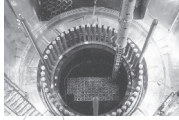


# ilk

**INTERNATIONALE  
LÄNDERKOMMISSION  
KERntechnik**

Baden-Württemberg · Bayern



## **ILK Statement**

**on the "Safety Requirements Governing the Final Disposal  
of Heat-Generating Radioactive Waste"**

*Für deutsche Fassung bitte umdrehen!*

**July 2009  
No.: ILK-33 E**

## Foreword

The International Committee on Nuclear Technology (Internationale Länderkommission Kerntechnik, ILK) was established in October 1999 and since 2009 it is carried by the German states of Baden-Württemberg and Bavaria. It currently consists of 9 scientists and experts from Finland, France, Germany, Switzerland and USA. The ILK acts as an independent and objective advisory body to the two German states on issues related to the safety of nuclear facilities, radioactive waste management and the risk assessment of the use of nuclear power. In this capacity, the Committee's main goal is to contribute to the maintenance and further development of the high, internationally recognised level of safety of nuclear power plants in the southern part of Germany.

The ILK has already addressed the disposal of radioactive waste on several occasions, lastly in its recommendation on the revitalization of the repository projects Gorleben and Konrad (ILK-25) from November 2005 and in its statement on a BMU document on site selection (ILK-30) from July 2007. In view of the latest BMU publication „*Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste*” the ILK has again deliberated this topic. In the current publication, which was adopted at the 53<sup>rd</sup> ILK meeting held on July 28<sup>th</sup>, 2009 in Frankfurt, the ILK presents the results of its deliberations. The ILK regards the protection target chosen by BMU and the proposed container service lifetime to require further discussion. In the view of the ILK, these safety requirements should be based on the best state of technical and scientific knowledge and should be jointly adopted by the Federation and the Länder.

The chairman



Dr.-Ing. Erwin Lindauer

Foreword	2
1 Introduction and Background	4
2 Legal Status of the Safety Requirements	5
3 Technical Objections	6
3.1 Protection target	6
3.2 Container service lifetime	8
4 Summary	10
5 Bibliography	11
ILK Members	13
ILK Publications	14

### ILK - Geschäftsstelle beim Bayerischen Landesamt für Umwelt

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

## 1 Introduction and Background

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, BMU) has long held the belief in the necessity of updating the „Safety criteria for the disposal of radioactive wastes in a mine“ [1] to the current state-of-the-art in science and technology. This paper had been published in the Federal Gazette in 1983 by the then responsible Federal Ministry of the Interior (Bundesministerium des Innern, BMI).

- In the years 2002, 2003 and 2007, Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) was commissioned by BMU to prepare drafts [2,3,4].
- BMU prompted its two nuclear advisory committees, namely Reactor Safety Commission (Reaktor-Sicherheitskommission, RSK) and Radiation Protection Commission (Strahlenschutzkommission, SSK) to prepare a statement on the latest draft by GRS. This joint statement by both commissions was adopted in July 2008 [5]. It contains a number of recommendations.
- Finally, BMU published its „Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste“ on July 29, 2008 [6], marked as “Draft”. This draft was heavily criticized in expert circles, such as, amongst others, at the „Endlagersymposium 2008 (“Repository Symposium 2008“) of BMU.
- In June 2008, BMU founded a third commission next to the two already existing ones, RSK and SSK, namely the Nuclear Waste Management Commission (Entsorgungskommission, ESK). ESK’s task is to advise BMU in all matters concerning nuclear waste management, including disposal of radioactive waste in deep geological formations.

One of the first tasks given to ESK by BMU in September 2008 was to prepare a statement on BMU’s Safety Requirements Draft. ESK adopted its statement on this topic on January 29, 2009 [7]. In this very detailed statement, ESK follows the main demands made by RSK/SSK and raises further ones.

- Following further internal deliberations, BMU finally published Revision 1 of its draft „Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste“ on March 18, 2009 on its website [8]. This Revision 1 took many of the comments and suggestions into account that had accumulated in the meantime.
- The question remained open in which way BMU intended to enforce the Safety Requirements. No agreement was reached on this matter with the Länder.

- Despite conflicting interpretations by many involved parties, BMU lastly published the „Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste“ [9] on July 15, 2009, on its website.

## 2 Legal Status of the Safety Requirements

The objective of the Safety Requirements is to create legal clarity on the standards to be applied to the licensing of a repository for all participants involved in the licensing process, particularly for the license applicant and the licensing authority.

The Federal Office for Radiation Protection (Bundesamt für Strahlenschutz, BfS), a higher federal agency subordinate to the BMU, is the license applicant. BMU is in a position to issue instructions to BfS at any time. Formally, BMU does not need to coordinate its activities with any other institution. Factually, however, due to the significance of the topic, it would be advisable if agreement existed both within the Federal Government as well as between the Federal Government and the Länder. At least as far as the Länder are concerned, this is not the case.

The relevant ministry of the Land in which the envisaged repository is to be located, will be the licensing authority. BMU cannot unilaterally prescribe general requirements to the Land. German law provides various possibilities for determining requirements that are generally valid; all of these require approval by the Länder. Thus, then as now there are no binding requirements for the licensing authority. Instead, open disagreement exists between BMU and the Länder on this issue.

Evidently, BMU takes a similar view. In its press release on the publication of the Requirements on July 15, 2009 [10], it mentions a „planning basis for the BfS“. Also, in the supplementary information accompanying the press release [11], it mentions „new standards for the BfS concerning planning a repository“. In this supplementary information, it even describes its paper as „BMU-Draft on the Safety Requirements“. Accordingly, the BMU Safety Requirements have not been published in the Federal Gazette nor in the Joint Ministerial Gazette, but only on the BMU website.

Irrelevant from a legal perspective but interesting in terms of content is the fact that BMU deviates on important issues from the recommendations made by its own advisory bodies RSK, SSK and ESK. In [11], in which BMU outlines the evolution of

its draft, the opinion given by ESK – which had been especially set up for nuclear waste management issues – is not even mentioned.

### 3 Technical Objections

In particular, ILK regards the following two points in the last version of the Safety Requirements to require further discussion and improvement:

- 3.1 the chosen protection target
- 3.2 the proposed container service lifetime

#### 3.1 Protection target

RSK and SSK, in their joint statement of July 2008 [5] made the following recommendations under the header „Radiological Assessment Standards“:

*„In agreement with its statement dating from 2002, RSK and SSK recommend basing the validation criteria „Effective Individual Dose“ on a value of 0.1 mSv per year for probable developments and suggest a value of 1 mSv per year for less probable developments. It follows from the protection targets that the design of the repository ensures the same level of protection for future generations as for people living today. Consequently, the less probable developments will at most lead to a value of 1 mSv for the effective individual dose. This value corresponds to the customary current limit values for the annual radiation exposure of the population resulting from nuclear facilities. However, since the design of the repository and the selection of its site are to be performed in such a manner that these requirements are surpassed, the probable developments for the repository should not exceed the value of 0.1 mSv per year. Taking into consideration the bandwidth of today’s naturally occurring radiation exposure, this value seems appropriate.“ (Translation by ILK)*

The newly founded ESK fully subscribed to the RSK/SSK recommendation concerning this point in its own statement dated January 2009 [7]. In chapter 6.7 „Protection Criteria“, ESK made the following statement, under the heading „Assessment“:

*„In this regard, ESK also points out that the limit value determined in the BMU-draft for probable developments...leads to a limitation of the annual dose of about 0.025 mSv. This value is by a factor of 4 lower than the value*

*recommended by RSK and SSK of 0.1 mSv per year. The ESK recommends retaining the RSK/SSK value from 2008.“ (Translation by ILK)*

Despite these clear-cut recommendations, the Ministry adhered to its original risk-oriented protection target for the disposal of heat-generating radioactive waste. Thus, in its last version of the Safety Requirements [9], in Chapter 6 „Protection from damage caused by ionising radiation“, it reads under section 6.2:

*„For the post-operational phase, evidence must be provided that the additional risk to humans associated with the final repository of suffering serious health damage during their lifetime from the release of minimal quantities of radionuclides from the isolating rock zone is less than  $10^{-4}$  for all probable developments. This risk refers to individuals with a lifetime of exposure, whereby the calculation of “lifetime” is based on current life expectancy figures.“*

BMU justifies its proposal by calling on a reference value by the World Health Organization (WHO) for limit values of hazardous materials in drinking water. In ILK’s opinion, this analogy is invalid. In the case of drinking water, the concern is with a known existing contamination the impact of which is to be limited. This cannot be equated with a load that may only possibly arise in the future whose magnitude is assessed on a conservative basis (the „probable development“ over the course of 1 million years is assumed to happen at the most unfavorable point in time, all parameters are determined in a conservative way, etc.).

Tightening the protection target does not add more safety. The safety of a repository is based on having features for isolating and retaining radioactive materials so that any possibly occurring releases are negligible at most. It is thus crucial that the existence of these features can be proven in a verifiable way. The demand that any releases should be harmless is sufficiently accounted for by RSK’s and SSK’s suggestion for the upper limit of quantitative dose analyses: It sets a protection target that is more restrictive for the entire period of observation than the requirements of the Radiation Protection Ordinance (Strahlenschutzverordnung, StrlSchV) for today’s population.

An international comparison does not show a uniform approach:

- Sweden has suggested a protection target that is comparable to the BMU one using a damage probability of  $10^{-6}$  per year for the individual [12].
- Switzerland, with its demand for an individual dose of 0.1 mSv per year for each probable development, follows the value given by RSK and SSK [13].

- France and the US differentiate between the first 10,000 years and the time beyond this period. France laid down a value of 0.25 mSv per year for the individual dose for both periods. This value constitutes a requirement for the first period and a reference value for the second period [14]. The US demands 0.15 mSv per year for the first period, and 1 mSv per year for the second [15].

ILK believes that the value of 0.1 mSv per year suggested by RSK and SSK prescribes a sufficiently conservative limit. It supports this proposal. An international comparison does not indicate any necessity for a lower value.

### 3.2 Container service lifetime

In the first published version of BMU's Safety Requirements [6], the following demand was originally made under section 8.3.7 „Proof of quality for waste containers“:

*„The waste containers must offer a sufficient level of stability and corrosion resistance that containment of the solid waste against probable and extraordinary developments is guaranteed for a period of at least 500 years.“*

This demand by BMU led to strong debates among all participants during the discussion on Safety Requirements. Section 8.6 of the last version [9] has now been worded as follows:

*„Waste containers must fulfil the following safety functions, with due regard for the waste products packaged therein and the backfill surrounding them:*

- *For probable developments, handleability of the waste containers must still be guaranteed after 500 years in case of salvage from the decommissioned and sealed final repository. Care should be taken to avoid the release of radioactive aerosols.“*

The following comments apply to this:

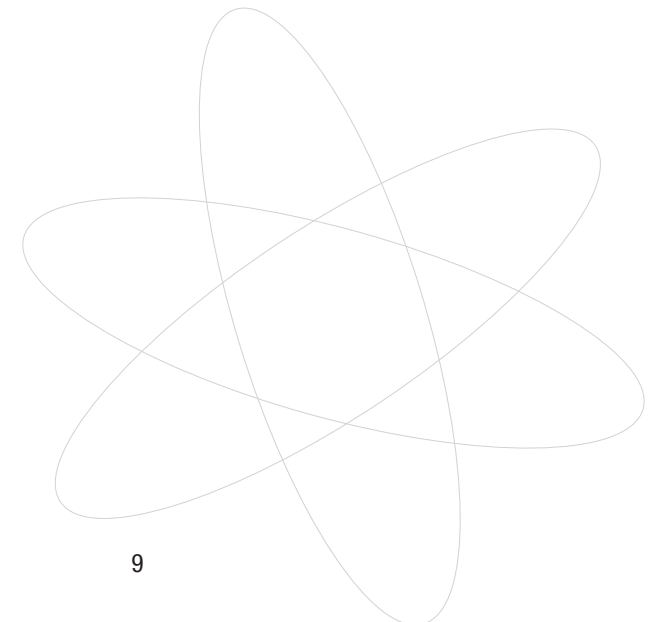
- The term „salvage“ (German: „Bergung“) was newly introduced by BMU. It is not found either in the definition of terms of the Safety Requirements [9] nor in those of the Atomic Energy Act (Atomgesetz, AtG), the Radiation Protection Ordinance (StrlSchV) and neither in the acceptance criteria of the BfS for the Konrad repository [16] that is under construction. It thus remains unclear what exactly BMU means by „salvage“.

- The above-mentioned demand in section 8.6 contradicts the approach to safety philosophy taken by the Safety Requirements. The latter aims to promptly emplace the waste, to backfill the emplacement areas and to reliably seal them off from the remaining mine building (section 8.5). In section 4.6 of the Safety Requirements [9], the following is called for:

*„The final repository shall be constructed and operated in such a way that no intervention or maintenance work is required during the post-operational phase to ensure the reliable long-term containment of the radioactive waste in the isolating rock zone.“*

- Additionally, the choice of a time period of 500 years is not justified anywhere.

Therefore, there is no technical justification for a salvage of waste containers after sealing the repository. Within a comprehensive and internally consistent safety philosophy, BMU should completely delete this demand from section 8.6 during the further revision of the Safety Requirements that continues to be necessary.



#### 4 Summary

After a convoluted history, BMU published the new „Safety Requirements on the Final Disposal of Heat-Generating Radioactive Waste“ on July 15, 2009. In its view, these constitute the „Final version of the Federal Environmental Ministry“ [9].

The Safety Requirements have not been agreed upon with the Länder; they represent a directive by BMU to BfS.

Several technical issues and determinations of the Safety Requirements were not exhaustively discussed in terms of content.

In summary, publication of these Requirements does not provide a basis for progress in the disposal of high-level radioactive waste.

In ILK's view, safety requirements for the disposal of high-level radioactive waste are necessary so that all participants in the licensing procedure as well as the general public are clearly informed about what standards are to be applied. These requirements should be based on the best state of technical and scientific knowledge and should be jointly adopted by the Federation and the Länder.

#### 5 Bibliography

- [1] Bundesminister des Innern (BMI): „*Safety criteria for the disposal of radioactive wastes in a mine*“, publication of German original: Bundesanzeiger, January 5<sup>th</sup> 1983, S. 45 – 46
- [2] Gesellschaft für Anlagen- und Reaktorsicherheit (GRS): „*Sicherheitskriterien für die Endlagerung radioaktiver Abfälle in einem Bergwerk – Aktualisierte Diskussionsgrundlage* –“, GRS-A-2990, January 2002
- [3] Gesellschaft für Anlagen- und Reaktorsicherheit (GRS): „*Sicherheitskriterien für die Endlagerung radioaktiver Abfälle in einem Bergwerk – Vorschlag der GRS* –“, GRS-A-3110, April 2003
- [4] Gesellschaft für Anlagen- und Reaktorsicherheit (GRS): „*Sicherheitsanforderungen an die Endlagerung hochradioaktiver Abfälle in tiefen geologischen Formationen – Entwurf der GRS*“, GRS-A-3358, Januar 2007
- [5] Reaktor-Sicherheitskommission (RSK) and Strahlenschutzkommission (SSK): „*Gemeinsame Stellungnahme der RSK und der SSK zum GRS-Bericht „Sicherheitsanforderungen an die Endlagerung hochaktiver Abfälle in tiefen geologischen Formationen*“, Bonn, May 9<sup>th</sup> 2008 / July 3<sup>rd</sup> 2008
- [6] Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU): „*Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste – Draft* –“, Bonn, July 29<sup>th</sup> 2008
- [7] Entsorgungskommission (ESK): „*Stellungnahme zum Entwurf des BMU „Sicherheitsanforderungen an die Endlagerung wärmeentwickelnder radioaktiver Abfälle*“, Bonn, January 29<sup>th</sup> 2009
- [8] Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU): „*Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste*“ - Draft: Revision 1 – Bonn, March 18<sup>th</sup> 2009
- [9] Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU): „*Safety Requirements Governing the Final Disposal of Heat-Generating Radioactive Waste*“, Berlin, July 2009, Final version by BMU  
[http://www.bmu.de/files/pdfs/allgemein/application/pdf/endaussage\\_sicherheitsanforderungen\\_en.pdf](http://www.bmu.de/files/pdfs/allgemein/application/pdf/endaussage_sicherheitsanforderungen_en.pdf)

- [10] Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU): „Gabriel setzt neue Sicherheitsmaßstäbe für ein Atommüllendlager“ – BMU-Pressemitteilung Nr. 240/09, Berlin, July 15<sup>th</sup> 2009  
[http://www.bmu.de/pressemitteilungen/aktuelle\\_pressemitteilungen/pm/44587.php](http://www.bmu.de/pressemitteilungen/aktuelle_pressemitteilungen/pm/44587.php) (in German)
- [11] Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU): „Sicherheitsanforderungen an die Endlagerung wärmeentwickelnder radioaktiver Abfälle“ – Hintergrund: Sicherheitsanforderungen  
[http://www.bmu.de/atomenergie\\_ver\\_und\\_entsorgung/endlagerung/sicherheitsanforderungen/doc/39745.php](http://www.bmu.de/atomenergie_ver_und_entsorgung/endlagerung/sicherheitsanforderungen/doc/39745.php) (in German)
- [12] Swedish Radiation Protection Agency: „The Swedish Radiation Protection Authority’s guidelines on the application of the regulations (SSI FS 1998:1) concerning protection of human health and the environment in connection with the final management of spent nuclear fuel and nuclear waste“ – SSI FS 2005:5, September 5<sup>th</sup> 2005
- [13] Eidgenössisches Nuklearsicherheitsinspektorat (ENSI): „Spezifische Auslegungsgrundsätze für geologische Tiefenlager und Anforderungen an den Sicherheitsnachweis“ – Richtlinie für die schweizerischen Kernanlagen, ENSI-G03, April 2009
- [14] Règles Fondamentales de Sûreté Relatives aux Installations Nucléaires de Base autre que Réacteurs : « RÈGLE No. III.2.f : Stockage Définitif de Déchets Radioactifs en Formation Géologique Profonde » - 10 juin 1991, 470 – 480
- [15] United States Environmental Protection Agency: “Public Health and Environmental Radiation Protection Standards for Yucca Mountain, Nevada; Final Rule” – 40 CFR Part 197, Federal Register / Vol. 73, No. 200, Wednesday October 15, 2008, 61256 – 61289
- [16] Bundesamt für Strahlenschutz (BfS): „Anforderungen an endzulagernde radioaktive Abfälle (Endlagerungsbedingungen), Stand: Dezember 1995 – Schachanlage Konrad –“ ET-IB-79, Salzgitter, December 1995

1. **Prof. Dr. George Apostolakis, USA**  
Professor of Nuclear Engineering and of Engineering Systems at the Massachusetts Institute of Technology (MIT) in Cambridge, USA
2. **Prof. Dr. phil., Dr.-Ing. E.h. Adolf Birkhofer, Germany**  
Managing Director of the ISaR Institute for Safety and Reliability GmbH  
Former Chair for Reactor Dynamics and Reactor Safety at the Technical University of Munich
3. **Jean-Claude Chevallon, France**  
Former Vice President “Nuclear Power Generation” at EDF, France
4. **Prof. Dr.-Ing. habil. Hans Dieter Fischer, Germany**  
Holder of the Chair for Communication Theory at the Ruhr-University Bochum
5. **Prof. Dr. rer. nat. habil. Winfried Hacker, Germany**  
Former Professor for General Psychology at the Technical University of Dresden
6. **Prof. Dr.-Ing. Klaus Kühn, Germany**  
Former Director of the gsf - Institut für Tieflagerung  
("Institute for Underground Disposal")  
Professor at the Technical University of Clausthal
7. **Dr.-Ing. Erwin Lindauer, Germany (Chairman)**  
Former Chief Executive Officer of the GfS Gesellschaft für Simulatorschulung mbH  
Former Chief Executive Officer of the KSG Kraftwerks-Simulator-Gesellschaft mbH
8. **Dr. Serge Prêtre, Switzerland (Vice Chairman)**  
Former Director of the Swiss Nuclear Safety Inspectorate (HSK)  
Chairman of the ILK from December 2000 to January 2006
9. **Antero Tamminen, Finland**  
Former long-time Technical Manager at Loviisa NPP, Finland

(Members are listed in alphabetical order)

- ILK-01** ILK Statement on the Transportation of Spent Fuel Elements and Vitrified High Level Waste (July 2000)
- ILK-02** ILK Statement on the Final Storage of Radioactive Waste (July 2000)
- ILK-03** ILK Statement on the Safety of Nuclear Energy Utilisation in Germany (July 2000)
- ILK-04** ILK Recommendations on the Use of Probabilistic Safety Assessments in Nuclear Licensing and Supervision Processes (May 2001)
- ILK-05** ILK Recommendation on the Promotion of International Technical and Scientific Contacts of the Nuclear Safety Authorities of the German States (October 2001)
- ILK-06** ILK Statement on the Draft Amendment dating from July 5, 2001 to the Atomic Energy Act (October 2001)
- ILK-07** ILK Statement on Reprocessing of Spent Fuel Elements (November 2001)
- ILK-08** ILK Statement on the Potential Suitability of the Gorleben Site as a Deep Repository for Radioactive Waste (January 2002)
- ILK-09** ILK Statement on the General Conclusions Drawn from the KKP 2 Incidents associated with the Refueling Outage of 2001 (May 2002)
- ILK-10** ILK Statement on the Handling of the GRS Catalog of Questions on the "Practice of Safety Management in German Nuclear Power Plants" (July 2002)
- ILK-11** ILK Recommendation on Performing International Reviews in the Field of Nuclear Safety in Germany (September 2002)
- ILK-12** Internal ILK-Report on the Intentional Crash of Commercial Airlines on Nuclear Power Plants (March 2003)
- ILK-13** ILK Statement on the Proposals for EU Council Directives on Nuclear Safety and on Radioactive Waste Management (May 2003)
- ILK-14** ILK Statement on the Recommendations of the Committee on a Selection Procedure for Repository Sites (AkEnd) (September 2003)
- ILK-15** ILK Recommendation on the Avoidance of Dependent Failures of Digital I&C Protection Systems (September 2003)
- ILK-16** ILK Statement on Sustainability Evaluation of Nuclear Energy and other Electricity Supply Technologies (January 2004)
- ILK-17** ILK Statement on Maintaining Competence in the Field of Nuclear Engineering in Germany (March 2004)
- ILK-18** ILK Summary Report of the 2<sup>nd</sup> International ILK Symposium „Harmonisation of Nuclear Safety Approaches – A Chance for Achieving more Transparency and Effectiveness?“ (May 2004)

- ILK-19** ILK Statement on the Regulator's Management of the Licensee Self-Assessments of Safety Culture (January 2005)
- ILK-20** ILK Statement on Requirements on Anticipated Transients without Scram (ATWS) (March 2005)
- ILK-21** ILK-Report: Summary of the International ILK Workshop „Sustainability“ (May 2005)
- ILK-22** ILK Recommendations on Requirements on Updated General Nuclear Regulatory Guidelines in Germany (July 2005)
- ILK-23** ILK Statement on determining Operating Periods for Nuclear Power Plants in Germany (September 2005)
- ILK-24** ILK Statement on the Utilization of Nuclear Energy in Germany (November 2005)
- ILK-25** ILK Recommendation on the Revitalisation of the Repository Projects Gorleben and Konrad (November 2005)
- ILK-26** ILK Statement on the Impacts of the Chernobyl Accident – An Inventory after 20 years (January 2006)
- ILK-27** ILK Recommendations on the Further Development of Periodic Safety Reviews in Germany (November 2006)
- ILK-28** ILK Report on the Assessment of Nuclear Oversight Activities of the Ministry of Environment, Baden-Württemberg (December 2006)
- ILK-29** ILK Statement on BMU Project „Update of Nuclear Regulatory Guidelines“ (June 2007)
- ILK-30** ILK-Statement on BMU Paper „Taking on Responsibility: Implementing the Consensus Agreement on Final Disposal“ (July 2007)
- ILK-31** ILK Statement on Fundamental Safety Requirements for Nuclear Power Plants (September 2008)
- ILK-32** ILK Statement: Safety Management in Nuclear Power Plants – Status and necessary Requirements for Development (April 2009)
  - CD with presentations held at the ILK Symposium "Opportunities and Risks of Nuclear Power" in April 2001
  - Proceedings of presentations held at the 2<sup>nd</sup> ILK Symposium "Harmonisation of Nuclear Safety Approaches – A Chance for Achieving more Transparency and Effectiveness?" in October 2003