td><td>1/8</td></tr>
<tr><td>1 – 36 month</td><td>25</td><td>32.5</td><td>1/4</td></tr>
<tr><td>3 – 18 years</td><td>50</td><td>65</td><td>1/2</td></tr>
<tr><td>18 – 45 years</td><td>100</td><td>130</td><td>1</td></tr>
<tr><td>> 45 years</td><td>0</td><td>0</td><td>0</td></tr>
</table>
Pregnant women and breast-feeding mothers receive the same iodine dose as the 18 – 45 age group. In general, it is sufficient to take iodine tablets once.</td></tr>
<tr><td>96</td><td>17</td><td>With regard to the existing re-evaluation of seismic safety, what is the schedule for completing the necessary backfitting measures to improve seismic safety at older German NPPs?</td><td>The ongoing re-evaluation on behalf of the BMU examines the existing design against impacts from earthquakes and identifies the need for backfitting measures. This investigation will be finished in 2003.

See also questions Nos. 72 and 97.</td></tr>
<tr><td>97</td><td>17</td><td>Article 17 of the Report says that re-evaluation of the ability of structures and components of older plants (Philippsburg and Biblis A) to withstand seismic impacts</td><td>Concerning the backfitting of Biblis A see question No. 72.

For KKP 1 a backfitting programme to cope with seismic impacts has taken place in the early 90ties. Beside stiffening of walls in different buildings, improvement e.g. of the anchoring of compressed air storage tanks, the ventilation system, the</td></tr>
</table>

		demonstrated the need for comprehensive backfitting of components and systems of these plants. What actions have been taken at older plants to protect them against the potential seismic impacts?	cable routes and of penetrations of lines through the containment were achieved.
98	17.3, 17(iii), p. 81	It is reported that concerning aircraft crashes the older nuclear installations were re-evaluated with regard to the transfer of the respective loads in conjunction with the probabilistic safety assessments and the results from these assessments showed that even in the cases where the reactor building does not withstand the load assumptions as defined today, the contribution to damage states with considerable release is assessed to be sufficiently low. Do the evaluation conditions include commercial airplane crash?	The mentioned evaluation of aircraft crashes considers accidental crashes of military airplanes. Airplane crashes with a terrorist background were not considered in this investigation. The NPPs in Germany currently operating have different levels of protection against aircraft crash. The design of the 19 operating nuclear power plants with respect to external impacts includes the orthogonal impact of a 20-ton military aircraft flying at 215 m/sec (roughly 770 km/h). 10 of the 19 NPPs currently operating, which came on line later than 1983 – have rather massive reinforced concrete reactor building walls (nearly 2 m thick). This massive reactor building protects the steel shell containment inside, which is mechanically decoupled from the building walls. Older NPPs have a lesser level of protection (wall thickness down to 40 – 60 cm).
99	18, 15	While deciding the siting and/or construction of nuclear facilities, are the acceptance criteria for exposure to members of the critical group of population at emergencies (up to design basis accident) identical to dose limits for members of the public at normal operation? If different, provide specification.	As for exposure of the public, normal operation and design basis accidents are treated differently. For normal operation, the dose limits for the public are set to 0.3 mSv/year effective dose due to airborne discharges and also 0.3 mSv/year due to liquid discharges. These are committed doses from cloud shine, ground shine, inhalation and ingestion. Additionally, a dose limit for the public of 1 mSv per year (total dose, direct radiation from the plant and contribution from releases) has to be met. Additionally, organ doses have to be considered. (See Sec. "Radiation Exposure of the General Public during Operating Conditions" of Chapter 15 of the National Report.) For design basis accidents, it has to be shown that doses from short term releases are below 50 mSv over 50 years integration time, assuming the same

			pathways as for normal operation. Also in this field organ doses have to be considered additionally (see Sec. “Radiation Exposure of the General Public during Design Basis Accidents” of Chapter 15 of the National Report).
100	18	Is the probability and acceptability of a particular scenario used as prerequisite to determine the design basis accident? If so, what probabilities are considered.	Deterministic criteria, not probabilistic ones, determine the basic design accidents.
101	18	Is there consistent physical separation between high-pressure admission steam pipelines and those of feedwater in all operating German NPP’s?	For the design of the feedwater and main steam pipelines of plants of third and fourth generation PWRs (see Appendix 1.1 of the National Report), rupture preclusion is required, from the steam generators up to the first isolation valve outside the containment (RSK guidelines [4-1]). In addition, physical separation is applied for these pipes. For first and second generation PWRs no physical separation between high pressure steam and feed water lines have been required. Limited plant specific improvements have been implemented (partial separation, exchange of piping).
102	18.1, p. 87	Related to the installation of Hydrogen recombiners: What are de design basis for the recombiners? And what is the typical capacity ?	1. The following four severe accident scenarios are the design basis for the passive autocatalytic recombiner (PAR) system: - Large Break LOCA: rupture of the surge line - Small Break LOCA: leak of 50 cm^2, hot leg, without secondary side depressurisation (primary depressurisation not required) - Station Blackout, with primary depressurisation and flooding of a partial damaged core (only in-vessel) after restoration of the power supply and - Total loss of secondary feedwater supply with primary depressurisation. The requirements are based on recommendations of the RSK 2. The capacity of the PAR-system installed in NPPs of Konvoi type is about 200 kg/h; this is equivalent to the installation of 60 PARs.
103	18.1, 18 (i)	With reference to last indent but one of the Section 18(i), addressed to single out measures to cope with severe accidents, it would be appreciated the availability of more detailed information on the	Tables Q103.1 + Q103.2 show the status of implementation of the on-site accident management measures at PWR and BWR, respectively. Only very few measures are not finalised to date.

		implementation of such measures, in particular the concerned plants and the schedule for completing the implementation of specified measures.	
104	18.3, 18 (iii), p. 89-92	Could you indicate what are the mitigating measures implemented to cope with beyond design basis accidents or severe accidents in your plants? Could you indicate the status of passive auto-catalytic recombiners implementation and its schedule for the not-implemented so far?	See answer to question No. 103. For the status of catalytic recombiners see Table Q103.1.
105	19, 6, 19(iii), p. 8, 98	Table 6-1 on p. 8 shows high level of the average availability of German nuclear power plants. Meanwhile, it is reported in section 19(iii) that the basis for activities such as the preventive maintenance is the regulatory guideline on maintenance [3-41]. 1. How many days is the average duration of outage per unit? 2. Is the scheduled outage of a unit determined by refueling demand or necessity of maintenance of a specific system and/or equipment? 3. Is plant outage for maintenance a regulatory demand? If so, how often?	1. The duration of the fuel exchange and service outage in year 2000 is indicated in Fig. 15-2 of the National Report. The average duration of plant outages is round about 30 days per unit. Basically, all NPPs perform their outage on a 24 h per day shift schedule. The regulatory inspectors and their experts participate in the shift cycle. 2. The scheduled plant outage is determined by the demand for refuelling, not by demand for maintenance of components. But the need for exchange of equipment or upgrading measures may require outage extensions. 3. Many tests and inspections can only be performed during shut-down state of the plant. The frequency of tests and inspections are formally laid down in the Testing Manual and Schedule (see Chapter 19(iii) of the National Report). Many tests are to be performed yearly and therefore require yearly plant outages. Some BWR have operated longer cycles (18 months), requiring approval by the regulatory body with regard to safety checks and compliance with regulatory requirements as far as test frequency is concerned.
106	19.5	What are the qualification requirements for external organizations providing technical support to the operator? What are provisions for continued qualifications	The qualification requirements for external organisations providing technical support to the operator are the same as for the operator's own personnel. It is the responsibility of the operator to supervise the work being done by external organisations at his plant and to make sure that these organisations fulfil all requirements laid down in applicable guidelines, standards and regulations, be it

		of those organizations in the situation of declined interest in the nuclear power industry in Germany?	with respect to the qualification of their personnel or be it with respect to the quality of their services [KTA-1401]. The operating organisations of NPPs find it increasingly difficult, however, to keep a sufficient number of qualified external technical support organisations productive and competitive, as many of them have started to leave the market. The operators are currently assessing possible counter actions against this development.
107	19.6, 19 (vi), p. 103	It is reported that any event that is categorized as reportable in accordance with the corresponding criteria is reported by the licensee to the competent supervisory authority. The supervisory authority, in turn, after its initial evaluation of the circumstances will inform the BMU which is responsible for federal supervision. At the same time, the BfS and the GRS, an expert organization working under contract of the BMU, are informed. 1. What are the criteria of the notification by the licensee to the competent authority? 2. After implementation of corrective measures against the event reported, who has the authority to approve the corrective measures and the plant restart? 3. Concerning the event in Philipsburg 2 nuclear power plant in last August, which was tentatively ranked 2 in INES scale, what was the root cause of the event and what are the corrective measures considered?	1. As mentioned in chapter 19(vi) on page 103 of the National Report some 80 criteria are laid down in an annex to the Ordinance on Reportable Events [1A-17]. These criteria define on the basis of technical descriptions what kind of event is considered reportable. Separate sets of criteria are defined for nuclear reactors, for facilities other than reactors and for transportation of spent fuel. 2. It is part of the supervisory procedure by the regulatory authority to define safety review and agreement of applicable modifications, which are proposed by the licensee as corrective measures. In many cases the support organisations are involved for review. Modifications may also be subject to regulatory licensing. After proper implementation, the regulatory body will agree on it. If the plant was shut down after the event, the supervisory regulatory authority (*Land*) will approve the restart as it does regularly after any service outage. 3. After the yearly refuelling outage, the plant has been restarted (12 August 2001) without testing the boron concentration in the four borated water storage tanks of the emergency core cooling system (ECCS). The plant personnel began with first boron concentration checks on 25 August 2001. On the 27. August 2001 it was recognised that the boron concentration in three of the four tanks had been below the specified limit of 2,200 ppm since start-up. The plant personnel had restored the specified status by adding boric acid but did not shut down the plant. On 8 October 2001 the plant was shut-down to investigate the reasons for the deviations, the operators actions and the present administrative procedures. In the course of the investigation following the incident "Boron concentration below specification in borated water storage tanks of 3 out of 4 ECCS trains" the licensee on 22 October 2001 detected that the plant was started up with too low levels in all borated water storage tanks. The specified level in the tanks is ≥ 12.6 m. The level indications showed 12.5 m, 10.8 m, 10.6 m and 9.3 m, respectively. According to the technical specifications the water storage tanks must be filled up to the specific level if the primary circuit pressure exceeds 10 bars. The plant

			personnel ignored the related alarms in the control room, so that the filling of the tanks was only done on 12. August 2001, with the reactor at hot stand-by condition (sub-critical). Both incidents have been characterised by deviations from technical specifications and deficiencies in procedures but also in the safety management of the plant. It has been reported as level 2 in the INES rating. Similar observations as in KKP 2 have been made subsequently in the Obrigheim NPP and in the Neckarwestheim 1 NPP. In the Obrigheim plant, regulations regarding the water level in the borated water storage tanks have been violated deliberately in the period 1991 until 2001. In the Neckarwestheim 1 plant, the plant has been operated with low level in the storage tanks only once in 1997. These incidents have been characterised by deviations from technical specifications and deficiencies in procedures but also in the safety management of the plants. They have been reported as level 1 in the INES rating. Beyond the technical measures to improve the ergonomics of the valves of the boron- and demineralised water injection system to the ECCS in the Philippsburg 2 NPP, the company will improve its safety management system at all its sites and will compose a system of objective and detectable safety indicators.
108	19.7, p. 104, Table 19.1	When comparing the German Reporting Categories with the INES ones, one finds, for 1994, one S event (high safety significance), however in the corresponding INES categories only category 0 and 1 events are found. On the other hand, in the year 1998, the table shows one INES category 2 event (high safety significance) but only E and N events in the corresponding German classification. How is this to be explained?	This can be explained by the different reporting criteria: the INES criteria are graded according to off-site impact, on-site impact, and degradation of defence-in-depth, whereas the German national reporting criteria are graded according to the necessity of in-time notification of the responsible authorities to enable them to initiate investigations or to take the necessary actions. Three event categories exist (S for immediately information, E for information within 24 h, N for normal information), and the reporting criteria for each category are different from the INES criteria. So it can happen that an INES level 2 event requires no immediate investigations or actions and is therefore not classified as category S (e.g. limited loss of a safety function), and vice versa.
109	19.7, 19(vii), p. 103	It is stated that Germany has been performing OEFB system for over 25 years. What is the quantitative analysis method for a selected event for feedback to other plants? Which	Selection of events for experience feedback is performed on the basis of potential or factual safety relevance for other plants. An "Information Notice" is written and submitted to the authorities, the NPP and technical support organisation, if deficiencies in one or more of the following areas are detected during the event

		organization does perform the quantitative analysis?	analysis: - deficiencies in design measures related to the different levels of defence in depth, - deficiencies in the design of structures, systems, components, - increased probability for initiating events or for system damage states, - events with common cause failures or events with systematic failures, which could affect one or several levels of defence, - deficiencies in administrative matters, e.g. operating procedures, maintenance procedures, test procedures, training procedures. The organisation, which performs the selection of events for experience feedback and in-depth analysis, is GRS.
110	19.7, 19(vii), p. 105	Are field investigations by the regulatory body performed if nuclear event occurs? If so, a) When is the investigation team dispatched? b) What is the scope of the investigation? c) How is the investigation report utilized? d) How and when are the events evaluated?	a, b) Scope and start of field investigations depend on the severity of the nuclear event. c, d) In general, the *Länder* authority and their technical support organisations carry out the investigations on-site. Where appropriate, the Federal Government performs additional and more generic investigations on the basis of the results of the *Länder* authorities. See also chapter 19(vi) of the National Report "Reporting of Events, Regulatory Reporting Procedure"
111	19.8, section 19, p. 108	The disposal and storage of radioactive waste and spent fuel were described in the report. How did the GERMANY government assure the safety in transportion of these radioactive materials and obtain understanding and support from the public.	The number of transports will be drastically reduced by interim storage of irradiated fuel. Packages for radioactive material as well as the transport have to meet the requirements of national regulations based on the IAEA "Regulations for the Safe Transport of Radioactive Material" (TS-R-1). These IAEA Regulations are the basis for the national and international regulatory framework world-wide. Broad information on the transport licenses is published in the internet (www.bfs.de). A booklet on "Radioactive Freight on the Road", explaining the different stages of the transport, is available for the public. Support from the public is not achieved.
112	19.8,	As regards article 19 (viii) on page	The clearance levels are calculated on the basis of the 10 µSv/y below regulatory

	19.8	108, the Report states that clearance levels provided for in the new Radiation Protection Ordinance are calculated on the basis of the 10 µSv/y below regulatory concern criterion. Is account also taken of the 1 man·Sv collective effective dose criterion?	concern criterion. The collective effective dose was estimated on the basis of conservative scenarios and assumptions using these clearance levels. The results show that approximately 1 man Sv will not be exceeded.
113	19.8	Article 19 (viii) of the Report fails to mention which indicators (volume, source term, place of storage etc.) are taken into consideration when performing annual survey of the accumulated radwaste in Germany?	As the Safety Convention focuses on the plant sites and the additional Waste Convention is already in force, the survey on accumulated waste is only slightly touched in the National Report. Table 19-2 of the Report shows numbers on the plant sites. To be more complete, Table Q113.1 attached here, shows accumulated radioactive waste volumes, untreated waste, conditioned waste with negligible heat generation and heat generating waste. Table Q113.2 shows the time development.
114	99, p. 113	*There are just a few general statements in the Chapter on "Planned Activities for Improvement of Safety" (p.113.)* How does Germany intend to maintain the technical competence in a phasing-out nuclear industry environment?	See question No. 28 as well as the questions Nos. 48 and 49.
115	99, p. 112	"Measuring" the efficiency of safety management by means of safety indicators is not a simple process. Is there already an outline of the safety indicators to be used for this process? What kind of actions use the licensees to enhance the safety culture in the respective plants? Is it a system based on reward and punishment if necessary? Are there official "confidants" in a plant where operators can indicate their doubts/ worries	1. Safety indicators to be used for this process are not yet available in Germany. 2. The actions of the licensees to enhance safety culture are described in the answer to question No. 53. Employees can express their concerns by contacting the HF officer. But this possibility is not directly linked to the self-assessment system.

		regarding safety issues?	
116	99, p. 113	Due to phasing-out the German NPPs maintaining competence is an issue for licensees, research establishments, regulatory bodies. This might also be true for suppliers with the result that they will leave the market. Are there agreements made between industry, government and licensees or VGB to maintain competence in the industry?	Operators and suppliers are responsible for the competence of their personnel. The qualification requirements for the operation personnel are a prerequisite of the licence. It is the task of the regulator to check this. If the industry is not capable of making its jobs attractive, it is not the task of the state to do so, as promotion of nuclear energy does not belong to its policy.
117	99, Planned Activities	In your report on planned activities for improvement of safety, you mention that there is a combined effort in order to maintain the necessary competence at utilities and authorities, including promotion of the coming generation of scientists. In a situation where the nuclear energy program is being phased out, and the nuclear industry seems to be less than popular among large parts of the young generation, are there signs of ”ageing of experts” and what concrete steps have been taken to overcome this?	There are a lot of activities in Germany to keep the competence on a high level and to prevent an impact on the safety of NPPs due to ageing of experts. Various aspects concerning this subject including ongoing measures are described in detail in the answers to questions Nos. 28, 32, 33, 47, 49 and 116.

Table Q4: **The Agreed Residual Operation Time for German NPPS, Based on the Phase-out Decision of 2001 (32 calendar years from the commencement of commercial power operation)**

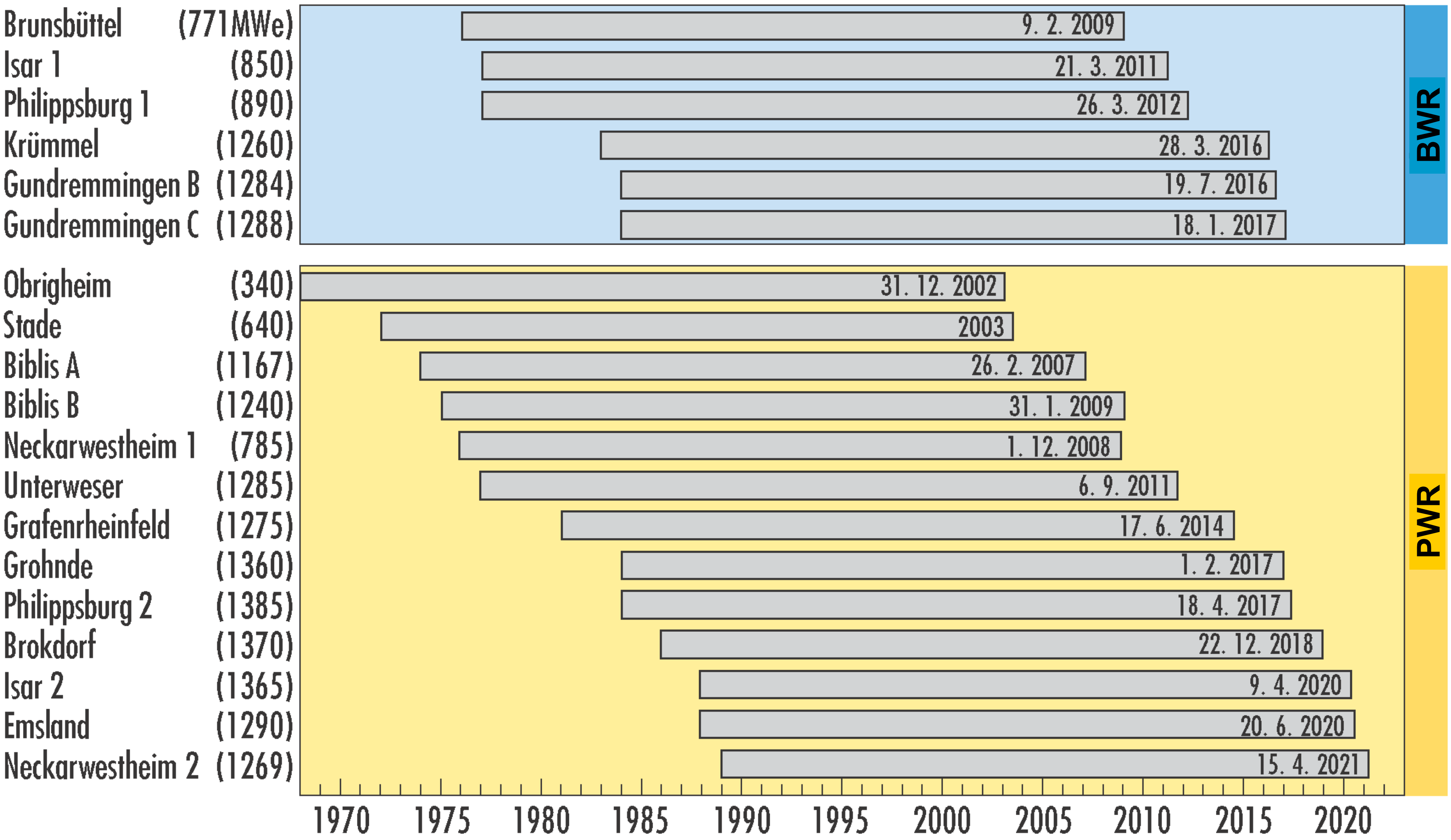

Table Q13: Examples for Regulations Updated During the Past Five Years

Legally binding regulations

Revision of the Atomic Energy Act
Revision of the Radiation-Protection Ordinance

Legally non-binding regulations

Promulgations of the BMU

Recommendations on emergency preparedness and radiological bases for decision making and protective measures
Guidelines on the control of emissions and immissions
Guidelines with regard to competence and training of responsible shift personal and other personal in NPP's
Procedure guides for periodic safety reviews

KTA Nuclear Safety Standards

- Requirements for the Operating Manual (6/98, KTA 1201)
- General Requirements Regarding Quality Assurance (6/96, KTA 1401)
- Monitoring and Assessing of the Discharge of Gaseous and Aerosolbound Radioactive Substances; Part 2: Monitoring and Assessing of the Stack Discharge of Radioactive Substances during Anticipated Operational Occurrences and Accident Conditions (6/99, KTA 1503.2)
- Monitoring and Assessing of the Discharge of Gaseous and Aerosolbound Radioactive Substances; Part 3: Monitoring and Assessing of Radioactive Substances not Discharged via the Stack (6/99, KTA 1503.3)
- Monitoring the Discharge of Gaseous, Aerosolbound and Liquid Radioactive Materials from Research Reactors (6/98, KTA 1507)
- Design of Nuclear Power Plants against Seismic Events; Part 5: Seismic Instrumentation (6/96, KTA 2201.5)
- Components of the Reactor Coolant Pressure Boundary of Light Water Reactors; Part 1: Materials and Product Forms (6/98, KTA 3201.1)
- Components of the Reactor Coolant Pressure Boundary of Light Water Reactors; Part 2: Design and Analysis (6/96, KTA 3201.2)
- Components of the Reactor Coolant Pressure Boundary of Light Water Reactors; Part 3: Manufacture (6/98, KTA 3201.3)
- Components of the Reactor Coolant Pressure Boundary of Light Water Reactors; Part 4: In-service Inspections and Operational Monitoring (6/99, KTA 3201.4)
- Reactor Pressure Vessel Internals (6/98, KTA 3204)
- Pressure and Activity Retaining Components of Systems outside the Reactor Coolant Pressure Boundary; Part 4: In-service Inspections and Operational Monitoring (6/96, KTA 3211.4)
- General Requirements for the Electrical Power Supply in Nuclear Power Plants (6/99, KTA 3701)
- Emergency Power Generating Facilities with Rotary Converters and Static Inverters in Nuclear Power Plants (6/99, KTA 3704)
- Switchgear Facilities, Transformers and Distribution Networks for the Electrical Power Plants (6/99, KTA 3705)
- Inspection, Testing and Operation of Lifting Equipment in Nuclear Power Plants (6/99, KTA 3903)
- Load Attaching Points on Loads in Nuclear Power Plants (6/99, KTA 3905)

Table Q75.1: Main Measures Derived and Implemented or Planned to be Implemented

Plant	Modification (Examples for measures)
Obrigheim	-----
Stade	----- (application of decommissioning)
Biblis A	2nd PSR in process (regulatory review)
Biblis B	2nd PSR in process (regulatory review)
Neckarwestheim 1	Secondary System: - Improvement of steam release for 100 K/h cooldown Nuclear service water system: - Improvements to prevent / limit internal floods (automatic switch-off of pumps)
Brunsbüttel	Secondary System - Backfitting of main steam safety relief valve system (reduction of CCF probability by adding 4 motor driven valves to the already installed 7 steam controlled valves with 2 solenoid pilot valves for each main steam valve and by introducing a diverse trip signal using self-actuating spring loaded pilot valves with reduced “pneumatic load”)
Isar 1	ECCS: - Technical modification of ECCS to increase system reliability Feedwater supply system: - Technical modification of connected lines to improve mechanical resistance Containment: - Improvements of containment penetration assemblies in order to prevent impermissible pressure rise and to assure system integrity I&C: - Measures to adapt reactor protection system and I&C-system to current standards (KTA) Plant Protection Systems: - Technical and administrative improvements and additional tests on systems and components for fire protection, internal flooding (turbine building), lightning protection and earth quake protection

Plant	Modification (Examples for measures)
Unterweser	2nd PSR in process (regulatory review)
Philippsburg 1	Feedwater Supply: - final evaluation and comprehensive exchange of feedwater lines in the turbine building in order to fulfil material quality requirements and „basic safety criteria“ (e.g. leak-before-break-criterion) Secondary System: - exchange of safety relief valves I&C: - Improvements of the reactor protection system (RPS) and the independent sabotage and accident protection system to protect from flash-over - Additional technical measures to improve air-cooling of RPS and I&C - Improvements of the quality assurance documentation of I&C-facilities - Improvements for detectability and limitation of neutron flux oscillations Fire protection: - Improvements of fire protection measures to protect the main cable-route outside the containment Earthquake protection: - Technical improvements to increase seismic qualification (e.g. non-load masonry walls, ventilation ducts, hangers and supports in safety-related areas of the operation-, control- and switchgear-building
Krümmel	- Based on ca. 300 implemented backfitting measures (from it ca. 60 backfitting measures requires licensing procedure) during review-time-interval (1988-1998) were realised to optimise plant safety. The safety level improvement was moderate.
Gundremmingen B/C	ECCS: - Installation of a diverse residual heat removal (RHR) and injection system (ARHR-system) - Additional shutdown line at the level of the feedwater line nozzles in a RHR train - Operation of HP injection pump without low pressure stage (demeshing of I&C actuation and installation of separate cooling for HP pump) - Reduction of interlocking time from 30 to 5 minutes to shut down the residual heat removal pumps and maintain the supply of coolant within the containment Pressure suppression pool (PSP):

Plant	Modification (Examples for measures)
	- Actuation of operational PSP cooling by all subsystem controls Feedwater supply: - Assurance of feedwater supply (RL system) after loss of the main heat sink (shut-off of RL system feeding after failure of PSP water level control only if at least one of the residual heat removal systems is working) RPV depressurisation: - Manual actuation of RPV depressurisation at high PSP temperature (60 deg C) only if RPV feeding is available RPV feeding: - Possibility of RPV feeding with control rod purge water, pump seal water, fire fighting system, raw water from river with service water system (AM) - Cross-ties of AC buses within the same unit and between units (AM)
Grohnde Grafenrheinfeld Philippsburg 2 Brokdorf (all 3rd generation, Pre-Konvoi-type) Isar 2 Emsland Neckarwestheim 2 (all 4th generation Konvoi-type)	For Grohnde PSR is in process (regulatory review). Based on the far-reaching conformity of technical equipment and safety features of the 7 Pre-Konvoi-type respectively Konvoi-type NPP the deterministic safety status analyses and probabilistic safety analyses as parts of PSR could be performed in a similar manner. The results led only to minor improvements to optimise plant safety. Increasing experiences and insights on modern methods of deterministic and probabilistic safety analyses, staff-know-how transfer and increasing safety culture made the greatest benefit.
Mülheim-Kärlich	-----

Table Q75.2: Frequencies for Plant Hazard States and Core Damage Frequencies for Power Operation

Status: 2000

NPP	Frequency for Plant Hazard States f [1/y]	Core Damage Frequencies f [1/y]
KWO [1, 2)]	$1{,}3\cdot10^{-5}$	-
KKS [1, 2)]	$5{,}3\cdot10^{-6}$	$4{,}4\cdot10^{-7}$
KWB A [1, 2)]	$3{,}7\ 10^{-5}$	-
KWB B [1, 2)]	$2{,}1\cdot10^{-5}$	$3{,}6\cdot10^{-6}$
GKN 1 [1, 2, 3)]	$2{,}1\cdot10^{-5}$	$1{,}6\cdot10^{-6}$
KKU	-	-
KKB [1, 2)]	$1{,}2\cdot10^{-5}$	$3{,}8\cdot10^{-6}$
KONVOI / Pre-KONVOI (KKI 2, KKE, GKN 2 / KWG, KKG, KKP 2, KBR)	$\sim 2\cdot10^{-6}$	$\ll 1\cdot10^{-6}$
KKI 1	$6{,}3\cdot10^{-6}$	$1{,}4\cdot10^{-6}$
KKP 1 [1, 2)]	$4{,}1\cdot10^{-6}$	-
KKK [1, 2)]	$8{,}3\cdot10^{-6}$	$5{,}3\cdot10^{-6}$
KRB 2 B/C	$2{,}7\cdot10^{-6}$	-

1) without fire analysis
2) without external events
3) with planned backfitting

Table Q85: **Example for Environmental Measurements: Airborne Radioactivity Monitoring Programme**

Medium, Number locations	Measurement	Measurement method	*„Routine Operation Mode“* Sampling / Measurement interval	*„Routine Operation Mode“* Detection limit	*„Intensive Operation Mode“* Sampling / Measurement interval	*„Intensive Operation Mode“* Detection limit
Aerosols, 39	γ-emitter	Step feed filter Measuring system	daily	$1 \cdot 10^{-2}$ Bq/m³	every two hours	$1 \cdot 10^{-1}$ Bq/m³
Aerosols, 42	γ-emitter	Gamma ray spectrometry	weekly	$5 \cdot 10^{-6}$ Bq/m³	daily	$3 \cdot 10^{-4}$ Bq/m³
Aerosols, 40	Artificial Alpha-activity	ABPD, AERD [1]	daily	$3 \cdot 10^{-2}$ Bq/m³	every two hours	$4 \cdot 10^{-1}$ Bq/m³
Aerosols, 40	Artificial Beta-activity	ABPD, AERD [1]	daily	$5 \cdot 10^{-2}$ Bq/m³	every two hours	$6 \cdot 10^{-1}$ Bq/m³
Aerosols, 40	^{90}Sr, ^{89}Sr	Geiger counter	*monthly*	$1 \cdot 10^{-6}$ Bq/m³	daily	$5 \cdot 10^{-5}$ Bq/m³
Aerosols, 10	^{235}U, ^{239}Pu	Alpha spectrometry	*monthly*	$2 \cdot 10^{-7}$ Bq/m³	daily	$2 \cdot 10^{-5}$ Bq/m³
gaseous iodine, 20	γ-emitter	Gamma ray spectrometry	weekly	$2 \cdot 10^{-2}$ Bq/m³	daily	$5 \cdot 10^{-2}$ Bq/m³
Noble gases, 5	Kr-85, Xe-133	Beta counter	weekly [2]	$3 \cdot 10^{-3}$ Bq/m³	weekly [2]	$3 \cdot 10^{-3}$ Bq/m³
Precipitation, 40	γ-emitter	Gamma ray spectrometry	monthly	$2 \cdot 10^{-3}$ Bq/l	daily	1 Bq/l
Precipitation, 8	^{90}Sr, ^{89}Sr	Geiger counter	monthly	$1 \cdot 10^{-3}$ Bq/l	daily	$5 \cdot 10^{-2}$ Bq/l
Precipitation, 8	^{235}U, ^{239}Pu	Alpha spectrometry	monthly	$3 \cdot 10^{-5}$ Bq/l	daily	$2 \cdot 10^{-3}$ Bq/l
Precipitation, 8	Tritium	Liquid scintillation counting	monthly	10 Bq/l	daily	10 Bq/l
Precipitation, 40	γ-activity	Geiger counter	daily	$2 \cdot 10^{-1}$ Bq/l	daily	$2 \cdot 10^{-1}$ Bq/l l

[1]ABPD: Alpha-Beta-Pseudo-Coincidence-Difference
[1]AERD: Alpha-Energy-Range-Discrimination

[2] IAR: Daily sampling, measurement in case of demand
Detection limit about $2 \cdot 10^{-2}$ Bq/m³

Table Q103.1: On-site Accident Management Measures for PWR, Status of Implementation

Status March 2002

Measure	KWO	KKS	KWB A	GKN 1	KWB B	KKU	KKG	KWG	KKP 2	KBR	KKI 2	KKE	GKN 2
emergency management manual	●	●	●	●	●	●	●	●	●	●	●	●	●
secondary side bleed	●	●	≈	●	❍ 2003	●	●	●	●	●	●	✓	✓
secondary side feed	●	●	≈	●	❍ 2003	●	●	●	●	●	●	●	●
primary side bleed	●	●	●	●	●	●	●	●	●	≈	●	●	●
primary side feed	●	●	●	●	●	●	●	●	✓	●	●	✓	✓
assured containment isolation	●	●	●	●	●	●	●	✓	●	●	●	✓	✓
filtered containment venting	●	●	≈	●	❍ 2003	●	●	●	●	≈	●	●	●
catalytic hydrogen recombiners	❍	❍	≈ 2002	●	❍ 2003	●	●	●	●	❍	●	●	●
supply-air filtering for control room	●	●	●	●	●	●	●	●	●	●	●	✓	●
emergency power supply from neighb. plant	☐	☐	●	●	●	☐	☐	☐	●	☐	☐	☐	●
sufficient capacity of batteries	●	✓	●	●	●	✓	●	✓	●	●	●	●	●
prompt restoration of off-site power supply	✓	●	●	●	●	●	●	●	●	≈	●	●	✓
additional off-site power supply (cable)	●	●	●	●	●	●	●	●	●	●	●	●	●
sampling system in containment	≈			●		≈	≈	●	●		●	●	≈ 2003

✓ within original design ● implemented by backfitting ≈ licensed or partially implemented ❍ applied for ☐ not applicable
dates: year of planned fully implementation

Table Q103.2: On-site Accident Management Measures for BWR, Status of Implementation

Status January 2002

Measure	KKB	KKI 1	KKP1	KKK	KRB B	KRB C
emergency management manual	●	●	●	●	●	●
independent injection system	●	●	●	●	☐	☐
additional injection and refilling of RPV	●	●	●	●	●	●
assured containment isolation	●	●	●	●	✓	✓
pressure relief of the reactor pressure vessel	●	●	●	●	●	●
filtered containment venting	●	●	●	●	●	●
Inertisation of the containment atmosphere	●	●	●	●	● [1]	● [1]
supply-air filtering for control room	●	●	●	●	●	●
emergency power supply from neighb. plant	☐	☐	●	☐	●	●
sufficient capacity of batteries	●	✓	●	●	✓	✓
prompt restoration of off-site power supply	●	●	●	●	●	●
additional off-site power supply (cable)	●	●	●	●	●	●
sampling system in containment	❍	❍	≈	❍	❍	❍

✓ within original design ● implemented by backfitting ≈ licensed or partially implemented ❍ applied for ☐ not applicable

[1] wetwell inerted, drywell equipped with catalytic recombiners

Table Q113.1: Accumulated Untreated Waste on 31 December 1999

Origin	Untreated waste volume [m³]	Conditioned waste with negligible heat generation [m³]	Conditioned waste heat generating [m³]
Research facilities	6 660	30 634	79
Industry	10 941	2 864	--
Nuclear power plants	4 482	11 792	1 265
and from decommissioning	4 927	4 206	--
State collecting facilities	614	2 165	19
Other waste producer	3 393	212	--
Reprocessing	617	11 839	70
Sum	**31 634**	**63 712**	**1 433**

Table Q113.2: Accumulated Radioactive Waste 1984 - 1999 in [m^3]

	Untreated waste	Conditioned waste				
		Negligible heat generating			Heat generating	
	Amount at end of year	Amount at end of year	Accrual	Disposed in ERAM	Amount at end of year	Accrual
1984	6 350	24 930	4 146		184	19
1985	5 416	29 347	4 593		213	29
1986	5 039	33 606	4 596		249	36
1987	7 662	37 504	4 225		416	46
1988	10 694	40 248	3 449		463	37
1989	11 671	43 940	3 719		480	28
1990	14 875	49 997	6 878	708	573	93
1991	18 076	54 930	5 098	49	607	36
1992	27 780	58 405	3 493	-	612	5
1993	27 556	61 322	4 072	-	1 372	760
1994	26 266	63 180	3 802	1 842	1 623	276
1995	30 107	60 798	3 376	5 758	1 928	305
1996	27 611	61 789	8 352	7 361	1 774	-154
1997	28 446	61 191	7 288	7 885	1 423	-351
1998	33 845	60 895	6 236	6 533	1 428	5
1999	31 634	63 712	2 817	--	1 433	5