

ASME-BNCS

Nuclear Codes & Standards Workshop
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INTERNATIONAL NUCLEAR CODES

Harmonization to assure
safety and economical competitiveness



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- ✓ General Introduction
- ✓ Non-Harmonized Rules
- ✓ Harmonization tools
- ✓ Conclusions

Harmonization and Nuclear International Environment

- ✓ The "**Global Nuclear Energy Partnership**" proposed by different international organizations, like WNA-CORDEL or OCDE-NEA or IAEA...:
 - **Competitiveness and economical aspects** need to design and manufacture components and plants **in series**
 - It's possible through a limited number of typical plants recognized by the Regulators as "**safe and mature technology**"
- ✓ "**convergence**": When the standards are aligned internationally, by way of the relevant national authorities making them more similar
- ✓ "**harmonization**": When the essential elements of the requirements are fully aligned
- ✓ harmonization of **safety requirements** will lead to standardization of reactor SSCs designs

*Refer to: "Benefits Gained through International Harmonization of Nuclear Safety Standards for Reactor Designs"
WNA-CORDEL Discussion Paper*

Nuclear Standards harmonization benefits

- ✓ A lot of benefits can be obtained by harmonization of :
 - various regulations,
 - codes and standards,
 - and safety evaluations of reactor design and operation

- Benefits for Safety
- Benefit for Regulators
- Benefit for Nuclear Industry competitiveness (Vendors and Utilities)

Finally **Benefit for Electricity Consumers and Public confidence**

Nuclear Codes non-harmonized rule examples

Why a component "designed & manufactured" for a given country is not easily acceptable in an other country ?

Why design margins varied from 2.4 to 4 / Codes?

Why SG tube-sheet between 400 and 550 mm thick / Codes?

Why CUF can be 10 times higher , using different Code?

Why cobalt content is limited in some Codes, not in an other one ?

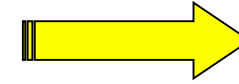
Why Charpy V requirements can be strongly different for similar Codes?

Why some welder qualification are different in different countries ?
Same for NDE personal qualification ?

Why remaining life evaluation can be strongly different ? 20 or more years ?

Why hydrogen flakes are detected end of fabrication with some codes, not with others?

Why heterogeneity of forged pieces is an issue with some Codes, not with others ?



National
regulation
&
Codes &
Standards

Connection with National Safety Authorities

Case 1

- ✓ Code "*selected by nuclear law*" through Safety Authority
- ✓ Practically impossible to use alternative Codes
- ✓ Authority agreement is needed for Code modifications

- ✓ Like in USA, Korea, Japan, Spain, Switzerland, Russia, China...

Case 2

- ✓ Only "*Essential Safety Requirements*" are expressed by Safety Authority
- ✓ Many Codes can be used
- ✓ Conformity assessment is needed by Safety Authorities or Technical Support or 3rd party

- ✓ Like in UK, Finland, France...
- ✓ Similar to non-nuclear Pressure Equipment Directive

Impose the Code to Manufacturer is not necessary the more efficient way...

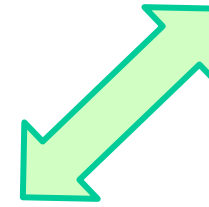
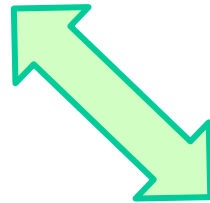
3 major "actors" to progress in Harmonization

CSWG: Codes & Standards Working Group
VICWG: Vendor Inspection Coordination Working Group

WNA: World Nuclear Association
CORDEL: Cooperation in Reactor Design Evaluation and Licensing
TFCS: Task Force in Codes & Standards

MDEP
CSWG and VICWG
www.oecd-nea.org/mddep

WNA - CORDEL
TFCS
www.world-nuclear.org



SDO Convergence Board
USA-Japan-France-Korea-Canada-Russia-Germany
ASME-JSME-AFCEN-KEPIC-CSA-NIKIET-KTA

SDO: Standard Development Organization

- **Minimize Future Code Divergence**
- **Facilitate Areas of Convergence**

3 major "actors" to progress

- ✓ MDEP: Multinational Design Evaluation Program
 - 13 regulators (involved in New Designs) + guests
 - CSWG: Codes & Standards WG
 - VICWG: Vendor Inspection Cooperation WG
 - Technical Secretariat: www.oecd-nea.org/mdep
- ✓ WNA: World Nuclear Association
 - CORDEL: Cooperation in Reactor Design Evaluation and Licensing
 - All the world Nuclear Actors: Industry + Utilities
 - CSTF/ Codes & Standards Task Force
 - Mechanical codes convergence Pilot Project:
Non linear design rules – NDE personal qualification
 - www.world-nuclear.org
- ✓ SDO (Standard Development Organizations) Convergence Board :
 - ASME-JSME-AFCEN-KEPIC-CSA-NIKIET, and soon China
 - All nuclear codes developers to
[Minimize future Code Divergence](#) and [Facilitate Areas of Convergence](#)
 - Chart has been reviewed in Nov. 2012 (Phenix), Feb. 2013 (LosAngeles) and May 2013 (Miami)
 - List of interesting topics remains under discussion

CORDEL has proposed a 4-step approach

- 1 Perform Detailed Review of "**existing international codified rules**" on a particular topic : nuclear and non-nuclear Codes
- 2 Develop an "**international harmonized best practice document**" with R&D needs, if necessary
- 3 **Review and improve** the "best practice document"
 - by International expert groups
 - by International Safety Authorities through MDEP-CSWG
 - by all SDO's to obtain the final internationally approved proposal
- 4 **Implement in each Code** using their own process (through Committee approval procedure...)
 - Same Code Case for different International Codes
 - Code Case to confirm "Mutual Recognition" of "Equivalent Codified Practices", including by Safety Authorities
 - Remains Under Each SDO responsibility

➤ Non linear analysis in design rules

- Limit loads
- Elastic-plastic analysis: monotonic, cyclic, dynamic
- 1st draft release during ICONE Conference
- **Next meeting: September 8-9-10, 2014 London WNA-CORDEL**
- Any interesting experts are welcome by email to: wasylyk@world-nuclear.org

➤ Non Destructive examination personal qualification

- SNT TC 1A
- EN 473
- ISO 9712
- 1st draft release during ICONE Conference
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Different proposals (1/2)

✓ Design

- Non linear analysis and associated data and criteria (including stress classification)
- nozzles design rules under pressure and piping loads
- tube-sheet design rules and tube / tube-tube sheet weld
- high seismic level design rules (in connection with OCDE-NEA-WGIAGE: MECOS)
- Fracture Mechanic at Design level
 - Appendix G: fracture analysis of class 1-2 components
 - Leak Before Break & Incredibility of Failure rules
 - Hydrostatic stress criteria : background of criteria
- Operability and functional capability mechanical criteria, including for some systems severe accident and beyond design events
- small components design and fabrication rules: valves, piping... less than 4"

✓ Fabrication - Examination

- qualification of personnel in charge of examination / welding ...

✓ Material

- Assure multi-national use of "large forged pieces" procurement
- Use of new materials accepted by one Code not by an other one (more common materials through the different C&S)

Different proposals (2/2)

- ✓ **HDPE/ non metallic** : it's good time to harmonize...
 - ASME CC N755 – ASTM standards
 - RCCM CC (with UK, EU industry and EPRI support) - ISO standards
 - Lot of work done in many countries in non-nuclear industries...
 - Larger scope for RCCM CC (1st version available end of 2013):
 - Buried, trench, above ground
 - Butt fusion / Electro fusion welds
- ✓ **Codes for ISI ??? Possible topic...**
 - surveillance and maintenance
 - Inspection program definition in operation: RI or alternative proposals
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 - including flaw evaluation and acceptance criteria
 - Connection with Ageing Management Program
- ✓ **High Temperature Reactor ??? Possible topic...**
 - design rules : creep-fatigue, plastic shakedown, buckling,
 - fracture mechanic and Break Exclusion-IOF-LBB
 - and associated material properties and criteria

Conclusion (1/2)

✓ Harmonization of Nuclear Codes & Standards is a long term process, essential :

- for NPP safety guarantees
- for NPP competitiveness
- for more international information sharing and more efficiency
- for public acceptance

✓ 2 types of differences:

➤ Technical differences

that have to be solved by Industry and Standard Development Organizations

➤ Safety requirement differences

that have to be solved through regulator involvements (MDEP has been developed with this objective...)

- ✓ It has to be handle at international level
 - by different countries
 - by different industrial companies or technical support organizations
 - by different SDOs
 - and different Regulators
- ✓ It's important to include in the discussion
 - Large experience nuclear countries
 - And new nuclear countries, in particular interesting by C&S developments
- ✓ A set of topics are proposed by different SDOs...
- ✓ SDO board can **Manage International Priorities** to progress...
 - fatigue analysis rules is one of them

"Tools" are available, industry is welcome...



Thanks for your Attention !!

Open for questions and/or comments...