Gesellschaft für Reaktorsicherheit (GRS) mbH

(Innentitel)

GRS-Bericht

The Nuclear Licensing and Supervisory Procedures for Nuclear Facilities in the Federal Republic of Germany

Ludwig Ferdinand Franzen

GRS-43 (Februar 1982)

Glockengasse 2 · 5000 Köln 1 · Telefon (02 21) 20 68–1 · Telex 8 881 807 grs d

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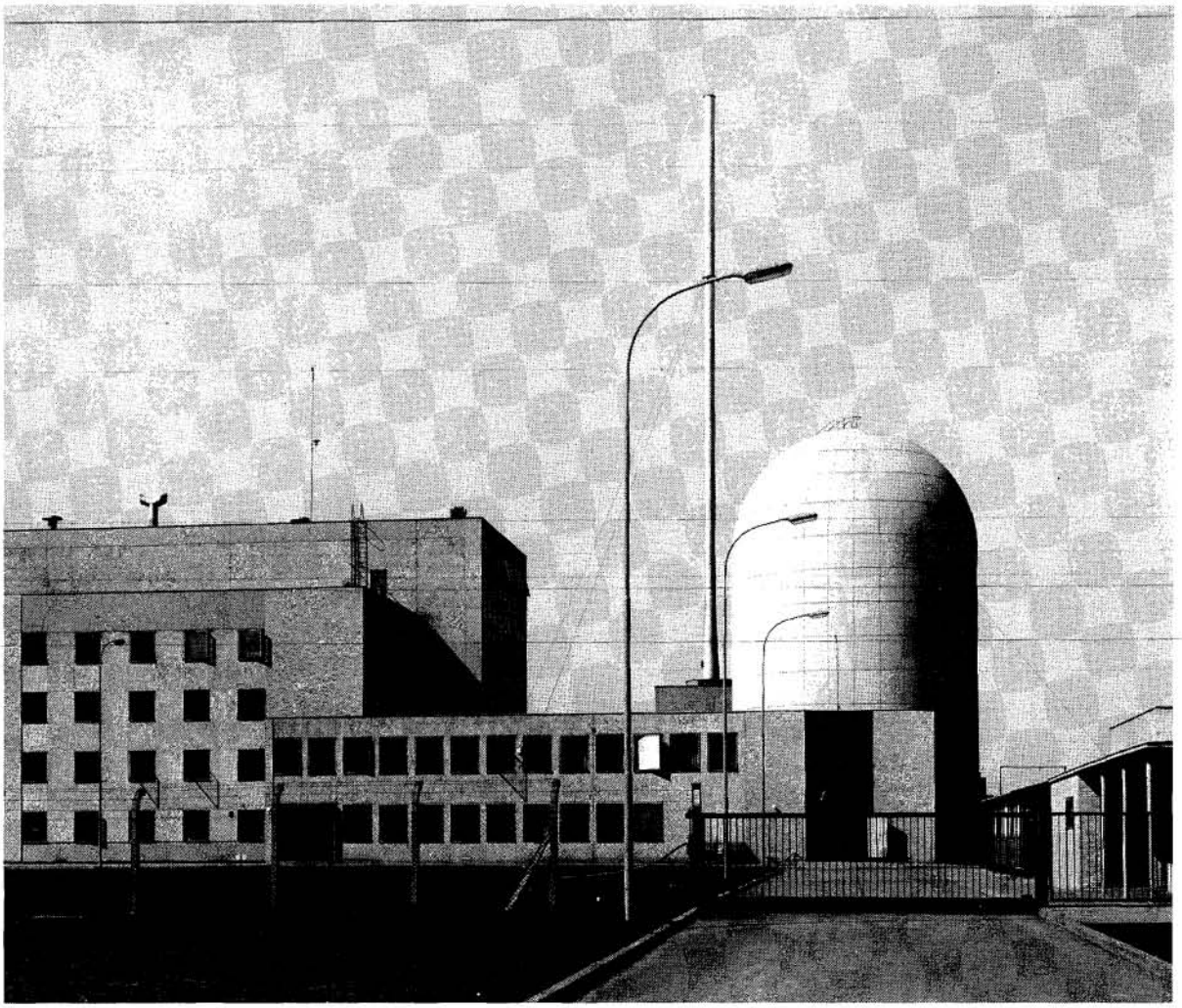

KWU Frankfurt/M., photograph

Figure 1:

Experimental Atomic Power Plant Kahl (Boiling Water Reactor);
Electrical Net Power 16 MW, Commercial Operation since 1961

INTRODUCTION

The Federal Republic if Germany is a centralized confederacy consisting of 11 states - West Berlin has a special status which, nevertheless, includes the application of the German nuclear legislation. There is a Federal Government and there are the State Governments whose respective responsibilities are defined in detail.

The legal prerequisites fot the peaceful use of nuclear energy were established relatively late since all kinds of activities in the nuclear field had been prohibited by the allied military powers until 1955. Only in 1959 has the constitution been amended in order determine the respective responsibilities of the Federal and State Authorities and to establish further legislative prerequisites.

In accordance with the principle of as much centralism as necessary and as much federalism as possible, these responsibilities have been defined in such a manner that the nuclear legislation is being enacted by the Federal legislative bodies, i.e. the Federal Diet and the Federal Council whereas the States are responsible for the implementation of these laws. In addition, the Federal Government has the right, with the consent of the Federal Council, to issue ordinances and general administrative regulations. The respective Federal Minister responsible for the supervision of the States can, in addition, give directives concerning the legality and expediency with which the States carry out their tasks.

The Nuclear Licensing and Supervising Procedure for nuclear facilities has been strongly influenced by the federal structure of the Federal Repulic. It is carried out according to the regulations of the Atomic Energy Act (chapter 1), the associated legal provisions (chapter 2), the administrative regulations, the Guidelines of the Reactor Safety Commission (Reaktor-Sicherheitskommission = RSK) and the regulatory guides (chapter 3) as well as to relevant technical rules (chapter 4).

After the explanation of these four levels of regulations, those involved in the nuclear licensing and supervising procedure are dealt with (chapter 5) as well as the procedure itself (chapter 6) and the measures for safety assurance (chapter 7). A brief survey is given of the international aspects of reactor safety including short sample presentations of the licensing and supervising procedures in other countries (chapter 8). The volition process taking place in the political arena concerning the role of nuclear energy in the future supply of the German energy needs with particular regard to the advanced rector lines of the Fast Breeder Reactor (Schneller Brutreaktor = SNR) and of the High Temperature Reactor (Hochtemperaturreaktor = HTR) are not discussed in the compilation. The appendices contain surveys on the technical provisions for nuclear facilities.

1. ATOMIC ENERGY ACT

1.1 Legal Framework

The legal prerequisites for the peaceful use of nuclear energy in the Federal Republic have been established relatively late since until 1955 any activity in the nuclear field had been prohibited by the allied military powers.

In 1959, the constitution has been amended (Article 74, No. 11a) /1/. It is determined in Article 87c of the constitution that laws which are passed according to Article 74, No. 11a can, with the consent of the Federal Council, stipulate that they are to be enforced by the States on behalf of the Federal Government (Federal Executive Administration). The Atomic Energy Act (Atomgesetz = AtG) /2/ has made use of this possibility. Consequently, the Atomic Energy Act is implemented by the States. In this connection, the States are subordinated to the Federal supervision which covers the legality and expediency of the implementation. The Federal Minister of the Interior is, in this respect, allowed to provide directives (Article 85 of the constitution). The basic principles for the peaceful use of the nuclear energy are legislated in the Atomic Energy Act. The Atomic Energy Act is divided into six chapters: (1) General Regulations, (2) Supervisory Regulations, (3) Administrative Regulations, (4) Liability Regulations, (5) Penalty and Fine Regulations and (6) Final Regulations. On the basis of the Atomic Energy Act, five ordinances have been issued:

- Ordinance for the Protection against Injury or Damage caused by Ionizing Radiations, Radiological Protection Ordinance (Strahlenschutzverordnung = StrlSchV),
- Ordinance for the Protection against Injury or Damage caused by X-Rays, X-Ray Ordinance (Röntgenverordnung = RöV),
- Ordinance for the Procedures for the Licensing of Facilities in Accordance with sec. 7 of the Atomic Energy Act,

Nuclear Licensing Ordinance (Atomrechtliche Verfahrensverordnung = AtVfV),

- Ordinance for the Financial Security in Accordance with the Atomic Energy Act, Financial Security Ordinance (Atomrechtliche Deckungsvorsorgeverordnung = AtDeckV),
- Ordinance for the Costs in Conjunction with the Atomic Energy Act (Atomrechtliche Kostenverordnung = AtKostV),

Further Ordinances are being prepared (figure 2).

1.2 Purpose

The purpose of the Atomic Energy Act is outlined in its first paragraph:

- to promote the research, the development and the use of nuclear energy for peaceful purposes,
- to protect life, health and property from the dangers of nuclear energy and from the harmful effects of ionizing radiation, and to compensate for damages caused by nuclear energy or ionizing radiation,
- to prevent that the internal or external security of the Federal Republic is jeopardized because of the use or the release of nuclear energy,
- to guarantee the fulfilment of the international obligations of the Federal Republic in the field of nuclear energy and radiation protection.

1.3 Licensing and Supervision

The peaceful use of nuclear energy is permitted only with governmental licensing. The license is only to be granted if the licensing prerequisites legally stipulated are met in order to guarantee the necessary protection of the public. A comprehensive and detailed licensing procedure verifies that the licensing prerequisites have been met. In order to cover the en-

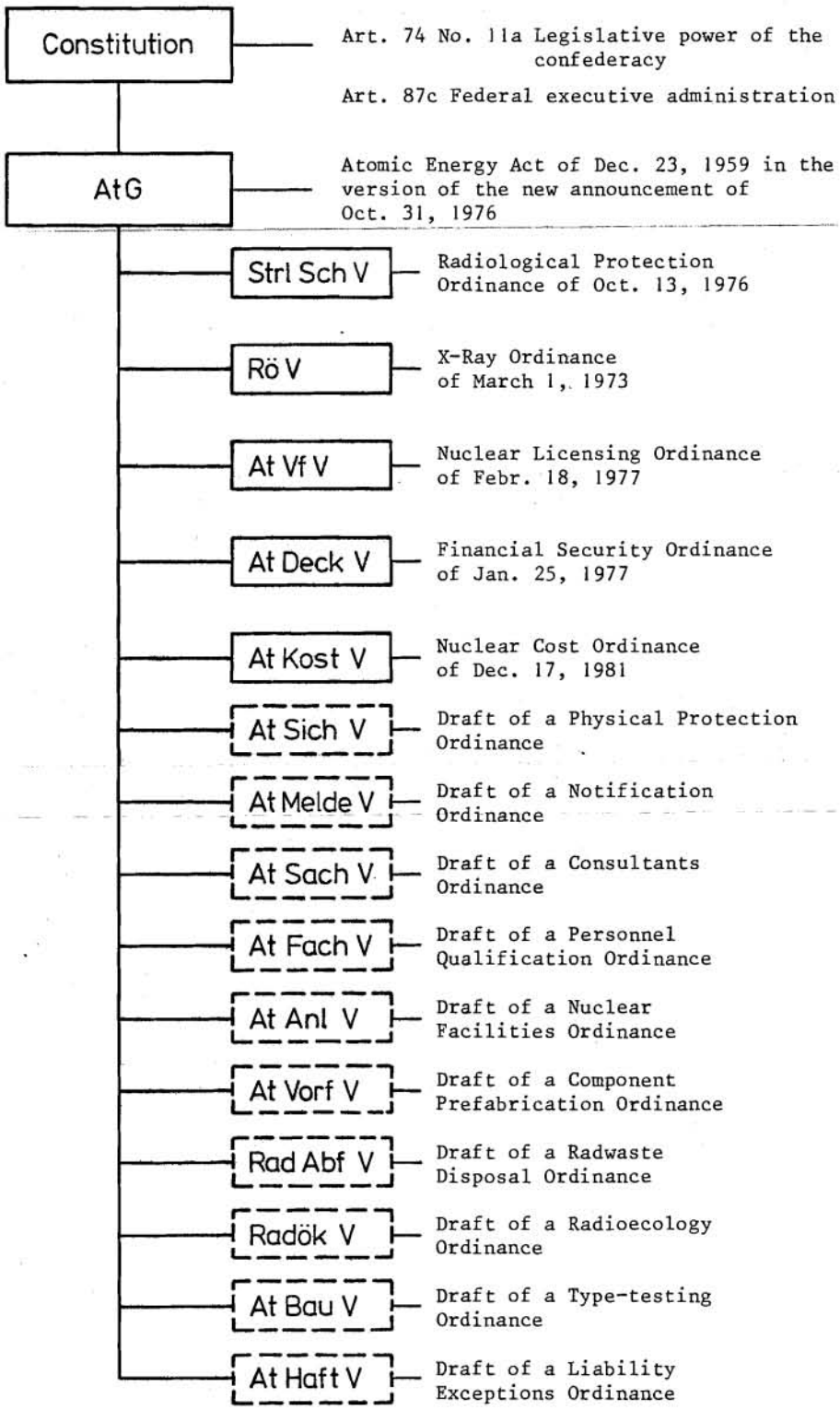

Figure 2:
Atomic Energy Act and Related Ordinances

tire nuclear fuel[1]) cycle, the licensing requirements according to the Atomic Energy Act refer to:

- Import and export (sec. 3),
- the transportation of nuclear fuel (sec. 4),
- the storage of nuclear fuel (sec. 6),
- the construction, operation or other ownership of facilities for the production, treatment, processing or fission of nuclear fuel and for the reprocessing of irradiated nuclear fuel or change of the facilities or of their operation (sec. 7, para. 1),
- the decommissioning of a facility according to sec. 7, para. 1 and safe inclusion of the decommissioned plant or the demolition of the facility or of components (sec. 7, para. 3),
- treatment, processing ot other use of nuclear fuel outside od facilities subject to licensing (sec. 9),
- the construction of collection facilities in the States for the intermediate storage of radioactive wastes (sec. 9a para. 3, sec. 9c),
- the construction od facilities for securing and for disposing radioactive wastes (sec. 9a, para. 3, sec. 9b).

The licensing requirement according to sec. 7 of the Atomic Energy Act is of special importance for the nuclear facilities mentioned there, i.e. enrichment plants, nuclear fuel fabrication plants, nuclear reactors and reprocessing plants. The granting of a license depends on the fulfilment of all licensing prerequisites concerning the protection of employees, unrelated third persons and the general public. A license can only be granted (sec. 7 para. 2 of the Atomic Energy Act)

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[1]) Plutonium 239 and 241, uranium 233, uranium enriched in the isotopes 233 and 235, any substance containing one or more of these substances, and uranium and substances containing uranium of such purity as to enable a self-sustaining chain reaction.

- if there are no facts giving rise to any doubts as to the reliability of the applicant and the persons responsible for the construction, management and supervision of the operation of the facility and if the persons responsible for the construction, management and supervision of the operation of the facility possess the expert knowledge required;
- if it is guaranteed that other persons involved in the operation of the facility possess the necessary knowledge of a safe operation of the facility, the possible dangers and the protective measures to be taken;
- if the necessary precaution has been taken by taking into consideration the state of science and technology in order to prevent damages resulting from the construction and operation of the facility;
- if the necessary financial security has been provided for concerning the compliance with legal compensation liability;
- if the necessary protection is provided for against interferences or other third party's interactions;
- if there are no preponderant public interests against the siting of the facility, in particular with regard to keeping the water, air and soil free of contamination.

These licensing prerequisites are rendered more concrete by means of ordinances, general administrative regulations, guidelines or directives (often on the basis of the recommendations of advisory bodies) of the Federal Minister of the Interior and by technical standards (figure 3). A special feature of the nuclear legislation which is to emphasize the protection purpose of the Atomic Energy Act is the fact that the applicant has no legal claim to the granting of a license according to sec. 7 para. 2 of the Atomic Energy Act as it is the case in other legal fields when the licensing prerequisites have been met. This reservation of a possible refusal underlines the priority the legislation concedes to the protection of the public over the applicant's interests.

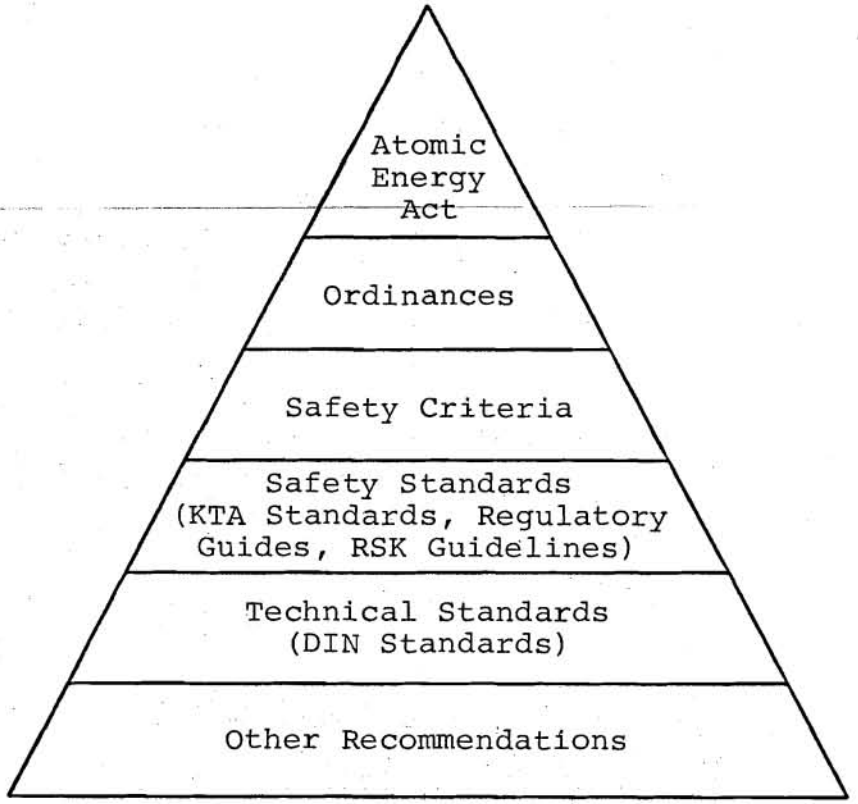

Figure 3:
Hierarchy of Regulations

The licensing regulations of the Atomic Energy Act are supplemented by supervisory regulations which are to impede any violations of the Atomic Energy Act and the associated ordinances, or of regulations and regulatory decisions based thereon. For this purpose, the handling and carrying of radioactive materials, the construction, operation and ownership of nuclear facilities as well as the transportation of radioactive materials are subject to the supervision of the States (sec. 19 of the Atomic Energy Act).

During the pursuance of this supervision, without being limited to this connection, it may become necessary to impose additional requirements or to cancel licenses already granted

(sec. 17 of the Atomic Energy Act). Under certain circumstances, the licensee must be awarded compensation if the license has been revoked (sec. 18 of the Atomic Energy Act).

1.4 Liability and Financial Security

The liability and financial security regulations of the Atomic Energy Act settle the questions of liability in the case of damages caused by nuclear energy or by ionizing radiation and provides for the fulfilment of liability compensation obligations.

In this connection, the obligations assumed by the Federal Republic of Germany in the Paris Convention including the Brussels Supplementary Convention are taken into consideration. According to this, the licensee is subject to an absolute liability (legal canalization), the liability only requires the proof of causing damage and not proof of fault (endangering liability). In addition, the Atomic Energy Act contains several improvements from the financial point of view in comparison to the international agreements as international customary exclusions from liability do not find application and as the maximum liability limit has been raised. In this way, it covers even damages resulting directly from armed conflicts, hostilities, a civil war, a revolution or from a severe catastrophe of an exceptional kind. Furthermore, the regional liability limitation to the contracting states has been abolished and the time limit to claim compensation has been prolonged from ten to thirty years. The maximum liability limit of the Atomic Energy Act amounts to 1 billion DM per case of nuclear damage. This regulation, applying presently to the Federal Republic of Germany, is supplementary to the regulations of the international agreement according to which the maximum liability limit is 120 million Monetary Units[1]) in the contracting states

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[1]) When the Paris Convention was signed (July 29, 1960), 1 Monetary Unit was equivalent to 4,1684 DM.

and 15 million Monetary Units in the non-contracting states. Apart from that, German residents, with regard to damages caused by foreign nuclear facilities, will be compensated independent of the respective legal provisions as if the damage has been caused by a German nuclear facility, i.e. the German maximum liability will also be applied to such cases.

The owner of a nuclear facility is required to provide evidence of financial security up to the amount stipulated in the license by the licensing authority according to the Financial Security Ordinance. This amount depends on the risk potential of the facility. In the regular case, it should not fall below the maximum insurance coverage available on the insurance market on reasonable terms, but it can reach 500 million DM at the most.

The public authorities provide indemnity of up to 1 billion DM for all damages not covered by the financial security. 75 % of this supplementary amount are provided by the Federal Government and 25 % by the States where the facility causing damage is located. Liability insurance of up to 200 million DM is available on the market. A liability insurance of up to 500 million DM can, however, only be granted indirectly by the insurance companies. For this reason, the owners of nuclear facilities, who are required to provide financial security, have founded the Nuclear Liability Incorporated (Nuklear-Haftpflicht GbR) as a self- serving organization. According to this, the insurance companies undertake liability in relation to the aggrieved party up to an amount of 500 million DM. The companions of the Nuclear Liability Incorporated obligate themselves to reimburse up to 500 million DM for payments made in excess of the liability insurance according to a percentage relationship agreed to by the members.

2. ASSOCIATED LEGAL REGULATIONS

2.1 Radiological Protection Ordinance

The reissue of the Ordinance for the Protection against Injury or Damage Caused by Ionizing Radiation, Radiological Protection Ordinance (Strahlenschutzverordnung = StrlSchV) in 1976 refers to radioactive materials including nuclear fuel as well as to facilities for the production of ionizing radiation (nuclear reactors, accelerators)/3/. X-ray equipment and sweep radiators in which electrons can be accelerated to a maximum of 3 MeV are not covered, with the exception of X-ray equipment used in schools for educational purposes. The operation of these types of equipment is specially settled in the Ordinance for the Protection against Injury or Damage from X-rays, X-ray Ordinance (Röntgenverordnung = RöV) issued in 1973 /4/.

The scientific basis of the Radiological Protection Ordinance is formed by the recommendations of the International Commission on Radiological Protection (ICRP) which deals with all essential questions of radiological protection beginning from the basic problems of the biological effect of high energy radiation up to the practical rules for the radiological protection applied. The results of this work have been published in the presently existing 30 reports or recommendations. Concerning these questions, there is also close cooperation with the World Health Organization (WHO), the International Commission on Radiological Units (ICRU) and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). Part of the ICRP-Recommendations is a system for limiting radiation exposure. The main features of this system are:

- the interdiction of any practice whose introduction does not lead to a positive benefit,
- any radiation exposure must, by taking into consideration economical and social factors, be kept as low as possible,
- the dose equivalent of an individual person must not exceed the limits recommended for the respective conditions.

The ICRP recommendations have become part of several international radiation protection regulations. It is in this context that the Basic Safety Standards for Radiation Protection /5/ developed jointly by the International Labour Organization (ILO), the World Health Organization (WHO), the Nuclear Energy Agency of the Organization for Economic Cooperation and Development (NEA-OECD) and the International Atomic Energy Agency (IAEA) must be mentioned as well the Council Directive of the European Communities (EC) laying down the Basic Safety Standards for the Health Protection of the Population and Employees against the Hazards of Ionizing Radiation /6/. Whereas the recommendations of the ICRP and IAEA only become relevant because of their scientific-technical quality, the EC Guidelines oblige the members of the Community concerning the goals to be achieved. It remains up to the national authorities to come to arrangements which are more detailed or even more restrictive within this given framework.

The new Radiological Protection Ordinance replaces the First and Second Radiological Protection Ordinance previously valid, takes into consideration the advanced state of science and technology as it is reflected in the relevant recommendations of international bodies (ICRP, IAEA) as well as the continuation of the radiological protection legislation in the EC Guidelines and in the national passing of laws and regulations with the goal of a general concentration and harmonization. At the same time, the objective field of validity has been extended insofar as accelerators and plasma facilities have become subject to notification or licensing respectively. The system of the State supervision, which up to now has been two-step (facilities subject and facilities not subject to licensing), has been explanded by a third step (facilities subject to notification). In this way, the sec. 4 para. 1 of the Radiological Protection Ordinance, in conjunction with appendix II no. 1 provides for the introduction of a handling with radioactive materials up to the tenfold of the allowances which is, however, not subject to licensing but to notification.

In sec. 28 para. 1 of the Radiological Protection Ordinance, the general radiological protection principle is defined to the effect that any avoidable radiation exposure or contamination of persons, objects or environment is to be eliminated and any unavoidable radiation exposure must be kept as low as possible even below the stipulated limits by taking into consideration the state of science and technology as well as the circumstances of the individual case. According to sec. 28 para. 3, a maximum whole body dose limit of 5 rem or a maximum thyroid dose limit of 15 rem respectively in the environment are to be taken as a basis when planning constructional and other technical protective measures against accidents of a nuclear facility. The licensing authority can regard this precaution as fulfilled, if, concerning the design of the facility, those incidents have been taken as a basis which, according to the Safety Criteria for Nuclear Power Plants (sec. 3.1) and the Guidelines of the Reactor Safety Commission (sec. 3.2) are to determine the design.

The immission protection concept of sec. 45 of the Radiological Protection Ordinance stipulates the whole body dose limit for individual persons of the public. It includes all discharges from other nuclear facilities within the respective site and eventual radiological pre-impacts. At the same time, the least favourable locations and all relevant exposure pathways must be taken into consideration. The whole body dose limit of 30 mrems/year is valid for the liquid as well as for the airborne release. 90 mrems/year must not be exceeded for the thyroid through food chains. The fulfilment of this regulation can, as a rule only be proved by radio-ecological analyses. This expenditure can be justified in the case of nuclear facilities, research centres and large hospitals, but not in the case of minor uses of radionuclides to which is applied the emission protection concept of sec. 46. It stipulates release limits in form of concentration limits as far as an exceeding of the immission protection limits of sec. 45 can be exluded, i.e. the emission protection concept functionally depends on the immission protection concept.

The occupationally exposed persons are classified into two groups, the category A, for which by dropping the former exposure dose limit of up to 12 rems per year depending on the accumulated occupational dose (life dose) only 5 rems per year are now permitted, and the category B, for which the dose limit is fixed at 1,5 rems per year (sec. 49 para. 1 of the Radiological Protection Ordinance). Furthermore, a licensing requirement, according to sec. 20a has been introduced for those having their personnel at another facility, and a dose card according to sec. 62 para. 2 for the supervision of the total radiation exposure. This regulation, which is of particular importance to maintenance, testing and repair personnel, is to ensure that employed and contracted personnel in nuclear plants are likewise subject to a general radiological protection supervision.

With the fourth amendment of the Atomic Energy Act and sec. 47 of the Radiological Protection Ordinance, a new legal basis has been established for the disposal of radioactive wastes. There still exists a general requirement to deliver radioactive wastes to a State collection facility or to a licensed facility for the disposal of wastes. For the delivery to conventional facilities for disposal, only those materials are permitted which, in accordance with the definition, are no longer radioactive wastes but conventional wastes. It is settled in particular that nobody can evade the delivery requirement by dividing his radioactive wastes into wastes below the activity or concentration allowance. It is, however possible to clarify the diposal of radioactive wastes in a special licensing procedure which is to be carried out by the responsible authority by considering radio-ecological aspects.

The Radiological Protection Ordinance distinguishes between two groups of persons responsible for radiological protection: The person responsible for the radiological protection, identical with the licensee or the person responsible for the notification, and the mandatories charged by the person responsible for the radiological protection to guide or to supervise

the work subjekt to licensing or to notification. A person is responsible for the radiological protection if he is subject to licensing or to notification. It is his duty to provide for the radiological protection necessary in particular by preparing suitable rooms, protective engineered features, utensils and safety equipment for the personnel, by an appropriate control of the operation and by providing for sufficient and well-trained personnel. The person charged with the radiation protection has to supervise the observance of the protective regulations of the Radiological Protection Ordinance. In order to fulfil his task, he must dispose of internal independence and possess the decision competence. Appropriate settlements are to be notified to the responsible authority.

2.2 Nuclear Licensing Procedures Ordinance

The Ordinance for the Procedures for the Licensing of Facilities in Accordance with sec. 7 of the Atomic Energy Act, Nuclear Licensing Procedures Ordinance (Atomrechtliche Verfahrensverordnung = AtVfV) /7/, which has been enforced in 1977, is a modified concept of the former Atomic Installations Ordinance. The licensing procedures for nuclear facilities are settled according to the regulations of the Nuclear Licensing Ordinance which, in numerous aspects corresponds to those of the Federal Immission Protection Act (Bundes-Immissionsschutzgesetz = BImschG). These regulations are supplemented by the Federal Administrative Procedures Act (Verwaltungsverfahrensgesetz des Bundes = VwVfG), which contains guidelines for relevant constitutional issues, as e.g. the participation of the parties concerned in licensing procedures, solutions for simplifying the procedures in case of mass involvement, and requirements for organizing a public hearing.

In sec. 3 of the Nuclear Licensing Procedures Ordinance, the documents to be submitted for the examination of the licensing prerequisites in the case of an application, are rendered more

precise. In detail, the following documents must be submitted:

- a safety report describing the facility and its operation and explaining it by means of site plans and survey diagrams, as well as describing the effects and risks connected with the facility and its operation and presenting the protective measures required according to sec. 7 para. 2 no. 3 of the Atomic Energy Act,
- supplementary plans, illustrations and descriptions of the facility and its components,
- statements as to which components and operational proceedings are to be secured in particular against interferences and third party's impacts and which protective measures are planned for this,
- data to enable an examination of the reliability and the expert knowledge of those persons responsible for the construction of the facility and for control and supervision of its operation,
- data to verify that the persons having other functions in the operation of the facility posses the knowledge required according to sec. 7 para. 2 no. 1a of the Atomic Energy Act,
- a catalogue containing all the data essential for the safety of the facility and of its operation, the measures for the prevention and mitigation of accidents and damages; and a programme for the tests planned at components important to safety (safety specifications),
- propositions concerning the financial coverage of liability claims, and
- a catalogue of the measures planned in order to keep water, air and soil free of contamination.

The Federal Minister responsible for nuclear safety may determine additional details by means of general administrative regulations.

Apart from these documents, the applicant has to submit an understandable short description of the facility and of its pre-

sumptive effects on the public and the environment to the licensing authority; these documents are supposed to be of use for a better general comprehension when making the documents accessible to the public. If the documents do not meet the requirements, the licensing authority requests the applicant to complete them within an appropriate period of time.

After having noticed the application for a licensing of a nuclear facility, the licensing authority makes the application, the safety report and the short description accessible to the public for a two-month period in order to facilitate the assertion of objections. Besides, the licensing authority can grant perusal into the documents according to its discretion (sec. 4 - 7 of the Nuclear Licensing Procedures Ordinance).

In the sec. 8 - 13 of the Nuclear Licensing Procedures Ordinance, purpose and object of the public hearing, participation, omission, cancellation and continuation of the hearing, chairmanship and minutes are settled in such a manner that an orderly and proper course is ensured. In particular, the chairmanship of the hearing can structure the objections to be discussed according to the subjects and determine the order of the objections, to restrict the presence of the objectors to the time period during which the subject to which their objections refer is dealt with and to limit the speaking time.

The authority decides on a licensing application by considering the total result of the procedure (sec. 15 of the Nuclear Licensing Procedures Ordinance). It has to issue the decision by letter, to justify it by letter and to send it to the applicant and to the objectors.

In order to simplify the mode of proceeding, it is possible to replace the otherwise prescribed direct transmission of the licensing decision by a public notification if there are more than 300 objections tp a licensing application (sec. 17).

Part licenses or preliminary decisions can be issued upon application. If a part license is applied for, definitive statements as a rule, need only be made with respect to the object of the partial license. It can be granted if a preliminary examination proves that the licensing prerequisites, with respect to the construction and operation of the entire facility are complied with and if there is a justified interest in the granting of a part license (sec. 18 of the Nuclear Licensing Procedures Ordinance). Applications for preliminary decisions may refer to the site or not. The preliminary decision must, in addition to the exact definition of the object on which definite decisions will be taken, contain among other things the prerequisites and provisos as well as the notice that the preliminary decision does not give claim on the construction of the facility or of its components (sec. 19 of the Nuclear Licensing Procedures Ordinance).

The Nuclear Licensing Ordinance settles the nuclear licensing procedure for enrichment facilities, fuel fabrication plants, nuclear reactors and reprocessing facilities. The additionally required licenses, permissions and concessions according to other legal regulations (building, water, trade, environmental regulations etc.) for the construction and operation of the facilities are granted on the basis of individual licensing procedures. An exception is only made if a nuclear facility is simultaneously subject to lincensing according to sec. 4 of the Federal Immission Protection Act: in this case, it will be then included in the nuclear license. In order to achieve an expedient cooperation of the authorities as comprehensive as possible despite this split into numerous individual procedures, the nuclear licensing authority is obliged to coordinate functions according to sec. 7 para. 4 no. 6 of the Atomic Energy Act and to sec. 14 of the Nuclear Licensing Procedures Ordinance. It is required to involve all Federal, State, local and other authorities whose field of responsibility is concerned.

2.3 Nuclear Financial Security Ordinance

The liability regulations of the Atomic Energy Act would be incomplete, if those required to pay compensation would not compose of the means to comply with any claims laid on them. The security to be provided by the owner of a nuclear facility for covering the legal liability for damages, the financial security, is fixed by the nuclear licensing authority. The evidence of financial security, as a rule a liability insurance, is a licensing prerequisite. Details are settled in the Ordinance for the Financial Security in Accordance with the Atomic Energy Act, Nuclear Financial Security Ordinance (Atomrechtliche Deckungsvorsorgeverordnung = AtDeckV) which replaced the former Nuclear Financial Security Ordinance and came into force in 1977 /8/. According to this ordinance, the coverage for a standard case has to be taken as a basis when fixing the coverage sum. The standard coverage depends on the type, mass, activity or characteristics licensed of the radioactive materials.

In the case of nuclear reactors (sec. 9 of the Nuclear Financial Security Ordinance), the standard coverage depends on the maximum output, i.e. the maximum thermal output at which the reactor is permitted to be operated according to the licence. It amounts to 5 million DM up to 1 MW and 1 million for each additional MW up to the maximum sum of 500 million DM. Consequently, the maximum amount is reached at a thermal output of 496 MW.

In the case of fuel fabrication plants and enrichment facilities, the standard coverage depends on the type and mass licensed of the nuclear fuels permitted to be handled at the facility (sec. 11 para. 1 of the Nuclear Financial Security Ordinance). In the case of reprocessing facilities (sec. 11 para. 2), the licensed annual capacity is to be taken as a basis, whereby the maximum standard coverage of 500 million DM is reached at an annual capacity of 500 t.

3. REGULATORY GUIDES

3.1 Safety Criteria

The first step toward rendering the safety requirements of the Atomic Energy Act and of the associated ordinances more concrete by technical provisions was to draw up Safety Criteria for Nuclear Power Plants /9/ (figure 3). They are supposed to become the technical appendix of a general administrative regulation still to be established. In order to be able to practice the requirements contained therein as early as possible and homogeneously, they have been published and released for utilization. The Safety Criteria have, in particular, been developed for nuclear power plants with light water reactors. A draft of Safety Criteria based thereon for gas-cooled high temperature reactors has well been elaborated /10/. They apply to all other types of nuclear power plants entirely in the non-specific requirements and analogously in the specific requirements. Parts of the groups dealt with in detail are: principles of safety precaution; quality assurance, testability, radiation exposure of the environment and within the facility, design of the working place, working process and working surroundings, external events, protection from fire and explosion; access control, escape routes and communication means as well as the decommissioning and demolition of nuclear power plants; reactor design, inherent safety, and reactor pressure vessel internals; reactor coolant pressure boundary, residual heat removal after specified normal operation and after a loss of coolants; process monitoring and alarm systems, incident instrumentation, equipment for control and shutdown of nuclear reactors, control room and auxiliary control equipment; reactor protection system; emergency power supply; nuclear reactor containment, design bases for the containment, containment leakage tests, containment penetrations, heat removal from the containment; ventilation systems; radiological protection monitoring, activity monitoring of gaseous and liquid wastes, environmental monitoring; handling and storage of nuclear fuels and other radioactive materials.

3.2 RSK Guidelines

The Reactor Safety Commission (Reaktor-Sicherheitskommission = RSK), advising the Federal Minister of the Interior, has summarized the safety requirements, which, according to its opinion, should be met concerning the design, construction and operation of nuclear power plants, into Guidelines. For nuclear power plants with pressurized water reactors, Guidelines have already been worked out in the third edition /11/, and there is a draft of Guidelines for nuclear power plants with boiling water reactors /12/. It is the purpose of these guidelines, first of all, to simplifty the deliberation process within the Reactor Safety Commission and to give, already at an early point of time, indications as to the requirements it considers necessary. These Guidelines deal with site, reactor core, vessels amd piping systems, containments, electrical equipment of process and safety systems, control room, ventilation systems, radiological protection monitoring, protection from fire, working place and working surroundings, work preparations, handling of nuclear fuels and other radioactive materials, decommissioning and demolition, protective measures against component failure, natural and man-made events, failure of reactor scram at operational transients, possible leaks and breaks, systems for the heat removal after accidents, measures for the limitation of hydrogen concentration and incident instrumentation. Some chapters of the RSK Guidelines are very detailed since the corresponding regulatory guides or standards of the Nuclear Safety Standards Commission (Kerntechnischer Ausschuß = KTA) are still lacking. As far as the respective guides or standards have been worked out, they are referenced and necessary supplements stated. If manufacturing and operating organizations comply with the guidelines, the Reactor Safety Commission can, within a short period of time, decide on the respective project. If the fulfilment cannot be proved, a solution must be offered which is equivalent from a safety point of view. The Guidelines, originally compiled for internal use of the Reactor Safety Commission, have obtained a great practical importance, as the licensing authorities usu-

ally demand the proof of their fulfilment within the scope of the assessment of facilities.

3.3 Other Guidelines

In supplement to the legal regulations, consisting of the Atomic Energy Act and the associated ordinances, there are additional guidelines to make the vague legal terms used to describe safety requirements for nuclear facilities more concrete; this is, for example, applied to Safety Criteria, RSK Guidelines and other regulatory guides (figure 3). As a rule, the subordinate authorities have, according to a voluntary agreement, sticked to the standards stipulated therein. It is in the scope of the official contracting ensured that experts called in during the nuclear licensing and supervising procedure take these guidelines into consideration.

These regulatory guides proceed from different ways; they are partly based upon the recommendations of the advisory bodies of the Federal Minister of the Interior, responsible for safety and radiological protection, and partly upon the results of special task groups or of ordered research studies. They have all been passed by the States' Committee on Nuclear Energy, which means that the Federation and the States have agreed upon their homogeneous application in nuclear licensing and supervising procedures. The reason for such proceeding was that, concerning certain questions, there was no recognizable state of science and technology which would, if not the establishment of safety standards, in any case justify the establishment of general administrative regulations. On the other hand, however, decisions which, for reasons of expediency should be independent of the individual case, were to be taken in the current procedure (appendix 1).

4. ASSOCIATED TECHNICAL PROVISIONS

4.1 Safety Standards

Safety standards are to show a recognized way to the fulfilment of safety requirements (figure 3). Whereas it is reserved to the legislator and to the authorities responsible for enforcing the Atomic Energy Act, the associated ordinance and administrative regulations to indicate the safety requirements to be met by the nuclear facilities, all interested groups are asked to contribute to the elaboration of safety standards. Since only the cooperation between manufactures and constructors, owners and operators, independent experts as well as Federal and State authorities renders possible the use of the entire present knowledge, the Federal Minister of the Interior has in 1972 established the Nuclear Safety Standards Commission (Kerntechnischer Ausschuß = KTA). This committee consists of 10 members respectively from the groups mentioned above and of 10 additional members of organizations with special technical knowledge.

It is the task of the KTA to provide for the establishment and application of the safety standards in those fields in which general approval of experts can be expected. These Safety Standards are usually worked out by task groups which are supervised by standardization organizations, scientific-technical associations or by enterprises concerned. The work usually begins with the establishment of a collation in which all relevant pieces of information are compiled and in which opinions are expressed concerning the question to which extent the respective subject is suited for the establishment of a safety standard. It continues with the meetings of the task group which concludes its work by submitting a first draft. This draft will then be examined by a sub-committee responsible for a larger field of activity, presented to the five member groups of the KTA for (internal) comment and finally be passed as a draft by the KTA for publishing. At the same time, the public is requested to express its opinion within three

months; these opinions will be taken into consideration when preparing the final version. Only after having conducted this preparing and ratifying procedure, the KTA can finally decide on the safety standard.

Even if applying KTA Standards, the licensing and supervising authorities can only then consider the safety requirements met, if they correspond to the respective state of science and technology, which means that their applicability has to be verified.

In all KTA meetings, decisions must be taken concerning the placing of orders for new projects, the acceptance of collations as well as the approvement of draft standards and standards. Any KTA decision must be borne by a 5/6 majority whereby majorization of KTA member groups is excluded. In the meantime, there is a larger number of KTA Standards which are gradually forming a comprehensive standards programme (appendix 2).

4.2 Technical Standards

Technical standards are, above all, to contribute to a rational order in the technical field by the establishment of standards concerning production, delivery, dimensioning, planning, testing, quality, safety, material and information in order to make an effective contribution to the general rationalization endeavourments (figure 3). The German Standards Institute (Deutsches Institut für Normung = DIN) is one of the most important organizations working on technical standards. Like in the other standards committees, all interested groups are represented in the Technical Committee on Nuclear Engineering (Normenausschuß Kerntechnik = NKe) although there is no fractionating or voting procedure. As far as the NKe works out safety standards as part of its work program, its activity is coordinated with the KTA. The NKe provides task groups; the draft standards worked out by them pass the KTA ratifying procedure. These KTA Standards are at the same time DIN Standards

and part of the nuclear standards programme. The elaboration of the other DIN Standards is less formalized; usually collations are not worked out, but a standard draft is directly tackled. The respective subcommittees meet as often as necessary until the draft can be published for general comments within 6 months. After this period, the comments submitted are discussed and a final version is eventually approved. A major number of nuclear standards and draft standards have already ben published (appendix 3). In addition, the work results of other standards committees, particulary of the Technical Committee on Radiology (Normenausschuß Radiologie = NAR) and on Materials Testing (Fachnormenausschuß Metrialprüfung = FNM) are of interest for radiological protection.

4.3 Other Recommendations

Independent of the legal regulations directly applicable according to the building, water, trade law etc. and of the guidelines established for their enforcement, other conventional guidelines are often referred to as far as there are no relevant safety standards for nuclear facilities (figure 3). It is, however, necessary to verify each individual case whether they are applicable unchanged or only after a corresponding adaptation to meet safety requirements which might be more comprehensive. Among the conventional safety guidelines, standards and recommendations which are used in the described way, there are the Technical Standards for Steam Boilers (Technische Regeln für Dampfkessel = TRD) /13/, leaflets of the Pressure Vessel Association (Arbeitsgemeinschaft Druckbehälter = AD) /14/, DIN Standards, Provisions of the Society of Electrical Engineers (Vorschriften des Vereins Deutscher Elektrotechniker = VDE-Vorschriften) /15/, Guidelines of the Society of Mechanical Engineers (Regeln des Vereins Deutscher Ingenieure = VDI-Regeln) /16/ and numerous guidelines, leaflets and specifications of professional associations.

Supplementary to the national nuclear and other standards, international and foreign safety standards are considered. Part of these standards is the Nuclear Safety Standards Program (NUSS Program) of the International Atomic Energy Agency (IAEA) which compiles the general safety requirements for nuclear power plants in Codes of Practices concerning the subjects of site, design, operation, quality assurance and governmental organization as well as the instruction for meeting these requirements in associated Safety Guides (appendix 4). These recommendations are usually more general than national standards; they have, in any case, the advantage that they take into consideration the worldwide obtained experiences on the nuclear field and accordingly indicate a common basis of minimum safety requirements and recognized instructions for their compliance. The International Organization for Standardization (ISO) has, in addition, a nuclear standardization programme which in particular considers radiological protection, nuclear power plants, radioactive sources and nuclear fuel technology. The International Electrotechnical Committee (IEC) is as well worth mentioning with its standardization program in the field of nuclear instrumentation. IAEA, ISO and IEC cooperate closely and have coordinated their activities in such a manner that they mutually serve as supplements.

5. DISTRIBUTION OF RESPONSIBILITIES

5.1 Federal Executive Administration

It lies within the responsibility of the States, which act on behalf of the Federal Government, to translate the legislation on nuclear energy and on radiological protection into practice. For this purpose, they have established their own responsible authorities. In addition, the States have issued several administrative directives for the implementation. Although these directives are addressed exclusively to the State authorities, they are of importance for the applicant/licensee by giving him indications as to the correct application and the regula-

tory position in the licensing and supervising procedure. The administrative directives consider the results of joint discussions between the supreme State authorities and the Federal Minister of the Interior (Bundesminister des Innern = BMI) responsible for the supervision of lawfulness and expediency. Licences for the construction and operation of nuclear facilities are granted by the supreme State authorities, in most cases by the Ministers of Economics in cooperation with the Ministers for Labour and Social Affairs.

The supreme State authorities are also the supervisory authorities, according to sec. 19 of the Atomic Energy Act, to ensure the observance of all relevant regulations. According to sec. 9 and 9b, they are the licensing authorities and overall zoning authorities respectively, who license treatment, processing or other use of nuclear fuels outside of facilities subject to licensing, construction of State collection facilities for the intermediate storage of radioactive wastes, and construction of Federal facilities for securing and disposing radioactive wastes. Besides, there are also direct responsibilities of Federal authorities, as, for example, the Federal Office for Trade and Industry (Bundesamt für gewerbliche Wirtschaft = BAGW) is responsible for the import and export of nuclear fuels, and the Federal Institute of Physics and Technology (Physikalisch-Technische Bundesanstalt = PTB) for the transportation of nuclear fuels (Table 1).

The implementation of the Atomic Energy Act by the States on behalf of the Federal Government means that

- the selection of the authorities responsible for licensing, according to the sec. 7, 7a nd 9, and the cancellation and revocation of these licenses, as well as the overall zoning according to sec. 9b and the suspension of the overall zoning decision lie within the responsibility of the States,

- the State authorities are subject to the directives of the responsible Federal Minister,

State	Licensing Authorities		Supervisory Authorities	Governmental Custody of Nuclear Fuel (§ 5)	Transportation of Nuclear Fuel (§ 4)
	Nuclear Installations (§ 7)	Utilization of Nuclear Fuel (§ 9)	Nuclear Installations (§ 7) Utilization of Nuclear Fuel (§ 9)		
Baden-Württemberg	Min. f. Wirtschaft, Mittelstand u. Verkehr im Einvern. mit Min. f. Arbeit, Gesundheit u. Sozialordnung u. Innenmin.	Min. f. Arbeit, Gesundheit u. Sozialordnung im Einvern. mit Min. f. Wirtschaft, Mittelstand u. Verkehr u. Innenmin.	Min. f. Arbeit, Gesundheit u. Sozialordnung	Physikalisch-Technische Bundesanstalt	Genehmigung: Physikalisch-Technische Bundesanstalt Aufsicht: Min. f. Arbeit, Gesundheit u. Sozialordnung
Bayern	Staatsmin. f. Landesentwicklung u. Umweltschutz im Einvern. mit Staatsmin. f. Arbeit u. Sozialordnung, bei Energieanlagen außerdem mit Staatsmin. f. Wirtschaft u. Verkehr	Staatsmin. f. Landesentwicklung u. Umweltfragen im Einvern. mit Staatsmin. f. Arbeit u. Sozialordnung	Staatsmin. f. Landesentwicklung u. Umweltfragen Für bestimmte Einzelfälle ist das Landesamt f. Umweltschutz mit der Ausübung der Aufsicht beauftragt worden (§ 24 Abs. 2, 8.3 AtG)	Physikalisch-Technische Bundesanstalt	Genehmigung: Physikalisch-Technische Bundesanstalt Aufsicht: Landesamt f. Umweltschutz
Berlin	Senator f. Wirtschaft	Senator f. Wirtschaft	Senator f. Wirtschaft	Senator f. Wirtschaft	Senator f. Wirtschaft
Bremen	Senator f. Wirtschaft u. Außenhandel im Einvern. mit Senator f. Arbeit Im Aufsichtsbereich der Behörden - Senator f. Wirtschaft u. Außenhandel allein	Senator f. Wirtschaft u. Außenhandel im Einvern. mit Senator f. Arbeit Im Aufsichtsbereich der Bergbehörden - Senator f. Wirtschaft u. Außenhandel allein	Senator f. Arbeit Für die der Bergaufsicht unterliegenden Anlagen - Oberbergamt f. d. Freie u. Hansestadt Bremen - Clausthal-Zellerfeld	Physikalisch-Technische Bundesanstalt	Genehmigung: Physikalisch-Technische Bundesanstalt Aufsicht: a) Senator f. Häfen, Schiffahrt u. Verkehr b) Gewerbeaufsichtsamt
Hamburg	Arbeits- u. Sozialbehörde	Arbeits- u. Sozialbehörde	Arbeits- u. Sozialbehörde	Physikalisch-Technische Bundesanstalt	Genehmigung: Physikalisch-Technische Bundesanstalt Aufsicht: Arbeits- u. Sozialbehörde
Hessen	Hessischer Min. f. Wirtschaft u. Technik im Einvern. mit dem Hessischen Sozialmin. u. dem Hessischen Min. d. Innern	Hessischer Min. f. Wirtschaft u. Technik im Einvern. mit dem Sozialmin. u. dem Hessischen Min. d. Innern	Hessischer Min. f. Wirtschaft u. Technik	Physikalisch-Technische Bundesanstalt	Genehmigung: Physikalisch-Technische Bundesanstalt Aufsicht: a) Kreispolizeibehörde b) Bezirkspolizeibehörde c) Wasserschutzpolizei d) Gewerbeaufsichtsamt
Niedersachsen	Sozialmin. Im Bereich d. Bergwesens - Min. f. Wirtschaft u. Verkehr	Sozialmin. Im Bereich d. Bergwesens - Min. f. Wirtschaft u. Verkehr	Sozialmin. Im Bereich d. Bergwesens - Min. f. Wirtschaft u. Verkehr	Physikalisch-Technische Bundesanstalt	Genehmigung: Physikalisch-Technische Bundesanstalt Aufsicht: Gewerbeaufsichtsamt Im Bereich d. Bergwesens - Bergamt

Table 1 (1):

Nuclear Licensing and Supervisory Authorities

State	Licensing Authorities		Supervisory Authorities	Governmental Custody of Nuclear Fuel (§ 5)	Transportation of Nuclear Fuel (§ 4)
	Nuclear Installations (§ 7)	Utilization of Nuclear Fuel (§ 9)	Nuclear Installations (§ 7) Utilization of Nuclear Fuel (§ 9)		
Nordrhein-Westfalen	Min. f. Arbeit, Gesundheit u. Soziales u. Min. f. Wirtschaft, Mittelstand u. Verkehr gemeinsam	Min. f. Arbeit, Gesundheit u. Soziales u. Min. f. Wirtschaft, Mittelstand u. Verkehr gemeinsam	Min. f. Arbeit, Gesundheit u. Soziales Im Bereich des Bergwesens - Min. f. Wirtschaft, Mittelstand u. Verkehr	Physikalisch-Technische Bundesanstalt	Genehmigung: Physikalisch-Technische Bundesanstalt Aufsicht: a) Min. f. Arbeit, Gesundheit u. Soziales f. Bahn n. d. Landeseisenbahnges. b) Reg. Präs. Münster u. Reg. Präs. Düsseldorf f. Luftfahrzeuge c) Örtl. Polizeibeh. f. Straßen d) Wasserschutzpolizei f. Wasserstraßen
Rheinland-Pfalz	Min. f. Wirtschaft u. Verkehr im Einvern. mit Min. f. Soziales, Gesundheit u. Umwelt	Min. f. Soziales, Gesundheit u. Umwelt im Einvern. mit Min. f. Wirtschaft u. Verkehr	Min. f. Soziales, Gesundheit u. Umwelt	Physikalisch-Technische Bundesanstalt	Genehmigung: Physikalisch-Technische Bundesanstalt Aufsicht: Min. f. Soziales, Gesundheit u. Umwelt
Saarland	Min. f. Wirtschaft, Verkehr u. Landwirtschaft im Einvern. mit Min. f. Umwelt, Raumordnung u. Bauwesen	Min. f. Wirtschaft, Verkehr u. Landwirtschaft im Einvern. mit Min. f. Umwelt, Raumordnung u. Bauwesen	Min. f. Umwelt, Raumordung u. Bauwesen im Einvern. mit Min. f. Wirtschaft, Verkehr u. Landwirtschaft	Physikalisch-Technische Bundesanstalt	Genehmigung: Physikalisch-Technische Bundesanstalt Aufsicht: Min. f. Wirtschaft, Verkehr u. Landwirtschaft
Schleswig-Holstein	Sozialmin. im Einvern. mit Min. f. Wirtschaft u. Verkehr	Sozialmin. im Einvern. mit Min. f. Wirtschaft u. Verkehr	Sozialmin.	Physikalisch-Technische Bundesanstalt	Genehmigung: Physikalisch-Technische Bundesanstalt Aufsicht: Sozialmin. oder Min. f. Wirtschaft u. Verkehr i.R. ihrer fachlichen Zuständigkeit

Table 1 (2):

Nuclear Licensing and Supervisory Authorities

- the Federal supervision includes the lawfulness and expediency applied by the States concerning the compliance with their tasks,

- the Federal Government can require reports and the submission of files and documents on the subject and send commissioners to all authorities.

5.2 Licensing Authorities

After receipt of the application for the granting of a license, the nuclear licensing authority examines whether the licensing prerequisites have been complied with (figure 4). This judgement, which depends on the state of science and technology, requires substantial expert knowledge. For this purpose, the authorities, according to sec. 20 of the Atomic Energy Act, consult expert organizations, as, for example, the Technical Inspection Agencies (Technische Überwachungs-Vereine = TÜV) and the Reactor Safety Company (Gesellschaft für Reaktorsicherheit = GRS), but it consults as well independent experts (sec. 5.4). By order of the licensing authorities, the experts work out detailed safety assessments and conduct technical inspections concerning all components important to safety. The experts participate in the whole licensing procedure, beginning with the assessment of site and concept, during the entire construction time, commissioning and operation and ending with the decommissioning/demolition.

In accordance with the authorities responsible for the conventional environmental protection, the licensing authority has, as well, to judge whether the prerequisites of the licence necessary according to the Federal Immission Protection Act are fulfilfed. The granting of all other licenses necessary is the task of the respective responsible authority. Experts are also consulted during these procedures.

The nuclear licensing authority has to announce the project in its official gazette and also in local newspapers which are in

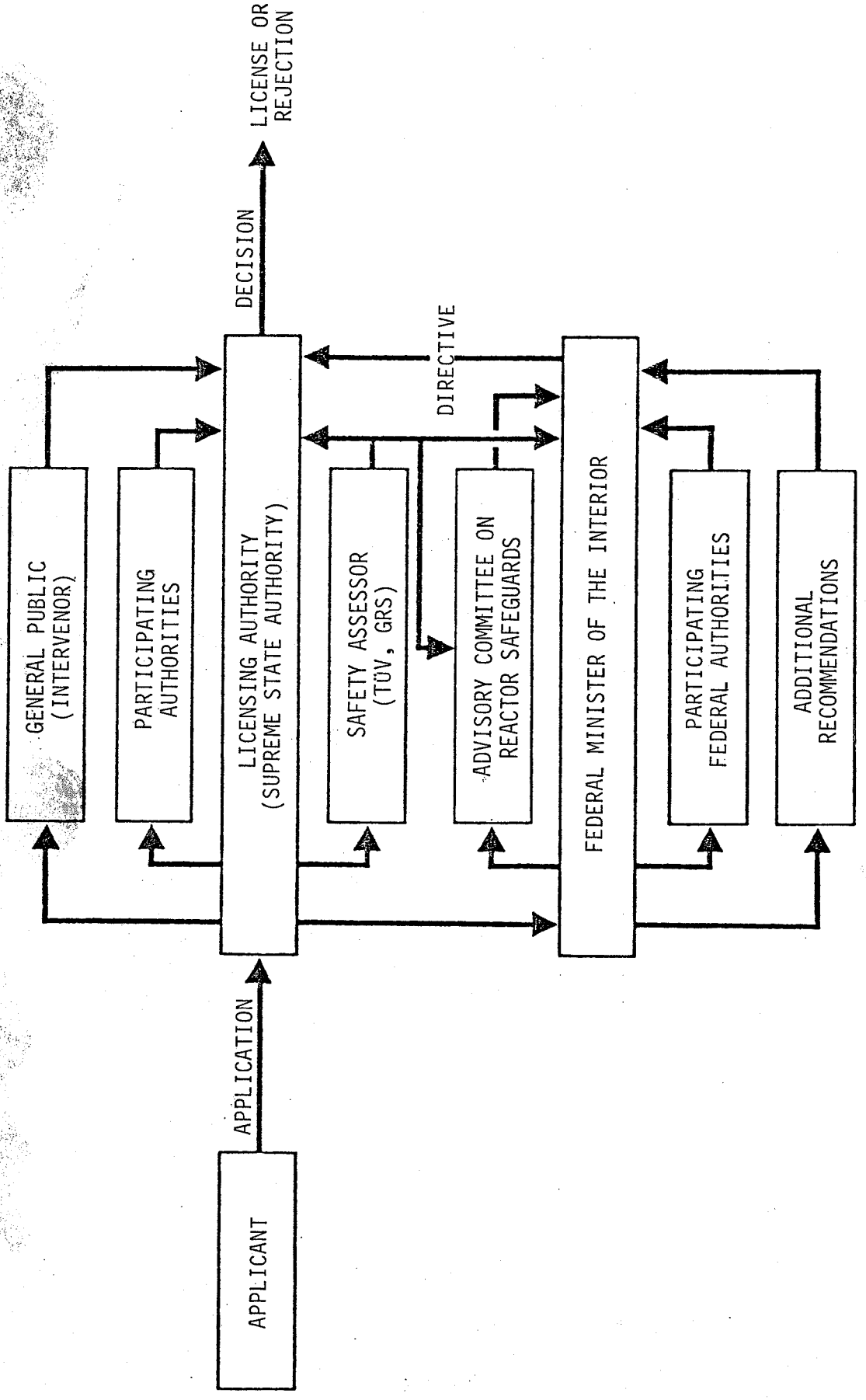


Figure 4:

Nuclear Licensing Procedure, Participants and their Interaction

circulation in the region of the facility site. The announcement must be indicated in the Federal Register.

The announcement has (sec. 5 of the Nuclear Licensing Procedures Ordinance) to

- indicate, where and when the application and other documents are accessible for inspection;

- invite to raise eventual objections at a place to be indicated in the announcement within the two months during which the documents are available for inspections;

- set a date for the public hearing or to indicate that a date for a hearing will be set and announced in the same manner as the project;

- point out that the objections will be debated during that hearing, even if the applicant or the persons who raised the objections are absent;

- point out that the transmission of the decision on the objections can be substituted by a public announcement in case of a transmission number of over 300.

The public announcement and the availability of documents for inspections is not necessary if a former announcement and availability of the relevant documents for inspection of the facility to be licensed has already been carried out and if a repetition would not reveal any circumstances which would be of interest for third persons.

Oral discussions of the objections are to take place with the applicant and those persons who reaised the objections (figure 5 and 6). This does not apply to objections which are based on special civil law claims and which are referred to the course of law before the regular courts. During the nuclear licensing procedure, the public hearing is to give the persons, feeling

TAR-123049-777PJ
R 203621-777IH
R 220024-777IH

The Mayor
of the City of Lingen
445 Lingen/Ems

Subject: Construction of the nuclear power plant of power plants Lippe-Ems-GmbH at Dortmund according to documents made available

I forbid the construction of the planned nuclear power plant since the use of nuclear energy is against the written declaration of God's will. In accordance with the writing in 1. Moses 2, 15, we human beings shall cultivate the earth and preserve, but not infiltrate and contaminate it for ever with deadly zones by nuclear fission and fusion. Jehova has created life and demands that we take care of, preserve and further it. By the use of nuclear energy, we, however, destroy that life and the bases of life on earth and consume material in an unretrievable manner which was provided for the preservation of life in eternity.

I will take strict actions against any contravening person and any person tolerating such contravening. I will support anybody who fights the construction of the nuclear power plant Lingen for legal reasons and for preservation of life and for protection of nature. I will deny anybody my support and my protection who continuously acts against God's declared will and word. Since all important reasons against the use of nuclear energy are known and are continuously presented by those fighting nuclear energy, there is no excuse available for those contravening. On the contrary, they have to expect the most severe consequences.

Our Lord Jesus Christ wants life and knows very well how to create and preserve it. I am thankful to Him and to our God the Father that They gave power to us by Jesus's death and resurrection, to effectively withstand lawlessness and evil in any form by simply insisting on God's rights, on His words and promises and to protect, to tend and to preserve the life that is good, beautiful and pleasant on the earth. It is the work of our Lord Jesus Christ that the earth with all on it will develop all its beauty and preserve it in peace.

Figure 5:

Examples of Objections Raised in Nuclear Licensing Procedures

The Ministry
of Economics and Technique

Wiesbaden

Darmstadt, April 10, 1981

Subject: Objections against the planned RWE nuclear power plant Biblis C at Biblis

We herewith protest most rigorously against the above planning and reject it for the following reasons:

1.) Large unused excess capacity of power plants.

2.) Prevention of mandatory legal measures for energy conservation, non-utilization of alternate energy resources.

3.) Slowing-down demand of energy/electricity.

4.) Pretention that nuclear electricity is cheapest, is wrong.

5.) Present double risk of Biblis A and B will be increased to threefold.

6.) Low-level and target flights at Biblis A are not suspended.

7.) Human and technical failures can never to be excluded.

8.) Still unclear disposal of intermediate and high-level waste.

9.) Terrible catastrophe by rocket/bomb impact in case of war.

10.) Deficient emergency preparedness.

11.) Lacking data on radioactivity level before commencement of construction of Biblis A and deficient reporting on current radioactive discharges into air, water, and soil by units A and B.

12.) Lacking health (cancer and abortion) statistics from construction of Biblis A and B up to the present time.

13.) Climatic deterioration and detrimental effect on the temperature of the Rhine.

14.) Potential of catastrophic events by exploding tankers on the Rhine.

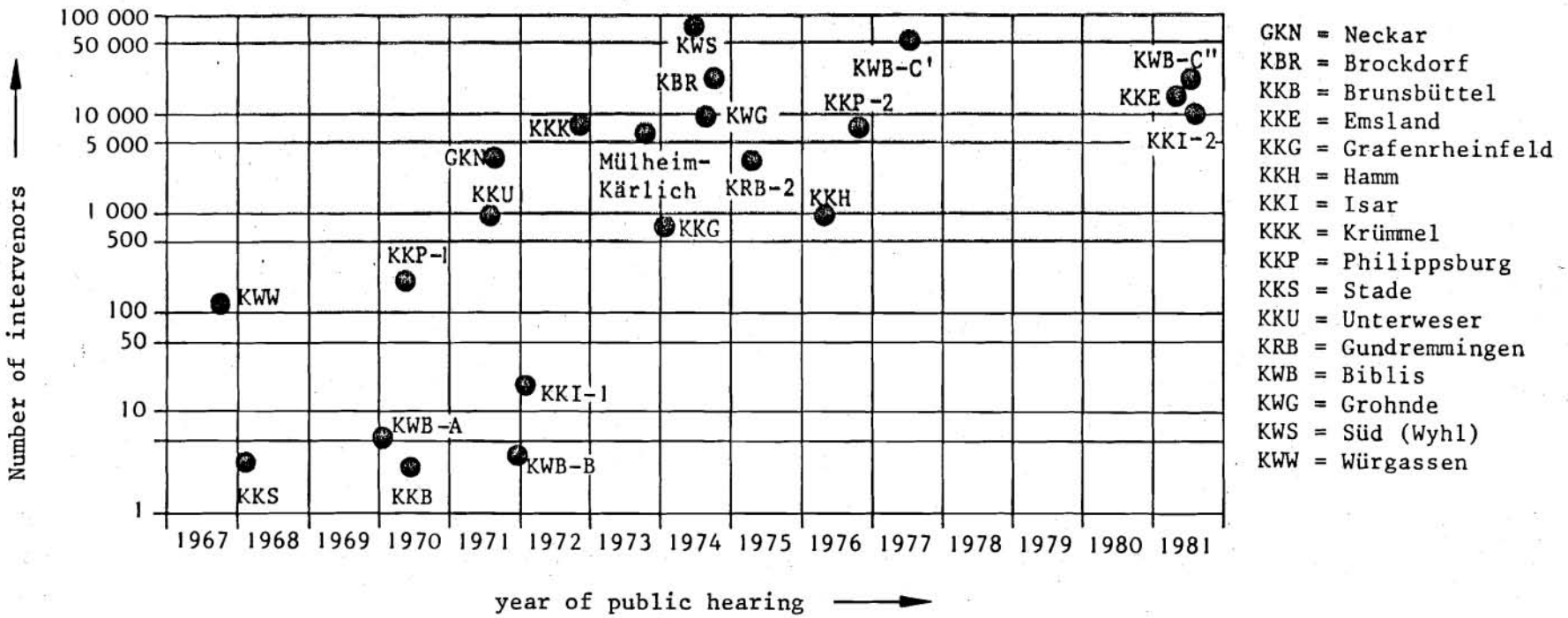


Figure 6:

Number of Objections Raised in Nuclear Licensing Procedures

infringed upon their rights, the opportunity to explain their objections and deliberations in detail, which makes it possible for the licensing authority to consider all the objections raised in its decision.

The decision of the licensing authority must be transmitted to all persons who raised objections. These objections must either be taken into consideration, be included in the licensing conditions or be rejected if the licensing authority regards them as unfounded. The licensing decision becomes effective within a determined period of time. Within this time period, applicant and objectors can bring action against the decision in the administrative courts.

The experience showed that, in this phase, objectors often appeal to administrative courts to have the lawfulness of the licensing decision and the preservation of their rights investigated. For this case, the entire system of proceedings, in particular the suspension of the immediate execution of the license is at disposal until the decision in the main issue is taken. The duration of legal administrative procedures carried through all instances can delay the execution of the license, e.g. the beginning of the construction or the commissioning of a facility, by years.

5.3 Federal Supervision

After the receipt of a license application, the nuclear licensing authority involves the Federal Minister of the Interior (Bundesminister des Innern = BMI), who is responsible for the supervision of lawfulness and expediency and who can, for this purpose, demand the submission of all relevant documents. The BMI involves other Federal authorities whose field or responsibility is concerned and he consults experts if considered necessary. In particular, he relies on the recommendations of his advisory bodies, especially of the Reactor Safety Commission (Reaktor-Sicherheitskommission = RSK), the Radi-

ological Protection Commission (Strahlenschutzkommission = SSK) and of the Expert Commission for Security Questions of the Nuclear Fuel Cycle (Sachverständigenkommission für Fragen der Sicherung des Kernbrennstoffkreislaufes = SSB).

For many years now, the RSK has been advising the Federal Minister of the Interior concerning safety questions of nuclear facilities. The advice concentrates on basic questions and basic problems. The RSK, as a rule, consists of 20 members. The membership in the RSK is personally and honorary. The members are called by the BMI from the following special fields: reactor operation, constructional and mechanical engineering, thermodynamics, chemical engineering, materials, constructions, instrumentation and control, reactor physics, electrical engineering, reactor chemistry, radiation protection, environmental protection, radiation biology and nuclear medicine. The RSK members are independent and not subject to directives; within the RSK, they represent solely their personal expert opinion and not the organizations or institutions they belong to in their main occupation. The results of the RSK discussions are submitted to the BMI in form of comments or recommendations. The BMI publishes the recommendations of the RSK in der Federal Register to make the consulting process transparent.

The Radiological Protection Commission has the task to advise the Federal Minister of the Interior in all questions of protection from the dangers of ionizing radiation. As a rule, the SSK consists of 15 members who are to have experience in one of the following main categories: biophysics, radiochemistry, radioecology, radiation biology, radiation genetics, radiation physics, health physics, health physics instrumentation, and radiological protection techniques. Like in the RSK, the membership in the SSK is also a personal honorary office; the members are independent experts and not subject to directives; they only state their own expert opinion and not the opinion of the organizations or institutions they belong to. SSK decisions (recommendations, comments) are submitted to the Federal

Minister of the Interior. The BMI publishes the recommendations of the SSK in der Federal Register.

The third advisory body is the Expert Commission for Security Questions of the Nuclear Fuel Cycle. The recommendations of this committee refer to the protection of nuclear facilities from third party's impacts or interferences and are therefore usually confidential.

The BMI informs the responsible licensing authority of the results of his examination of an application and provides directives which must be considered. This means that a license can only be granted if the licensing authority affirms the fulfilment of the licensing prerequisites and if the BMI does not provide different directives. The directives may include supplementary requirements concerning safety and radiological protection.

In order to organize an effective system for obtaining information on the individual licensing and supervisory procedures, on operational experiences and on international cooperation, the States' Committee on Nuclear Energy has been established, which annually meets several times under the chairmanship of the BMI. In this committee, representatives of the nuclear licensing and supervisory authorities meet to discuss general and specific problems and to decide on regulatory guides.

The tasks of the BMI on the field of the safety of nuclear facilities and of radiological protection are generally to stipulate a uniform Federal system of protective measures required according to the state of science and technology. This is to ensure a homogeneous and high safety level for all States. Responsibilities lie in the following fields:

- adaptation and development of the legislation on nuclear energy amd radiation protection,
- identification and solution of the inherent basic problems in law, administration and politics,

- establishment of relevant criteria, guidelines, standards and recommendations, as well as
- international harmonization of the measures for the protection from the dangers of nuclear energy.

The figures 4 and 7 illustrate the cooperation of the Federal and State governments in the implementation of nuclear licensing procedures.

5.4 Expert Consultants

An essential feature of the nuclear licensing and supervisory procedures practice in the Federal Republic of Germany is the consultation of experts by the responsible authorities for safety assessments, conducting examinations and other supervisory tasks. Such expert consultants can be organizations for global tasks and individual experts for special task. The licensing authorities charged the Technical Inspection Agencies (Technische Überwachungs-Vereine = TÜV) and the Reactor Safety Company (Gesellschaft für Reaktorsicherheit = GRS) with the delivery of global assessments. For certain tasks, however, experts from Federal or States' authorities, universities, research institutions, and other places are called in. The experts make assessments concerning the safety questions related to site, design, concept, construction, commissioning, and decommissioning/demolition. In the global assessments, quality examinations are proposed for the structures, systems and components important to safety. The entire testing scope of the quality examinations is divided into

- design review,
- materials, construction and pressure testing,
- acceptance and functional testing.

After the commissioning tests, nuclear facilities are subject to recurrent tests, carried out in regular intervals.

The TÜVs are private agencies. For about 100 years, they have been inspecting safety measures in industrial installations

subject to licensing and supervising. Their experts are independent concerning their assessments. For certain activity fields, as for example for steam boilers and pressure vessels or in the supervision of motor vehicles, they are officially recognized, in other activity fields they are called in because of their qualification. The TÜVs are subject to governmental supervision. 7 out of the 11 TÜVs operating in the Federal Republic of Germany and Berlin have established special nuclear departments.

Within the scope of the global assessment of nuclear facilities, the regional TÜV is normally charged with the necessary assessments and tests. It usually subcontracts major parts of the work to other TÜVs and GRS. As the individual Technical Inspection Agencies are independent, it is necessary to dicuss different opinions in order to achieve an assessment as uniform as possible of similar reactor systems, which are constructed in different States and examined by different TÜVs. Therefore, the BMI has promoted the establishment of a Nuclear Steering Committee of the Technical Inspection Agencies (TÜV-Leitstelle Kerntechnik), to which belong all TÜVs with nuclear departments and the GRS. The scope of the Steering Committee includes facilities according to sec. 7 of the Atomic Energy Act. Within this scope, it has the task to ensure a homogeneous examination and assessment of similar technical contents, to establish and to control special task groups, to coordinate the activities of its members in Committees outside of the TÜVs and GRS (e.g. KTA, AD, NKe, ISO, IEC), to record and to transmit problems which are to be submitted to the BMI, as well as to balance personnel capacities between the individual TÜVs and the GRS.

The GRS - supported and financed by the Federal Government, the States Bavaria and Northrhine-Westfalia, the 11 TÜVs and the German Lloyd - takes over scientific studies on the field of the safety of nuclear facilities and of the radiological protection by order of the Federal Minister of the Interior. By order of nuclear licensing and supervisory authorities, the

GRS makes assessments concerning special safety-related questions, contributes to the preparation of safety-related standards and guidelines, and manages the German light-water reactor safety research by order of the Federal Minister of Research and Technology. Part of the other GRS tasks are the support in the assessments made by other expert organizations by official order, the participation in exchanging experiences with authorities at home and abroad, the conducting of its own research and development activities, and the analysis of new safety concepts and safety systems. Affiliated to the GRS are the secretariats of the Nuclear Safety Standards Commission, of the Reactor Safety Commission and of the Radiological Protection Commission.

5.5 Applicants

The owner and subsequent operator of a nuclear power plant as applicant addresses his licensing application to the responsible licensing authority of the State where the facility is to be constructed. For this purpose, he has to submit several documents which, for the most part, stem from his contractor, who usually builds the installation as a turnkey project. Applicant is generally one of the major (electric) utilities (Elektrizitäts-Versorgungsunternehmen = EVU), a fusion of several EVUs or a subsidiary. Besides the EVUs, also other companies can be applicants, as, for example, an industrial plant which needs electricity and process steam for its production. The documents required according to sec. 3 of the Nuclear Licensing Ordinance are added to the application.

6. PROCEDURAL STEPS

6.1 General Procedure

The procedure for obtaining a construction or operating license for nuclear facilities according to sec. 7 of the Atomic Energy Act is opened by the application submitted to the re-

sponsible licensing authority (figure 7 and 8). It is finished by the decision transmitted to the applicant, which may be a license, in case with conditions, or a refusal. The licensing authority involves all Federal, States' and other local authorities concerned (sec. 2.2), informs the public by announcing the application and by displaying the application documents (sec. 5.2), discusses objections raised against the project with applicant and objectors (sec. 5.2), and takes steps for the assessment of the technical licensing prerequesites by experts called in and for the conductance of the quality examinations during construction and commissioning (sec. 5.4).

6.2 Part Licences

Its is settled in sec. 7 of the Atomic Energy Act that the applicant must have a construction license before he starts the construction works, and an operating license before the commissioning of the facility. The practical experience, however, showed that this way is inexpedient since the licensing authority requires final information on the subject of the license at a point of time when the applicant is not yet prepared to submit these documents. On the other hand, the licensing authority must not take final decisions precipitately so that it need not alter the decisions taken rashly by supplementary requirements or by a revocation. This problem becomes even more complicated since the licensing prerequisites stated in the Atomic Energy Act are kept very general and ordinances with a more detailed information on the technical prerequisites for construction and operating licenses are lacking. Therefore, the licensing authority, when deciding on any licensing prerequisite, has, to a certain degree, also to examine the prerequisites concerning the eventual operation of the facility. For these reasons, and in order to enable the licensing authority to consider the latest state of science and technology on the field of reactor safety during the construction period of a nuclear facility lasting several years,

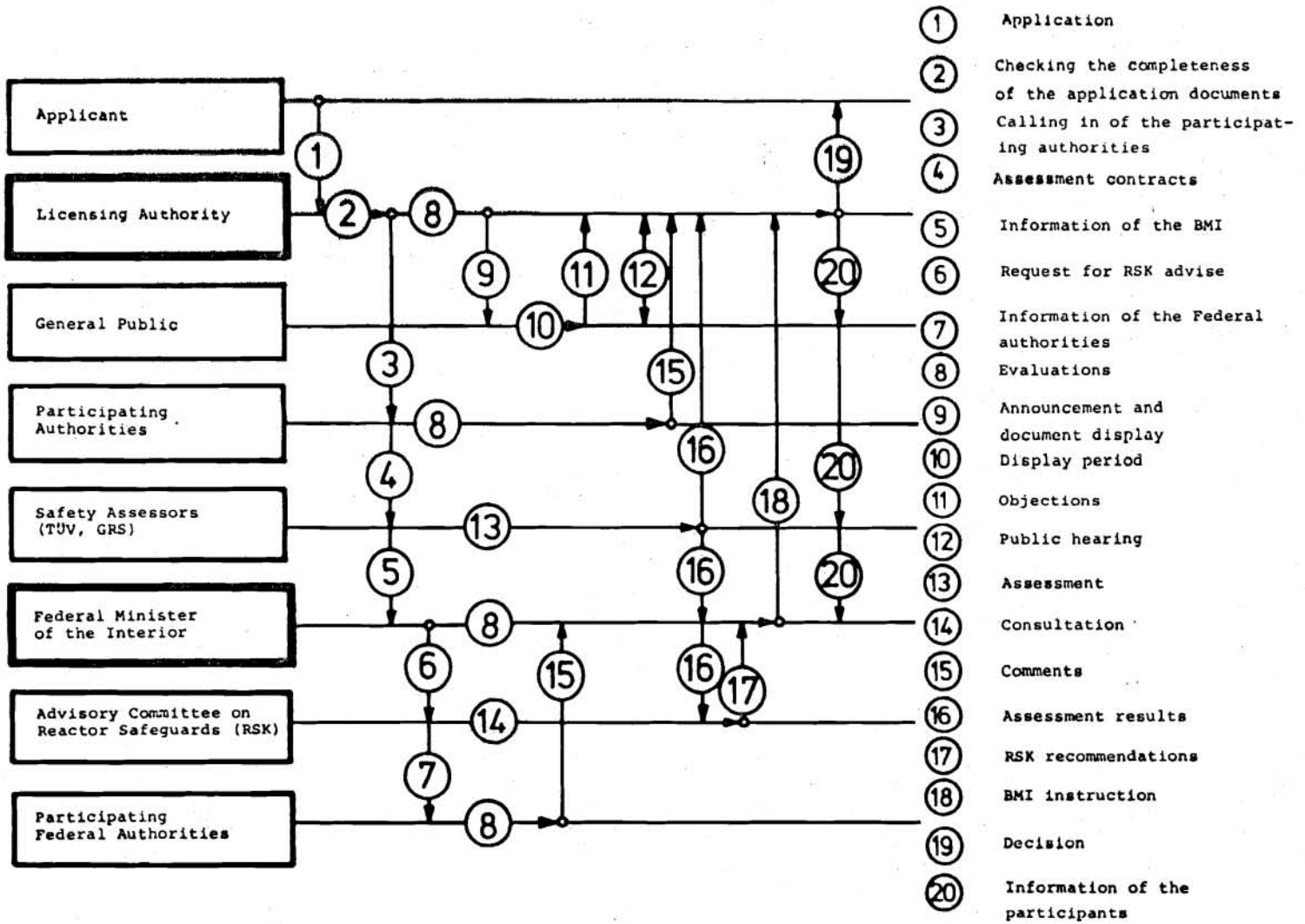


Figure 7:
Principal Course of Nuclear Licensing Procedures

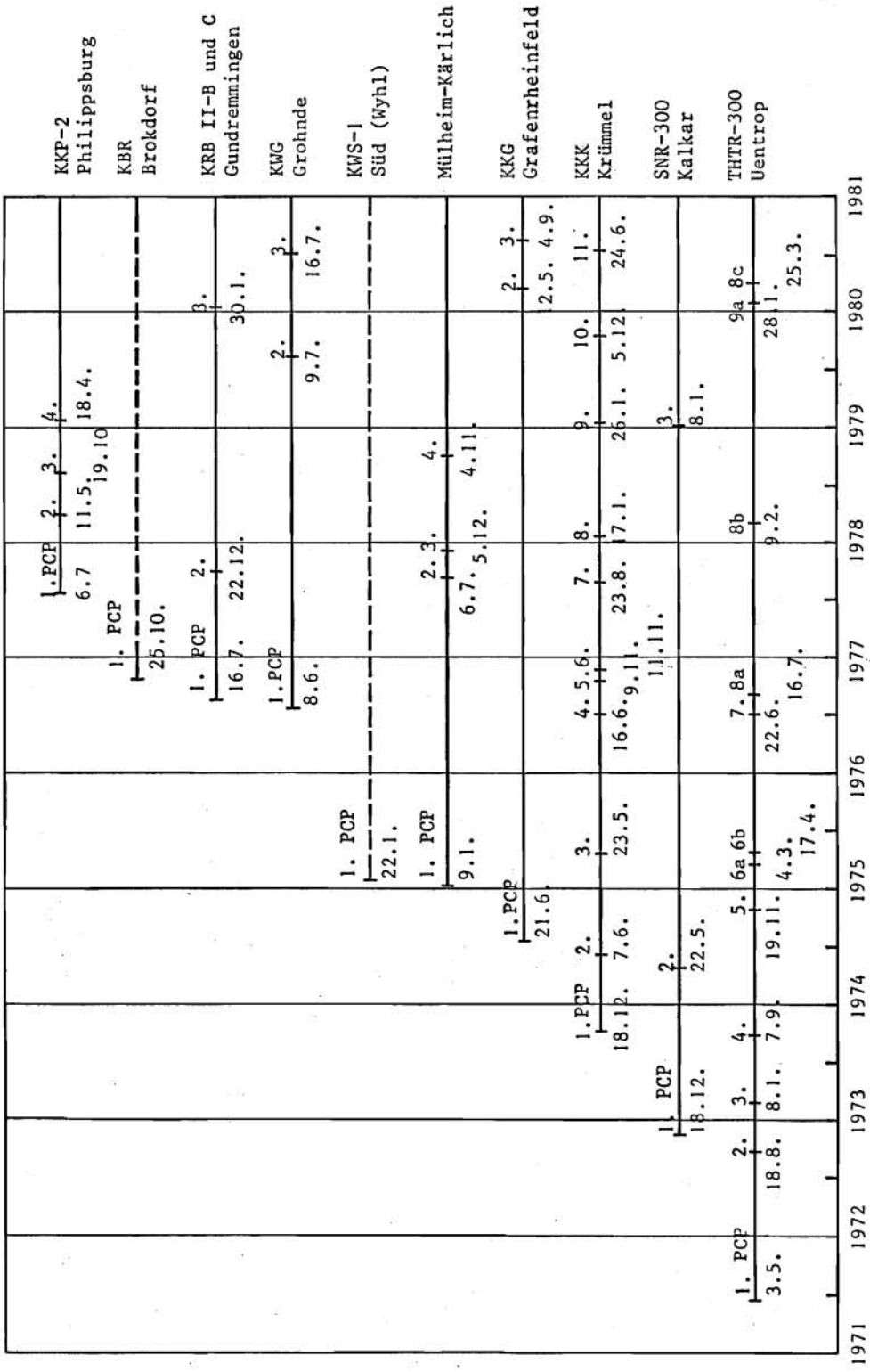


Figure 8:
Actual Course of Nuclear Licensing Procedures

construction and operating licenses are usually split into several part licences.

On the whole, the licensing procedure can, for example, be divided into the following steps:

- First part construction license (permits limited first constructional measures and at the same time contains the approval of the site and of the basic safety concept of the facility to be constructed. Subsequent changes of plant components or system can, to a certain extent, be permitted or prescribed by requirements).

- Several steps of construction licenses (licenses for the construction of the auxiliary building, assembly of components, piping systems, control and protection systems, delivery of fuel elements, etc.).

- Several steps of the commissioning and operating license (licenses for the non-nuclear trial operation, for the first criticality, for various power steps up to full power operation).

- Operating license (permits the operation of the facility under full or reduced power).

For the granting of a part licence, the applicant has to submit all documentation required for the subject of the part license and give the evidences required. In addition, he has to provide information, which, at a preliminary examination, allows a sufficient judgement as to whether the licensing prerequisites for the entire facility are complied with. The submission of the documents by the applicant, the assessment of the documents by the experts called in, and the granting of the associated part licenses are, for reasons of expediency, coordinated such that a methodical construction and commissioning of the facility can be achieved. The granting of a part license does, however, not give claim to further licenses. Each part license can be contested before the administrative courts (sec. 5.2).

6.3 Preliminary Decisions

Since the Atomic Energy Act has, in 1969, been amended by the insertion of a new sec. 7a, following sec. 7, which deals with the licensing of nuclear facilities, there is the possibility to apply for and to take preliminary decisions. Accordingly, a preliminary decision can be taken on an application concerning individual questions the licensing of a plant depends on. The preliminary decision becomes null and void if the applicant does not, within two years after the commencement of the incontestability, apply for the license; this period of time can be prolonged up to four years. The preliminary decision differs from a construction or operating license insofar as the applicant is not yet allowed to begin with any construction work, as, for example, excavating and pouring the concrete for the foundations. A preliminary decision equals a basic, anticipated statement. It answers questions the licensing of a nuclear facility depends on. The preliminary decision is, within the period of validity mentioned, binding for authority and applicant with regard to the particular question unless it is, according to sec. 17 of the Atomic Energy Act, restricted, connected with requirements or revoked.

Two typical questions are usually of special interest for the applicant: firstly, whether the planned site, and secondly whether the planned facility concept meet the licensing prerequisites. A positive preliminary decision concerning the siting means that, on the proviso of sec. 17 of the Atomic Energy Act, the authority cannot repudiate the site in the course of the further licensing procedure. The authority is, however, independent in its requirements concerning the safety features of the facility and can require more than the applicant has proposed in his documents for the preliminary decision. A positive preliminary decion on the concept means that the authority (again on the proviso according to sec. 17 of the Atomic Energy Act) cannot, in the course of the further licensing procedure, reject the basic concept. The determination concerning the basic concept means that requirements can

only be alleged within the scope of the licensed concept. This case is more binding on the licensing authority than a preliminary decision concerning the site. In practise, the preliminary decision has, up to now, been rather seldom applied for.

6.4 Overall Zoning

In deviation from the licensing regulations for nuclear facilities according to sec. 7 of the Atomic Energy Act, the Federal facilities for securing and disposing radioactive wastes, according to sec. 9b of the Atomic Energy Act, require overall zoning. The overall zoning authority has, within the scope of the overall zoning procedure to supervise the fulfilment of all prerequisites connected with the construction and operation of such a facility. The overall zoning procedure is opened when the applicant submits his plan for the project to the responsible authority. The authority has to gather decisions of all authorities whose functions and duties are concerned by the project, and it has, in case, to call in experts.

The involvement of the public (announcement of the project and hearing, display of the plan, raising of objections, conductance of the hearing and transmission of the decision) follows the Nuclear Licensing Procedures Ordinance (AtVfV). The overall zoning decision replaces all licences necessary according to other legal regulations. For the project, which is the basis for the overall zoning, only one procedure before one authority takes place with a comprehensive legal decision, i.e., all decision competences are concentrated in one authority.

By the overall zoning decision, the overall zoning authority decides on the admissibility of the project, on the objections not settled, on the type, quality, site and implementation of the project and on the requirements and conditions to be observed; it can even refuse the overall zoning. The overall zoning decision is contestable by the objectors before the administrative courts.

6.5 Supervision

The construction, operation and ownership of nuclear facilities are subject to regulatory supervision. This supervision has in particular, to ensure that no regulations of the Atomic Energy Act and associated ordinances, licensing decisions taken and possible subsequent requirements, provisions and directives of the supervisory authority are violated (sec. 19 of the Atomic Energy Act). For this purpose, members of the supervisory authority or experts called in can enter the nuclear facility at any time, conduct inspections and verifications and demand information from the licensee. On order of the supervisory authority, suitable protective measures can be carried out or the operation of the facility or of its components can be temporarily or definitively be suspended. Such measures are taken for example in the case of unusual occurrences, incidents or accidents. In the case of serious occurrences, the supervisory authority usually orders a temporary shutdown of the facility concerned until the cause is revealed and corrective measures are taken. The permission for the re-start-up operation of the facility can be made subject to further protective measures.

The nuclear supervisory authorities of the States are subject to the supervision of the Federal Minister of the Interior to the same extent as the licensing authorities.

6.6 Subsequent Requirements

It is explicitely settled in the Atomic Energy Act that the responsible authority can make subsequent requirements even after the granting of a license (sec. 17 of the Atomic Energy Act). This is the legal basis to ensure backfitting if the licensing prerequisites according to sec. 7 para. 2 nos. 2 and 3 cannot be complied with otherwise. In addition, the supervisory authority is obliged to revoke the license if the financial security does not correspond to the statement according to sec. 13 para. 1 of the Atomic Energy Act, or if - as it has already

been mentioned - such a measure becomes necessary because of a substantial jeopardizing of the employees, third persons or the public and if it is not possible to carry out corrective measures by subsequent requirements within an appropriate period of time. In certain cases, the authority is liable for the cost of a subsequent requirement or for the revocation of a licence granted.

6.7 Costs, Penalties and Fines

According to sec. 12 of the Atomic Energy Act, the licensee has to pay a license fee for the granting of a licence. The fees for the construction and operating license of a nuclear facility depend on the construction costs, restricted, however, to the part of the facility subject to nuclear licensing. It is true that the license fees are small compared to the construction costs, but, from an absolute point of view, they can well amount to some ten million DM. Furthermore, the applicant or the licensee has to repay the costs which accrue for the licensing and supervisory authority when consulting experts.

The Federal supervision of the nuclear licensing and supervisory authorities is free for applicants or licensees. This applies also to the costs accrueing for the Federal Minister of the Interior when engaging advisory bodies.

Besides the liability and financial security regulations the Atomic Energy Act contains in case of violations several clauses on penalties and fines concerning the improper handling of nuclear fuels and other radioactive materials (sec. 45-49 of the Atomic Energy Act). They are derived from the governmental control of the peaceful use of nuclear energy and are adjusted to the respective risk potential.

7. SAFETY ASSURANCE

7.1 Safety Analysis

The most important document to be submitted together with the application for a construction or operating license is the safety analysis report. This report must contain a detailed description of the planned site, the power plant, the radiological protection measures, the operation and of the accident analyses carried out. These are theoretical analyses of all possible accidents, requiring substantial efforts and a systematic mode of proceeding, which is without parallel in other industrial fields. It has to be shown that the safety features either prevent a possible accident or limit its consequences such that even under the most unfavourable circumstances the radiation exposure in the environment caused by the accident remains below the annual limits for persons occupationally exposed to radiation. All safety features must be designed against extreme loads and must have the effect of stepped protective measures against an uncontrolled release of radioactive materials into the environment. The thereby achieved multiple barrier system is, at the same time, an effective protection against those accident sequences, which are not dealt with individually in the analyses, but which nevertheless are also covered by this proceeding.

The main feature of the accident analyses are the so-called design basis accidents. The accidents most important to safety are those leading to the most serious loads acting on the components. These accidents are to determine the design of the components. This proceeding makes it possible at the same time to reduce the extent of the accident spectrum to be first analyzed. The remaining 10-30 accidents per reactor type must be analyzed in detail. The components, however, must be designed not only for the additional loads due to accidents such ascertained, but, on the contrary, more frequent additional loads due to operation must be considered in order to ensure also the fatigue strength. The accidents to be analyzed in detail

are examined by considering individual faults, failed first initiations, and unfavourable start conditions for counter measures with the help of computer programmes, and partly of experimental arrangements (in the case of prototypes). If the modelling of detail processes, the available data sets and the analytical possibilities require simplifications, safety margins are introduced in order to achieve an overestimation of the accident consequences rather than an underestimation.

The probabilistic approach is a supplement of the described deterministic mode of proceeding concerning the accident analyses to be carried out within the scope of the licensing procedure. It represents a development of the recognized reliability analysis, which contributes to ascertain the availability of technical systems because of the known failure rates of the associated components, of the system configuration chosen and of the applied maintenance strategy. If considering any influence and in case of sufficient data material, it is possible to ascertain the probability and effect of an accident sequence. The result of multiplying probability by damage is the risk of a certain accident. The sum of the risks of all accidents is the total risk of a nuclear facility which can be compared to the risks of other facilities.

It is presently not possible to fix a numerical value for the tolerable residual risk as a standard for technical licensing decisions, since, according to prevailing understanding, occurrence probabilities cannot be separated from the inherent damage extent. The proceeding of compensating an increased damage extent by a decreased occurrence probability seems to be uncontested, as long as precautions against damages are taken required according to the state of science and technology, which is during the nuclear licensing procedure to be proved for possible accidents. This is the matter in the case of risk with danger quality recognized. It is doubtful whether all accident sequences and influences examined in risk analyses belong to that category or where the limit is to the risk with

danger quality not recognized (or even not recognizable in principle) which must be accepted according to general understanding.

It is presently not possible to convert the licensing procedures for nuclear facilities to probabilistic approaches and decision criteria. Accident sequences can still not be registered with the completeness required, and associated data bases have not yet been perfected such that the results can be limited to an only small error band. Nevertheless, an integral risk concept for nuclear facilities is the ultimate goal in the development of analysis proceedings, associated data bases and judgement criteria.

The discussion on the techniques refined in the course of the years for accident analyses can serve as example for the fact that, according to the wording of the Atomic Energy Act, judgment criteria variable with time (dynamic principle) are applied insofar as the advancing state of science and technology is to be taken as a basis.

According to this principle, the results of the current research and development work are introduced into the licensing and supervisory practice. The Federal Minister of the Interior, being in charge of the lawfulness-and-expediency supervision of the execution of the Atomic Energy Act, arranges for studies and examinations which are related directly to his task in the nuclear licensing and supervising procedure. In contrast to this, the nuclear safety research program of the Federal Minister for Research and Technology is structured more basically, more extensive and more future-orientated. It is true that it conforms to the individual questions to be decided on, but it furthermore tries to prepare independent of applicants (constructor, utility) models, methods and data for judgement, to evaluate the existing safety margins, to develop the achieved state in reactor safety and radiological protection as well as to increase in general the knowledge concerning the safety questions of nuclear facilities.

7.2 Assessment

The term "Assessment" means the examinations conducted by expert consultants of the entire design of the nuclear power plants and of the associated structures, systems and components. The documents submitted by the applicant are examined and, in case, separate supplementary inspections are carried out as to whether the safety requirements according to the state of science and technology have been met. The documents to be assessed are primarily the safety analysis report and supplementary information (sec. 4.5), which contain a complete description of the nuclear power plant concerned as well as an analysis of the expected effects of operational states and accident conditions.

The site conditions must be evaluated in detail, by taking into consideration on the one hand factors influencing the effects of the nuclear power plant on the environment (meteorology, hydrology, agricultural and industrial utilization, population distribution), and on the other hand external events influencing the plant (events of natural and man-made origin). For a decision on the concept, the most important structures, systems and components must be examined for all load conditions. In this connection, the evaluation of the accident analysis carried out by the applicant plays an important role. The decisive factor is the proof that the effects on the environment are not only below acceptable limits, but that all efforts have been made to keep them as low as possible.

The analyzed accidents are usually arranged in a scheme, ranging from the smaller ones which affect only the facility itself to those causing the failure of one or more safety barriers. An upper limit is represented by the so-called design basis accidents which are crucial factors for the design of safety features. More serious accidents can, according to human experience, be excluded because of an extremely low probability. Nevertheless, they are the basis for preventive emergency planning.

The deliberations of the applicant to the topics concerend are examined within the assessment by the expert consultants. Among other things, this includes static and dynamic reactor analyses, thermo-hydraulic core computations, coolant systems studies, stress analyses, determination of thermal stresses and vibration characteristics, reliability analyses, and atmospheric dispersion calculations. This also applies to the analyses of accidents which are examined with regard to origin, sequence and consequences; in this respect, attention is paid in particular to the assumptions made, the computational methods used, the input data chosen, and the results obtained. It is normally not possible to obtain the independent judgement by means of simple calculations; on the contrary, an appropriate examination requires the use of special computer programmes.

According to the practice to split the licensing procedure into appropriate steps (part licences), this method is also applied to the elaboration of Assessments, so that there are part Assessments to each important step of the licensing procedure. The results of the Assessments usually aim at constructive or operational modifications, which are submitted in form of repuirement propositions to be considered when taking the respective licensing decisions.

7.3 Quality Examination

The term "Quality Examination" means the work-related examination of individual structures, systems and components, which can, by reason of expediency, be divided into "Design Review", "Materials, Construction, and Pressure Tests", and "Acceptance and Functional Tests". Type and scope of the Quality Examination are scheduled in the individual licensing procedure. It is required for all structures, systems and components important to safety, as, for example, in the case of a nuclear power plant, for the ractor pressure vessels and its internals, including fuel elements and control rods, other parts of the primary coolant system, all systems and components carrying

radioactive fluids, all pressure vessels, all safety features, reactor protection and control systems, transport and refuelling equipment and emergency power supply systems. Within the scope of the Design Review (examination prior to manufacture), which, related to nuclear facilities, has exceeded the conventionally usual scope, the submitted reports, plans and drawings serve the demonstration of compliance with the official licensing requirements. Further review areas include the consideration of all loading cases, the conformance of system and component data, constructive features, dimensioning, choice of materials, manufacturing and production methods, circuit installation, testability, accessibility for maintenance and repair, as well as instrumentation.

Within the scope of the Materials, Construction and Pressure Tests, above all, the conformance of the actual construction of structures, systems and components with the Design Review documents is verified. In this connection, materials and products are, first of all, examined to what extent they correspond to the reviewed specifications and show the determined characteristics. If the manufacturing process can influence the quality and if this quality can only be verified through destructive tests, additional test samples must accompany all phases of the manufacture in the same way as the component to be examined, and must afterwards be tested. Sometimes, it is necessary to conduct functional tests important to safety already at the manufacturing plant, as later these tests may be either impeded or give unsatisfactory results. This is, of course, only admitted if the functions tested will not be affected during the subsequent transport or installation.

The Acceptance and Functional Tests not only verify whether all structures, systems and components exist, but also whether their construction permits the compliance of the indicated functions according to the respective specifications. These tests can be conducted individually on test stands, within the scope of the preoperational tests or during commissioning.

7.4 Recurrent Tests

In order to maintain the quality standard once achieved during the entire operational life of the facility, Recurrent Tests must, besides the normal maintenance, be carried out. These must be conducted according to a plan, which has been developed by experts before the commissioning, accorded with the utility's own inservice inspection program, and submitted to the licensing authority. These tests and inspections aim in particular at an early identification of problems which could affect safety. Recurrent Tests, which are carried out according to schedules by taking advantage of shut-downs due to operation, supplement the current surveillance of all safety relevant characteristics within the scope of the operating programme. In order to ensure optimum testing conditions and informative results, accessibility, testability, auxiliary equipment and working conditions must, with regard to the necessary recurrent tests, already be examined and considered when designing the systems and components. The necessary documentation must also be specified at an early point of time.

7.5 Security Measures

The security need of nuclear installations according to sec. 7 para. 2 no. 5 of the Atomic Energy Act against interferences or other third party's interaction (including sabotage and terrorism) depends on the respective risk potential. Insofar, it must be differentiated between the existence of major amounts of highly enriched nuclear fuels and, for example, the existence of major amount of radioactive wastes. In any case, the release potential of radioactivity plays a decisive roll. It is the continual goal of the security measures to keep the risk of intentional interferences as low as possible. The contribution to be made by the utility responsible for the operation of a nuclear facility in this respect is stipulated in the legal requirements. It is the task of the authorities responsible for public safety to provide for supplementary protective measures.

Relevant aspects of the protection concept for nuclear installations are: redundancy and spatial separation of the components important to safety, massive structural protection, measures for early identification of intentional interferences, multiple barriers for the protection of the components important to safety, effective control of the entry and exit of persons and of goods, establishment of a security service, security clearance for key personnel, preventive measures taken by the authorities responsible for security, and the determination of action plans for emergency cases.

For the transportation of radioactive materials, the following measures are to be taken: technical examination and approval by the Federal Institute of Physics and Technology, notification of the consignee in advance, employment of specially protected transportation equipment, continuous communication between the mobile transportation units and the stationary coordination office, choice of the optimum transportation means (number of transports, transportation time) and of the, from the point of view of protection, optimal transportation route, limitation of publicity as well as police escort and information of the authorities responsible for security.

8. INTERNATIONAL ASPECTS

8.1 Cooperation across the Borders

As it has been recognized that the safety assurance concerning nuclear facilities represents an international requirement, an information exchange across borders has been organized among the interested countries already at an early point of time. This took place, on the one hand, within the scope of international organizations, the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency (NEA) of the Organization for Economic Cooperation and Development (OECD) and the European Community (EC) are to be mentioned, and, on the other hand, on a bilateral basis, particulary in connection with fa-

cilities nearby frontiers. Nevertheless, the nuclear licensing and supervisory procedures lie, despite all these associations, in the field of national responsibility, whereas the international cooperation or information only represents a supplementary measure in the sense of a good neighbourhood. In compliance with such good-neighbourly recommendations, there do exist several agreements between the Federal Republic of Germany and other countries, as, for example with Denmark, Great Britain, the Netherlands, Belgium, Luxembourg, France, Switzerland, Austria, Czechoslovakia and the German Democratic Republic, which refer to information exchange, consultations in joint commissions, and mutual support in the case of emergency situations. An excellent example for this is the close cooperation between Germany and France, which led to the establishment of a "German-French Commission for Questions Related to the Safety of Nuclear Installations" (Deutsch-Französiche Kommission über Fragen der Sicherheit kerntechnischer Einrichtungen = DFK). Site questions, comparative safety analyses, protection problems in case of emergency, and similar topics are discussed in the associated task groups. In addition, there exist agreements for information exchange in the case of unusual occurrences and for mutual assistance in the case of accidents.

8.2 French Licensing and Supervisory Procedure

The French authorities responsible for the nuclear licensing procedure are the Ministre de l'Industrie and the Ministre de la Santé et de la Sécurité Sociale. Within the Industry Ministry, a Central Office for the Safety of Nuclear Installations (Service Central de Sûreté des Installations Nucléaires = SCSIN) has been established in 1973, which has to conduct the procedures, to issue nuclear safety regulations, and to supervise operating facilities. Within the Atomic Energy Commission (Commissariat à l'Energie Atomique = CEA), there is the Institute for nuclear protection and safety (Institut de Protection et de Sûreté Nucléaire = IPSN), whose experts work for the au-

thorities responsible for the licensing procedure, especially for the Industry Ministry.

The Central Office for Protection against Ionizing Radiation (Service Central de Protection contre les Rayonnements Ionisants = SCORI), established within the Governmental Hygienics Institute, supports the Health Ministry concerning all questions of radiological protection.

Decisions on the construction of nuclear power plants lie in the competence field of the Government, which, to this respect, issues two ordinances:

- the ordinance on the award of public utility, after having taken the advice of the Privy Council,

- the ordinance on the construction license, after having taken the advice of the Interministerial Committee for Nuclear Facilities.

Part of the preparation of these ordinances is a hearing, which is preceded by the statement of a comprehensive dossier with the technical main data of the planned facility, information on the necessary buildings, costs etc. A separate technical description deals mainly with environmental protection aspects and safety problems. In the hearing, objections and questions can be written down into books which are displayed together with the dossiers, and they are collected and examined by an investigating committee. Objectors who are directly concerned by the project are, as a rule, dealt with individually, whereas questions of general interest are answered on a global basis. Finally, the ordinance prepared by the Industry Ministry, after having taken the advice of other interested ministries, is discussed in the Privy Council. As soon as it has been signed by the Prime Minister and the Industry Minister and has been published in the Governmental Gazette, it comes into force.

For the ordinance on the construction license, the future operator submits an application for the license, to which is attached information concerning relevant technical data, a description of the site and of the effects on the environment and a preliminary safety analysis report. The public hearing equals the hearing for the award of public utility. The safety verification in the Industry Ministry by SCSIN is conducted by consultation with IPSN and other experts if this is considered necessary. By taking into consideration the decision of the Interministerial Committee, and after the consent of the Health Minister, the ordinance is being prepared, signed by the Prime Minister and the Industry Minister, and published in the Governmental Gazette. Further steps of the licensing procedure refer to the fuelling, commissioning and commencing of power operation, for which the operator submits preleminary and definitive safety reports. The Industry Minister takes the license decisions applied for. The discharges of radioactive gases and fluids are dealt with in separate licenses of the Health Minister. The operating nuclear power plants are, with regard to safety and security questions, subject to the supervision by the Industry Ministry, and, with regard to radiological protection (employees, discharges, environment) subject to a supervision by the Health Ministry.

8.3 British Licensing and Supervisory Procedure

In 1974, the Health and Safety Commission has been established in the United Kingdom, which is responsible for the licensing and supervising of nuclear facilities. Under its control is the Health and Safety Executive as the responsible authority, to which is subordinated the Nuclear Installations Inspectorate (NII). The NII is not an independent organization, but an authority which conducts hearings, inspections and on-site controls concerning nuclear facilities, beginning with the siting, on to design and construction and up to operation. Although Commission, Executive and Inspectorate do not belong to the Government, they are part of the responsibility field of

the Minister for Energy, who, in this respect, bears the parliamentary responsibility.

The nuclear licensing procedure includes the site, construction and operation. It is little formalized and comprises numerous contacts between applicant and licensing authority already prior to the application, so that it can prepare the examination documents in due time and adequateness. The public and local authorities are informed of the planned nuclear facility. Subject to their decision, a public hearing is decided on. The technical examination of the application documents is the task of the Inspectorate, which assesses in particular the preliminary safety analysis report and which schedules, in case, the requirements necessary for the construction license. About the end of the construction work, the definitive safety analysis report is submitted, which forms the basis of the final judgement prior to the granting of the licence. All nuclear facilities are subject to a supervision by the Inspectorate, in order to maintain the safety standard once achieved during the whole life time of the facility.

8.4 American Licensing and Supervisory Procedure

Despite the federal structure in the United States, the licensing and supervisory procedures for nuclear facilities is, in contrast to that in the Federal Republic of Germany, centralized in the Nuclear Regulatory Commission (NRC). It is not part of the Federal Administration, subject to the directives of the President, but, as a special authority, responsible directly to Congress. Besides the task of the Executive, its activities also comprise tasks of the Legislature and Judiciary. The basis of its activities is the Atomic Energy Act of 1949 with the subsequent changes and the regulations issued by the NRC. The Commission has in the case of nuclear power plants conferred the responsibility for the granting of licenses to the Office of Nuclear Reactor Regulation, as far as no public hearings must be carried out. In such cases, the decision is

up to an Atomic Safety and Licensing Board (ASLB), with a lawyer as chairman anf two technically qualified experts as assessors.

The licensing procedure is divided into two steps. A construction permit is required before an (electric) utility is allowed to begin the construction of a nuclear power plant, and an operating license is necessary prior to the fuelling and the following commissioning. Part of the application documents to be submitted for a construction license are the preliminary safety analysis report, a comprehensive environmental protection report, which forms the basis for the examination of the effects of the facility on the environment, and the information necessary for the antitrust examination. The documents submitted are, first of all, reviewed concerning their contents, supplemented if necessary, filed and, in the Public Document Room, made accessible to the public. The NRC staff conducts the necessary safety verifications with the help of the safety analysis reports and supplementary documents; at the same time, the examination concerning the environmental protection compatibility and the antitrust procedure are carried out. The NRC is supported by an independent advisory body, the Advisory Committee on Reactor Safeguards (ACRS), which deals with all relevant safety questions. After the examination of the application concerning safety questions and environmental protection has been finished, public hearings are planned. They are conducted by the ASLB, whose decision can be challenged before the Appeal Board or the Commission itself.

As soon as the construction work has proceeded so far that definitive information concerning the facility and the mode of operation planned are available, the final safety analysis report is submitted by the applicant together with the application for the operating licence. In accordance with the proceeding when granting a construction permit, the safety verification is conducted by the NRC staff, the ACRS is involved, another public hearing is, however, only carried out upon particular request.

In addition to this general procedure for construction and operating licenses, there are some particularities, as, for example, the limited work permit, according to which certain works are admitted at the site planned before the construction license is granted, or the qualification test of the site, which can be compared to the German preliminary decision procedure.

The supervision of nuclear facilities is also a task of the NRC, beginning prior to the construction of the facility and being continued during the whole operating period. This activity can, to some extent, be compared to the quality examinations by experts called in during the German supervising procedure, except that the emphasis is on different aspects. The recurrent tests after the commissioning show, as well, comparable features and goals.

SUMMARY

In all countries with a nuclear energy program, the licensing and supervisory procedures show homogeneity as to their goals, but differences in the settlement, whereby, in most cases, even in the case of a federal administration structure, preference is given to a centralized proceeding. In contrast to this, a combined system has been developed in the Federal Republic of Germany: the States execute the Atomic Energy Act on behalf of the Federal Government. Despite these differences, the safety requirements and the safety standard achieved vary only insignificantly, as a result of a world-wide communication and of international cooperation.

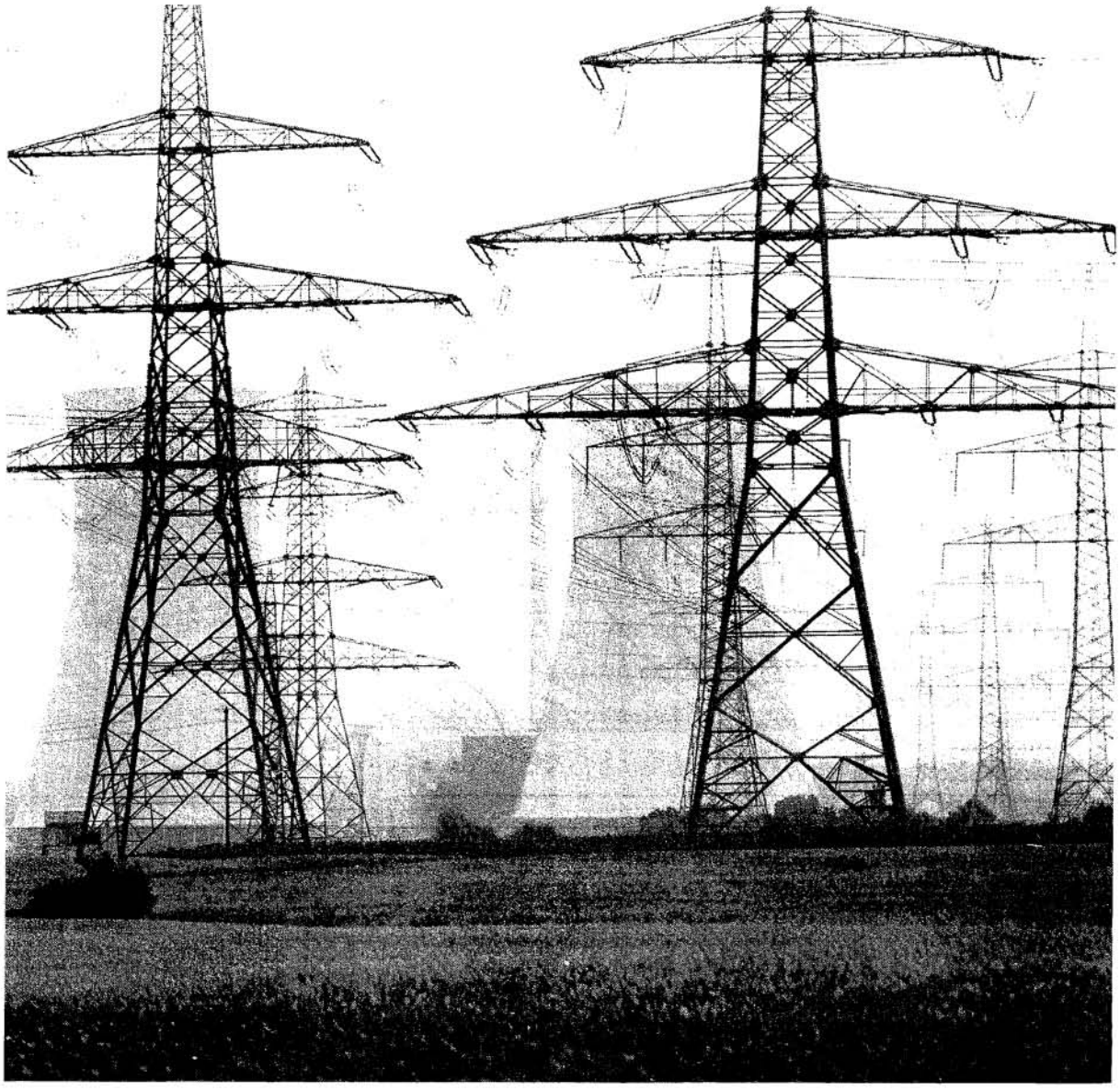
The legal prerequesites for the German nuclear licensing procedures have been established about 20 years ago, and, by a number of amendments have been adapted to new perceptions and developments. Several supplementary ordinances, due to further developments in nuclear technology, are being prepared. The work on associated technical provision, which had been neg-

KWU Erlangen, photograph

Figure 9:
Nuclear Power Plant Grafenrheinfeld (Pressurized Water Reactor); Electrical Net Power 1229 MW, Commercial Operation since 1981

lected for a long time, has in recent years been tackled systematically and should, before long, lead to a comprehensive programme of safety standards, which simplifies and expedites the nuclear licensing procedures.

Essential features of the licensing procedure are the phased structure and the division into intermediate steps which render



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Essential features of the licensing procedure are the phased structure and the division into intermediate steps which render

it possible to adapt the safety requirements to the advancing state of science and technology. The responsible authorities call in experts for the safety verification of the application documents. It is the task of these experts to make assessments and to conduct quality examinations in the manufacturing plants and at the site, and to carry out recurrent tests. The public is involved by the announcement of the projects, the display of the documents and by the opportunity to raise objections during the licensing procedure. Licenses granted can be contested before the administrative courts. This procedure paves the way for the achievement of a satisfactory balance between private and public interests.

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