FORATOM
for nuclear energy in Europe

ENISS - Initiative

Contribution of European Nuclear Licensees Towards the European Safety Reassessment

ENSREG 2011

June 28-29, 2011 Brussels

Luc Vanhoenacker

ENISS Chairman

Contents

ENISS

- ENISS (**European Nuclear Installations Safety Standards**) has been set up in 2005 under the umbrella of FORATOM

- ENISS currently represents the nuclear utilities and operating companies from 16 European countries with nuclear power programme, including Switzerland.

- ENISS has been engaged in constructive debates with WENRA when discussing the safety reference levels for operating plants and the safety objectives for new plants that WENRA has proposed

Membership

All ENISS Members are representing licensees

Belgium (Tractebel/Electrabel)

Bulgaria (Kozloduy NPP)

Czech Republic (CEZ)

Finland (Fortum, TVO)

France (EdF, AREVA NC)

Germany (EON, RWE, EnBW)

Hungary (Paks NPP)

Italy (SOGIN, ENEL)

Romania (Nuclearelectra)

Slovakia (Slovenske Elektrarne,)

Slovenia (Krško NPP)

Spain (UNESA)

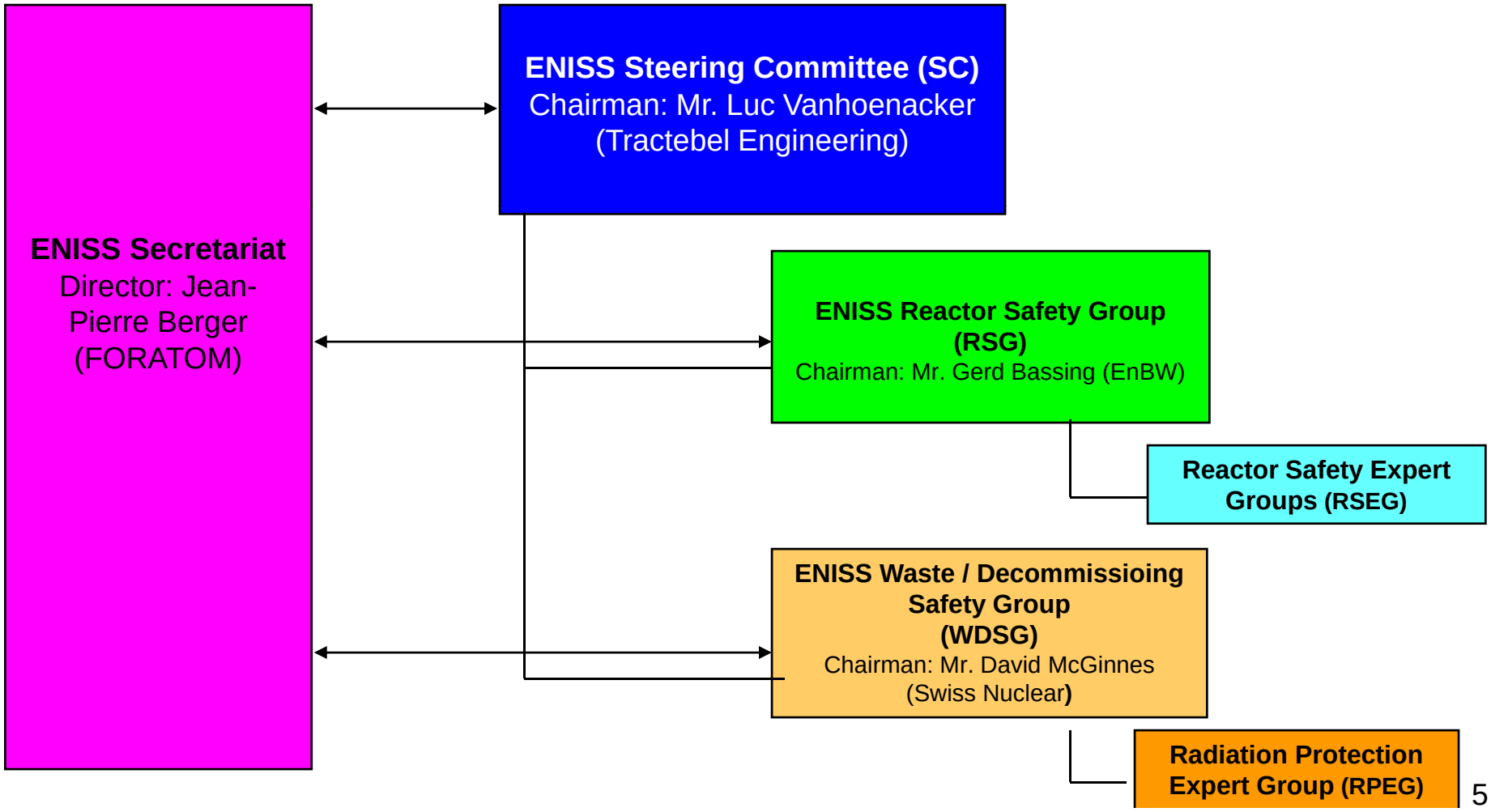
Sweden (EON-SE, Vattenfall AB)

Switzerland (swissnuclear)

The Netherlands (EPZ)

United Kingdom (EDF/BE)

ENISS - Organisation

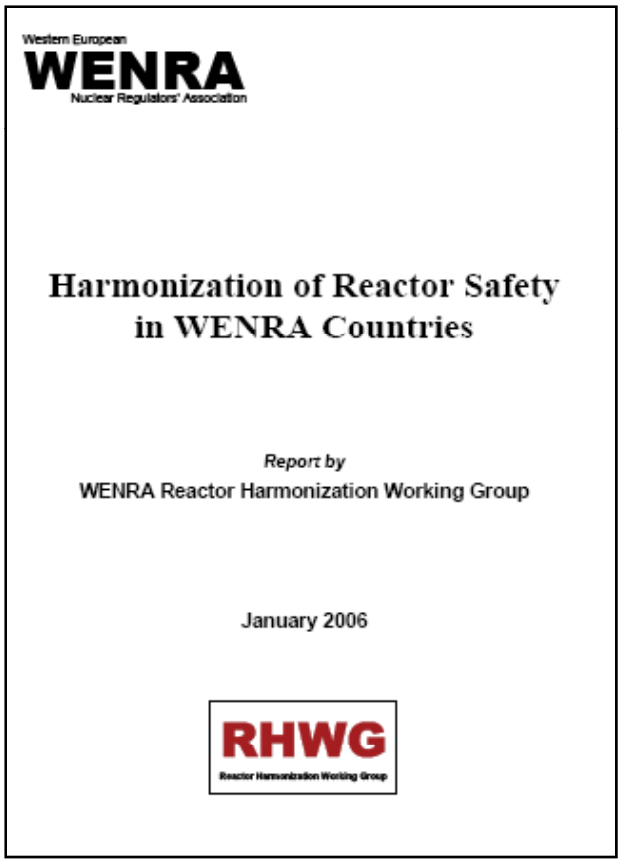


ENISS Objectives

- To establish a common licensee view with respect to the “WENRA RLs”
- To present the industry position in discussions with WENRA
- To support an exchange of information about the interaction of license holders with their national regulators, in order to achieve a harmonised set of new regulations.
- To create an information platform for the European nuclear license holders with respect to new national and international regulatory activities
- To strengthen the integration of expertise of licensees in the revision work of the IAEA Safety Standards
- To discuss with the European Institutions on regulatory issues in the area of nuclear safety, radiation protection, waste management and decommissioning
- To collaborate with international associations dealing with regulatory issues

ENISS Main Activities

- Commenting WENRA publications

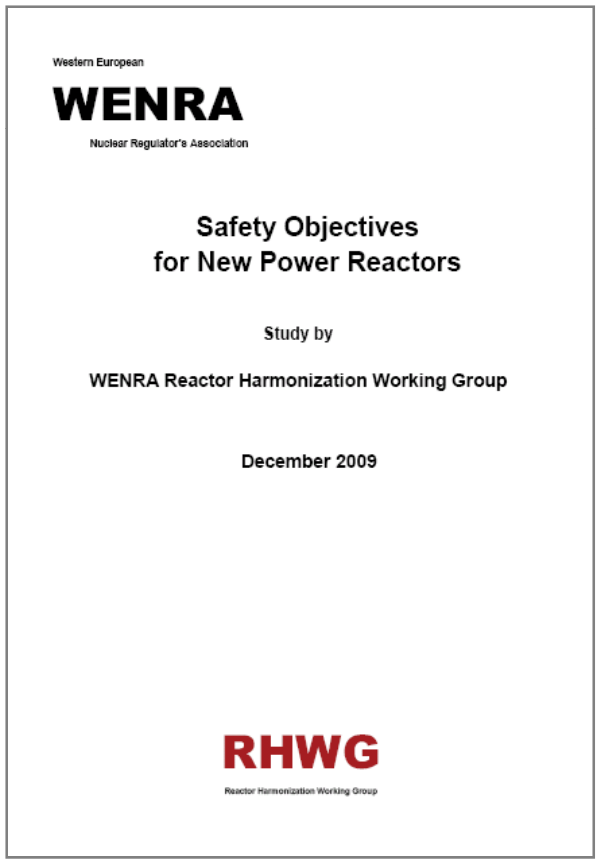

Western European
WENRA
Nuclear Regulators' Association

Harmonization of Reactor Safety in WENRA Countries

Report by
WENRA Reactor Harmonization Working Group

January 2006

RHWG
Reactor Harmonization Working Group


Western European
WENRA
Nuclear Regulator's Association

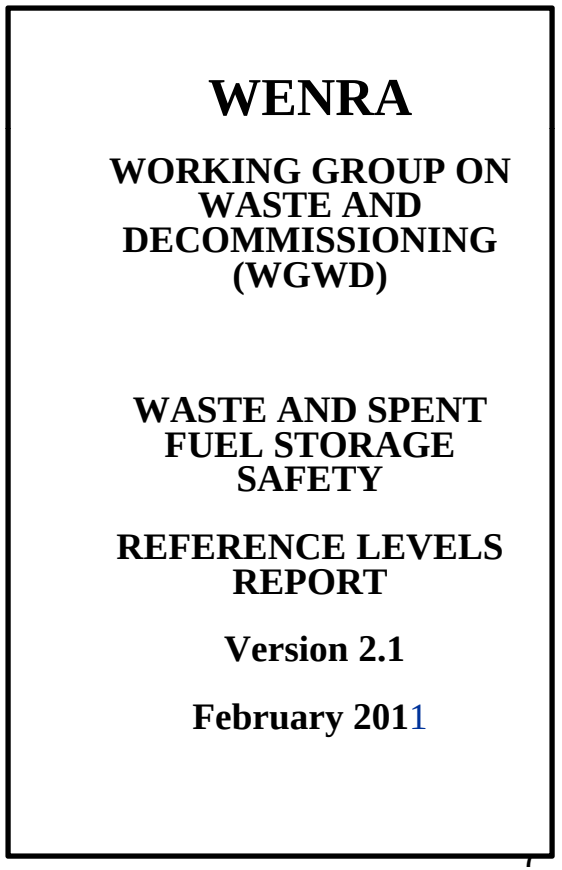
Safety Objectives for New Power Reactors

Study by

WENRA Reactor Harmonization Working Group

December 2009

RHWG
Reactor Harmonization Working Group


WENRA

WORKING GROUP ON WASTE AND DECOMMISSIONING (WGWD)

WASTE AND SPENT FUEL STORAGE SAFETY

REFERENCE LEVELS REPORT

Version 2.1

February 2011

ENISS Main Activities

- Involvement in the IAEA Safety Standard revision work
  - NSR1 : Safety of nuclear power plants :design
  - Safety Classification of SSC
  - Revision of the Basic Safety Standards
  - ……

ENISS Main Activities

- At EU level
  - Comments on the Basic Safety Standards (radioprotection)
  - Participation in the ENEF process
    - "*Considerations on a potential EU Directive on Common Fundamental Safety Principles for nuclear installations"* presented at the ENEF Bratislava meeting in November 2008
    - Roadmap "*Considerations on Criteria and Safety Objectives for safe long-term operation of NPPs"* addressed at the ENEF plenary meeting (May 2010)
  - Definition of a methodology for the European Safety reassessment post Fukushima event (STORE)

STORE

To STRESS TESTS which carry the “Stress” idea,

we prefer

“Safety Terms Of REference”

STORE

The STORE Schedule

- March 15: Commissioner Oettinger with CEOs, national regulators
- March 21: ENISS Steering Committee
- March 24: Presentation of the working program at ENEF WG Risk (with representatives from the EC)
- April 6: WENRA (task force) - ENISS Meeting
- April 8 & 28 : ENEF NIS - ENISS meeting
- May 4: Proposal endorsed by ENEF Risks WG
- May 12: WENRA- ENSREG meeting
- May 19-20: ENEF Plenary session (Prague)

OBJECTIVE

- STORE established as a basis for the targeted reassessment of European plants safety in the light of the events which occurred in Fukushima
- Assessment is to be performed by the utilities
- It will be overseen by the national safety authorities, with a guidance of WENRA/ENSREG
- To identify what more can be done in prevention, control and mitigation to lower the residual risk

Preliminary statement

- Defence in Depth is one of the basic principles of safety of nuclear power plants (different layers)
  - Prevention
  - Control
  - Mitigation

- The objective of the reassessment
  - To evaluate the consequences of the subsequent and progressive loss of these safety layers
  - And to identify what more can be done in prevention, control and mitigation to lower the residual risk as reasonably as achievable

SCOPE

- A focus on issues highlighted by Fukushima accident:
  - Extreme natural events
  - CCF
  - All units of a site affected
  - All states of the plant to be considered
  - Reactor cores and spent fuel pools
  - Emergency and mitigation measures
  - SAM
- Keep in mind in Europe: LWR (including VVER), AGR, CANDU

TECHNICAL SCOPE

Issues highlighted by events in Fukushima, combination of initiating events

- Initiating events (IE)
  - Earthquake
  - Flooding
  - Other extreme natural conditions
- Consequential loss of safety functions (CL)
  - prolonged total loss of electrical power
  - prolonged total loss of the main ultimate heat sink
  - combination of the two situations
- Accident management issues:
  - core melt accident
  - degraded conditions in the spent fuel storage

METHODOLOGY (1)

- Reassessment to be based on
  - Existing and available studies
  - Engineering judgement to evaluate the adequacy of the margins and means available
  - Walk downs
- Main focus : defence in depth approach
  - Identification of the existing independent safety layers
  - Assessment of available mitigation measures

METHODOLOGY (2)

A four step approach

1. Review the current design basis
2. Review the existing preventive and mitigation protection measures
3. Review of vulnerability of the plant to hazard exceeding the design basis
4. Simplified beyond design studies if needed
   - Realistic assumptions
   - Identification of a safe shutdown path
   - Identify weak points and propose corrective measures

Natural Hazards to be considered

- **Earthquake**
  - SSC's to bring the plant to a safe shutdown state
  - Likelihood of leaks or ruptures of non seismic pipeworks
  - External consequences (accessibility, long term fuel supply, long term cooling water and electrical supply)
  - Cliff edge effects
  - SSC's margins
  - Identify weak points and propose corrective measures
  - ….
- **Flooding**
  - Design criteria for dams, levees
  - Characteristics of flood monitoring, alerting systems
  - Threshold for the operator action
  - External consequences (accessibility, long term fuel supply, long term cooling water and electrical supply)
  - Cliff edge effects
  - Identify weak points and propose corrective measures
  - ….

Natural Hazards to be considered

- **Combined earthquake and flooding**
  - Site specific
  - If and only if there is a common mode (e.g a dam upstream)

- **Other extreme natural events**
  - Snow and ice, heavy rainfalls, storms and tornadoes
  - Country and site specific
  - Characteristics of hazards monitoring, alerting systems
  - Threshold for the operator action
  - External consequences (accessibility, long term fuel supply, long term cooling water and electrical supply)
  - Cliff edge effects
  - Identify weak points and propose corrective measures

Consequential loss of safety functions

- Prolonged loss of electrical power
  - Loss of offsite power and failure of the main emergency diesel generators by a common cause failure
  - Offsite power lost for several days
  - AC and DC bus bars powered by batteries to function normally
  - Any alternative AC power sources can be credited if they are diverse and independent
- Prolonged loss of primary ultimate heat sink
  - Connection with the main ultimate heat sink is lost (sea, river, lake)
  - Heat sink lost for several days
  - Diversified ultimate heat sink could be available according to the plant design
- Combined loss of both

Accident management

- Reactor and spent fuel pools
- SF:Reactivity control
  - Additional supplies (e.g. boron) stored on the site
- SF: Removal of heat
  - Means for a long term cooling
- SF: Confinement
  - Eliminate high pressure core melt
  - Control of generated hydrogen
  - Protect the integrity of the confinement
- Long term activities
  - Staffing (external support)
  - Means (external support)
  - Protection of emergency personnel

The Peer review as proposed by ENSREG

- The peer review will contribute to an increase in public confidence
- It should be conducted consistently with regard to each national report
- It must not lead to a ranking of the Nuclear Power Plants
- It should be organised in a way to contribute to the continuous improvement of nuclear safety
- The draft recommendations of the peer-reviews should be discussed with the national regulators before publication

Conclusion

- Nuclear energy is an important part of the EU low-carbon energy mix and play an increasing role in limiting CO_2 emissions
- Nuclear safety is the integration of human, technical, organisational and regulatory issues
- Nuclear safety remains the prime responsibility of the licensee
- The European Safety Reassessment should contribute to an increase in public confidence
- ENISS has developed a comprehensive proposal
- ENISS is available to contribute to the peer review methodology.
- ENISS will continue to monitor the situation and share between its members the lessons learned

Thank you for your attention