Adoption of ASME requirements for VVER-440 NPP

P Trampus
peter.trampus@ttsa.hu

ASME Workshop on Nuclear Codes and Standards
Prague, Czech Republic, July 7-8, 2014
Nuclear power in Hungary

In operation:
• 4 x 500 MW(e), Paks
  – 4 x VVER-440/V-213
  – 1982/87 – 2012/17
  – Power uprate: 4 x 500 MW(e)
  – Service life extension: 2013/18 – 2032/38

Under preparation:
• 2 x <1200 MW(e), same site
  – AES-2006 (MIR-1200)
  – 2026 (?) – 2086

Nuclear capacity ensured for a century
Operating units
Need for / possibility of adoption

- Early 2000s: decision on service life extension
- Hungarian ISI rules (based on PK-1514; PNAE G-7-008 and 010) do not support this strategic goal
  - ISI / NDE acceptance standards do not serve FFS
    - expressed in equivalent reflector size (QC criteria)
    - no relation to fracture mechanics
- Nuclear Safety Rules (in ~2000): „authoritative technical standard” for ISI program and acceptance criteria
- Nuclear Safety Rules (today): „scope, schedule, criteria and methods of ISI are determined by licensee...”
Why BPVC Section XI?

- No unified European ISI code / standard
- Codes of leading „nuclear” countries (France, Germany) show ASME origin
- IAEA standards are nuclear safety centered; guides are too general (and show strong ASME features)
Goals for ASME requirements adoption

• To facilitate the implementation of
  – ISI and IST,
  – repair and replacement,
  – strength and fracture mechanics analyses
  with state-of-the-art methods, and give the possibility for their
direct comparison with current methods and requirements

SAFETY GOAL

• To serve for plant life extension
  – technically (extend ISI cycle of Class 1 components from 4 year to
    an 8-year)

COST-EFFECTIVENESS GOAL

– „politically” (to support international acceptance / consent of life
  extension)
ASME requirements have to be fitted in a special situation:

- Paks NPP was not constructed and operated/inspected in line with ASME requirements

- Compliance with an inspection code is replaced by the compliance with an other code (not unique, see Finland)
Major principles (1)

- Requirements met during construction have to be equivalent with ASME requirements
  - Construction requirements for design state,
  - Inspection methods and frequency for design state,
  - Acceptance criteria of deviations from design state requirements
Major principles (2)

- **Design state:** idealistic status
  - all technical parameters, features are taken into consideration by design,
  - fully meets design requirements

**Construction review (completed)**
- Class 1 components and pipelines
- Class 2 components and pipelines (commodity groups)
- selected Class 3 components and pipelines

- **Status after manufacturing and assembling:** safety margins embedded in construction requirements allow deviations
  - analysis of *equivalence* in safety margins of ASME code and Hungarian safety rules
Major principles (3)

- **Status after commissioning (zero-level):** key role in assessment of service induced changes (ageing)
  - flaw-free status (!?),
  - initial value of DBTT,
  - local wall thickness,
  - etc.

- **In-service status of components:** it has to be demonstrated that deviations do not exceed acceptance level
  - until the next inspection
  - trend assessment
Implementation

- Proven practice kept as much as possible
- Technical Inspection Plans replaced by ISI Programs
  - integrating concept and requirements of Section XI
  - more emphasis on ageing management
- NDE
  - supplemented by relevant examinations (*e.g.* attachments of welded components and pipes)
  - examinations outside the scope of Section XI remained (*RPV base metal*)
- ISI interval:
  - 8 years (current goal: 10 years as a consequence of 15 months fuel cycle)
- NDE procedures upgraded to comply with Section V
- Inspection qualification - *European approach* (*ENIQ*)
- NDE personnel qualification / certification – ISO 9712
Further items

Hungarian standards (2013)

- MSZ 27003 – Section III
- MSZ 27011 – Section XI
- MSZ 27020 – OMC
- Supplementary document developed for applying
  - Proposals for required modifications to be made in regulatory guidelines or operational procedures when a given standard of the MSZ 270xx series is applied

Professional Engineer equivalent established (2012)

Authorized Inspection Agency, Inspector, Supervisor pending
New units
Current position

- ASME or other standard if equivalent with BPVC, and approved by regulator (similar to 10CFR50.55a)
- Code edition
  - currently: 2010
  - will be managed in regulatory guideline
- Differentiated requirements
  - relation between safety classes and quality groups (see RG 1.26)
  - non safety relevant components
- Other issues, e.g.
  - Russian materials, semi-products
  - Responsibilities, duties (designer, inspector, manufacturer)