RECENT WASTE DISPOSAL RELATED DEVELOPMENTS IN GERMANY

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ABSTRACT

The Federal Republic of Germany intends to dispose of all types of radioactive waste in deep geological formations. This waste comprises spent fuel elements, vitrified fission products, nuclear power plant operational and decommissioning waste as well as spent sealed radiation sources and miscellaneous waste originating from small waste generators. The Atomic Energy Act, which deals with all aspects regarding the peaceful use of nuclear energy in Germany, gives the responsibility for the disposal of radioactive waste to the Federal Government with the Bundesamt für Strahlenschutz (BfS - Federal Office for Radiation Protection) as the legally responsible authority. All other radioactive waste management procedures, i.e., spent fuel storage, reprocessing, conditioning, transportation and interim storage, are within the responsibility of the waste generators. The federal states must construct and operate regional collecting depots for the interim storage of radioactive waste originating, in particular, from radioisotope application in industry, universities and medicine.

As a result of the September 1998 federal elections, a coalition government of the Social Democrats and Alliance ´90/The Greens was formed. The new Federal Government has made a pronounced change in energy policy, the most important feature of which is the abandoning or phasing out of nuclear energy. This shall be performed in a gradual process, including so-called consensus talks with representatives of the utilities as well as legislative measures. An essential (basic) step towards a nuclear consensus in Germany is the agreement, which was achieved by the Federal Government and the utilities on June 14, 2000. Thus, the new radioactive waste management policy comprises important disposal-related alterations and changes.

INTRODUCTION

In the Federal Republic of Germany the use of nuclear energy started with the operation of the first nuclear power plant in 1960. Since the early sixties, i.e., from its very beginning, the German radioactive waste disposal policy has been based on the decision that all types of radioactive waste are to be disposed of in deep geological formations. Such a decision is based on the isolation potential of natural barriers over very long periods of time, during which radionuclides will decay significantly. Thus, vitrified fission products from reprocessing and spent fuel elements, as well as spent sealed radiation sources and miscellaneous waste from small waste generators are affected by this decision. It also applies to alpha-emitting waste originating in particular from reprocessing facilities, nuclear research establishments or the nuclear fuel cycle industry. Near-surface disposal or shallow land burial is not practiced in Germany because of a high population density, climatic conditions and the availability of potentially suitable deep geological formations.

GERMAN RADIOACTIVE WASTE DISPOSAL POLICY

Basic Aspects of Radioactive Waste Disposal

The publication "Safety Criteria for the Disposal of Radioactive Waste in a Mine" (1) describes the basic aspects, which have to be taken into account to achieve the objective of disposal. The authors qualitatively specify the measures, which must be taken to achieve the protection goal of disposal, and define the principles by which it must be demonstrated that this goal has been reached.

The Safety Criteria embody the most important features characterizing the German approach to disposal (basic concept) and the respective philosophy employed, viz.:

(a) Radioactive waste is disposed of in a suitable deep geological formation, this being an approach to ensure, in particular, the long-term and safe isolation of the radioactive waste from the biosphere.
(b) Under these assumptions, basically, no other measures will be necessary after the completion of waste package emplacement, backfilling and sealing as well as after having the repository closed.

Revision of the Safety Criteria

The Safety Criteria were issued in 1983 and are at present being revised on behalf of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU - Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit). BMU is the competent federal authority for nuclear safety, radiation protection and waste management in Germany. The overall aim of this revision may be outlined as follows:

(a) Survey of the international status of the development of safety criteria for the disposal of radioactive waste and its evaluation as compared to the German situation.
(b) Consideration of respective activities being performed by international institutions such as the International Atomic Energy Agency (IAEA) (e.g., the RADWASS program and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management), the Organization for Economic Co-operation and Development/Nuclear Energy Agency (OECD/NEA) and the International Commission for Radiation Protection (ICRP).
(c) Preparation of proposals for the actualization and harmonization of the Safety Criteria, in particular according to the international status and the experiences resulting from the Konrad repository licensing procedure.

On an international level, irrespective of the research already lasting for more than three decades, methodological-conceptual questions have been discussed intensively.

The development of the "state-of-the-art" of science and technology has shown that the previous Safety Criteria should be revised. This development is expressed in recent international publications, e.g., in the documents "Confidence in the Long-Term Safety of Deep Geological Repositories - Its Development and Communication" (OECD/NEA

1999)"Geological Disposal of Radioactive Waste: Reviews of Developments in the Last Decade" (OECD/NEA 1999)"Safety Indicators, Complementary to Dose and Risk, for the Assessment of Radioactive Waste Disposal" (IAEA 1999) and "Disposition of High-Level Radioactive Waste through Geological Isolation - Development, Current Status, and Technical and Policy Challenges" (National Research Council 1999). Important questions like the possibilities to assess long-term safety and human intrusion were discussed in depth in the ICRP Committee 4 and recommendations have recently been published (ICRP Publication 81). In several countries, for a couple of years, the increasing concretization of waste management planning and site-specific findings has led to this development which is reflected, among other things, in the aforementioned documents. These aspects are of special importance for the licensing procedure in Germany, which under the Atomic Energy Act requires the application of the "state-of-the-art".

REPOSITORY PROJECTS / REPOSITORY

According to the German disposal concept, all radioactive waste has to be emplaced in deep geological formations. As liquid and gaseous wastes are excluded from disposal in such a mine, only solid or solidified radioactive waste is accepted. According to the 1979 German radioactive waste management concept, two sites have been considered for disposal:

(a) The abandoned Konrad iron ore mine in the Federal State of Lower Saxony has been investigated for disposal of radioactive waste with negligible heat generation (short- and long-lived low and intermediate level waste), i.e., waste packages which do not increase the host rock temperature by more than 3 K on an average. At a depth of 800 m to 1,300 m the emplacement of up to 650,000m³ waste package volume has been planned. A total activity of about 10^{18} Bq and an alpha emitter activity of about 10^{17} Bq are anticipated in this facility.

(b) The Gorleben salt dome in the north-east of Lower Saxony has been investigated for its suitability to host a repository at depths between 840 m and 1,200 m for all types of radioactive waste, mainly for heat-generating radioactive waste (high-level waste) originating from reprocessing and spent fuel elements. The accumulated inventory of beta/gamma and alpha emitters to be emplaced is estimated to be about 10^{21} Bq and 10^{19} Bq, respectively.

In the former German Democratic Republic short-lived low and intermediate level radioactive waste with an alpha emitter concentration of up to $4.0 \cdot 10^{8}$ Bq/m^3 originating from the operation of nuclear power plants and the application of radionuclides in research, medicine and industry was disposed of in the Morsleben repository, an abandoned salt mine located near the village of Morsleben in Saxony-Anhalt. From December 1971 through February 1991, radioactive waste with a total volume of approximately 14,500 m^3 and about 6,700 spent sealed radiation sources were emplaced. Since German unity, which took place on October 3, 1990, the Morsleben facility has the status of a federal repository in the sense of section 9a (3) of the Atomic Energy Act.

Emplacement of radioactive waste in the Morsleben repository was stopped in February 1991 because questions with regard to licensing had been raised. On January 13, 1994, emplacement operations were resumed. From that date through September 28, 1998, radioactive waste with a total volume of 22,320 m^3 and 394 spent sealed radiation sources were emplaced. The activity of beta/gamma emitters emplaced in that period of time totals to

$9.1 \cdot 10^{13}$ Bq, of which $8.0 \cdot 10^{10}$ Bq are alpha emitters. The total activities of the waste emplaced since 1971 amount to $1.7 \cdot 10^{14}$ Bq.

According to the September 25, 1998, order of the Superior Administrative Court of the federal state of Saxony-Anhalt, BfS had to immediately stop further radioactive waste disposal in the so-called eastern emplacement field of the Morsleben repository. Due to the results of the BfS examination of the court order (preliminary decision) of September 25, 1998, it was decided to stop waste emplacement in the Morsleben facility. Thus, the last waste emplacement operations were carried out on September 28, 1998. Technical stand-by service is maintained; emplacement operations are not intended to be resumed. BfS has applied for a license to finally backfill and seal the repository.

NEW DEVELOPMENTS IN RADIOACTIVE WASTE MANAGEMENT AND DISPOSAL

In Germany, federal elections took place on September 27, 1998. As a result, a coalition of the Social Democrats and Alliance '90/The Greens came into power. The political aims of the new Federal Government are given in the coalition agreement of October 20, 1998 (2). The most important feature of the new energy policy is the abandoning or phasing out of nuclear energy. Thus, the new Federal Government makes a pronounced change compared to the previous energy policy. It is intended to phase out nuclear energy use for electricity generation. This shall be performed in a stepwise procedure. In a first step consensus talks on a new energy policy with representatives of the utilities have been successfully finished: They resulted in the termination of the use of nuclear energy for electricity production without claims for compensation by the affected utilities, and the respective objectives of a new radioactive waste management and disposal concept. In a second step the necessary legislative measures will be taken, e.g., an amendment of the Atomic Energy Act.

Coalition Agreement of October 20, 1998

Energy policy is addressed in particular in chapter 3 "Modern Energy Policy" of the coalition agreement (2). As to waste management, the coalition parties agree on the following:

(a) The coalition parties agree that the previous radioactive waste management concept has failed with regard to its content and no longer has a technical basis. A national waste management plan for the legacy of radioactive waste will be developed.
(b) A single repository in deep geological formations is sufficient for the disposal of all types of radioactive waste.
(c) The disposal of high-level waste (HLW) by the year 2030 is the objective under the new policy for disposal of all types of waste.
(d) There are doubts with regard to the suitability of the Gorleben salt dome. Therefore, its exploration shall be interrupted and further sites in various host rocks shall be investigated for their suitability. The final site shall be selected based on a subsequent comparison of the sites, including the Gorleben site.
(e) The emplacement of radioactive waste in Morsleben shall be terminated. The plan-approval (licensing) procedure remains restricted to decommissioning.
(f) Basically, each operator of a nuclear power plant is obliged to construct interim storage facilities on site. Spent nuclear fuel may only be transported if no licensed interim storage capacity exists at the nuclear power plant site and if the power plant operator is not

responsible for this waste. The interim storage facilities shall not be used for disposal purposes.

The coalition agreement is the basis for all respective activities, discussions and planning work presently initiated and/or carried out in Germany. With respect to disposal it should be pointed out, that, in accord with prevailing international opinion, the Federal Government considers the emplacement of radioactive waste in deep geological formations of the earth's crust the best possibility to meet the safety objectives according to the state-of-the-art of science and technology, which is required by the Atomic Energy Act.

RE-EXAMINATION OF THE GERMAN DISPOSAL PROGRAMME

Due to the doubts regarding the suitability of the Gorleben site, further sites in different host rock formations shall be investigated (2). As a first step in this direction, BMU has set up a special working group to develop repository site selection criteria on a scientifically sound basis and to recommend a transparent procedure for site selection. The time needed for this task is estimated to be about 2 years. In February 1999, the working group "Selection Procedure for Repository Sites" started its work. First results have been presented and discussed in a workshop in Kassel on September 15 and 16, 2000. An in-depth discussion of the proposals with the public is planned from 2001 on, so that the completion of work can be expected in 2002. The criteria and procedures aim at finding the relatively best suitable site among different host rocks in Germany. The recommended site selection criteria and respective procedures will finally be discussed nationally (including stakeholders, environmental groups, other interested initiatives and the general public) and internationally, before they will be legally implemented. During this criteria development phase, new sites will neither be selected nor investigated.

The future generation of radioactive waste depends on the further use of nuclear energy in Germany. Estimates and prognoses of the waste arisings to be expected in future were performed within the scope of scenarios with different conditions. In the frame of principle considerations waste arisings were estimated taking the continued operation of nuclear power plants during 50, 35, or 25 years into account (3). From these scenarios it was concluded that waste package volumes between approximately 300,000 m^3 and approximately 340,000 m^3 would accumulate up to the year 2080 varied. This span of about 12 % takes into account the assumptions and periods prognosticated, and results mainly from the different amounts of operational waste produced by the nuclear power plants. On average, 75 m^3 of operational waste are produced per year per nuclear power plant.

Against the background of the operational life-time of the nuclear power plants decommissioned up to now, which is clearly lower than projected, the peaceful use of nuclear energy, which is distinctly below previous plans, and the application of modern conditioning technologies aiming at waste product volume reduction, the total waste volume to be expected in future has clearly decreased as compared to former estimates. Thus, in 1984, the expected amount of conditioned radioactive waste with negligible heat generation up to the year 2000 was estimated to be about 238,000 m^3. Compared to that, according to the 1998 prognosis (3), the expected waste package volume up to the year 2000 was estimated to be about 76,100 m^3, and that up to the year 2080 to be about 304,100 m^3. These estimates will continue to decline with the abandoning of the use of nuclear energy for electricity production. Therefore, already today it is clear that, with regard to volume only, it will be possible to dispose of all waste

produced by the nuclear power plants until the end of their operation, as well as waste from other sources, in one repository.

Impact on the Gorleben and Konrad Repository Projects and the Morsleben Repository

For the underground investigation of the Gorleben salt dome two shafts were sunk. Both shafts were interconnected at a depth of 840 m on October 21, 1996. At this depth the exploration drifts and galleries are being excavated. Though the Federal Government has expressed doubts with respect to the suitability of the Gorleben site, it is not considered to be unsuitable and will for now be included in the future site selection process (2). BMU has announced a moratorium for the exploratory work, lasting 3 years as a minimum and 10 years as a maximum (cf. chapter 6). In this period the operation of the exploratory mine will be restricted to maintenance work to keep the mine open safely. The suitability of the Gorleben site for waste disposal will be reconsidered after safety criteria has been developed.

The licensing procedure for the planned Konrad repository is nearly finished; nevertheless, a positive decision by the competent licensing authority (federal state of Lower Saxony) is still pending. BfS sees no fundamental legal or safety reasons why the Konrad repository could not be licensed.

It is not intended to resume emplacement operations in the Morsleben repository. An application for the licensing procedure for decommissioning has been filed on May 9, 1997. The licensing procedure for decommissioning is in progress. Up to now, more than 70 documents have been presented to the competent licensing authority, the Ministerium für Raumordnung, Landwirtschaft und Umwelt des Landes Sachsen-Anhalt (MRU LSA – Ministry for Regional Planning and the Environment of the Federal State of Sachsen-Anhalt). Those documents dealing with geological/geoscientific data and information were nearly all submitted.

Present activities are in particular focusing on the further development of the backfilling and sealing concept including respective safety assessments for the post-closure phase. The assessment of the isolation potential within this procedure is of special importance. The safety assessment was originally based on a preliminary backfilling and sealing concept; more detailed site-specific information and respective safety analysis proved this concept not to be acceptable. Thus, two alternative concepts "delayed designed migration path" and "complete backfilling and sealing" are being developed but, up to now, have not yet given sufficient confidence in meeting the safety objectives thus requiring further planning work. Decisions on the final backfilling and sealing concept are still to be taken, probably at about mid-2001.

The National Waste Management Plan

At present, the German radioactive waste management and disposal concept is being reviewed and will be adopted due to political decisions, new findings and specific evaluations. In particular, as already mentioned, the assessment basis for the selection of a suitable repository site is being reviewed and site selection criteria, including a scientifically sound procedure for final site selection, is being developed. Nevertheless, the emplacement of waste packages into deep geological formations is still the preferred option for safe disposal of all types of radioactive waste.

According to the coalition agreement (2), activities to develop a new national radioactive waste management plan have been initiated. As far as waste disposal is concerned, this plan comprises the following main issues:

(a) Restriction of spent nuclear fuel management to direct disposal; termination of reprocessing of spent fuel as soon as possible.
(b) A single repository in deep geological formations is sufficient for disposal of all types of radioactive waste (i.e., co-location of LOW, ILW, HLW and spent nuclear fuel).
(c) Disposal of high-level waste by the year 2030 is the target for the disposal of all types of radioactive waste.

According to the intended termination of reprocessing and the erection of on-site interim storage facilities for spent nuclear fuel, the number of shipments of spent fuel elements will be reduced considerably.

As far as the repository projects Konrad and Gorleben are concerned there is scientific evidence that a separate disposal of low- and intermediate-level radioactive waste may have special advantage from a safety point of view, e.g., with respect to gas generation in the post-closure phase. Thus, the political aim to construct and to operate one single repository in deep geological formations for all types of radioactive waste is still to be examined in detail focusing on safety-related aspects and on specific issues of the waste management concept.

The OECD/NEA report "Confidence in the Long-term Safety of Deep Geological Repositories - Its Development and Communication" (4) addresses many aspects presently discussed. With respect to the three basic elements of confidence in decision-making, in Germany only one (Confidence in the appropriateness of geological disposal) is met, whilst confidence in long-term safety aspects and confidence in procedures and regulations are still lacking. Retrievability and human intrusion are additional topics, which have not been solved finally. Many national and international parties are now reconsidering the strategic merits of ongoing monitoring and possible retrieval as opposed to a program that involves closure of a repository and absence of planned activities thereafter. Human intrusion scenarios and the resource potential of sites are other topics discussed internationally in favor of including these scenarios in making a safety case. As an example aspects of retrievability are addressed in more detail in the following.

Aspects on Retrievability

The defining characteristic of the post-closure phase of a disposal repository is that no further engineering measures are expected to be necessary in order to ensure proper future performance of the disposal facility. In a geological repository, the post-closure phase pertains to the period following the final shaft sealing and surface facility decommissioning. Retrievability as a design base may thus be in conflict with the post-closure objective On the other hand, the ethical requirement of not foreclosing decisions and responsible actions including recoverability/retrievability of future generations may be easier to meet. Thus, final conclusions on retrievability will have to consider both scientific/technical aspects and ethical issues.

As to the present evaluation of retrievability, it may be concluded that the protection and limitation of burdens to future generations basically require a filled and sealed repository without surveillance during the post-closure phase. Nevertheless, a perfect technical system is

not - and will not be - available. As a consequence, future generations should be offered the possibility to take decisions on their own, to perform responsible actions including further safety-related assessments, as well as measures on retrievability and/or recoverability. Thus, a repository in a geological formation must be planned, operated, backfilled and finally sealed in such a way that a subsequent control/surveillance and repairability/retrievability will not be necessary, but not be impossible (anthropogenic deposit). The respective prerequisites must be examined in detail, clearly distinguishing between the operational and post-closure phase of a repository. In addition to prevailing planning work, the conceptual design of a repository, including the intention to retrieve the waste packages as a design base requirement, is to be scrutinized. In this connection, two different possibilities are to be taken into account:

(a) The retrievability of waste packages during the operational phase.
(b) The retrievability of waste packages from a sealed repository during the post-closure phase.

As to the latter case, it should be mentioned that, because of the time- and heat-dependent characteristics of rock salt, an investigation into the feasibility to retrieve waste packages from a sealed repository using rock salt as host rock needs further detailed investigation.

Last but not least the recommendations and results of the November 4-5, 1999, Irvine workshop (5) will have to be taken into account. According to the pre-conference discussion papers the merits of a strategy based on long-term (more than 100 years) monitoring and retrieval is being reconsidered, as opposed to a program that involves closure of a repository and no retrieval. All repositories will be monitored after closure for some time. Several factors motivate continued study and monitoring rather than expediting repository closure as soon as the HLW and spent fuel have been emplaced. First, the response of the geological site and of the engineered barriers to the waste may lead to adjustments in the containment system. Second, provisions for on-going monitoring may be viewed by the public as preferable, so that if very unlikely containment failures or unexpected events should occur at the repository, effective and timely action can be taken to avoid releases of radioactivity into the biosphere. Third, retrievability may become desirable in the future because of the existing considerable energy value in spent nuclear fuel.

Thus, with respect to retrievability and spent nuclear fuel, safeguards considerations must be taken into account at an early stage of repository planning. It may turn out to be necessary to continue safeguarding spent nuclear fuel, even after it has been emplaced in a repository constructed and operated in deep geological formations. The duration of such safeguards measures should be decided by future generations and will depend on the future development of society. It is possible that safeguarding of nuclear materials may continue to be of high priority for hundreds of years. Nevertheless, it should be pointed out that the requirement for open-ended surveillance contradicts ethical considerations of radioactive waste disposal by imposing a burden on future generations, and would also involve costs, which cannot be reliably estimated.

The counter arguments to retrievability are that safe disposal is already now feasible and that delaying closure for a long time presents a greater hazard. For example, operational expertise and funding in the future are not guaranteed. Retrieval from a closed geological repository remains in principle possible for very long times. Nevertheless, it may be appropriate to consider strategies for extending the time between emplacement of waste and closure of a repository, and to regard an underground repository in a deep geological formation as a

monitored, retrievable HLW storage facility, until sufficient confidence in its safety can be developed and the repository closed.

THE NUCLEAR CONSENSUS

The so - called consensus talks between the Federal Government and the utilities started in January 1999. About 18 months later, on June 14, 2000, the basic document on nuclear consensus in Germany was agreed upon. This agreement was reached between and initialed by the Federal Government and Germany's four main nuclear utilities (EnBW, RWE, Veba and Viag). According to this consensus document, the Federal Government and the utilities agree to limit the future utilization of the existing nuclear power plants. On the other hand, keeping a high safety level and fulfilling the requirements pursuant to the Atomic Energy Act for the remaining period of utilization, the undisturbed operation of the nuclear power plants shall be guaranteed.

Both sides shall contribute their share to implement the contents of this agreement permanently. On that basis the Federal Government shall elaborate the draft of an amendment of the Atomic Energy Act. The Federal Government and the utilities shall assume that this agreement and its implementation will not lead to claims for compensation between the parties involved.

The most important agreements refer to a restriction in operation of the existing nuclear power plants. For each installation the amount of energy it may produce is calculated from January 1, 2000, until it's decommissioning. In total, 2,623.30 TWh (net) can be produced by any one power plant. The right to operate a nuclear power plant shall terminate when the amount of energy planned or altered due to transfer has been reached by the corresponding installation. For each installation the remaining operating time from January 1, 2000, is calculated on the basis of a normal operating time of 32 calendar years starting at the beginning of commercial operation. For the Obrigheim nuclear power plant an interim period until December 31, 2002, has been agreed.

The utilities may transfer amounts of energy (production rights) from one nuclear power plant to another by notification of the participating operators to the Federal Office for Radiation Protection. Each power plant operator has to report the nuclear power production to the BfS on a monthly base.

As far as the operation of the nuclear power plants during the remaining operating time is concerned, the high safety standard required by law will be applied. If the requirements according to the Atomic Energy Act are fulfilled, the Federal Government shall guarantee the undisturbed operation of the installations. The utilities shall perform safety assessments (SSA and PSA) and submit the results to the supervisory authorities. With this, a practice started with the majority of the nuclear power plants shall be continued. The assessments shall be repeated every 10 years.

The Federal Government shall take no one-sided initiative, which shall discriminate against the use of nuclear energy. However, the financial security shall be increased to an amount of 5 thousand million DM.

With respect to radioactive waste management and disposal, the most important agreements are as follows: The utilities shall construct as soon as possible interim storage facilities at the

sites of the nuclear power plants or near them. Both sides will support the erection of interim storage facilities at or near the sites prior to the use of the existing central storage facilities. Until the interim storage facilities near the sites have been brought into operation, the utilities may however transport spent fuel elements to the central storage facilities as well as to foreign countries for reprocessing, if the legal prerequisites exist. Both sides assume that the interim storage facilities near the sites will be ready for operation within a period of five years at maximum.

The management of radioactive waste (spent fuel) from the operation of nuclear power plants shall be restricted to direct disposal from July 1, 2005, on.

The investigation of the Gorleben salt dome shall be deferred for at least 3 years, and for 10 years at maximum, until conceptual and safety-related questions will have been clarified. The Gorleben Moratorium became effective on October 01, 2000 (6). The responsible authorities shall complete the licensing procedure for the Konrad repository according to the legal provisions. The applicant withdrew the application for immediate enforcement of the plan-approval (i.e. licensing) decision on July 17, 2000 (7), enabling a court examination of the license still to be issued. The utilities prepayments for the costs of Gorleben and Konrad will not be reimbursed.

Finally, the Atomic Energy Act shall be amended. The utilities take note that the Federal Government intends to establish a legal ban on the construction of new nuclear power plants, and legislate an obligation to construct and utilize interim storage facilities near the sites. The Federal Government will elaborate a draft of the amendment of the Atomic Energy Act on that basis. Then, the parties involved will negotiate the implementation of the draft amendment before the Cabinet deals with this issue.

CONCLUSIONS

Having the present radioactive waste disposal-related situation in mind, it is to be recognized that future developments and decisions will be determined by the agreement between the Federal Government and the utilities and by its realization. With respect to waste disposal, first steps have already been taken. Regarding the on-site interim storage of spent nuclear fuel, starting at the end of 1999 and continuing until Fall 2000, applications were filed to initiate licensing procedures for the construction and operation of 13 interim storage facilities and 5 interim storage places. A survey on the most important technical data of those facilities and places in given in Table 1 (Mg reads metric tons).

Table I: On-site interim storage facilities and storage places

Site (NPP-Nuclear Power Plant)	Type of Facility	Applied Capacity Heavy Metal	Applied Activity	Storage Positions for Casks
Biblis NPP	storage building	1,600 Mg	8.5×10^{19} Bq	135
Biblis NPP	Storage place	300 Mg	7.8×10^{18} Bq	28
Brokdorf NPP	storage building	1,200 Mg	1×10^{20} Bq	100
Brunsbüttel NPP	storage building	1,500 Mg	2×10^{20} Bq	150
Brunsbüttel NPP	storage place	140 Mg	1.6×10^{19} Bq	18
Grafenrheinfeld NPP	storage building	1,050 Mg	5×10^{19} Bq	88
Grohnde NPP	storage building	1,200 Mg	1×10^{20} Bq	100
Gundremmingen NPP	storage building	2,500 Mg	3×10^{20} Bq	216
Isar NPP	storage building	1,800 Mg	2×10^{20} Bq	152
Krümmel NPP	storage building	1,500 Mg	2×10^{20} Bq	150
Krümmel NPP	storage place	120 Mg	1.5×10^{19} Bq	12
Lingen NPP	storage building	1,500 Mg	1×10^{20} Bq	130
Neckarwestheim NPP	tunnel	1,600 Mg	1×10^{20} Bq	169
Neckarwestheim NPP	storage place	250 Mg	1.5×10^{19} Bq	24
Philippsburg NPP	storage building	1,800 Mg	2×10^{20} Bq	152
Philippsburg NPP	storage place	260 Mg	3×10^{19} Bq	24
Stade NPP	storage building	300 Mg	4×10^{19} Bq	80
Unterweser NPP	storage building	1,000 Mg	8×10^{19} Bq	80

All licensing procedures require a public hearing. The public hearing for the on-site interim storage place at the Neckarwestheim nuclear power plant took place at Neckarwestheim, October 05 through 07, 2000 (8); the respective hearing for the on-site interim storage place at the Philippsburg nuclear power plant took place at Philippsburg, November 02 through 06, 2000 (9).

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