

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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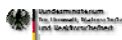
Federal Ministry

for the Environment, Nature Conservation and Nuclear Safety

Germany

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Nuclear Power Plants in Germany

17 NPP in operation:

11 Pressurized water reactors
6 Boiling water reactors

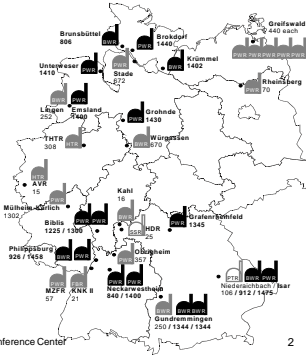
PWR	Pressurized Water Reactor
BWR	Boiling Water Reactor
FBR	Fast Breeder Reactor
HTR	High Temperature Reactor
PTB	Pressure Tube Reactor
SR	Swiss-type Sodium-Cooled Reactor

Numbers indicate gross capacity (MW_e)

in operation

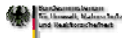
shut down

completely dismantled



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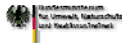
Recent Developments in the Evaluation of Operating Experience

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

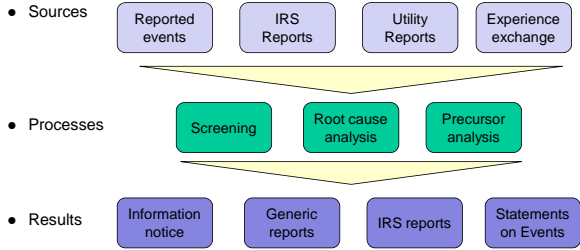
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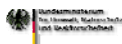
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Recent Developments in the Evaluation of Operating Experience

Use of Operating Experience in Germany

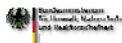




Recent Developments in the Evaluation of Operating Experience

German Information Notices

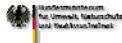
- Information Notices are prepared if events have actual or potential safety significance for other facilities
 - Events that show deficiencies with regard to
 - physical barriers (e.g. reactor pressure boundary, containment)
 - safety systems at the different levels of the defense-in-depth concept, 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

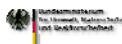
- The International Reporting System on operating experiences (IRS) is jointly operated by IAEA and NEA since the early 1980ies
 - Main goal is the exchange of important lessons learned from nuclear reactor events
- Germany participates actively from the beginning in the IRS
- All IRS reports are evaluated 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

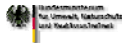
Lessons Learned from Recent Events (2)

- 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

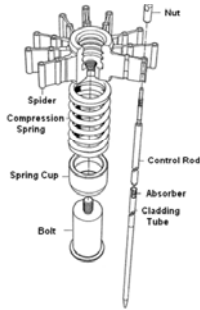




Recent Developments in the Evaluation of Operating Experience

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



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Source: AREVA NP 10



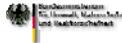
Recent Developments in the Evaluation of Operating Experience

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

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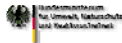
Recent Developments in the Evaluation of Operating Experience

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

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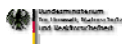
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Recent Developments in the Evaluation of Operating Experience

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

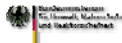
- English version of the renewed German "Safety Criteria" (draft) can be found on <http://regelwerk.grs.de>
- Pipe rupture and damage of other safety significant components due to radiolysis gases explosion
 - in German NPPs (BWRs) several safety important events with deformation of valve internals or 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)

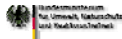
- Damages of small-diameter pipes
 - operating experience demonstrates that damages of small-diameter pipes occur more frequently than large pipe damages
 - failures of small-diameter pipes were not covered by the former German regulations but can have a significant safety importance
 - new Safety Criteria 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)

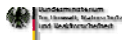
- Prevention of multiple failures
 - common mode failures are particularly appropriate to attack the defense-in-depth concept of nuclear reactors
 - failures can effect more than one safety layer and several redundancies simultaneously
 - new Safety Criteria contain requirements to prevent common mode 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

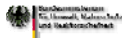
- CNRA-WGOE issued "The Use of International Operating Experience Feedback for Improving Nuclear Safety" in 2008
 - based on IAEA Safety Standard NS-G 2.11
 - showing status and deficits of international OE feedback
- EU established the European Clearinghouse in 2008
 - goal is to improve OE feedback 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



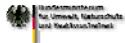
Recent Developments in the Evaluation of Operating Experience

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!



Regulatory Structure - Nuclear Safety

