ILK
INTERNATIONALE
LÄNDERKOMMISSION
KERNTECHNIK
Baden-Württemberg · Bayern · Hessen




ILK Recommendations

on Requirements on Updated General Nuclear Regulatory Guidelines in Germany

Für deutsche Fassung bitte umdrehen!

July 2005
No.: ILK-22 E

Foreword

The International Committee on Nuclear Technology (Internationale Länderkommission Kerntechnik, ILK) was established by the three German states of Baden-Württemberg, Bavaria and Hesse in October 1999. It is currently composed of 13 scientists and experts from Finland, France, Germany, Sweden, Switzerland and USA. The ILK acts as an independent and objective advisory body to the German states on issues related to the safety of nuclear facilities, radioactive waste management and the risk assessment of the use of nuclear power. In this capacity, the Committee's main goal is to contribute to the maintenance and further development of the high, internationally recognised level of safety of nuclear power plants in the southern part of Germany.

Faced with present efforts to revise the German nuclear regulatory guidelines, the ILK has dealt with the requirements which have to be addressed on updated General Nuclear Regulatory Guidelines. In so doing, the ILK has taken into consideration the regulations in effect in France, Sweden and the United States and the customary approach to oversight in these countries as well as the corresponding suggestions made by the IAEA and WENRA. In the current publication, which was adopted at the 36th ILK meeting on July 11, 2005 in Munich, the ILK makes a total of ten recommendations for the revision of the General Nuclear Regulatory Guidelines in Germany. These recommendations are primarily addressed to the German state authorities in their function as the commissioning party of the ILK, but of course they are also available to other groups such as federal authorities, technical support organizations, operators and manufacturers for their participation in the renewal of the regulatory guidelines.

The chairman

Dr. Serge Prêtre

ILK - Geschäftsstelle beim Bayerischen Landesamt für Umwelt

Bürgermeister-Ulrich-Str. 160
D-86179 Augsburg
Telefon: +49-173-65 707-11/-10
Telefax: +49-173-65 707-98/-96
E-Mail: info@ilk-online.org
http://www.ilk-online.org

Executive Summary

Faced with present efforts to revise the German nuclear regulatory guidelines, the ILK has dealt with the requirements which have to be addressed on updated General Nuclear Regulatory Guidelines. Such guidelines should systematically cover, among others, the existing safety criteria, the BMU guidelines, the accident guidelines and the RSK guidelines. In so doing, the ILK has taken into consideration the regulations in effect in France, Sweden and the United States and the customary approach to oversight in these countries as well as the corresponding suggestions made by the IAEA and WENRA. For the revision of the General Nuclear Regulatory Guidelines in Germany, the ILK makes a total of ten recommendations. These recommendations are primarily addressed to the German state authorities in their function as the commissioning party of the ILK, but of course they are also available to other groups such as federal authorities, technical support organizations, operators and manufacturers for their participation in the renewal of the regulatory guidelines. Work on the revision should begin immediately. In the process, existing material should be used where appropriate.

The ten recommendations are:

1. The vertical outline of the German nuclear regulatory guidelines should be given a flatter hierarchy.
2. The non-legislative general regulatory guidelines should make a clear distinction between effectively binding goals and requirements and non-binding recommendations.
3. The technical basis of the requirements should be explained.
4. The General Nuclear Regulatory Guidelines should be non-contradictory, comprehensive, and complete.
5. The General Nuclear Regulatory Guidelines should have an international orientation.
6. The prescriptiveness of the General Nuclear Regulatory Guidelines should be reduced to increase its performance-based orientation.
7. The preparation of the set of guidelines should be undertaken in a way that has been tried and tested internationally. Stakeholders should adequately participate in the revision.
8. The revision of the General Nuclear Regulatory Guidelines should follow the acknowledged principles of project management.
9. For the appropriate application of the new set of guidelines to existing plants, an "application guide" should be prepared. The new set of guidelines should be introduced gradually via a transition phase.
10. The new regulatory guidelines should be regularly updated and be subjected to a peer review with international participation.

1 Scope of applicability

1.1 The German nuclear regulatory guidelines can be represented as a hierarchically structured pyramid (see Fig. 1 below) [UVM-2001]. The pyramid demonstrates the range of interactions from general to concrete requirements with a decreasing level of bindingness. It also clearly illustrates the separation of the legislative from the non-legislative set of regulations.

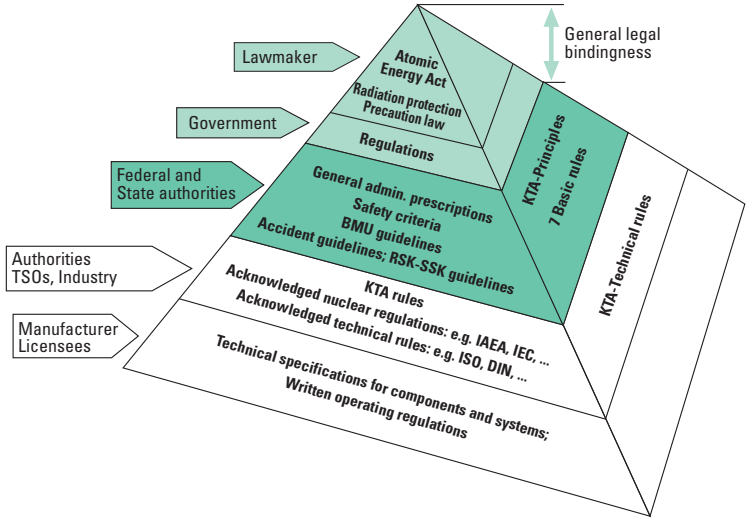

Fig. 1: Pyramid of nuclear regulatory regulations

A license for the construction and operation of a nuclear facility in accordance with the Atomic Energy Act can only be issued once the required „precaution against damage" has been undertaken „according to the state-of-the-art in science and technology". The legislative arm of government has left it to the executive branch to further define this indeterminate legal term and thus to lay down the requirements to be applied in the individual case. If the required precaution is modified to keep up with scientific progress, then it needs to be correspondingly adjusted regardless of whether the „outdated" regulation has already been annulled or modified (so-called dynamic precaution against damage). German nuclear power plants (NPPs) have been given open-ended operating licenses in terms of the Atomic Energy Act and thus enjoy a certain protection (for continuing operation). Subsequent additional requirements issued by the German state authorities are only permissible insofar as they are necessary to protect life, health and property against the hazards of nuclear power and the damaging impact of ionizing radiation or to prevent a hazard to the inner or outer security of the Federal Republic of Germany.

1.2 The subject of these ILK recommendations are the non-legislative general nuclear regulatory guidelines, abbreviated to „General Nuclear Regulatory Guidelines" (GNRG; German: AKR, Allgemeines Kerntechnisches Regelwerk) in the following, to the extent that they include those aspects essential to the safety of light water reactor (LWR) facilities. They include the safety criteria, the BMU guidelines (of the German federal ministry of the environment), the accident guidelines with accident calculation foundations and the RSK guidelines (reactor safety commission, Reaktorsicherheitskommission). The KTA rules (Kerntechnischer Ausschuss) are mentioned in their entirety. These are already revised in predefined intervals with regard to whether they are up to date and are modified if necessary.

1.3 The ILK recommendations are primarily addressed to the German state authorities in their function as the commissioning party of the ILK. Of course, they are also available to other groups such as federal authorities, technical support organizations, operators and manufacturers for their participation in the renewal of the GNRG.

2 Reason for statement and statement of affairs

2.1 The nuclear regulatory guidelines specify the requirements on the safety of nuclear installations and describe the state-of-the-art in technology for safety measures. The main application is for the licensing and regulation of NPPs. The current set of guidelines has been considerably shaped by the construction and licensing of Convoy plants. It is for this reason that the requirements on NPPs are dominated by those concerning pressurized water reactors (PWRs) in the nuclear regulatory guidelines. KTA rules frequently refer to technical solutions for the Convoy plants.
The regulatory guidelines came into being in a stepwise fashion without a written general concept. However, from the very start, a clear distinction was made between the legally binding area and the non-legislative area. Basically, they display a top-down approach, even if a systematic structure is not always apparent, in which the superordinate regulations provide the framework for more detailed specifications. General objectives in the non-legislative guidelines are primarily to be found in the safety criteria of the Federal Ministry of the Interior (BMI) and in the RSK guidelines. The former have been in force unchanged for more than 15 years. The RSK has not adjusted its guidelines to recent developments in reactor safety technology since 1996. The KTA rules in particular show that not only are objectives postulated, but that suggestions for achieving these are pointed out. In this way, concrete examples are mentioned which illustrate the requirements to both manufacturers and operators and also to the regulatory authorities and their technical experts, thereby avoiding unnecessary discussions and saving time (for all involved parties).

Recommendation

The existing nuclear regulatory guidelines are partly no longer up to date and require revision. Such a need is given in, amongst others, the following areas:

1. incompleteness and gaps in terms of content
2. lack of a systematic approach and a clear hierarchical structure
3. lack of requirements that are ordered on the basis of safety goals
4. insufficient consideration of operating experience and scientific progress in the further development of the guidelines
5. excessive regulatory requirements.

2.2 In the second half of the past decade, the Kerntechnischer Ausschuss (KTA, nuclear engineering committee) initiated the project KTA 2000. The appendix to the agenda item 5.1 of the 7th meeting of the subcommittee Program and Basic Questions dated September 3rd 1998 mentions the (still topical) task [KTA-1998]:
„Starting from the insight that the requirements on reactor safety are described in numerous prescriptions with various degrees of bindingness and that the existing nuclear regulatory guidelines of the KTA largely aim to point out the tried and tested practical solutions or technical detailed requirements concerning the precaution against damages required by § 7 (2) Nr. 3 Atomic Energy Act without expressly listing the basic requirements on reactor safety and the safety goals that provide the foundation for reactor safety, the KTA rules are to be supplemented by a pyramid of regulations (cf. Figure 2) in order to show in a hierarchically structured manner the requirements on reactor safety in a self-contained way.

The pyramid of regulations is to consist of three levels:

- The first level is to summarize the basic principles, in particular the general safety principles for light water reactors, contained in diverse individual regulations of the legal and non-legislative guidelines as well as the basic principles for applying the KTA rules.
- The second level is to contain seven KTA basic rules (cf. Figure 2) with a safety goal oriented formulation of the safety-related requirements (safety functions) that are to be achieved for the design, construction and operation of NPPs with LWRs.
- The third level is to span the existing approx. 90 KTA rules.

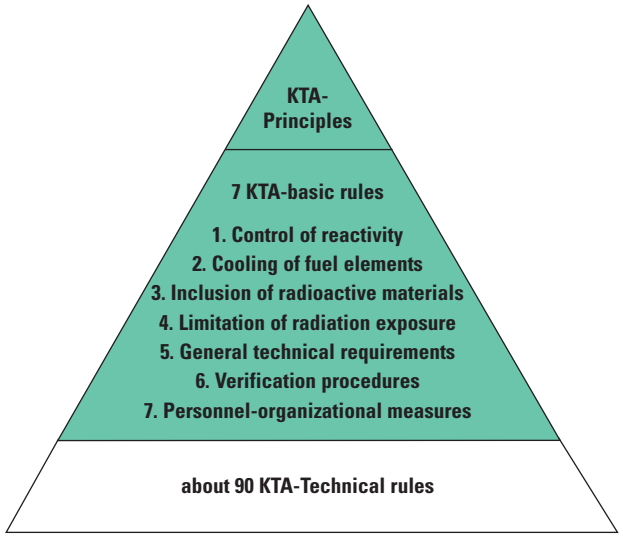

Figure 2: KTA 2000 – Pyramid of regulations

The requirements contained in the first two levels (KTA principles and KTA Basic rules) are independent of the design involved and are thus unrelated to possible concrete implementations and leave space for varying technical solutions and new developments. In contrast, the requirements of the third level (KTA Technical rules) are largely formulated in a design-oriented way. The focus of the KTA 2000 work program, next to a compilation of the safety principles, lies on the introduction of safety goal oriented basic rules found in the second level of the KTA pyramid of regulations."
In a systematic way, the KTA basic rules contain all overarching safety-related prescriptions for achieving the safety goals.

The KTA basic rules that were prepared by equal representation groups were distributed among stakeholder parties at the end of 2002. Up to this point, about 100 experts had made their knowledge and experience available for five years. In the framework of circulation among the stakeholder parties, a statement was issued by the Federal Ministry for the Environment, Nature Conservation and Reactor Safety (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, BMU) in which the Project KTA 2000 was declared to have failed without any plausible justification. This arbitrariness resulted in a resolution by the Executive Committee of the KTA to freeze the project as of November 2003.

Recommendation

2.3 After the end of the project KTA 2000, the BMU initiated its own project for revising the nuclear regulatory guidelines in the fall of 2003. The project is undertaken jointly by the GRS (Gesellschaft für Anlagen- und Reaktorsicherheit mbH, company for plant and reactor safety limited), the Öko-Institute and the Bremen Physikerbüro GbR (Bremen physics office). The aim is to identify existing deviations from or gaps in the state-of-the-art in science and technology in the currently valid non-legislative general nuclear regulatory guidelines and to make suggestions to the BMU on the necessary updates.
The project is intended to close substantial gaps in the current set of guidelines. This applies in particular to the areas of accident management, non-power operation, applied assessment measures, verification procedures and the personnel-organizational safety concept. The set of guidelines is to be structured in a self-referential, systematic and hierarchically structured way.
On the first level (module 1), the new regulatory guidelines are to replace the existing safety criteria. On the second level, regulations are to be established that replace prior recommendations of the Reactor Safety Commission (Reaktorsicherheitskommission, RSK) at the same level of detail. The third level consists of the existing BMU guidelines. The rules of the KTA represent the fourth level.

The nuclear regulatory guidelines are meant to solidify the precaution against damages according to the current state-of-the-art in science and technology and in so doing also take into account the results of work performed by WENRA (Western European Nuclear Regulators Association).

The ILK also considers these objectives to be appropriate. However, the ILK views the selected procedure to be unsuitable for the following reasons:

- Thoroughness requires time. The new regulatory guidelines are already to take effect in the year 2006. The remaining time is too short to arrive at a well-founded result when all experiences with regulation-making processes are taken into account. First drafts for a part of the planned scope were presented at an information event in December 2004. These showed a considerable need for improvement. Drafts for all of the guidelines are available on the internet as of July 2005.
- In the new formulation of the rule text, essential groups (stakeholders such as German state authorities, technical experts, licensees, manufacturers) have been restricted to the role of commentators. Even if they were to invest efforts by making constructive contributions despite their experiences with the project KTA 2000, their technical expertise will be only insufficiently integrated into the preparation of regulations with all the worrisome attendant consequences.

- A set of guidelines that raises objections among essential groups can be expected to face substantial acceptance problems. This is hardly conducive to a high safety culture.

Furthermore, the available drafts lead to the expectation that the required measures laid out in the new version will be of an even more prescriptive nature than before. This may weaken the responsibility of the licensee, an issue that is ascribed great importance in the international safety discussion since it does not promote a good safety culture.

2.4 Faced with this situation, the ILK has addressed the problem of a reformulation of the General Nuclear Regulatory Guidelines in Germany. It has commissioned a study which, taking the current state of the nuclear regulatory guidelines as its starting point, proceeds to establish principles for its desirable ideal state. Additionally, to support the regulatory authorities of the German states, the final report of the study [ISaR-2005] points out those regulations that have meanwhile become obsolete with regard to the current state-of-the-art in science and technology. In order to promote corresponding harmonization efforts, the regulations in effect in France, Sweden and the United States are taken into consideration as are the corresponding suggestions made by the IAEA and WENRA. The ILK's recommendations on the requirements on the updated General Nuclear Regulatory Guidelines (GNRG) are based on the results [ISaR-2005] of the above-mentioned study. These results could also be useful to the Project KTA 2000 in the event of its revival.

3 Concepts of comparable international guidelines

3.1 IAEA Safety Standards

The International Atomic Energy Agency (IAEA) is an independent international scientific-technical organization for worldwide nuclear cooperation within the United Nations. The IAEA's mandate includes the development of nuclear safety standards.
Over a number of years until 1994, the IAEA published a „Safety Series" as an orientation guide for its member states. This report series, subdivided into 4 levels (Fundamentals, Standards, Guides, Practices), touches on practically all aspects of nuclear safety. The safety level was oriented towards the greatest common denominator of the member states. The "Safety Series" primarily addressed the accession states to nuclear energy utilization. In 1996, the IAEA decided to convert the „Safety Series" into Safety Standards with three hierarchical levels (Fundamentals, Requirements and Guides). This restructuring was accompanied

by a move of the basic concepts away from „minimal requirements" towards a set of guidelines that takes the state-of-the-art in science and technology (Best-Practice-Standards) as its orientation. At the same time, the development, review and approval process was changed and is now controlled by four committees and the commission for safety standards, whose members are senior regulators.
The new standards are based on a dynamic concept. They are reviewed every five years and revised if necessary.
The safety standards of the IAEA are non-binding for the member states. They document the consensus on safety requirements on nuclear installations. However, the standards are binding for the IAEA activities under Technical Cooperation and for the Safety Review Services such as OSARTs (operational safety review team) and IRRTs (international regulatory review team), where they serve as reference for judging safety.

The safety standards of the IAEA [IAEA-2004] consist of the following areas (see Figure 3):

- General Safety,
- Safety of Nuclear Facilities,
- Radiation Protection and Safety of Radiation Sources,
- Safe Management of Radioactive Waste,
- Safe Transport of Radioactive Material.

All documents from the „Safety Series" that were relevant to NPPs were revised and assigned to the right place in the structure of the Safety Series.
The hierarchical structure is apparent in a single document on safety fundamentals, 15 documents with strict requirements and 104 documents of guidelines having a recommendatory nature. The safety fundamentals consist of safety goals, safety concepts and safety principles. Strict requirements are needed for their implementation which can be assigned by topic or for a typical activity or facility. Guidelines in particular recommend special measures with which the requirements can be satisfied.

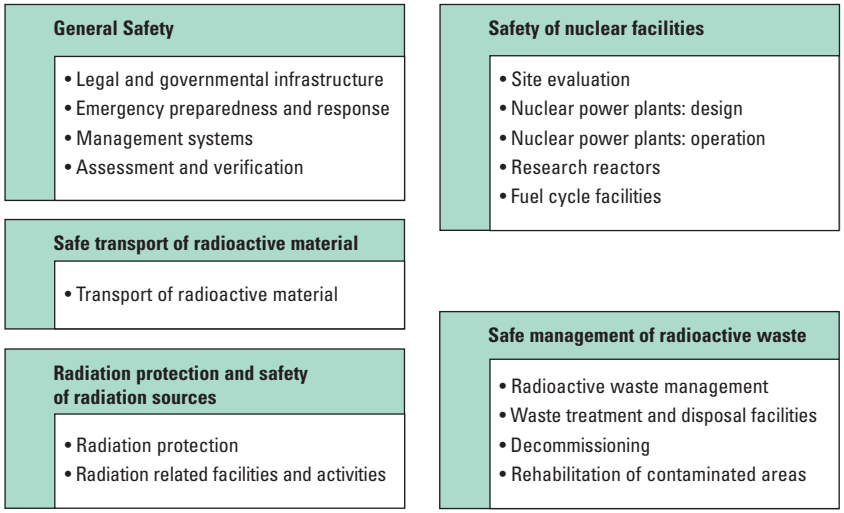

Fig. 3: IAEA Safety Standards

The third review meeting that took place in April 2005 under the Nuclear Safety Convention has recommended using the Safety Standards of IAEA as the reference for carrying the future reviews of national reports.

3.2 The WENRA Initiative

In early 1999, the licensing authorities for nuclear installations in the Western European countries (EU and Switzerland) established the „Western European Nuclear Regulators Association (WENRA)". It pursued the goal of a reinforced cooperation between the regulatory and licensing authorities of participating countries while retaining the independence and the qualified role of national regulatory authorities.

Furthermore, WENRA has set itself the following goals:

- harmonization of requirements on nuclear safety within the European Union and Switzerland (EU + CH),
- independent assessment of guaranteeing nuclear safety and oversight in the candidate countries of the EU,
- development of a joint approach for nuclear safety and oversight within the EU + CH.

One essential activity is the development of uniform and high „reference levels" for the safety of NPPs currently operating in the EU and Switzerland. These reference levels are established on the basis of the IAEA safety standards and are supplemented by European requirements exceeding those of the IAEA or by experiences gained from operating practice (European „delta") [BMU-2004].

The envisaged uniform approach is to arise in two working groups with different topic areas:

- power reactors,
- fuel reprocessing and disposal as well as dismantling of nuclear installations.

Following exploratory work within a pilot project, the main project for formulating reference levels was begun in early 2004. In the meantime, about 320 reference levels are available. They are now undergoing a review phase. The aim of this phase is to establish to what extent the reference levels are already anchored in the national regulatory guidelines of the member states and to what extent they have been implemented in the plants. The phase is to be completed by the end of 2005 with adoption of the reference levels.
They have been assigned to the general topic areas and subtopics according to the following structure (see Fig. 4).

Safety management	Design	Operation	Safety verification	Emergency preparedness
Safety policy	verification & improvement of design	operational limits & conditions	Contents & updating of SAR	On-site emergency preparedness
Operating organization	Design basis envelope for existing reactors	Ageing management	Prohabilistic Safety Analysis	Protection against internal fires
Quality management system	Classification of SSCs	Investigation of events & OEF	Periodic Safety Review	
Training and authorization		Maintenance, in-service, inspection & testing	Assessment of plant modifications	
		Emergency operating procedures; severe accident management guidelines		

Fig. 4: Structure of the WENRA Reference levels (version June 2005)

BWR = boiling **w**ater **r**eactor
OEF = operational **e**xperience **f**eedback
PWR = pressurized **w**ater **r**eactor
SAR = safety **a**nalysis **r**eport
SSC = structures, **s**ystems and **c**omponents

The reference requirements are to be integrated in the national regulatory guidelines of the member states by the end of the current decade. Additionally, there are considerations within WENRA to include the European „delta“ in future updates of the IAEA standards.

3.3 Structure of nuclear regulatory guidelines in the USA

3.31 In comparison to Germany, a central federal agency, the United States Nuclear Regulatory Commission (NRC), is responsible in the United States for the licensing and oversight of civilian nuclear facilities. The five Commissioners are nominated by the President and are confirmed by the Congress. In addition to the safety of nuclear facilities, the areas of radiation protection as well as the nuclear fuel cycle are under its auspices. The Commission has a few thousand employees for performing its tasks. The NRC's regulatory activities are supported by an extensive Regulatory Research program. The NRC is an independent federal agency, and does not report to any other federal agency or US government department. Its budget is determined directly by the Congress.

3.32 The NRC has created a very detailed and structured set of regulations, which are subdivided into various documents that have different levels of bindingness [USNRC-2001, USNRC-2004]:
Legal prescriptions: Title 10 of the U.S. Code of Federal Regulations (10 CFR) summarizes the legal prescriptions of the NRC. Compared to the legal regulations of other countries, these NRC Regulations are exceptionally extensive and detailed. The version that is available on the internet comprises more than 6700 pages of NRC Regulations.
Recommendations: These „NRC Guidance Documents“, while not representing requirements, serve various purposes as follows:

- NRC *Regulatory Guides (NUREG)*: These recommendations are meant to aid licensees and applicants in the implementation of specific parts of the legal prescriptions and to describe acceptable methods for the evaluation of specific issues. The applicant may choose to use alternative methods.
- *Standard Review Plans* describe how the NRC staff performs its reviews of various applications.
- *Consensus Standards*: The NRC cooperates with industry and industrial standardization organizations in the development of standards for the systems, components and materials used in the nuclear industry. Reference can be made to these „norms“ in legal prescriptions or NRC recommendations. These standards are usually approved, with possible exceptions, in Regulatory Guides.

- *Generic Communications*: The NRC publishes a diverse array of „Generic Communications“ to licensees and applicants. These may refer to information on incidents or to requests for actions or information:
  - *Bulletins* concern urgent safety-related topics and usually require actions or at least a reply.
  - *Generic letters* convey information and usually require an action or reply.
  - *Regulatory Issue Summaries* convey overviews of regulatory topics as well as general technical and/or regulatory information. Frequently, they do not require any action or response.
  - *Information Notices* relate to safety, security or environmental issues where licensees decide for themselves whether or not actions are appropriate.
  - *Circulars* relate to safety, security or environmental issues and do not require a reply.
  - *Administrative Letters* convey information of a non-technical nature or request administrative information on a voluntary basis.

3.33 About a decade ago, the NRC began the systematic revision of its concepts for oversight and licensing. One of the declared aims from the very start included increasing efficiency by focusing requirements and resources on issues important to safety [Jackson, 1996]. This includes relieving industry from burdens that have little or no significance to safety (relief from unnecessary regulatory burden). Further developments should take into account the large increase in operating experiences with NPPs and the advances in safety analysis.
Essential innovations concern both practical aspects of regulatory oversight (new Reactor Oversight Process, ROP) as well as a fundamental revision of the set of guidelines. A central role is accorded to the introduction of procedures and standards with systematic consideration of risk information. In this way, licensees are encouraged to shift from the originally purely deterministic to a more risk-informed approach. However, essential deterministic principles, the defense-in-depth concept and safety margins (conservatism) are maintained in this new concept of „risk-informed regulation“. One of the important preconditions for the implementation of the risk-informed approach is a plant-specific and continuously updated probabilistic safety analysis (a living PSA).

A further essential innovation is given by the introduction of Performance-Based Regulation, which follows Performance Goals for specific operating parameters without, however, prescribing in detail how these targets are to be reached. For example, no defined maintenance procedure is prescribed for emergency Diesels;

instead, a minimum availability (e.g., 96%) is required, which the licensee is called upon to demonstrate. [NUREG-BR-0303] documents the guidelines for applying the performance-based approach. The guidelines recommend adhering to sufficiently large safety margins for this purpose.
The long-term revision of the nuclear regulatory guidelines is to be implemented in three work options with varying priority in terms of time.

Summary

3.34 The American set of regulations can be characterized by the following main features:

- It is extremely comprehensive and has a detailed structure with systematic but also strongly formalized differentiation of the meaning of different types of regulatory documents. Binding requirements, non-binding recommendations and industrial standards are clearly delineated and kept apart. This approach is supported by a formal and strict quality assurance process by the NRC.
- The advantages lie in the clarity of the regulations which strongly restrict the room for discretionary interpretation regarding decisions made by the authority. The drawback lies in a considerable formalization of procedure.
- The high transparency of the procedure of rulemaking is noteworthy. It covers the public availability of essential drafts on the internet as well as participation of all interest groups (stakeholders) in rule preparation based on clear procedural rules. The results of rulemaking are thus consensual to a very high degree and future developments are predictable.
- The essential foundation for all safety requirements is the term „adequate protection". It is not understood as a concept of continual improvement as is the custom in Germany. In this way, requirements on the safety level can possibly also be maintained for longer periods of time and are updated if necessary, for example after the Rasmussen report (WASH 1400) was published or after the Three-Mile-Island accident.
- The optimization of the reasonableness of safety requirements is very significant. To achieve this, extensive use is made of risk-information while adhering to tried and tested safety principles. In so doing, quantitative values are used for the core damage frequency (CDG) and the large early release frequency (LERF) in proportion to the other civilization risks. This concept is used by the NRC as the basis for the current revision of the set of guidelines, for purposes of reducing unnecessary regulatory burden on the licensees and moving toward a performance-based regulatory system.

3.4 The situation in France

3.41 Oversight of the safety of French NPPs lies in the hands of a central authority. By a decree from February 2002, modifying the 1993 December one, the Direction générale de la sûreté nucléaire et de la radioprotection (DGSNR) is given the missions of defining and implementing the nuclear safety and radiation protection policy. Since it reports to the ministers of environment, industry and health, its political independence is reinforced. Together with its regional offices, it constitutes the French Safety Authority (autorité de sûreté nucléaire, ASN). The Institut de Radioprotection et de Sûreté Nucléaire (IRSN) is the technical support organization at its side. Several advisory committees (groupes permanents) are assigned to the ASN. The most important is the Permanent Committee on the Safety of NPPs (Groupe permanent chargé des réacteurs nucléaires - GPR).
The DGSNR organizes, orients, and supervises in particular the control and inspection activities in nuclear safety and radiation protection of the regional offices of industry, research and environment. It also relies on the regional and departmental offices of health and social affairs.
The ASN carries out its supervising activities in the following fields: natural ionizing radiation, basic nuclear installations, radioactive and fissile materials for civil use, production, transport, and utilization of ionizing radiation, radioactive waste and contaminated sites. It is also in charge of emergency situations management as well as of international relationships.
In its business plan for the time period 2005 – 2007, the French safety authority has committed itself

- to improve the French set of guidelines for nuclear safety and radiation protection with regard to effectiveness and simplicity,
- to support the harmonization of requirements on nuclear safety in Europe and
- to adapt the licensing process in such a way that the responsibility of the licensee towards safety is strengthened.

Furthermore, ASN seems fully aware that substantial modifications to the procedures and thus to the set of guidelines are necessary in connection with the liberalization of the electricity industry and the privatization of EdF. Correspondingly, revisions and new versions are being drafted. For instance, further decrees are in process (see below); amongst others concerning the safety level of existing plant concepts and on the periodic safety review [ASN-2004]. According to ASN, it can be expected that the revision of the French set of guidelines will make use of the current activities of the WENRA.

3.42 The significance of the nuclear regulatory guidelines in France must be viewed against the backdrop of the peculiarities of the French system. There is no necessity for a set of guidelines that acts as a unifying framework for the operation of different plants by several licensees. The relationship between the authority and the sole licensee has traditionally been marked by trust. It is the result of a longtime dialogue of two state-owned organizations. In practice, ASN frequently relays its requirements in the form of correspondence to EdF. Many of these requirements refer to a specific construction line, so that one can speak of construction line-specific requirements.
At the request of the regulatory authority – and based on a ministerial decree from December 1963 – the entirety of all requirements on plant safety for a specific plant are reassessed within the framework of a periodic safety review. In the process, all factors influencing plant safety are reviewed. These include, amongst others, advances in the state-of-the-art in science and technology brought about through the planning for new plants, feedback from experience and a probabilistic safety assessment. The outcome of the review is an updated safety report. The modifications this gives rise to are summarized in groups and are introduced into the plant during the following ten annual revisions. At the end of this process, the regulatory authority approves plant operation for a further ten years until the next periodic safety review provided that the formulated goals were indeed achieved.

3.43 A hierarchical series of texts determines the regulations, rules and practices to be used for nuclear safety. They are part of a pyramid of documents whereby the top is constituted by the International Conventions ratified by France. Next, with an increasing order of detail, are the General Technical Regulations (covering pressurized equipment, effluent releases and quality organization), followed one level down by the Fundamental Safety Rules (règles fondamentales de sûreté - RFS) which are recommendations issued by the French Authority and good practices identified at a given time, and finally the codes and norms prepared by the nuclear industry and approved by the authority.

- *Fundamental Safety Rules*

  These rules are issued by the authority on various technical topics and address the nuclear power plants as well as all the other nuclear installations. They define the safety goals and describe the practices judged by the authority as sufficiently safe in order to fulfil these goals.

  They do not constitute binding requirements: a licensee can depart from the rules but needs to prove that his alternate solution achieves the same goals.

  Through their flexibility, such rules allow for the evolution of technical measures in step with advances in technical and scientific knowledge.

- *Codes and norms elaborated by the French Industry*

  In the French practice for assuring nuclear safety, the licensee has to present all rules, codes and norms he uses during the different phases (design, realisation, start-up and operation) as far as they are significant to safety components and equipment.

  The codes concretely implement the technical regulation requirements and at the same time reflect good industrial practices. It is not the duty of the authority to deal with these codes but nevertheless it examines them and their revisions. In most cases, it issues a fundamental safety rule which acknowledges the codes' overall acceptability at a given date.

  The codes called RCC (Règles de Conception et de Construction) were written by the industry in order to cover different clusters of equipment in the design, realisation and start-up phases (civil construction, mechanical equipment, electrical equipment, fuel, etc.)

  The RCC-E codes for electrical equipments and components were revised in 2001 (4th edition) and approved by the regulator as consistent with the corresponding fundamental rule, especially regarding the safety of software that is important for computers in the safety system.

  The new 2000 version of the codes RCC-M for mechanical equipment and components has been approved by the authority with reservations. The authority will soon give the conclusions of its examination.

3.44 *The licensing process*

The French legislation entails an authorisation or licensing process for the construction of plants. This is followed by a series of authorizations that are associated with the main phases of an installation's lifetime:

- Step 1 site selection and safety options
- Step 2 construction authorization
- Step 3 start-up authorization
- Step 4 authorization for gas and liquid effluents and water sampling
- Step 5 authorization for final shutdown and deconstruction.

Summary

3.45 Essential elements of the French nuclear regulatory guidelines can be summarized as follows:

- The legal situation in France is shaped by laws and regulations. The nuclear regulatory guidelines are rudimentary; only few rules exist.
- Talks between the authority and licensee through official groups (e.g. GPR) as well as correspondence by the authority carry great significance since these take on the function fulfilled by a set of guidelines in other countries. This can be traced to the following circumstances:
  - Only one (state-owned) licensee for NPPs exists, so that regulations can be achieved by dialogue-based agreement as far as possible.
  - There are standardized reactor types – three construction lines, of which only two are relevant.
  - The relationship between licensee and regulator rests on mutual trust and on professional cooperation.
- The authority itself sees the need for preparing an improved set of guidelines. Thus, a number of regulations are currently being drafted.
- An interesting peculiarity is given by the tiered requirements on existing NPPs as a function of the construction line or their age. These requirements are determined in detail in the framework of the periodic safety review and are further specified during the operation the plant.

3.5 The nuclear regulatory guidelines in Sweden

3.51 In Sweden, there are central regulatory authorities for nuclear safety (SKI) and for radiation protection (SSI). The legal basis for the nuclear regulatory authority SKI is the Act on Nuclear Activities. This assigns the complete and sole responsibility for the safe operation and waste disposal to licensees. Next to the general customary regulatory aspects, the SKI statutes also emphasize initiatives for improving safety.

Chapter of the Swedish regulations

1. **Scope of Applicability and Definitions**
2. **Basic Safety Provisions**
   - Handling of deficiencies in barriers and defense-in-depth
   - Organization and safety management
   - Safety Program
   - Barriers and defense-in-depth
   - Physical Protection
   - Emergency Preparedness
3. **Construction of Plants**
4. **Assessment and Description of Plant Safety**
   - Safety Analysis
   - Safety Report
   - Safety Assessment
   - Periodic Safety Review
   - Modification
5. **Plant operation**
   - Technical Specifications
   - Procedures and Guidelines
   - Maintenance, Monitoring and Testing
   - Investigation of Events and Conditions
6. **Nuclear Material and Nuclear Waste**
7. **Reporting to SKI**
8. **Documentation and Document Retention**
9. **Decommissioning**
10. **Exceptions**

Fig. 5: Contents of the Swedish nuclear regulatory guidelines

3.52 In the year 2004, SKI put in force a revised set of regulations [SKI-2004:1] with general safety requirements. It consists of 14 pages with 5 appendices. It covers the 10 chapters pictured in Figure 5. Appendix 1 classifies deficiencies of a safety barrier or within defense-in-depth into three categories. Appendix 2 names the information to be included in the safety report while expressly pointing out that further information is required by SSI regarding radiation protection. Appendix 3 mentions the contents of technical specifications and Appendix 4 gives details on the notification procedures of plants to SKI. Here, a distinction is made between incidents with significant impact on plant safety, those with relatively normal influence and also between operating processes that apply to different time periods within which the notification needs to be made. The last Appendix 5 gives details on the content of the decommissioning plan.

On the next 21 pages, the regulatory authority SKI gives general recommendations to licensees on how to implement the safety requirements of the regulations. For this purpose, individual requirements are commented. While the requirements themselves are consistently formulated as „shall-statements", the recommendations are worded as „should-statements".

3.53 At the start of 2005, a new regulation [SKIFS-2004:2] came into force which outlines the requirements on the construction and design of reactors in 28 paragraphs spanning 10 pages. Some requirements also have commentaries in a supplementary section covering 9 pages.
The regulation was formulated by SKI itself. The licensees were included in its preparation at an early point in time [RaeMi]. The numerous and intense discussions spanned a time period of six years. The consequences of the regulation for existing plants were already explored during the preparation period. The outcome of this is a statement of the tangible backfit measures for the individual plants. SKI is legally obliged to present a „consequence analysis report" following a hearing with the licensees which outlines the impact of the new regulation. The report also includes a cost-benefit analysis of the mutually agreed upon backfit measures with concrete cost estimates. Details of the implementation of the new regulation are being prepared until year's end 2005 by the licensees Sydkraft and Vattenfall and will be submitted to SKI. The essential measures are to be implemented over a time period of eight to ten years.

3.54 The oversight philosophy of SKI is not based on prescriptions (non-prescriptive approach): The responsibility for nuclear safety rests exclusively in the hands of the licensee. For this reason, SKI monitors the way in which licensees implement this responsibility in a constructive dialogue with the licensees and by performing safety assessments. SKI is to be informed by the licensee in the event of modification projects; a mandatory approval is only required in few cases. About one-fifth of all modification projects are more closely scrutinized by SKI. A project can be halted with an explicit veto.
Depending on the results of the safety assessment or the extent of discovered deviations, SKI may demand actions by the licensee or can have the plant shut down. Substantial elements of this process-oriented oversight are multidisciplinary teams and a cooperative relationship with the licensees. Novel components or procedures are, for example, assessed by SKI while known components or procedures are assessed solely by the licensee. SKI requires the use of both deterministic and probabilistic safety assessments.
SKI's self-image commands involvement in science and research, the participation in international cooperations and intensive public relations activities.

Recommendation

Summary

3.55 The Swedish set of regulations is relatively compact. The Swedish oversight is process-oriented. The regulatory authority has made recommendations for implementing the requirements laid out in the regulatory guidelines.

- By law, in Sweden the responsibility for nuclear safety rests exclusively in the hands of the licensee.
- The philosophy of nuclear oversight in Sweden follows a non-prescriptive approach. The regulatory authority monitors the way in which licensees implement this responsibility in a constructive dialogue with the licensees and by performing safety assessments.
- At the start of 2005, a new regulation on the requirements on the construction and design of reactors came into force. In cooperation with the licensees, the regulatory authority has laid down backfit measures for each plant. In the process, a cost-benefit analysis with concrete cost estimates was prepared. The backfits are to be implemented over a time period of eight to ten years.

4 The current nuclear regulatory guidelines situation in Germany

4.1 Chapters 1 and 2 already sketched a brief overview of the current state of the General Nuclear Regulatory Guidelines (GNRG) in Germany. Further information can be found in the final report [ISaR-2005].

The German nuclear regulatory guidelines arose in conjunction with the development of German reactor facilities. It thus has a largely technical orientation, and its international orientation has thus far been rather insignificant. By international comparison, the German nuclear regulatory guidelines currently in force are extensive and detailed. They are also comparatively „prescriptive", i.e. they not only determine protective and safety goals but also establish in detail how these goals are to be achieved.
In its entirety, i.e. as a sum of non-legislative general guidelines, KTA rules and industrial norms, the German nuclear regulatory guidelines can be seen as still being applicable. Individual requirements of the GNRG that no longer correspond to the state-of-the-art in science and technology have been replaced by more progressive KTA rules. Areas in which the German nuclear regulatory guidelines fall behind the IAEA Safety Standards in terms of the scope of regulations can be covered – as is the case in many other countries – by operating practice regulations of NPPs or by the regulatory authority.

4.2 In the following, noteworthy weaknesses of the GNRG are listed. Details can be gleaned from the final report of the ISaR Institute [ISaR-2005] in section 2.5.5. on pages 36-43 [German language version]. These are not equivalent with corresponding deficits in the NPPs, since requirements are also fulfilled through KTA rules, specific licensing regulations or within the framework of a technical expertise as licensing preconditions. For this reason, individual rules on the topic of safety management can be found in various documents without having corresponding superordinate requirements in the GNRG. A similar situation applies for plant internal accident management.
Several rules are explicitly to be applied only to pressurized water reactor plants. Attention is mostly given to power operation. Design-dependent requirements are also found therein. The requirements concentrate on the design phase. In comparison, the topics operation and accident prevention are underrepresented. A balanced account of the proportional significance of deterministic requirements and probabilistic principles is missing. The existing GNRG are comparatively detailed and prescriptive, yet there is no systematic approach to levels of detail and prescriptiveness. Concrete requirements to ensure the reasonableness (of requirements) are thus far not contained in the GNRG.

Note: Reasonableness means that for all requirements exceeding basic protection, which always needs to be provided regardless of the costs involved, the ratio of expenditure to cost-benefit is taken into account.

In the same way, legal terms remain undefined. This does not contribute to an increased predictability of decisions. Such unclarities were relatively unproblematic in earlier years when a technically qualified and problem-solving orientation existed among all participants.
Explanations and comments thus far have not been introduced in a systematic way in the GNRG. Generally, it has a top-down structure. However, the guidelines to date span about 60 documents that have been arranged without a discernible ordering principle.
A regular review of the current set of guidelines does not take place. There is no documented procedure describing how to apply the rules and guidelines to NPPs in operation. Instead, decisions are reached in an ad hoc manner.

5 Recommendations for an updated set of nuclear regulatory guidelines in Germany

5.1 Recommendations for an updated nuclear regulatory guideline in Germany not only need to take international trends into account but also the tradition of the German set of guidelines and its practical application. Furthermore, the special

situation surrounding nuclear energy in Germany is definitely also acknowledged. Nuclear regulatory guidelines that are to be newly structured should be evolutionary and independent of forecasts on political developments. It should be focused on establishing the required high safety level of existing NPPs in all phases of their operation. In so doing, the technical requirements on plants with their components as well as safety-related requirements on the mode of plant operation are of equal significance. In the forefront are efforts to systematize the often historically shaped regulations while adjusting their scope to a situation in which the regulations are determined largely by the long-term safe operation of existing plants rather than by the licensing of new NPPs. Furthermore, the update of nuclear regulatory guidelines is frequently viewed as one element in the transfer of nuclear engineering know-how to a younger generation of scientists and engineers. Furthermore, the nuclear regulatory guidelines should pursue an international orientation. They should be based on the IAEA Safety Standards and the reference levels of WENRA and be consistent with them. The requirements on a revised set of German nuclear regulatory guidelines should cover all safety aspects concerning stationary power reactors including supply and disposal of fuel and its transport as well as decommissioning and dismantling of plants.

5.2 Hence, the ILK states the following recommendations for the revision of the General Nuclear Regulatory Guidelines in Germany. They are assigned to a top-down system: a general or conceptual recommendation can be found on the topmost level; the next level down contains noteworthy comments listing associated important details.

Recommendation 1: The vertical outline of the German nuclear regulatory guidelines should be given a flatter hierarchy.

Comments: The General Nuclear Regulatory Guidelines (GNRG) should be structured in a hierarchy of two levels. A compact pyramidal structure starting with general requirements and moving to successive finergrained detail is change-friendly and facilitates regular revisions. A modular structure lends further support to this approach. With clearly defined interfaces and the avoidance of overlaps and thus of repetition of content, the set of regulations is further supported by a performance-based approach as well as an orientation towards international standards (IAEA, WENRA) in terms of structure and content.
Consistency and ensuring clarity are indispensable requirements particularly for a modular structure. In selecting the sequence of requirements for the set of guidelines, attention

must be paid to thread/ordering principle since this can indeed be significant for the interpretation of content.

Example:

The above-mentioned recommendation (following the example of the IAEA) could be implemented in the following way:

- The topmost level of the GNRG should be headed by a relatively compact block of general, technology-neutral requirements that are formulated in a way that is independent of the plant generation involved and that is oriented towards the goals pursued with the new plants. These requirements constitute the safety-related basic protection. This block of general requirements should be comprehensive in the sense of the framework laid out by the WENRA requirements.
- On a subordinate, second level of the GNRG, more detailed requirements should appear. Its contents are subdivided into groups (modules). The extent of detail on this level could be reduced in comparison to the current set of guidelines. Plant-dependent descriptions given in associated comments serve to clarify the envisaged goals. They also serve to illustrate technical solutions with which the goals can be achieved. Naturally, a concrete solution in a particular case may be allowed to deviate from the given solution as long as the mentioned goal can also demonstrably be reached using the deviating solution.
  Also in order to increase legal certainty, where possible, the following sufficient statement should be considered in the formulation of requirements: *If a technical requirement is binding, then it belongs to the design basis area.* Therefore, the second level of the GNRG contains both effectively binding requirements as well as non-binding recommendations.
- A third level below the GNRG largely corresponds to today's KTA rules. This area needs to be restructured in the longer term with regard to a paradigm change concerning bindingness. It should contain non-binding requirements, recommendations or „Codes of good practice" that consist of detailed technical requirements and design-independent exemplary solutions, possibly with a variety of alternatives.

Fig. 6 shows a graphic representation of the structure described in the example, which is comparable to the current structure in Fig. 1.

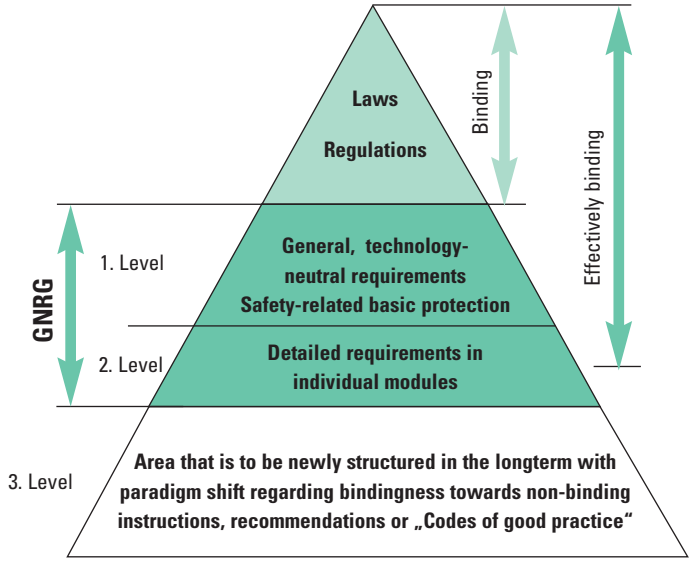

Fig. 6: Exemplary structure of an updated GNRG

Recommendation 2: The non-legislative general regulatory guidelines should make a clear distinction between effectively binding goals and requirements and non-binding recommendations (cf. Fig. 6).

Comments:

- This recommendation is not only intended to lead to an increased legal certainty but also aims to promote the development of a performance-based regulatory system. Thus, the topmost level of new GNRG should only include requirements similar to the „shall-statements" of the IAEA safety requirements documents (cf. the example of Sweden). These define the safety-related basic protection. They are not initially legally binding, but will develop a binding effect in fact. The rules below the (level of) GNRG should not be considered as binding also in practice. These would include, following a test of suitability and relevance, KTA rules, recom-

mendations by the RSK and SSK (radiation protection commission, Strahlenschutzkommission), guidelines or further industrial rules.

- The second level of the GNRG consists both of effectively binding requirements and of non-binding recommendations. Taking Sweden as an example, this includes recommendations made by the regulatory authority. In this respect, room for interpretation opens up in maintaining the reasonableness of corresponding requirements:

- The safety-related basic protection is non-negotiable. The safety principles it contains are to be adjusted to the current state-of-the-art in science and technology. The basic protection is expressed in deterministic requirements, supplemented by probabilistic findings, for a sufficient precaution. It is implemented by, amongst other things, sufficiently defined and structured safety levels, the barrier concept within the framework of a „defense-in-depth", the single failure concept as well as the postulate of ineffectiveness of operating systems during accident mitigation or prevention with additional pessimistic analysis framework conditions.

- Requirements exceeding the basic protection that is to be afforded at all times (level 2 in Fig. 6) should take into account the cost-benefit ratio. In this way, ensuring reasonableness will serve both economic concerns as well as safety concerns since significant safety-related aspects can be pursued and considered with the necessary care while avoiding relatively unimportant requirements. In particular, principles of reasonableness have the task of ensuring the appropriateness of implementing new requirements in plants with limited lifetimes. Improving the balancedness and reasonableness of safety measures belongs to the particularly effective optimization possibilities when taking into account the increasing maturity of nuclear engineering.

- Assessing the balancedness of safety measures is improved by advances in the methods of safety analysis. These include, in particular

  - the use of PSA (probabilistic safety analysis) as a tool for design-independent assessment of the appropriateness of the safety level in design and operation of the plants,

  - the development of improved verification methods for safety reserves for postulated accidents and the reduction of conservative assumptions for accident analysis this enables.

    The improved assessment can be used for a reliable determination of the cost-benefit relationship of modification measures.

- The safety goals should be preserved as an expression (paradigm) of a systematic structure of safety-related tasks. The measures that are defined via safety functions serve to achieve the safety goals.

Recommendation 3: The technical basis of the requirements should be explained.

Comments:

- This recommendation aims to ensure that requirements are plausible, have been correctly understood and can be properly applied. In so doing, the readability should not be hampered. Here, a clear separation between requirements and justifications as well as an intelligent use of modern digital media is advocated.

- Comments should be made in a hierarchical way, whereby comments should in principle be all the more comprehensive the more the rules go into detail. For the effectively binding regulations of the first level of the GNRG, a commentary in the same document appears unnecessary and is more likely to be counterproductive since it reduces readability and overloads the texts. For those recommendations aimed at making concrete good practices for the second level of the GNRG, however, plausible comments or justifications are of great significance.

- This recommendation also supports the maintenance of competence in nuclear engineering. The young generation of experts no longer have the background knowledge stemming from active involvement in the planning, design and construction of NPPs. This fact needs to be acknowledged in future guidelines.

Recommendation 4: The GNRG should be noncontradictory, comprehensive, and complete.

Comments:

- The set of guidelines should apply to LWRs in all operating conditions and contain safety requirements for all phases of operation including non-power mode.
- PWR and BWR should be distinguished in an appropriate way.
- The national and international operating experiences that have been gained to date should be taken into account.
- The design basis area defined by the licensing of a NPP should be separated from the beyond design basis area (safety level 4).
- Safety level 4 (beyond design basis area) should be structured in a systematic way so that it adequately reflects the developments that have occurred in the meantime. Here, preventive emergency protection could be differentiated from mitigative emergency protection.
- A suitable aging management should be taken into account.
- Essential requirements on decommissioning and dismantling of plants should be formulated.
- Requirements should include the safe transport of radioactive materials.
- The requirements should be consistent with aspects pertaining to supply and disposal of fuel.
- Requirements in the personnel-organizational field (Man-Technology-Organization, MTO) should be formulated in the necessary depth. For this purpose, a safety management system as well as requirements on self assessment systems for improving safety culture should be taken into account.

Recommendation 5: The GNRG should have an international orientation.

Comments:

The scope of the rules should largely take the topics dealt with by WENRA as its guide. In so doing, attention should be given to consistency with international practice. The revision should

closely follow international developments; after proper review, formulations that are customary on an international level, e.g. as found in the IAEA Safety Standards, can be directly taken on.

It is essential that

- attention today is not only given to the specific design basis features of a certain technology but instead refers increasingly to the whole spectrum of questions relevant to the safe operation of existing plants
- via harmonization efforts of international organizations, a convergence of varying national requirements is promoted and that Germany does not close itself off to these developments,
- the orientation towards international developments should not take the form of narrowly selecting single international requirements that are more stringent than the national ones. Instead, in the interests of consistency and effectiveness of safety precautions, the entire spectrum of these international developments should be considered in a representative and well-balanced way.

Recommendation 6: The GNRG's prescriptiveness should be reduced to increase its performance-based orientation.

Comments:

- Internationally, steps have been taken in the last few years to reinforce the responsibility of the licensee. The licensee is to be given more flexibility for optimizing plant operation and the authority is to be given the chance to focus on essentials. Examples include the goal-oriented approach to oversight and licensing found in the UK, the transfer of certain tasks from the authorities to the licensees in Sweden [SKI-2004], as well as enlarging the leeway for plant and operating optimizations within the framework of risk-informed regulation that is practiced in the USA and in some other countries. This also means that the regulatory authorities of the German federal states carry out their tasks of licensing and oversight of nuclear installations with the same safety approach.
- The appropriate structuring of bindingness and level of detail is closely associated with delimiting the scope of discretion

in regulatory decision-making. The essential safety goals and their expression in the form of safety functions should always be determined as precisely as possible. Faced with the special hazard potential of NPPs, there is no leeway for aspects of reasonableness. The case is different where issues of operation and areas of low safety-related relevance are concerned: here, a regulation of specific questions is more likely to weaken the licensee in his responsibility. The formulation of operation goals is incumbent upon the licensee.

- The introduction of levels of bindingness and detail is closely related to the goal of increasing the predictability of regulatory decisions. This goal can be pursued by formulating requirements as clearly and straightforwardly as possible. It could furthermore be helpful to define legal terms found in the law that are indeterminate in more detail in the GNRG or in the procedures.

Recommendation 7: The preparation of the set of guidelines should be undertaken in a way that has been tried and tested internationally. Stakeholders should adequately participate in the revision of the GNRG.

Comments:

- This aspect mirrors internationally acknowledged principles of a rulemaking process which are meant to be applied to the revision of the GNRG. A structured, iterative process with explicitly defined milestones that provide an opportunity for expressing opinions ensures a rapid revision.
- Stakeholders include: the regulatory authority, its technical experts, the licensees, manufacturers and representatives of the general public. It may be advisable to first agree on a suitable participation of the general public. The outcome of this decision should be documented.
- Since very contradictory views are held in the field of nuclear engineering, this makes transparency and appropriate participation of all interest groups all the more important to the acceptance of the achieved results.
- For this purpose, the resource „time“ is to be sufficiently measured out. Estimates for some parts of the GNRG cover

at least two to three years' preparation. The total revision of the GNRG will require clearly longer time periods; a realistic framework for a high quality and reviewed set of regulations will surely span five years.

- Participation and the information flow that it requires is extraordinarily facilitated by the proper use of digital media. Information from the current parallel activities regarding harmonization efforts by the WENRA, the regulatory guideline initiative of the BMU and the adjustment of KTA rules can be linked with each other in this way.

Recommendation 8: The revision of the GNRG should follow the acknowledged principles of project management.

Comments:

- Next to a clear and exhaustive task description that is available in written form, a schedule is also to be prepared. If delays should arise, then resources in terms of time, staff or tools (digital media!) should possibly be newly allocated during controlling talks held at periodic intervals. For this purpose, for example the review process used in the preparation of IAEA Safety Standards can be recommended.
- The project plan describes the procedure and approach taken in the coordination of individual parts of the GNRG which are prepared in parallel.
- The text drafts are prepared in groups with about three to five members. They should have diverse qualification backgrounds. Ideally, the following should be integrated:
  - Experts with in-depth special knowledge and long-term experience with German procedures who fully comprehend reason and purpose of the current German set of regulations and its applications in their area of expertise,
  - Generalists with a total overview and firm knowledge of the international safety practice, international guidelines as well as of the technical-scientific foundations that are essential to international practice
  - Young engineers and scientists as future users of the new set of guidelines, also for purposes of promoting the necessary transfer of knowledge.

- A glossary summarizes all terms and definitions.
  Such documentation represents a precondition for the consistent use of terms given a parallel processing of different parts of the guideline at the same time.

Recommendation 9: For the appropriate application of the new set of guidelines to existing plants, an "application guide" should be prepared. The new set of guidelines should be introduced via a transition phase.

Comments:

- The transition to a new GNRG should be performed in a measured way in order to enable a meaningful connection to the existing set of guidelines for the plants currently in operation. This includes drafting transition and option rules that mention concrete procedures and assessment criteria. Such guidelines simplify the professional handling of sudden instances of rule deviations while taking into account the residual operating periods and adhering to the principles of reasonability.
- The procedure applied in Sweden can be recalled at this point: Regulatory authority and licensee discussed the backfits for existing plants arising from a new regulation [SKI-2004:2]. As in France, such backfits are effectively assigned to groups for every existing plant in such a way that they can each be implemented during the annual revision. At the end of such a process, a periodic safety review (PSR) could demonstrate the conformity of the plant with the new set of guidelines.

Recommendation 10: The new regulatory guidelines should be regularly updated and be subjected to a peer review with international participation.

Comments:

- This recommendation intends to ensure the compatibility of the new GNRG with the customary international requirements. In this way, amongst other things, the speed and structure of the rulemaking process can be adjusted to international usage. At the same time, quality, balancedness and appropriate use of the new GNRG can be assured.
- A periodic update of the GNRG is the most likely to guarantee the required precaution according to the current state-of-the-art in science and technology. Revisions of the

set of regulatory guidelines should be undertaken whenever a new state-of-the-art in science and technology can be discerned; that is, in concrete terms

- if new findings of nuclear safety research or of operation are available; this can also lead to a reduction of conservative assumptions,
- if new technologies (e.g. digital safety I&C) are regarded as ready for use according to the criteria of the required precaution.

6 References

ASN-2004, Third French national report on implementation of the obligations of the Convention on nuclear safety, July 2004

BMU-2004, Übereinkommen über nukleare Sicherheit, Bericht der Regierung der Bundesrepublik Deutschland für die Dritte Überprüfungstagung im April 2005, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, September 2004

KTA-1998, Protokoll der 7. Sitzung des Unterausschusses Programm und Grundsatzfragen am 03.09.1998, Anlage zum Tagesordnungspunkt 5.1 „Beschlussvorschlag zum Arbeitsprogramm KTA 2000"

IAEA-2004, International Atomic Energy Agency, Homepage URL: http://www.iaea.org

ISaR-2005, Fortschreibung des deutschen kerntechnischen Regelwerks im internationalen Vergleich, Abschlussbericht, ISaR-A-0022, Februar 2005-02-25

Jackson, S. A., Nuclear Regulation in the United States: Policy Directions and Future Prospects, Korea Atomic Industrial Forum, Seoul, April 12, 1996

NUREG-BR-0303, Guidance for Performance-Based Regulation, U.S. Nuclear Regulatory Commission, Washington DC, December 2002

RaeMi, Ch. Raetzke, M. Micklinghoff, Die Überarbeitung des deutschen kerntechnischen Regelwerks; ein Vergleich mit dem Ausland, atw 50.Jg. (2005) Heft 5 – Mai, 298 - 304

SKI-2004:1, Statens kärnkraftinspektions föreskrifter om säkerhet I kärntekniska anläggningar, Statens kärnkraftinspektions allmänna rad om tillämpgningen av föreskifterna om säkerhet I kärntekniska anläggningar, ("Swedish Nuclear Power Inspectorate's Regulations concerning Safety in Nuclear Facilities; General Recommendations Concerning the Application of the Swedish Nuclear Power Inspectorate's Regulations above") SKIFS 2004:1,Swedish Nuclear Power Inspectorate (SKI), 2004

SKI-2004:2, Statens kärnkraftinspektions föreskrifter om konstruktion och utförande av kärnkraftsreaktorer, SKIFS 2004:2, only the Swedish version is available, adopted on October 7, 2004, published November 18, 2004, effective as of January 1, 2005. http://www.ski.se/se/index_about_uk.html

USNRC-2001, US National Report for the Convention on Nuclear Safety, U.S. Nuclear Regulatory Commission September 2001

USNRC-2004, How we Regulate, U.S. Nuclear Regulatory Commission, http://www.nrc.gov/what-we-do/regulatory.html

UVM-2001, Ministerium für Umwelt und Verkehr des Landes Baden-Württemberg, Abteilung Reaktorsicherheit, Umweltradioaktivität, Reaktorsicherheit und Strahlenschutz in Baden-Württemberg, Mai 2001

1. **Prof. Dr. George Apostolakis, USA**
   Professor of Nuclear Engineering and of Engineering Systems at the Massachusetts Institute of Technology (MIT) in Cambridge, USA

2. **Prof. Dr. phil., Dr.-Ing. E.h. Adolf Birkhofer, Germany**
   Managing Director of the ISaR Institute for Safety and Reliability GmbH
   Chair for Reactor Dynamics and Reactor Safety at the Technical University of Munich

3. **Annick Carnino, France**
   Former Director of the Division of Nuclear Installations Safety at the IAEA

4. **Jean-Claude Chevallon, France**
   Former Vice President "Nuclear Power Generation" at EDF, France

5. **Prof. Dr.-Ing. habil. Hans Dieter Fischer, Germany**
   Holder of the Chair for Communication Theory at the Ruhr-University Bochum

6. **Bo Gustafsson, Sweden**
   Chairman Board of Directors, SKB International Consultants AB, Sweden

7. **Prof. Dr. rer. nat. habil. Winfried Hacker, Germany**
   Professor of Psychology at the Technical University of Munich
   Former Professor for General Psychology at the Technical University of Dresden

8. **Prof. Dr.-Ing. habil. Wolfgang Kröger, Switzerland**
   Chair for Safety Technology and Director of Laboratory for Safety Analysis at the ETH Zurich

9. **Dr.-Ing. Erwin Lindauer, Germany** (Vice Chairman)
   Former Chief Executive Officer of the GfS Gesellschaft für Simulatorschulung mbH
   Former Chief Executive Officer of the KSG Kraftwerks-Simulator-Gesellschaft mbH

10. **Dr. Serge Prêtre, Switzerland** (Chairman)
    Former Director of the Swiss Nuclear Safety Inspectorate (HSK)

ILK Members

11. **Prof. Dr.-Ing. habil. Eberhard Roos, Germany**
    Holder of the Chair for Material Testing, Material Science and Material Properties at the University Stuttgart
    Director of the Staatliche Materialprüfungsanstalt, University Stuttgart

12. **Antero Tamminen, Finland**
    Former long-time Technical Manager at Loviisa NPP, Finland

13. **Prof. Dr. Frank-Peter Weiß, Germany**
    Professor of Plant Safety at the Technical University Dresden
    Director of the Institute for Safety Research at the Research Centre Rossendorf, Dresden

(Members are listed in alphabetical order)

ILK Publications

ILK-01 ILK Statement on the Transportation of Spent Fuel Elements and Vitrified High Level Waste (July 2000)

ILK-02 ILK Statement on the Final Storage of Radioactive Waste (July 2000)

ILK-03 ILK Statement on the Safety of Nuclear Energy Utilisation in Germany (July 2000)

ILK-04 ILK Recommendations on the Use of Probabilistic Safety Assessments in Nuclear Licensing and Supervision Processes (May 2001)

ILK-05 ILK Recommendation on the Promotion of International Technical and Scientific Contacts of the Nuclear Safety Authorities of the German States (October 2001)

ILK-06 ILK Statement on the Draft Amendment dating from July 5, 2001 to the Atomic Energy Act (October 2001)

ILK-07 ILK Statement on Reprocessing of Spent Fuel Elements (November 2001)

ILK-08 ILK Statement on the Potential Suitability of the Gorleben Site as a Deep Repository for Radioactive Waste (January 2002)

ILK-09 ILK Statement on the General Conclusions Drawn from the KKP 2 Incidents associated with the Refueling Outage of 2001 (May 2002)

ILK-10 ILK Statement on the Handling of the GRS Catalog of Questions on the "Practice of Safety Management in German Nuclear Power Plants" (July 2002)

ILK-11 ILK Recommendation on Performing International Reviews in the Field of Nuclear Safety in Germany (September 2002)

ILK-12 Internal ILK-Report on the Intentional Crash of Commercial Airliners on Nuclear Power Plants (March 2003)

ILK-13 ILK Statement on the Proposals for EU Council Directives on Nuclear Safety and on Radioactive Waste Management (May 2003)

ILK-14 ILK Statement on the Recommendations of the Committee on a Selection Procedure for Repository Sites (AkEnd) (September 2003)

ILK Publications

ILK-15 ILK Recommendation on the Avoidance of Dependent Failures of Digital I&C Protection Systems (September 2003)

ILK-16 ILK Statement on Sustainability Evaluation of Nuclear Energy and other Electricity Supply Technologies (January 2004)

ILK-17 ILK Statement on Maintaining Competence in the Field of Nuclear Engineering in Germany (March 2004)

ILK-18 ILK Summary Report of the 2nd International ILK Symposium „Harmonisation of Nuclear Safety Approaches – A Chance for Achieving more Transparency and Effectiveness?“ (May 2004)

ILK-19 ILK Statement on the Regulator's Management of the Licensee Self-Assessments of Safety Culture (January 2005)

ILK-20 ILK Statement on Requirements on Anticipated Transients without Scram (ATWS) (March 2005)

ILK-21 ILK-Report: Summary of the International ILK Workshop „Sustainability“ (May 2005)

ILK-22 ILK Recommendations on Requirements on Updated General Nuclear Regulatory Guidelines in Germany (July 2005)

- CD with presentations held at the ILK Symposium "Opportunities and Risks of Nuclear Power" in April 2001
- Proceedings of presentations held at the 2nd ILK Symposium "Harmonisation of Nuclear Safety Approaches – A Chance for Achieving more Transparency and Effectiveness?" in October 2003

Please visit our website http://www.ilk-online.org to view our most recent publications and to download or order the listed recommendations and statements free of charge.

We would like to point you to the pages „Advisory Topics“ and „News“ on our website for more details on the topics currently being treated by the ILK.