Lessons Learned from Hearings in Germany – Limits and Problems with Stakeholder Involvement

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Introduction

In 1998 the German government decided - in accordance with the utilities - to phase out of the commercial use of nuclear energy for electricity production. In context with this change in the federal energy policy, a new waste management program was developed including a new concept of dry on-site interim storage instead of centralised interim storage. Negotiations of the German government and the utilities resulted in the "Agreement between the Federal Government of Germany and the Utility Companies" of June 14, 2000.

In April 2002, an amendment of the Atomic Energy Act [1] came into force that legally secures this agreement on a phase-out of nuclear power. According to the amendment to the Atomic Energy Act, waste management is restricted to disposal. As from July 2005, transports of spent fuel elements to the reprocessing plants at La Hague in France and Sellafield in Great Britain are prohibited. In addition, operators of nuclear power plants have to build and to operate interim storage facilities for spent nuclear fuel on the site or in the vicinity of nuclear power plants. The aim is to reduce transports of spent fuel and to bridge the time until a national repository for radioactive waste in deep geological formations will be available.

From the end of 1998 to the end of 2000 and in conjunction with the agreement mentioned above, the operators of the German nuclear power plants (NPP) applied for 18 licenses for the storage of spent fuel at 13 sites of nuclear power plants. These applications comprised 13 on-site interim storage facilities and 5 interim storage areas. The latter were necessary to bridge the time gap until the respective on-site interim storage facilities come into operation. The application for the facility at Stade was withdrawn due to the final shut down of the corresponding NPP and the evacuation of the fuel elements.

All these applications were approved until the end of 2003 by the Federal Office for Radiation Protection (BfS) being the responsible authority. As an integral part of the respective procedure an environmental impact assessment was carried out. This comprised the involvement of the relevant environmental organisations as stakeholders. Apart from the involvement of the public in the procedure pursuant to the Atomic Energy Act a transboundary environmental impact assessment including involvement of the public took place for the on-site interim storage facilities of Biblis, Grafenrheinfeld, Gundremmingen, Isar, Neckarwestheim, and Philippsburg.

Involvement of the Public

The involvement of the public is an essential part in the early stage of such licensing procedures. The procedure for the involvement of the public in Germany includes the following steps:

- Announcement of the project in the Federal Bulletin and in local daily newspapers
- Laying open the relevant documents to public inspection for a period of two months in order to inform the public about the project. During that period objections can be raised.
- Discussion of the objections with the applicant and the objectors. This is to get to know where a more detailed investigation by the licensing authority may be necessary and thus contributes to the decision making process.

The following documents were laid open to public inspection for a period of two months on site (near the nuclear power plant site) and at the licensing authority BfS:

- Application
- Short description of the project
- Safety report
- Environmental impact assessment
- Landscape conservation support plan (if required).

The objections submitted as single or accumulated objections were structured by BfS as regards their content and assigned to topics, which were then taken as a basis for the agenda of the public hearing. During the public hearing the objections were discussed by the licensing authority with the applicant and those persons who had raised objections in time. Building authorities, experts, and other authorities participated in the public hearing, too. Main points of discussion at the hearings were the following:

- Competence of BfS for the licensing procedure or, respectively, the question whether § 6 or § 7 Atomic Energy Act is the legal basis
- Reliability of the applicants
- Safety of casks, in particular in case of incidents
- Aircraft crash as well as terrorist attacks with large passenger airplanes, in particular after the incidents of September 11, 2001, in the USA.

In some cases the objectors consulted technical or juridical experts to take part in the hearings. Thus, discussions often reached a high level. The objectors positively mentioned the mainly objective atmosphere during the discussions and the good organisation by BfS including the office equipment of the rooms put at the disposal of the objectors.

Table 1 shows some figures in order to get an overview of the public participation in the hearings. About 250,000 objections were raised against the applications. Throughout the 17 public hearings with altogether 63 days of discussion about 1,700 objectors were present. Thus, 0.7 % of those who had raised a written objection also participated in the public hearing. The shortest hearing took 2 days, the longest 7 days. About 0.5 to 2 % of the objectors participated in each hearing. The number of present objectors per hearing varied from 16 to 566.

Table 1: Overview of the public participation in the hearings

Storage facility	Laying out to public inspection		Public hearing	
	Number of objectors	Number of different objection letters	Days of discussion	Number of objectors present at the hearing
SZL Lingen	3,500	12	5	110
IL Neckarwestheim	4,100	81	3	81
IL Philippsburg	5,200	95	4	121
SZL Brokdorf	1,700	30	2	26
IL Brunsbüttel	1,900	13	2	24
SZL Brunsbüttel	2,300	16	2	16
IL Biblis	4,100	36	3	60
SZL Biblis	5,800	43	4	49
SZL Grohnde	9,600	36	3	83
SZL Unterweser	17,400	63	6	138
IL Krümmel	5,900	28	3	37
SZL Krümmel	5,700	34	4	35
SZL Isar	45,500	47	4	114
SZL Grafenrheinfeld	44,500	41	3	67
SZL Gundremmingen	76,000	252	7	566
SZL Neckarwestheim	3,500	27	3	48
SZL Philippsburg	7,800	43	5	97
SZL = Interim storage facility (concrete building) IL = Interim storage area (individual concrete shielding for each cask)				

In addition, involvement of the public and of authorities of the Republic of Austria took place for the six interim storage facilities located in the south of Germany within the scope of a transboundary environmental impact assessment. Other neighbouring countries did not ask for such an involvement in the licensing procedures. A total of 60,000 objections was raised from Austria. A public hearing for Austrian citizens took place on April 9, 2002, in Munich, Germany. Main topics of this hearing were again the possible radiological consequences of a terrorist attack with a large passenger airplane for the territory of Austria.

Storage Concepts

In order to realise the decentralised interim storage concept, the utilities have applied for 13 on-site interim storage facilities and 5 on-site interim storage areas at 13 nuclear power plant sites. The 18 applications were filed between December 1998 and November 2000. In between, applications have been modified and one application for the interim storage facility at Stade was withdrawn in August 2001 due to the planned final shut down of the Stade nuclear power plant in autumn 2003. After discussions with BfS the capacity of the storage facilities applied for has been reduced by the applicants from a total of 18,650 Mg to 14,300 Mg due to the realistic need. The mass of heavy metal applied for varies between 300 Mg and 2,250 Mg for on-site storage facilities and between 120 Mg and 300 Mg for interim storage areas. The number of casks varies between 80 and 192 for interim storage facilities and between 12 and 28 for on-site storage areas [2].

The storage facilities shall be operated for about 40 years, the storage areas for about 5 years. These short-term interim storage areas are necessary for power plants with limited fuel pool capacity in order to bridge the time gap until the on-site storage facilities are in operation and especially to avoid a break of operation for the respective nuclear power plant.

The technical concept of theses facilities is based on dry storage of massive casks. The applications represent three basic concepts: The storage building, the storage tunnel and the interim storage area.

The storage building concept exists in two technical variants [2], the WTI concept and the STEAG concept (see Figure 1).

- STEAG concept (a storage hall designed by the company STEAG encotec GmbH, Essen), with the following characteristics: monolithic building, thick concrete structures (in situ concrete), wall thickness approximately 1.2 m, roof thickness approximately 1.3 m, one-nave building. The STEAG concept has been applied for for the 6 north German sites of Brokdorf, Krümmel, Brunsbüttel, Grohnde, Lingen and Unterweser.

- WTI concept (a storage hall designed by the company of consulting engineers Wissenschaftlich-Technische Ingenieurberatung GmbH, Jülich), hall similar to the centralised storage facilities at Gorleben, Ahaus and Lubmin/Greifswald, with the following characteristics: pillar-/binder-system, separate bed plate, in situ concrete / pre-cast concrete-system, wall thickness approximately 0.7 m or 0.85 m, roof thickness approximately 0.55 m, two-nave building consisting of two halls separated by a wall. The WTI concept has been applied for for the 5 sites of Biblis, Philippsburg, Grafenrheinfeld, Isar and Gundremmingen located in the south of Germany.

For the site of Neckarwestheim, on-site interim storage in two tunnel tubes lined with concrete has been applied for. This special solution below ground was developed due to site-specific conditions, i.e. the limited space inside a former quarry. It has the advantage that the covering rock provides good shielding against radiation. Heat removal is achieved through an exhaust air chimney.

In interim storage areas the storage casks are stored on a defined area on the power plant terrain. In contrast to storage of casks in upright positions in interim storage buildings, horizontal storage of the casks on a concrete support has been applied for. To shield gamma and neutron radiation and as protection against the weather, each cask is covered by prefabricated concrete elements.

Since the only purpose of the interim storage area is to bridge the period until the 40-year on-site storage facility is ready for operation, a small number of casks is characteristic. It has the advantage of a short construction period of about 1 to 2 months in comparison to about 1.5 to 2 years for storage buildings or storage tunnel.

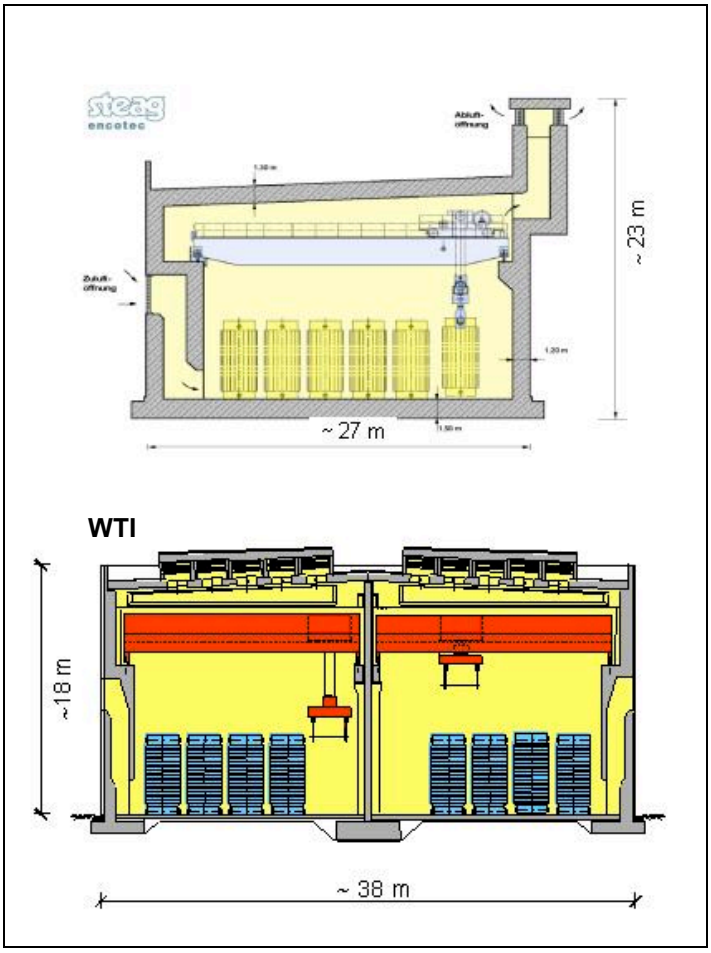

Fig. 1. Concepts for Interim Storage Buildings

Objections regarding ALARA

In Germany the ALARA issue has been implemented in § 6 of the Radiation Protection Ordinance [3] with the duty

- to avoid any unnecessary radiation exposure or contamination of man and environment, and
- to keep every radiation exposure or contamination of man and environment as low as possible below the limits taking into account the state-of-the-art of science and technology and the circumstances of the single case.

Essential points of criticism in the objections were that precaution against damage of the storage casks was regarded to be insufficient, in particular in the case of incidents. After the terrorist attacks of September 11, 2001, the main focus was also on safety in case of a forced air craft crash with large passenger airplanes.

Although not dominating the topics of public involvement, there were quite a few objections regarding the principle of minimisation / optimisation which in the context of this contribution is taken as a synonym for the ALARA principle. This topic was addressed in about 5 % of the 897 objection letters. However, regarding all the different topics in all these objection letters the

relative portion is less than 0.5 %. That means that ALARA expressed in terms of minimisation / optimisation was not a major concern in the German hearings.

Nevertheless, there are some closely related topics that gave rise to criticism. This applies to the different wall thickness of the buildings and the possible implications for radiation shielding and safety in case of an air craft crash. The objectors argued that the WTI concept with a wall thickness of 75 to 85 cm and a roof thickness of 55 cm did not comply with the state-of-the-art of science and technology, which is one of the licensing prerequisites. Especially after the terrorist attacks of September 11, 2001, in the USA, they mentioned that in contrast to WTI the STEAG storage facility has massive walls of 120 cm and a roof thickness of 130 cm and, thus, provides more safety against a forced aircraft crash with large passenger airplanes. In fact, the radiological consequences of such an event were analysed and the calculated radiation exposure turned out to be higher for the WTI facilities. However, with regard to the protection goal of 100 mSv for this type of emergency situation, the calculated effective dose was lower by about 4 orders of magnitude for the WTI and by 6 orders of magnitude for the STEAG facilities. Due to the fact that the storage licence according to § 6 Atomic Energy Act [1] needs to be granted if the licensing prerequisites are fulfilled (that means the applicant has a legal claim to get the licence), BfS was not authorised to modify the concepts applied for, especially in cases with such high safety margins.

The situation for radiation shielding and the resulting dose for the public is similar. It is true that direct radiation of gammas and neutrons is better shielded by thicker walls. However, the concept of dry interim storage of spent fuel implies that the storage building needs openings to provide for sufficient cooling of the casks. Therefore, to some extent, radiation shielding and heat removal from the storage building are conflicting protection goals. The openings in the walls (incoming air) and roofs (exhaust air) of the buildings are non avoidable pathways for scattered radiation, especially in the case of neutrons which normally dominate the radiation field of a spent fuel cask. For this reason, the dose rate in the environment is mainly determined by scattered radiation. A substantial reinforcement of the walls would only have led to a small reduction of the potential effective dose for the public. Bearing in mind the special circumstances of a German licence according to § 6 Atomic Energy Act [1] (legal claim of the applicant, see above) there was again no need for BfS to demand thicker walls in the case of the WTI facilities.

Some objectors also demanded that the casks were to be stored below ground on the basis of the tunnel concept at Neckarwestheim. However, first of all the applicant selects a certain concept, also taking into account economical aspects. The tunnel solution at Neckarwestheim was chosen because of the limited space at the site which is situated inside a former quarry. For other sites with regard to § 6 of the German Radiation Protection Ordinance [3] it was simply disproportionate to demand subsurface storage.

Many objectors also argued that the operation of additional interim storage facilities at the sites of the nuclear power plants would lead to an intolerable accumulation of risks. Thus, an equal and fair distribution of risks was claimed for. This objection is mainly focussed on possible accidents and interferences of the different facilities. Thus, BfS paid special attention to such interferences and their possible radiological consequences which may not be restricted to one facility only. This applies to a turbine rupture, a fall of the chimney possibly caused by aircraft crash, or any explosion on the reactor site. The radiological consequences turned out to be negligible or in many cases no accidental interferences were possible due to sufficient distances.

Especially one single objector asked for a weighing up of the imposed risks to the public by comparing the new concept of on-site interim storage with an ongoing storage of casks at the central storage facilities Gorleben and Ahaus including the necessary transports. Since it was a

political decision of the former German government resulting for the owners of nuclear power plants in a legal duty according to § 9a, Sect. 2 of the Atomic Energy Act [1] to build and operate on-site interim storage facilities, this concept was not called into question by the authorities and such risk balancing was never performed.

The dose-effect relationship for low doses (LNT-hypothesis, linear no threshold) was also called in question by the objectors. The risk of getting cancer as a result of low-dose radiation would generally be considered to be too low, they argued. They mentioned for example studies of Professor Horst Kuni from the university of Marburg yielding radiation weighting factors for neutrons higher by a factor of 300 as compared to the values commonly adopted. Furthermore, the Petkau and bystander effect were taken as arguments for an improper judgement of the dose-effect relationship at low doses. In 1972 the Petkau effect (designated to Dr. Abram Petkau) gave rise to the assumption that low-dose radiation applied over a long period of time causes more cellular damage than the same dose applied in a short time with a correspondingly higher dose rate. According to the bystander effect neighbouring cells are also affected even if they are not directly hit by the radiation.

Especially the bystander effect has been discussed in the German Commission on Radiological Protection (SSK) [4]. They came to the conclusion that the present status of knowledge is not sufficient to give reasons for any changes of the LNT-hypothesis. The SSK did not identify any need for a conceptual modification in the field of radiation protection or for lowering the dose limits of the Radiation Protection Ordinance [3]. This was recently confirmed by the International Commission on Radiological Protection (ICRP) [5]. The commission also noted that since the estimation of nominal cancer risk coefficients is based upon direct human epidemiological data, any contribution from these cellular phenomena would be included in that estimate. Therefore, there was no evidence for BfS to put the existing regulations into question.

Nevertheless, for the nuclear power plant sites in Bavaria the objectors raised the opinion that, due to studies, the occurrence of cancer and leukaemia seems to be higher compared to other regions in Germany. Besides the licensing procedures for the interim storage facilities this was the reason for BfS to initiate a comprehensive nation-wide case-control study under the guidance of the German Childhood Cancer Registry (GCCR) in Mainz.

Conclusions

In the course of 18 public hearings a large variety of topics including ALARA was discussed with the objectors - including stakeholders - and with applicants as well as experts. In the context of this paper ALARA is taken as a synonym for the principle of minimisation and optimisation. This specific topic was addressed in about 5 % of the 897 objection letters. However, regarding all the different topics in all these objection letters the relative portion is less than 0.5 %. That means that ALARA expressed in terms of minimisation and optimisation was not a major concern in the German hearings.

In most of these cases the objectors raised the opinion that the principle of minimisation and optimisation is generally not fulfilled. They felt themselves to be exposed to an undue burden or risk that had not been balanced with other alternatives than the operation of on-site interim storage facilities. Sometimes the objectors made proposals how to modify the facilities (i.e. thicker walls) or to change the concept of on-site interim storage in general and they gave reasonable justifications for it. However, in many cases their criticism was unspecified so that it was difficult for BfS to deal with it. Nevertheless, if it was possible, BfS summarised all the objections in a condensed form in the license followed by an evaluation by BfS. Separated from

this, BfS took care of the implementation of the ALARA principle in the licensing procedures according to § 6 of the Radiation Protection Ordinance [3].

In this paper some special topics, although not labelled with minimisation or optimisation, were discussed because they are somehow connected with the ALARA principle. This applies to the different wall thicknesses, the possible accumulation of risks by interference of the interim storage facility with the nuclear power plant, and the questioning of the LNT-hypothesis. These types of objections had an objective basis and were dealt with by BfS in the above mentioned way. As a result, no conceptual changes were necessary and /or there was no legal basis for BfS to demand further improvements.

It is a matter of fact that usually the objectors feel more emotionally involved compared to the other participants because they are afraid of damage and negative health effects. Furthermore, despite the high level of discussion in some cases, the objectors and stakeholders will probably not have the scientific knowledge in the field of radiation protection and not be familiar with safety assessments and the fulfilment of the licensing prerequisites. Both may lead to a discussion on different levels that should be avoided. Since the licence is written rather on a technical than an emotional basis it is of decisive importance to provide sufficient transparency in the decision making process. This will be, for example, a special challenge for the stakeholder involvement in the course of the site selection process for a repository.

Decisions are not commonly agreed when doubts arise regarding a fair balancing of interests.

References

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[5] Draft Recommendations of the International Commission on Radiological Protection, URL: <http://www.icrp.org/docs/ICRP_Recs_02_276_06_web_cons_5_June.pdf>