

# NRC Regulatory Information Conference 2010

## Session W 13 Regulatory Application of International Operating Experience

### **Recent Developments in the Evaluation of Operating Experience**

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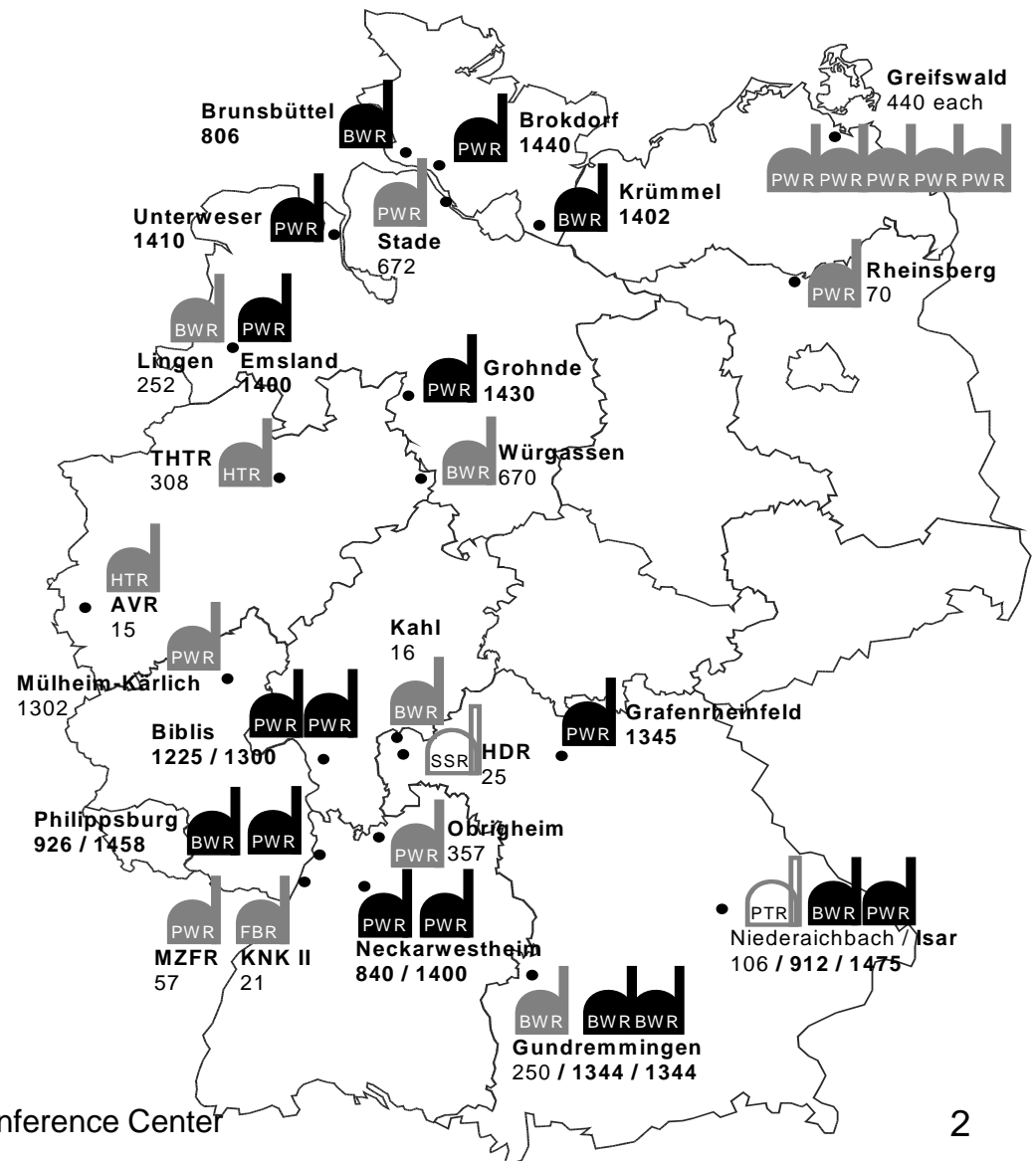
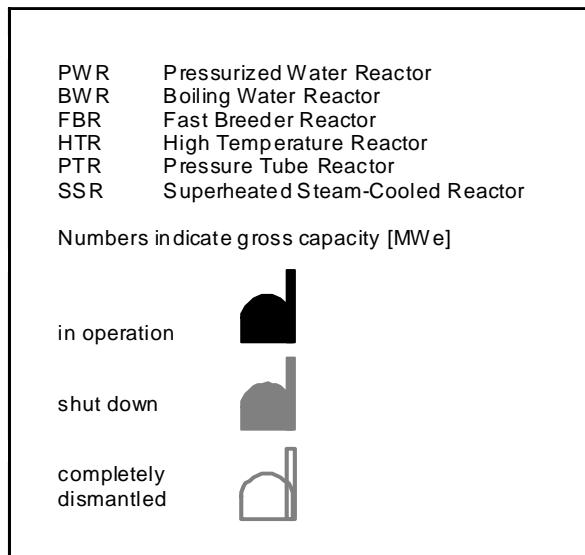
for the Environment, Nature Conservation and Nuclear Safety

Germany

# Nuclear Power Plants in Germany

17 NPP in operation:

11 Pressurized water reactors  
6 Boiling water reactors



# Recent Developments in the Evaluation of Operating Experience

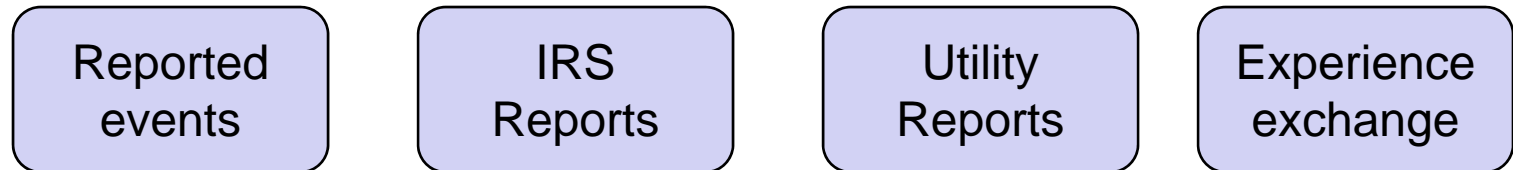
## Evaluation of Operating Experience in Germany

- Use of OE in Germany to
  - identify and eliminate deficiencies in the safety concept or safety installations
  - enhance the level of safety
- Addressees: Regulators and Operators, vendors and TSO
  - provide nuclear power plant operators with most recent insights
  - support the supervision of safe operation
- Establishment of the international interfaces, e. g.
  - IRS, INES
  - OECD/NEA Working groups

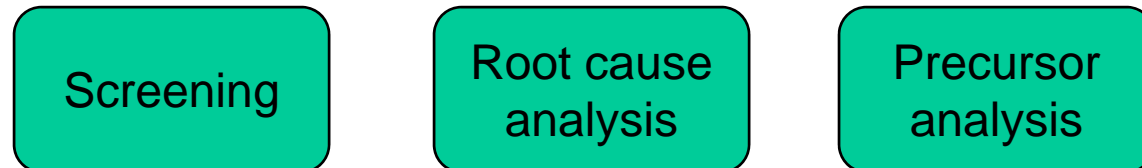
# Recent Developments in the Evaluation of Operating Experience

## Use of Operating Experience in Germany

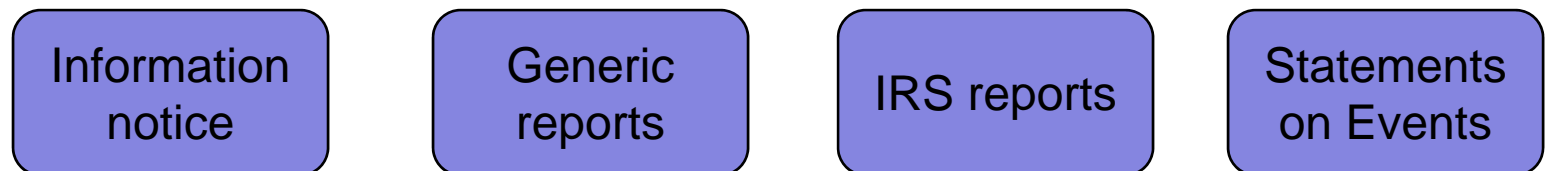
- Sources



- Processes



- Results



# Recent Developments in the Evaluation of Operating Experience

## German Information Notices

- Information Notices are prepared if events have actual or potential safety significance for other facilities
  - Events that show deficiencies with regard to
    - physical barriers (e.g. reactor pressure boundary, containment)
    - safety systems at the different levels of the defense-in-depth concept, e. g.
      - non-compliance with design specifications
      - common-cause failures or systematic failures
- Preparation of recommendations
  - recommendations are obligatory for all plants

# Recent Developments in the Evaluation of Operating Experience

## International Exchange of Events

- The International Reporting System on operating experiences (IRS) is jointly operated by IAEA and NEA since the early 1980ies
  - Main goal is the exchange of important lessons learned from nuclear reactor events
- Germany participates actively from the beginning in the IRS
- All IRS reports are evaluated in order to assess the applicability of the lessons learned for German NPPs
- The results of the evaluation are reported monthly to the nuclear authorities, NPPs, utilities, expert organizations, and vendors

# Recent Developments in the Evaluation of Operating Experience

## Process Steps in Preparing a German IRS Report

- Basis of German IRS reports are German Information Notices
- All Information Notices with potential relevance for international NPPs are selected and translated (e. g. 4 reports in 2009)
- Information on relevant specific design features of the German NPP is added to ease the appreciation for international users
- The related NPP has to agree to the IRS report before its release – thus the correctness of the information is ensured

# Recent Developments in the Evaluation of Operating Experience

## Lessons Learned from Recent Events (1)

- Cracks in austenitic valve housings due to chloride-induced stress corrosion cracking
  - cause: chlorides mainly originate from the former use of chloride-containing asbestos-seals
  - safety systems and non-safety related systems affected
  - long term shut down of two BWRs for repair work
- Lessons learned
  - event is of generic significance
  - chloride-induced transgranular stress corrosion cracking at components is no new degradation mechanism
  - enforcement of the inspection program in German NPPs
- IRS-Report submitted, information of other countries at bilateral meetings



# Recent Developments in the Evaluation of Operating Experience

## Lessons Learned from Recent Events (2)

- Load Drop from a Mobile Crane
  - for inspection about 1.7 to. concrete blocks should be lifted and horizontally transported
  - trolley dropped with the concrete block about 5 m
  - cause: Incorrect installation and unfavorable design of trolley
  - the event had no safety relevant effects on the systems beneath or other plant parts
- Lessons learned
  - specific requirements for the use of mobile cranes in German regulation to be added
- IRS-Report in preparation, information of other countries at bilateral meetings



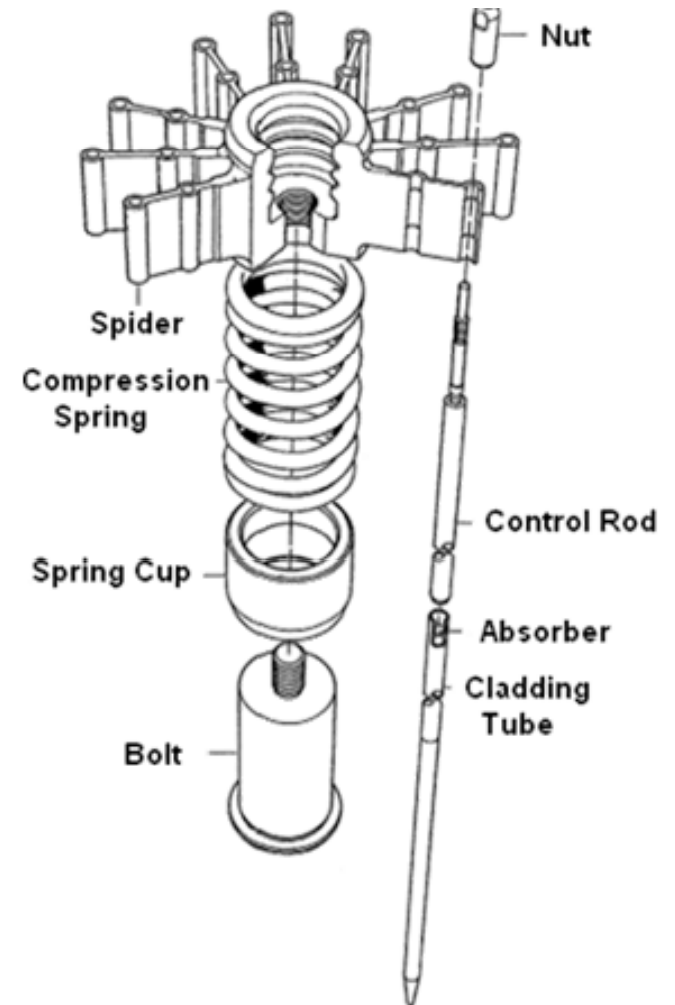
Source: KGG



# Recent Developments in the Evaluation of Operating Experience

## Lessons Learned from Recent Events (3)

- Deviations and Findings at PWR Control Rod Assemblies
  - Dimensional Deviation at Control Rod Finger Threads
    - cause: Fabrication error
  - Corrosion Attacks on Control Rod Fingers
    - cause: Chloride induced stress corrosion cracking
- Lessons learned
  - quality assurance problems at vendor and its new sub-contractor
  - IRS-Report in preparation



Source: AREVA NP

# Recent Developments in the Evaluation of Operating Experience

## Influence of Operating Experience on German KTA-Safety Standards (1)

- KTA Safety Standard 3602 (“Storage and Handling of fuel elements and other related components”) is dealing with criticality safety requirements during fuel handling and refueling
- Since about the year 2000 first discussions within KTA due to
  - the continuing increase of enrichment in fuel elements (from 3 % in the 80ies to 4.5 % in the 2000s) and
  - the increased use of MOX fuel

# Recent Developments in the Evaluation of Operating Experience

## Influence of Operating Experience on German KTA-Safety Standards (2)

- Discussions in KTA continued after a foreign event:
  - massive errors during the reloading of fuel (loaded in the wrong position)
  - potential criticality incident: only avoided by a too high boron concentration
- Two events in German NPPs
  - wrong positioning of a fuel element
  - damaging of a primary neutron source during repositioning of fuel elements in the storage pool
- In early 2003 a revision of KTA safety standard was suggested
  - Contains for example recommendations regarding fuel mispositioning

# Recent Developments in the Evaluation of Operating Experience

## Influence of Operating Experience on Renewal of German Safety Criteria for NPP (1)

- English version of the renewed German “Safety Criteria” (draft) can be found on <http://regelwerk.grs.de>
- Pipe rupture and damage of other safety significant components due to radiolysis gases explosion
    - in German NPPs (BWRs) several safety important events with deformation of valve internals or pipe rupture occurred up to 2001
    - new requirements to prevent radiolysis gas reactions respectively to limit the consequences, e.g.:
      - extent und quality of the countermeasures depending on the maximal possible consequences of an explosion
      - limiting the maximal consequences of an explosion to safety level 3
      - **considering all operating conditions, operating processes and disturbed conditions**

# Recent Developments in the Evaluation of Operating Experience

## Influence of Operating Experience on Renewal of German Safety Criteria for NPP (2)

- Damages of small-diameter pipes
  - operating experience demonstrates that damages of small-diameter pipes occur more frequently than large pipe damages
  - failures of small-diameter pipes were not covered by the former German regulations but can have a significant safety importance
  - new Safety Criteria contain requirements, for example:
    - prevention of single failures under dynamic excitations, in particular from the connecting systems and components, and preclusion of systematic failures
    - prevention of systematic failures by adequate material selection and high manufacturing quality under consideration of the operating media and conditions specific damage mechanisms
    - in-service inspection of small pipes and pipe supports

# Recent Developments in the Evaluation of Operating Experience

## Influence of Operating Experience on Renewal of German Safety Criteria for NPP (3)

- Prevention of multiple failures
  - common mode failures are particularly appropriate to attack the defense-in-depth concept of nuclear reactors
    - failures can effect more than one safety layer and several redundancies simultaneously
  - new Safety Criteria contain requirements to prevent common mode failures:
    - diversity of systems and components as far as feasible and technically reasonable
    - physically or constructionally separation of redundancies
    - limiting maintenance related human failures on a single redundancy
    - failures of components which are common to several redundancies do not affect more than one redundancy

# Recent Developments in the Evaluation of Operating Experience

## Further instruments of the International OE Exchange

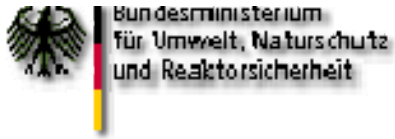
- CNRA-WGOE issued “The Use of International Operating Experience Feedback for Improving Nuclear Safety” in 2008
  - based on IAEA Safety Standard NS-G 2.11
  - showing status and deficits of international OE feedback
- EU established the European Clearinghouse in 2008
  - goal is to improve OE feedback for European Member States
  - major benefits especially for Member States with limited nuclear program
- European TSOs have formed the network ETSON in 2006
  - one main goal is to harmonize nuclear safety assessments in Europe
  - common Safety Assessment Guide has been developed



# Recent Developments in the Evaluation of Operating Experience

## Summary

- Systematical evaluation of national and international OE has always been a main issue in the BMU responsibility for German NPP safety
- The German system for feedback of OE is well established for national and international purposes
- Results from the evaluation of OE have been integrated into the new German Safety Criteria for NPPs
- BMU and its TSO GRS have taken an active part in the recent international developments to foster the OE feedback process



Thank You for Your Attention!

NRC Regulatory Information Conference  
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# Regulatory Structure - Nuclear Safety

