IAEA Workshop on Managing Nuclear Knowledge

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The German Approach to Nuclear Knowledge Management

Federal Office for Radiation Protection

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The German Situation - Trends and Facts `80 to `90

- since 1980: Stagnation in electricity consumption
- since 1990: decline of industrial production in Eastern Germany
- last NPP construction in begun in 1980 (grid connection 1989)
- Chernobyl and TMI accidents

Consequences of this general development:

- concentration process in industry, reduced job perspectives
- growing negative public attitude towards nuclear in general
- reorientation of main research centers (FZK, FZJ)
- nuclear sciences attract less students and funds
- at universities and research facilities

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The German Situation - Nuclear Phase out Decision

— **October 1998: Federal Elections**

- **Red-green coalition: Political goal to phase out of nuclear power**

— **June 2000: Phase out agreement between government and utilities**

- **Nuclear power plant lifetime limitation (roughly 32 years)**

— **July 2002: Federal Act on the regulated termination of nuclear power**

- **Cap on future electricity production by nuclear power plants**
- **Phase out will be complete around 2020**
- **No new licenses for nuclear power plants**

The German Situation - Problems faced

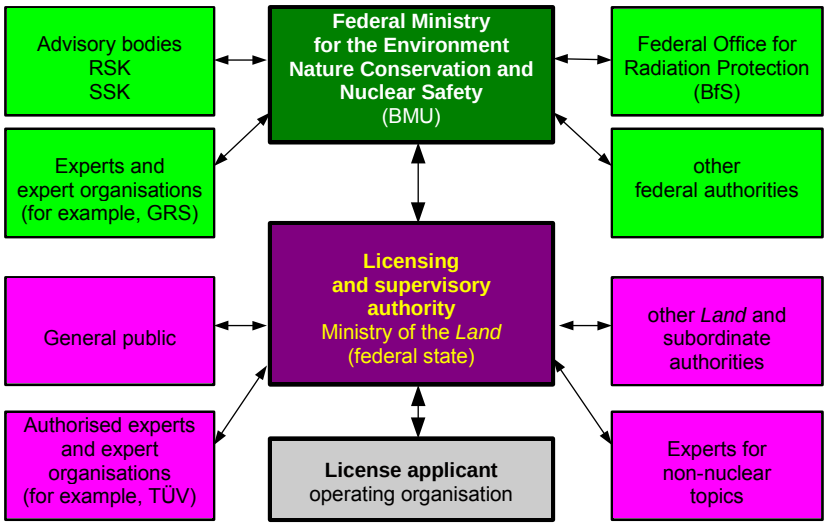
— **Replacement of retired experienced regulators**

- **1,5% reduction of personnel per year**
- **regulators and TSOs recruit mainly from universities**
- **fewer students with a university degree in nuclear sciences**
- **declining university research -> declining practical experience**

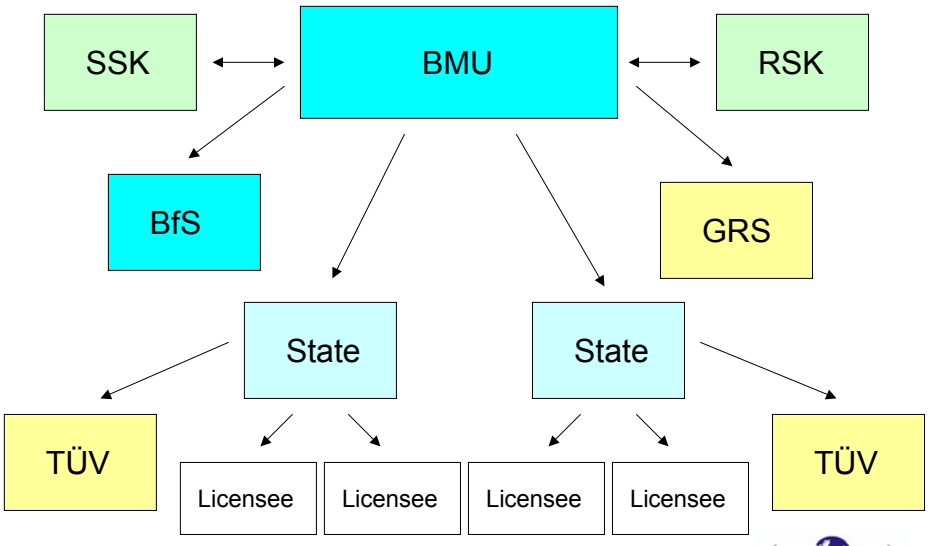
— **Federal regulatory system (State authorities, Federal authorities)**

- **each State authority requires the full regulatory spectrum**
- **strong reliance on TSOs (Federal level: GRS, State level: TÜVs)**
- **knowledge management activities are difficult to coordinate**

The German Situation - Nuclear Administration



The German Situation - Nuclear Administration



How does the Regulatory Body act?

— **Diminishing research activities**

→ **„Evaluation Committee“**

→ **„Nuclear Technology Competency Pool“**

— **Maintaining Expert Knowledge at Regulator and TSOs**

→ **Encourage Knowledge Management at TSOs (SR 2400)**

→ **Courses at TSOs and Regulator (SR 2484, TÜV Academy)**

→ **Integrated Information Management (BMU RS-Portal)**

→ **Competence loss analysis (BMU, BfS, State Authorities)**

— **Complicated Administrative Structure**

→ **Concentration: Federal to Centralized (Kienbaum Report)**

Nuclear Technology Competency Pool - Initiative

Continuing need for nuclear competence until at least 2030 recognized

— **October 1999: German Government appoints „Evaluation Committee“**

Main Objectives:

- **reassess the nuclear research program (new priorities!?)**
- **assess the current staff situation and mid-term staff requirements in the nuclear research facilities**
- **formulate recommendations to maintain the necessary research capabilities in the fields of nuclear safety and waste disposal**

— **January 2000: Committee Recommendations**

- **(among others): establish a nuclear technology competency pool**

Nuclear Technology Competency Pool

- March 2000: Nuclear technology competency pool founded
- Permanent members:
  - Research Centre Karlsruhe (FZK)
  - Research Centre Jülich (FZJ)
  - Research Centre Rossendorf (FZR)
  - Gesellschaft für Anlagen- und Reaktorsicherheit (GRS)
- Two meetings per year with participants from
  - other institutions (MPA, BGR, ITU, research coordinators)
  - BMWA, BMBF, BMU as permanent observers

Nuclear Technology Competency Pool - Objectives

- Monitor educational and job related trends
  - identify future demands with regard to nuclear work force
  - compare estimated demand with projected output of students
- Provide research opportunities for qualified students
  - Secure a pool of qualified students for Regulators and TSOs
- Promote cooperation betw Research Centres, TSOs and Universities
  - Secure capability to identify State of the Art in nuclear technology
- Coordinate publicly financed nuclear research activities
  - Advance State of the Art in nuclear safety and waste disposal
- Intensify the international cooperation

Nuclear Technology Competency Pool - Jobs

— year 2000: roughly 16 500 jobs in the Nuclear Sector
- 7 000 jobs requiring a University Degree
  - 1 250 at Nuclear Power Plants
  - 3 500 in Nuclear Industry
  - 1 350 in Regulatory Body and TSOs
  - 750 in Nuclear Research
  - 100 in International Organisations

— year 2010: estimated 13 000 remaining jobs in the Nuclear Sector
- 6 250 jobs requiring a University Degree

⇨ 1 700 new personnel required until 2010

(1000 in industry, 300 at Regulator/TSO)

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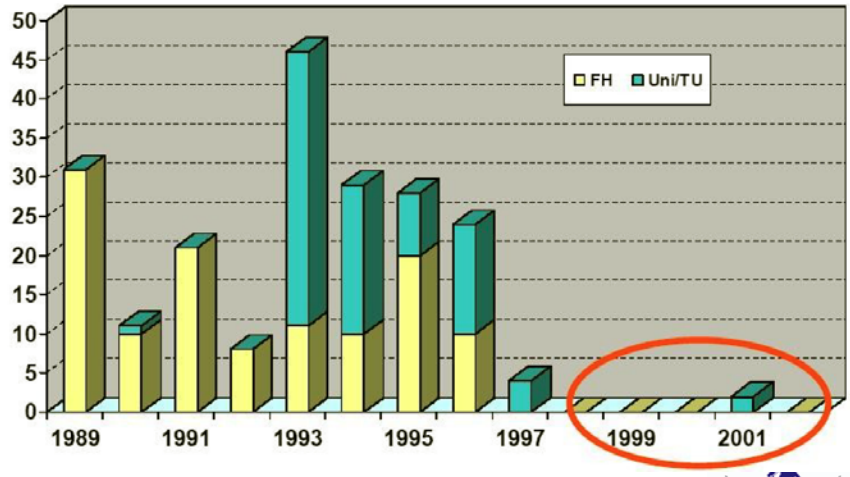
Nuclear Technology Competency Pool - Education

Diploma in nuclear academics



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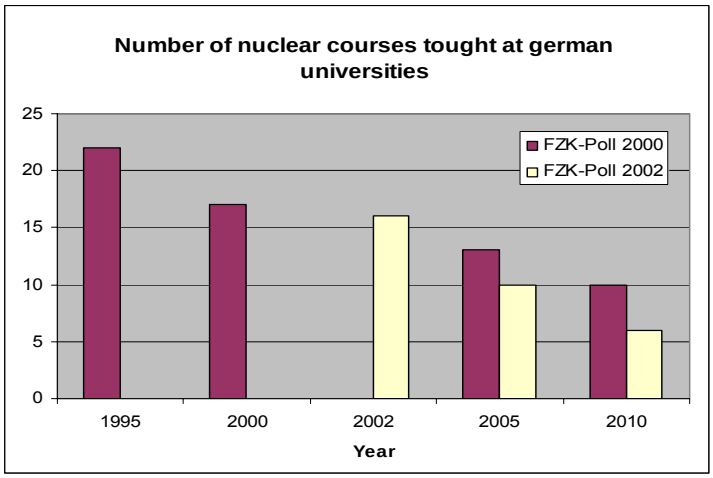
Nuclear Technology Competency Pool - Education



Nuclear Technology Competency Pool - First Results

— **PhD-Program**

- **Two Virtual Institutes / Platforms (FZK, FZJ, 5 universities)**
  +8 PhD, +2 assistants
- **Industry Mentorship (Frameatome ANP, RWE, EnBW)**
  +7 PhD
- **Meeting March 2005: total of 40 PhD students (28 talks)**

— **Activities of Utilities and Industry**

- **Young generation network**
  annual meeting of students and young nuclear scientists
  (2004: 70 participants)

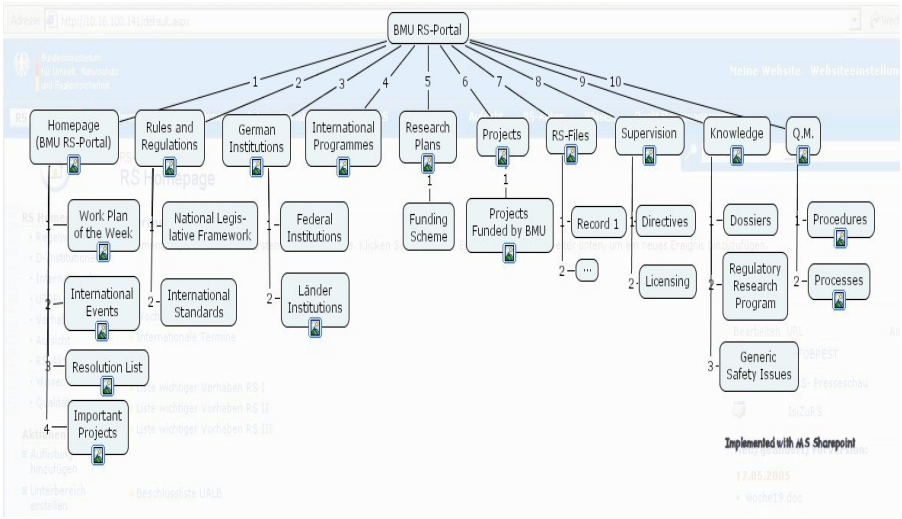
Maintaining Expert Knowledge at Regulator / TSO

- Training of beginners and advanced training for experienced staff
  - Seminars and lectures on topics of nuclear safety, for instance:
    - Safety concept of nuclear power plants
    - incidents, design basis accidents and accident progression
    - fundamentals of radiological protection
  - Coordinated and intensified training program (2004: SR 2484)
- Knowledge Management
  - Compilation of relevant information (-> RS-Portal)
  - Effective coordination of regulatory research
    (regulatory research program, State of the Art reports)
- Delegation of regulatory tasks to expert organisations (TSOs)

The German RS Portal - Contents and Functions

- Intranet and Sharepoint Portal systems
  - RS (Reactor Safety) Portal (for Regulator - BMU)
  - GRS Portal (for TSO - GRS)
- Nuclear Information Management (under construction)
  - Databases (> 50)
  - German Nuclear Legislation (Laws, Ordinances, Jurisdiction)
  - German Safety Standards (RSK, KTA)
  - International Safety Standards (IAEA)
  - Generic Safety Issues (GESI) Database
- Knowledge Management (future)
  - Ontologies
  - Process Oriented Approach
    analyse regulatory processes
    capture knowledge where it is produced

The German RS Portal - Contents and Functions

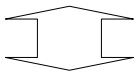


GESI Database (Generic Safety Issues) - Objectives

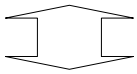
- Identification of generic safety issues with relevance for German NPPs
- Considerations of new findings in other countries
- Assessment with respect to relevance to German NPPs
- Information of the regulator regarding new safety issues early on
- Detailed analysis of important issues
- Definitions of areas for future regulatory research activities

GESI Database (Generic Safety Issues) - Scope

— **BMU / GRS Top 10**
- **update regulations**
- **terrorist impact and protection measures**
- **boron dilution**
- **high burn-up fuels**
- **ATWS**
- **...**



— **Structure of GESI database (TecDoc 1044)**



— **OECD / NEA resolution of key safety issues 2004**

GESI Database (Generic Safety Issues) - Sources

— **General Idea:**
- **collect generic safety issues from various sources**
- **assess applicability to German NPP and classify their importance**
- **provide the actual status with links to related papers, guidelines, etc.**

— **Sources of Information:**
- **IAEA TecDoc 1044**
  “GSI for NPPs with LWR and Measures taken for their Resolution”
- **NUREG-933 / USA**
- **Affaires Parc and Analyses Parc / France**
- **Insights from international cooperation**
- **German operating experience**

GESI Database (Generic Safety Issues) - Content

— **270 Generic Safety Issues**

- **137 GSI from IAEA TecDoc 1044**
- **15 High Priority GSI**
- **boron dilution**

— **Structure of Database**

- **Level 1: Issue Code (Countries, groups of significance)**
- **Level 2: Information on the issue**
- **Level 3a: Assessment of relevance for German NPP**
- **Level 3b: Additional information**

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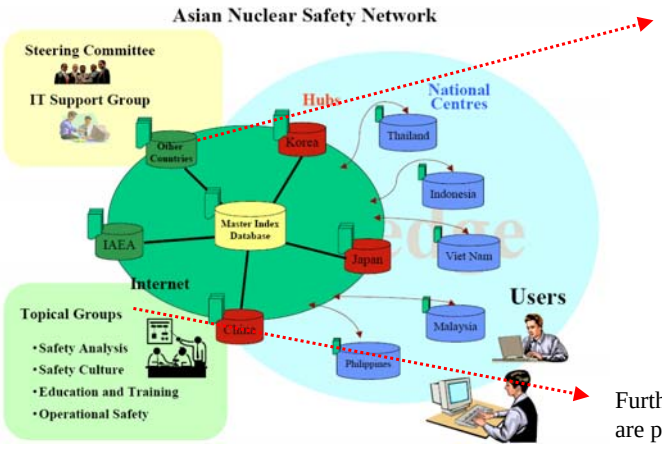
Asian Nuclear Safety Network



Australia
France
Germany
Russia
Spain
USA

Further Topical Groups are planned

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Knowledge Management in Germany - Conclusions

- **Many ongoing activities to expand nuclear Information and Knowledge Management at all levels**
  - **Federal Regulator (BMU)**
  - **Research Centers and Universities (BMBF, BMWA)**
  - **State Authorities**
  - **TSOs (GRS / TÜV)**
  - **Utilities, Manufacturer**
- **Activities are difficult to coordinate**
  - **complicated regulatory structure in Germany**
  - **many stakeholders (organisational freedom!)**
- **International cooperation is helpful**