MULTINATIONAL DESIGN EVALUATION PROGRAMME

ANNUAL REPORT

MARCH 2012 – MARCH 2013

April 2013

NUCLEAR ENERGY AGENCY

TABLE OF CONTENTS

Appendices

FOREWORD FROM THE POLICY GROUP CHAIRMAN

Washington D.C., 26 April 2013

In January 2013, I was honoured to assume the Chairmanship of the MDEP Policy Group, and grateful for my warm welcome into the MDEP community. It is always a pleasure to join an organisation that is doing good work. The contents of this report demonstrate another successful year for MDEP, in which the programme continues its collaborative work on both design-specific and generally-applicable issues.

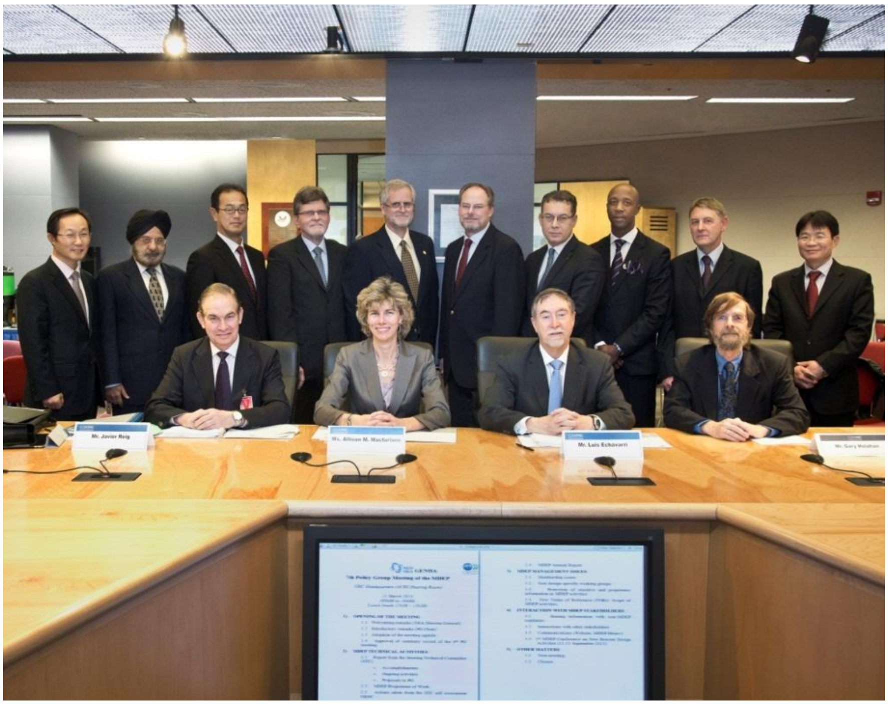
There are a number of important initiatives underway that are providing direct benefit to all countries involved, and the information produced during the course of this work has even broader benefit. In the past year, member countries gained insight from the Atomic Energy Regulatory Board of India, which participated in its first MDEP meetings. We have also welcomed into our membership the Federal Authority for Nuclear Regulation (FANR) of the United Arab Emirates. FANR's participation, and in particular, the creation of a new design-specific working group to address issues specific to the APR-1400 reactor design, demonstrates a strong interest in MDEP on the part of countries with emerging nuclear power programmes.

In the coming year, we expect this good work to continue. We will continue our co-operation on lessons learned from the Fukushima Daiichi accident, which has direct impact on both operating and new reactor programmes. We will participate in additional witnessed and joint vendor inspections, further broadening our understanding of issues of mutual interest and enhancing our ability to address concerns that may arise. We will further our work in the area of evaluating, and where appropriate, harmonising codes and standards. In addition, we will continue our discussions regarding potential co-operation in the areas of construction inspection and commissioning activities. These activities will enable a growing MDEP membership to further advance the programme's main mission of leveraging resources and expertise for common benefit.

In reflecting on MDEP's accomplishments in the past year and the important and interesting work that lies ahead, I would be remiss not to recognise the tireless efforts of the outgoing Policy Group Chairman, Mr André-Claude Lacoste. MDEP's accomplishments to date, and specifically those detailed in this annual report, are due in large measure to his vision and leadership.

Not surprisingly, MDEP functions best when all of its members participate fully in the programme. Based on what I have seen thus far, I believe we are on track for another successful year.

Dr Allison Mcfarlane
MDEP Policy Group Chairman



MDEP Policy Group Meeting - 15 March 2013

EXECUTIVE SUMMARY

The Multinational Design Evaluation Programme (MDEP) is a multinational initiative to leverage the resources and knowledge of national regulatory authorities who are, or will soon, undertake the review of new reactor power plant designs. MDEP member countries are: Canada, China, Finland, France, India, Japan, Korea, Russian Federation, South Africa, the United Kingdom (UK) and the United States (US). In addition to these members, the national regulator for the United Arab Emirates (UAE) has been accepted as an Associate Member. The IAEA also takes part in the work of MDEP and the OECD Nuclear Energy Agency (NEA) performs the technical secretariat support function for MDEP.

MDEP incorporates a broad range of activities including enhancing multilateral co-operation within existing regulatory frameworks, and increasing multinational convergence of codes, standards, guides, and safety goals. A key concept throughout the work of MDEP is that national regulators retain sovereign authority for all licensing and regulatory decisions.

The programme of work consists of short-term activities/goals that result in significant benefits with a minimum use of resources. Working groups implement the activities according to the programme plans, which are tailored to their specific activities and goals. They have also established the necessary interfaces both within and beyond MDEP membership. This report provides information regarding the current status of the programme after its fifth year of implementation.

Significant progress is being made on MDEP's overall goals of increased co-operation and enhanced convergence of requirements and practices. In addition, the lessons learned from the 11 March 2011 events at the Fukushima Daiichi nuclear power plant are being appropriately incorporated into MDEP activities.

A self-assessment of the programme[1] was conducted in 2012 to evaluate whether MDEP is meeting its goals and to identify areas for improvement. The results indicated that MDEP is meeting its stated objectives. Based on the results of the assessment it was decided that the current programme of work continue. Some improvements were identified in terms of programme implementation to increase outreach, identify completion strategies and increase membership.

Three design-specific working groups facilitate MDEP's programme goal of enhanced co-operation. The EPR working group comprises the regulatory authorities of France, Finland, the US, the UK, China, and India. The AP1000 working group comprises the regulatory authorities of Canada, China, the UK, and the US. The APR-1400 working group includes the regulatory authorities of Korea, the US, Finland, and the UAE. The design-specific working groups have been successful in sharing information and experience on the safety design reviews in order to enhance the safety of the designs, enable regulators to make timely licensing decisions, and promote the safety and standardisation of designs through MDEP co-operation.

The Vendor Inspection Co-operation Working Group (VICWG) has achieved its short-term goals and continues to focus on maximising information sharing, conducting joint inspections (multiple regulators inspecting to the regulatory requirements of one member country) and witnessing of other regulators' inspections. A total of seven witnessed and joint inspections were conducted through MDEP in 2012. The VICWG also works with Standards Development Organisations (SDOs) to encourage and explore harmonisation of quality standards. The working group continues to make progress towards achieving its long-term goal of harmonising a significant portion of the quality assurance inspection procedures.

The Digital Instrumentation and Controls Working Group (DICWG) has identified 12 topics to pursue/explore in order to foster the development of common positions based on the existing standards, national regulatory guidance, best practices, and group inputs using an agreed upon process and framework. To date, the working group has published five common positions on Software Tools, Communication Independence, Simplicity in Design, Verification and Validation, and Impact of Cyber Security Features on DI&C Safety Systems. Those common positions have been made publicly available on the MDEP website. The DICWG is enhancing its co-operation with the SDOs, the Institute of Electrical and Electronics Engineers (IEEE) and the International Electrotechnical Commission (IEC). In addition, the DICWG

[1] Available at: http://www.oecd-nea.org/mdep/working-groups/stc.html

members jointly review and comment on proposed IEC, IEEE, and IAEA standards that are relevant to the regulatory review of DI&C systems.

The Codes and Standards Working Group (CSWG) has completed an evaluation of the code comparison performed by the SDOs, which, with the encouragement and support of the working group, compared the Class 1 pressure vessel codes and developed a database that identified the similarities and differences between the Korean, Japanese, Russian, Canadian, and French codes with the ASME code. The CSWG is working closely with SDOs and the World Nuclear Association's Working Group on Co-operation in Reactor Design Evaluation and Licensing (WNA/CORDEL) to converge code requirements and reconcile code differences. In addition, the CSWG has drafted a technical report and three common positions.

MDEP's membership, structure and processes provide an effective method for accomplishing increased co-operation in regulatory design reviews. The interim results for 2012 attest to MDEP's relevance and efficiency; they include:

- the preparation of a comparison report on the differences in probabilistic safety assessment modelling and results for the EPR;
- the preparation of technical reports on the differences among the designs in each country about the arrangement and configuration of the severe accident heat removal system injection lines into the core catcher, and the pH control for the in-containment refuelling water storage tank for the EPR;
- the development of a common position addressing Fukushima-related issues for the EPR;
- co-operation on six witnessed vendor inspections and one joint inspection;
- interaction with SDOs to complete and issue comparison tables of the ASME Boiler and Pressure Vessel Code with French, Japanese, Korean, Canadian and Russian codes for Class 1 pressure vessels, piping, pumps, and valves. Evaluation of the report and conclusions drawn regarding the code-comparison and harmonisation of pressure-boundary codes and standards;
- finalising common positions on DI&C for new reactors in the areas of: Software Tools for the Development of Software for Safety Systems, Principles of Data Communication Independence, and Principles on Simplicity in Design;
- establishing the APR-1400 design-specific working group and prioritisation of four topics for future discussion;
- bringing the new members, India and the UAE, to pace and started to incorporate their views into the MDEP products that have already been issued;
- holding several seminars to discuss areas that the Canadian regulator designated as focus areas for their review of the AP1000 design;
- finalising a Technical Report on "Regulatory Frameworks for the Use of Nuclear Pressure Boundary Codes and Standards in MDEP Countries", and a Common Position on "Lessons Learned on Achieving Harmonisation of Codes and Standards for Pressure Boundary Components in Nuclear Power Plants".

MULTINATIONAL DESIGN EVALUATION PROGRAMME

1. INTRODUCTION

The Multinational Design Evaluation Programme (MDEP) is a multinational initiative that develops innovative approaches to leverage the resources and knowledge of national regulatory authorities who are, or will shortly be, undertaking the review of new reactor power plant designs. MDEP has evolved from a design evaluation programme to a multinational co-operation programme that includes inspection activities and generic issues.

A key concept throughout MDEP is that each regulatory authority retain sovereign authority over licensing and regulatory decisions and that the programme help regulatory authorities make informed decisions through multinational co-operation.

The programme of work consists of activities chosen because they could be accomplished in the near term and would result in significant benefits while requiring minimum resources. Working groups implement the activities in accordance with the programme plans[2]; they all have specific activities and goals and have established the necessary interfaces both within and outside MDEP members. Significant progress has been made over the past year on the overall MDEP goals of increased co-operation and enhanced convergence of requirements and practices. Accomplishments to date provide confidence that MDEP's membership, structure and processes provide an effective method of accomplishing increased co-operation in regulatory design reviews. The progress that has already been achieved demonstrates that a broader level of co-operation and convergence is both possible and desirable.

This report provides a status update of the programme after its fifth year of implementation.

2. PROGRAMME GOALS AND OUTCOMES

The main objectives of MDEP are to enable increased co-operation and establish mutually agreed upon practices to enhance the safety of new reactor designs. The enhanced co-operation among regulators will improve the effectiveness and efficiency of the regulatory design reviews, which are part of each country's licensing process. The goal of MDEP is not to develop new regulatory standards independently, but to build upon the existing similarities and harmonised practices drawn-up by the IAEA and other safety standards. In addition, the common positions developed in MDEP are shared with IAEA for consideration in the its standards development programme.

MDEP is meeting its goal of enabling increased co-operation through the activities of the working groups. MDEP has been very successful in providing a forum for regulatory bodies to co-operate on design evaluations and inspections. In addition to organising working groups, MDEP has provided each regulator with peer contacts who share information, discuss issues informally, and disseminate information rapidly. For example, the design-specific working group members have benefitted significantly from the sharing of questions among the regulators, resulting in more informed, and harmonised, regulatory decisions. MDEP members have also been highly successful in co-ordinating vendor inspections in which the regulators share observations and insights. MDEP has made improvements in communicating information regarding the members' regulatory practices through development of an MDEP Library which serves as a central repository for all documents associated with the programme.

MDEP is meeting its goal of convergence of regulatory practices by establishing common positions in both the issue-specific and design-specific working groups. The working groups are making comparisons of the regulatory practices in the member countries, identifying differences, and developing common positions. The working groups are also working with codes and standards organisations to identify differences and propose areas of convergence.

MDEP has been successful in meeting the expected outcomes as defined in the MDEP Terms of Reference by: increasing knowledge transfer, identifying similarities and differences in the regulatory practices; and enhancing the ability of regulatory bodies to co-operate in reactor design evaluations, vendor inspections, and construction oversight, leading to more efficient and more safety-focused regulatory decisions.

[2] Available at www.oecd-nea.org/mdep

The events of 11 March 2011, at the Fukushima Daiichi nuclear power plant further highlight the need to continue this effort, and the lessons learned from Fukushima are being appropriately incorporated into MDEP activities.

3. SELF ASSESSMENT

In order to assess the progress that MDEP has made towards achieving its goals of enhancing the safety of new reactor design reviews and promoting the harmonisation of regulatory requirements, a self-assessment was initiated in September 2011. The goal of the self-assessment was to evaluate whether MDEP activities meet the needs of both members and other relevant stakeholders such as industry, standards organisations, and non-member regulators, and to identify improvements and adjustments to current and future MDEP activities. Input was solicited from both MDEP members and external groups to get comprehensive and diverse input. The survey responses indicated that MDEP members view the programme as a unique and useful forum to connect with experts from other regulators. MDEP members strongly agree that MDEP is meeting the goals and outcomes stated in the Terms of Reference, and both internal and external stakeholders believe that the most effective aspect of MDEP is the co-operation and exchange of information it facilitates for design reviews.

The results of the self-assessment indicated that no significant changes were warranted to MDEP and that the current programme of work should continue. However, the members agreed that some actions should be taken to improve communications, and make MDEP activities more effective. The survey results identified the following actions, which have now been completed:

- Develop an agreed upon definition of convergence to be used for MDEP activities, in the form of a revision to the Terms of Reference;
- Modify the MDEP Terms of Reference to better reflect MDEP expected interactions with the public;
- Develop a communication plan that identifies stakeholders and specific communication products;
- Open at least a part of the MDEP Library to non-MDEP representatives and invite non-MDEP organisations to attend issue-specific working group meetings as appropriate;
- Enhance interactions with IAEA counterparts to identify areas in which MDEP can provide useful input to IAEA safety standards under development;
- Identify completion strategies (including final products, recommendations to SDOs or other organisations for follow-up activity) in the issue-specific working group Programme Plans;
- Continue the activities of the design-specific working groups at least through the construction oversight phase;
- Act quickly to implement new design-specific working groups (consistent with the existing Rule of Three for forming design-specific working groups);
- Support increasing MDEP membership consistent with the existing guidance, and encourage participation in MDEP by any national regulators who are considering designs under MDEP review.

4. PROGRAMME IMPLEMENTATION

4.1 Membership

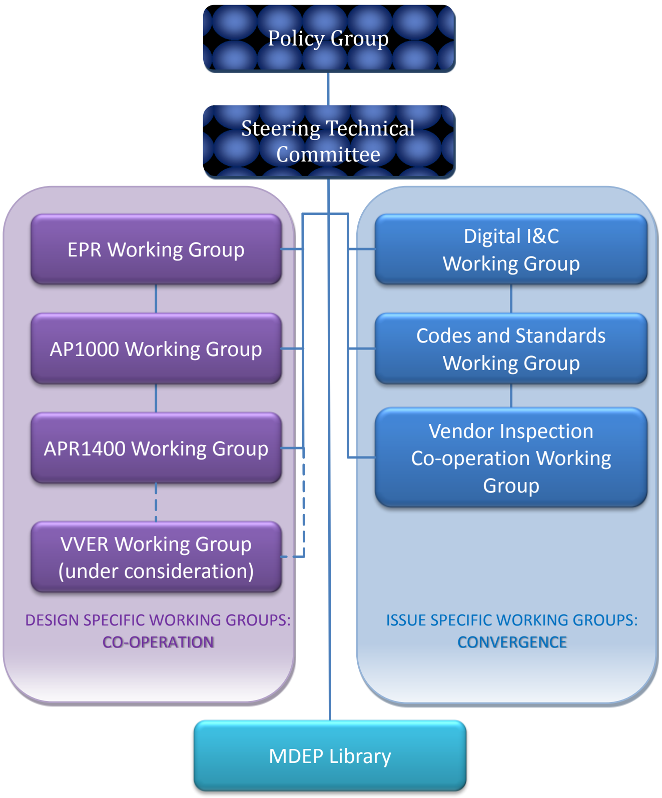
MDEP's membership is intended for mature, experienced national regulatory authorities of interested countries that have already committed to new build or have firm plans to commit to building new reactor designs in the near future. MDEP's founding members are: Canada, China, Finland, France, Japan, Korea, the Russian Federation, South Africa, the United Kingdom and the United States. The IAEA also takes part in MDEP's work. MDEP's Policy Group (PG) has discussed potential expansion of MDEP membership and several national regulatory authorities have expressed interest in joining MDEP. In 2012, the PG approved the Indian nuclear regulator, the Atomic Energy Regulatory Board (AERB), to join MDEP as a full member.

In January 2011, the PG approved additional levels of MDEP membership. An MDEP associate member will be a national regulatory authority without previous licensing experience that has been invited by the PG to participate in selected MDEP design-specific activities based on evidence that the organisation is actively involved in new reactor design review activities relevant to MDEP. Such a regulatory authority would be from a country that has made a firm commitment in the near term to proceed with safety design review activities, has proprietary agreements with the vendor, and is willing and ready to contribute to specific MDEP activities. It is expected that the associate member would be in a position to exchange information with MDEP members to enhance information sharing and experience in relevant design safety reviews.

In August 2012, the PG invited the United Arab Emirates' Federal Authority for Nuclear Regulation (FANR) to join MDEP as an associate member. As an associate member, FANR participates in the APR-1400 Working Group, and observes meetings of MDEPS's Steering Technical Committee (STC) and MDEP's issue-specific working groups.

The PG also recognises that there are other national regulatory authorities that may also benefit from close interaction with MDEP. For example there are several countries that have an experienced nuclear regulatory organisation, are already regulating nuclear power plants and also have mid- to long-term plans to pursue new reactor licensing and construction. Such regulators could clearly benefit from interacting with MDEP now and, in the near future, could be clear candidates to become MDEP members or associate members. It is therefore the intent to invite some experienced regulators to become MDEP candidates with the purpose of that regulators benefit from the issue-specific and generic aspects of MDEP.

4.2 Organisational structure



The programme is governed by a Policy Group (PG), made up of the heads of the participating organisations, and implemented by a Steering Technical Committee (STC) and its working groups. The STC consists of senior staff representatives from each of the participating national safety authorities, plus a representative from the International Atomic Energy Agency (IAEA).

The PG provides guidance to the STC on the overall approach; monitors the progress of the programme; and determines participation in it.

The STC manages and approves the detailed programme of work including: defining topics and working methods, establishing technical working groups, and nomination of experts; approving procedures and technical papers developed by the working groups; establishing interfaces with other international efforts to benefit from available work and avoid duplication; developing procedures for the handling of information to be shared in the project; reporting to the PG; identifying new topics for the programme to address; and establishing subcommittees of the STC to study specific topics.

The OECD Nuclear Energy Agency (NEA) performs the technical secretariat function in support of MDEP.

Two lines of activities have been established to carry out the work.

- **Design-specific activities.** Working groups for each new reactor design share information on a timely basis and co-operate on specific reactor design evaluations and construction oversight. Participants in these working groups are the regulatory authorities that are actively reviewing, preparing to review, or constructing the specific reactor design. A design-specific working group is formed when three or more MDEP member countries express interest in working together. Under the design-specific working groups, expert subgroups have been formed to address specific technical issues.
- **Issue-specific activities**. Working groups are organised for the technical and regulatory process areas within the programme of work. These currently include, but are not limited to, vendor inspections, pressure boundary component codes and standards, and DI&C standards. Membership in issue-specific working groups is open to all MDEP participating countries and the IAEA representatives.

4.3 MDEP Library

MDEP information is communicated among the members through the MDEP Library which serves as a central repository for all documents associated with the programme. The NEA provides the technical support for the development and maintenance of the library on a website. The website provides for 2 levels of access which are password protected: (1) MDEP member countries, and (2) member countries participating in design-specific working groups. Access to the library is based on requests of the STC member for each participating country and generally provided to STC members and members of the working groups. Publicly available documents related to MDEP are available on the MDEP page of the the NEA website.[3] The STC, through the secretariat, will continue to add documents and make enhancements to improve the effectiveness of the library.

In order for MDEP to be successful in fulfilling its goal of leveraging the work of peer regulators in the licensing of new nuclear power plant designs, a framework was developed to facilitate the sharing of technical information among MDEP participants, which at times may include the sharing of proprietary and other types of sensitive information. As a general rule, the information exchanged as part of the MDEP in meetings and the MDEP Library is solely for participating national regulatory authorities' use. The members of the design-specific working groups also have a communication protocol to share MDEP positions on topics with other members before releasing this information into the public domain. A large portion of the information shared may not be proprietary or sensitive; however, all participating members must protect and properly handle the information that an originator claims to be proprietary or sensitive.

4.4. Common positions

MDEP has developed a process for identifying and documenting common positions on specific issues among the member countries which may be based on existing standards, national regulatory guidance, best practices, and group member inputs. Design-specific Common Positions document common conclusions reached by working group members during design reviews. Discussions among the members and sharing of information in these areas help to strengthen the individual conclusions reached. Design-specific Common Positions require only working group members to agree on them because they need to be issued more quickly and the responsibility for these decisions rests with the regulators performing the design reviews.

Generic Common Positions apply generically rather than only to one design. Generic Common Positions document practices and positions that each of the working group members find acceptable. The common positions are intended to provide guidance to the regulators in reviewing new or unique areas, and will be shared with the

[3] www.oecd-nea.org/mdep

IAEA and other standards organisations for consideration in standards development programmes. After a Generic Common Position is agreed to by a working group, it is presented to the STC for endorsement. Upon endorsement by the STC, the proposed Generic Common Positions are made publicly available on the NEA MDEP website for external stakeholder information and comment. Those Common Positions will become best practices, recommended by MDEP. There is no obligation on the part of any regulatory body to follow them. If a regulatory body chooses to adopt a Generic Common Position, it would be through that country's normal processes.

5. INTERACTIONS WITH OTHER ORGANISATIONS

MDEP recognises that other organisations are implementing programmes to facilitate international co-operation on new reactors. These means should be available to countries interested in new build, but do not meet the criteria for entrance to MDEP. MDEP strives to keep abreast of, and interact with these other groups to ensure against duplication and to benefit from the results of these activities. MDEP also communicates its activities and results to other organisations. In order to maintain its specificity, MDEP focuses on short-term activities related to specific design reviews conducted by member countries as well efforts to harmonise specific regulatory practices and standards.

The CNRA Working Group on the Regulation of New Reactors (WGRNR) examines the regulatory issues of siting, licensing and regulatory oversight of Generation III+ and Generation IV nuclear reactors. The current focus areas of the WGRNR are construction experience and siting issues. The WGRNR co-ordinates its work with the work performed by MDEP such that it utilises its outputs and does not duplicate its efforts. It extends the results of MDEP to other CNRA members. MDEP interacts with the CNRA WGRNR and Working Group on Inspection Practices (WGIP) through the NEA staff who also serve as the technical secretariat for the CNRA. WGRNR is the focal point of interactions between MDEP and the CNRA and its working groups, and will assist in co-ordinating communications and requests between the two activities.

The IAEA participates in the work of MDEP through participation in the PG, STC, and issue-specific working groups. In addition, the Generic Common Positions developed by MDEP will be shared with the IAEA for consideration in the IAEA standards development programme.

MDEP's working groups are very interested in understanding the perspectives of the design vendors, codes and standards organisations, and component manufacturers in MDEP activities, and the challenges they face in dealing with numerous regulators and regulatory systems. MDEP's working groups interact with, and invite industry groups to participate in, selective portions of meetings and other activities. For example:

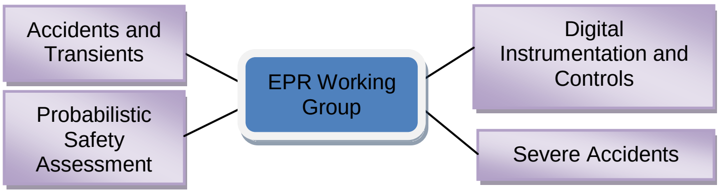
- the Codes and Standards Working Group interacted with a committee of SDOs (ASME, JSME, KEPIC, AFCEN, NIKIET and CSA) in a code comparison project;
- the EPR working group meets regularly with representatives of AREVA, EDF, and other EPR-licensees, applicants, and potential applicants to discuss similarities and differences among the EPR designs being licensed in each country;
- the Digital Instrumentation and Controls Working Group (DICWG) interacts frequently with applicable standards organisations, the IEC and IEEE, by inviting representatives of the IEC and IEEE to MDEP meetings, attending the IEC and IEEE meetings, and involving them in the development of common positions. The working group communicates specific suggestions to the standards organisations and the IAEA for consideration of harmonisation in a timely manner when they are identified during its activities;
- WNA/CORDEL met with members of the MDEP Codes and Standards Working Group (CSWG). Both MDEP and CORDEL see some benefits in collaborating in the areas of codes and standards harmonisation and safety classification;
- WNA/CORDEL also met with the STC to share their status of work and their views on harmonisation, and has opened the way to further interaction with MDEP working groups.

6. *CURRENT ACTIVITIES*

The current activities of MDEP are being implemented through design-specific and issue-specific working groups. The members of the design-specific working groups share information and co-operate on specific reactor design evaluations and construction oversight. Issue-specific working groups are organised for the technical and regulatory process areas within the programme of work. Each working group has a lead and co-lead country designated and has developed a programme plan that identifies specific activities, schedules and contacts.

Olkiluoto 3 EPR reactor, Finland: 5 March 2013. Copyright TVO.

6.1 EPR Design-specific Working Group



The EPR Working Group currently consists of the regulatory authorities of France, Finland, the US, the UK, India, and China. The regulatory authority of Canada, previously a member of the working group, announced in January 2013 its intention to withdraw from the working group because it was no longer actively reviewing this design. This working group was established in January 2006 as a multilateral initiative by France, Finland and the US. Numerous meetings and technical exchanges have taken place to exchange information on the reviews being conducted in each country: Olkiluoto 3, under construction in Finland; Flamanville 3 under construction in France; and the US version of the EPR under review for design certification in the United States and referenced by four combined license applications. In November 2008, China and the UK were added as members. China (NNSA) issued construction permits for two EPRs at the Taishan site, and construction is underway. The UK ONR is nearing completion of its Generic Design Assessment of the UK- EPR at the joint request of EDF and Areva. Canada (CNSC)'s review of the EPR design was placed on hold at AREVA's request.

The working group currently includes four subgroups that are addressing specific technical issues: Accidents and Transients, Digital Instrumentation and Controls (DI&C), Probabilistic Safety Assessment, and Severe Accidents. The subgroups meet regularly to exchange information on relevant aspects of the design review status, share relevant evaluations when they become available, produce technical reports to identify and document similarities and differences among designs, regulatory safety review approaches and resulting evaluations. In addition to the expert subgroups, the EPRWG addressed important ad hoc issues to support design safety review decision-making, such as internal hazards, technical specifications and radiation protection, which included source term issues.

Accomplishments

The EPRWG has documented common MDEP positions on some aspects of the review to enhance safety and standardisation of designs. It has co-ordinated communication on MDEP views and common positions to vendors and operators regarding the basis of safety evaluations and standardisation. It has drafted technical reports to identify and document similarities and differences among designs as well as approaches to regulatory safety reviews and the resulting evaluations. The working group has also documented lessons learned from design reviews and design issues faced during construction, commissioning and early phases of operation.

The EPRWG met regularly with representatives of AREVA, EDF, and other EPR-licensees, applicants, and potential applicants to discuss similarities and differences among the EPR designs being licensed in each country. The WG also met with AREVA to discuss post-Fukushima safety reviews. AREVA representatives discussed the actions AREVA/EDF is taking as a result of the Fukushima accident such as using probabilistic risk assessment to identify possible improvements and to strengthen defence-in-depth. It was agreed that the EPRWG and the EPR family (a forum of organisations involved in the design and licensing of the EPR in several countries) via AREVA will continue to communicate regarding this issue.

EPRWG Probabilistic Safety Assessment subgroup

The Probabilistic Safety Assessment subgroup is identifying the design differences and modifications affecting risk and the main differences in PSAs. The technical expert subgroup prepared a comparison report of the differences in probabilistic safety assessment modeling and results among the member countries. The report compares selected internal initiating events at power including: loss of offsite power, medium loss of cooling accident, steam generator tube rupture, and loss of cooling chain. The subgroup conducted a workshop attended by the EPRWG members and AREVA/EDF representatives in October 2012. At this workshop, the working group presented preliminary results of the initiating events comparisons. A restricted (proprietary) version of the report will be issued in April 2013, followed by a public version in October 2013.

EPRWG Accidents and Transients subgroup

The Accidents and Transients subgroup is identifying differences in regulatory criteria and approaches among the member countries. The subgroup has developed four products:

1. A survey of the regulatory approaches to analysis of accidents and transients;
2. An interim position statement on EPR containment mixing;
3. An interim position statement on mass and energy release into containment; and
4. A report on "Approaches and Criteria used in the Analysis of Accidents and Transients in MDEP Countries"**.**

EPRWG Digital Instrumentation and Controls subgroup

The Digital Instrumentation and Controls (DI&C) subgroup focused on the area of Extended Loss of Power (ELEP). The results of the subgroups' evaluation will be documented as Appendix 1 to the EPR Design-specific Fukushima Common Position. Progress is being made by all countries on the EPR Digital I&C review, and most countries are currently concentrating on close-out of technical questions in the DI&C area. The subgroup drafted a technical report that identifies the differences and similarities among the EPR designs and the major outcomes of EPRWG interactions. This report is expected to be issued in 2013.

EPRWG Severe Accidents subgroup

The Severe Accident expert subgroup is focusing on the following topics:

- sacrificial concrete composition in the reactor pit;
- containment heat removal system active flooding;
- debris ingression into valve compartments near the core catcher spreading area;

- pH control in the in-containment reactor water storage tank and the drawbacks of passive pH control;
- dual use of the Primary Depressurisation System (feed and bleed and severe accidents);
- containment venting/filtration system.

In addition, the subgroup will address lessons learned from Fukushima related to severe accidents. The group prepared technical reports on the differences among the designs in each country. The technical reports covered the arrangement and configuration of the severe accident heat removal system injection lines into the core catcher, and the pH control for the in-containment refueling water storage tank. The group began to prepare two technical reports addressing post-Fukushima considerations. These reports focus on management of containment pressure during severe accidents, and reliability and qualification of instrumentation for dealing with severe accidents.

New EPRWG subgroups

In June 2012, a new technical expert subgroup was formed to address the issue of ensuring long-term cooling of the spent fuel pool. The subgroup will address three subtopics: the reliability of the cooling system and make-up water, instrumentation, and hydrogen management issues.

The EPRWG has begun a new effort to consider co-operation on commissioning activities. As several of the member countries get closer to the late stages of construction and preparations for operation, MDEP will consider how it can co-operate to share experience in late-stage construction tests (e.g. hot functional tests) leading to fuel load and operations. An ad hoc expert subgroup was formed to pursue this. A workshop is planned for June 2013 to begin discussing this area.

The EPR working group held several discussions on the response by each of the member countries to the Fukushima accidents. The working group also met with AREVA and the EPR applicants in each country to discuss the EPR Family common approach to Fukushima lessons learned. The working group is developing a common position addressing Fukushima-related issues for the EPR. This paper identifies common preliminary approaches to address potential safety improvements for EPR plants as related to lessons learned from the Fukushima Dai-ichi accident or Fukushima-related issues. After the safety reviews of the EPR design applications that are currently in review are completed, the working group plans to update the common position to reflect their safety conclusions regarding the EPR design and how the design could be enhanced to address Fukushima-issues. The common preliminary approaches are organised into five sections: external hazards, reliability of safety functions, accidents with core melt, spent fuel pools, emergency preparedness in design. Based on its initial conclusions, the EPRWG decided to consider some areas of the EPR design in greater depth to gain a better understanding of possible differences among different EPR evolutions (i.e. Olkiluoto 3, Flamanville 3, Taishan 1, UK-EPR and US-EPR) in terms of design and to highlight possible recommended practices. The following areas were identified for further study:

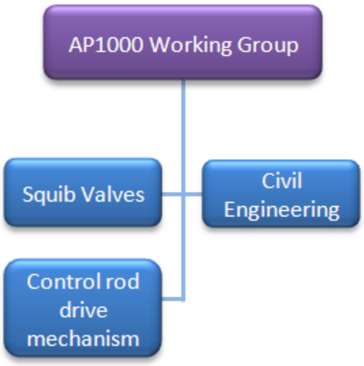
- arrangements for extended loss of electrical power (supplies and distribution systems) to ensure long term decay heat removal;
- reliability and qualification of severe accident management;
- management of pressure in containment during severe accidents;
- long-term cooling of spent fuel pool; reliability of cooling and make-up water systems, instrumentation and hydrogen management;
- maintaining long-term inventory and sub-criticality in primary circuit.

Flamanville 3 EPR reactor, France: March 2013. Copyright EDF.

Taishan EPR reactors, China.

Sanmen AP1000 reactor, China: 2013.

6.2 AP1000 Design-specific working groups



The AP1000 design-specific working group was established in November 2008 with initial participation by China (NNSA), the UK (ONR), and the US (NRC). Canada (CNSC) was added as a member in March 2009. A total of 4 AP1000 units are under construction in China at the Sanmen and Haiyang sites. The US NRC has certified the AP1000 design and is reviewing applications for combined licenses for 8 AP1000 units. Four units are under construction in the US at the Vogtle and Summer sites. The ONR has completed the current phase of its review and has issued an interim Generic Design Assessment (GDA) of the AP1000 design. At the request of Westinghouse, ONR has suspended its review of the AP1000 at the end of GDA Step 4. In January 2010, the CNSC completed phase 1 of its pre-project design review[4] on the potential choices for new reactor construction, which includes an assessment of the AP1000. The purpose of the Phase 1 review was to determine whether the design intent in the safety areas is compliant with the CNSC requirements and expectations for the design of new nuclear power plants in Canada. The CNSC is currently performing Phase 2 of its review.

Accomplishments

The working group members have shared design information, application documents, preliminary findings, and identified the most significant review issues. In the past year, CNSC re-established its review of the AP1000, and the US NRC completed its design review and began

[4] Find out more at http://www.nuclearsafety.gc.ca/

oversight of safety-related construction. As the working group members transitioned to different stages of their design reviews, the group re-evaluated the scope of the working group topics, and the issues to be addressed. The members agreed that Fukushima issues should be considered in future interactions and co-operation. In addition, the areas of focus for CNSC's Phase 2 review of the AP1000 were considered as candidates for co-operation. The following technical topics will be discussed by the working group:

- civil engineering (shield building): issues to be discussed include design of the composite shield building, modular fabrication and construction techniques, and seismic issues;
- passive safety systems: issues to be discussed include those that could affect the operation of the emergency core cooling systems such as the design and testing of the squib valves that initiate the cooling as well as testing and evaluation of the thermal hydraulic capability of the passive emergency core cooling system;
- DI&C safety systems;
- safety classification.

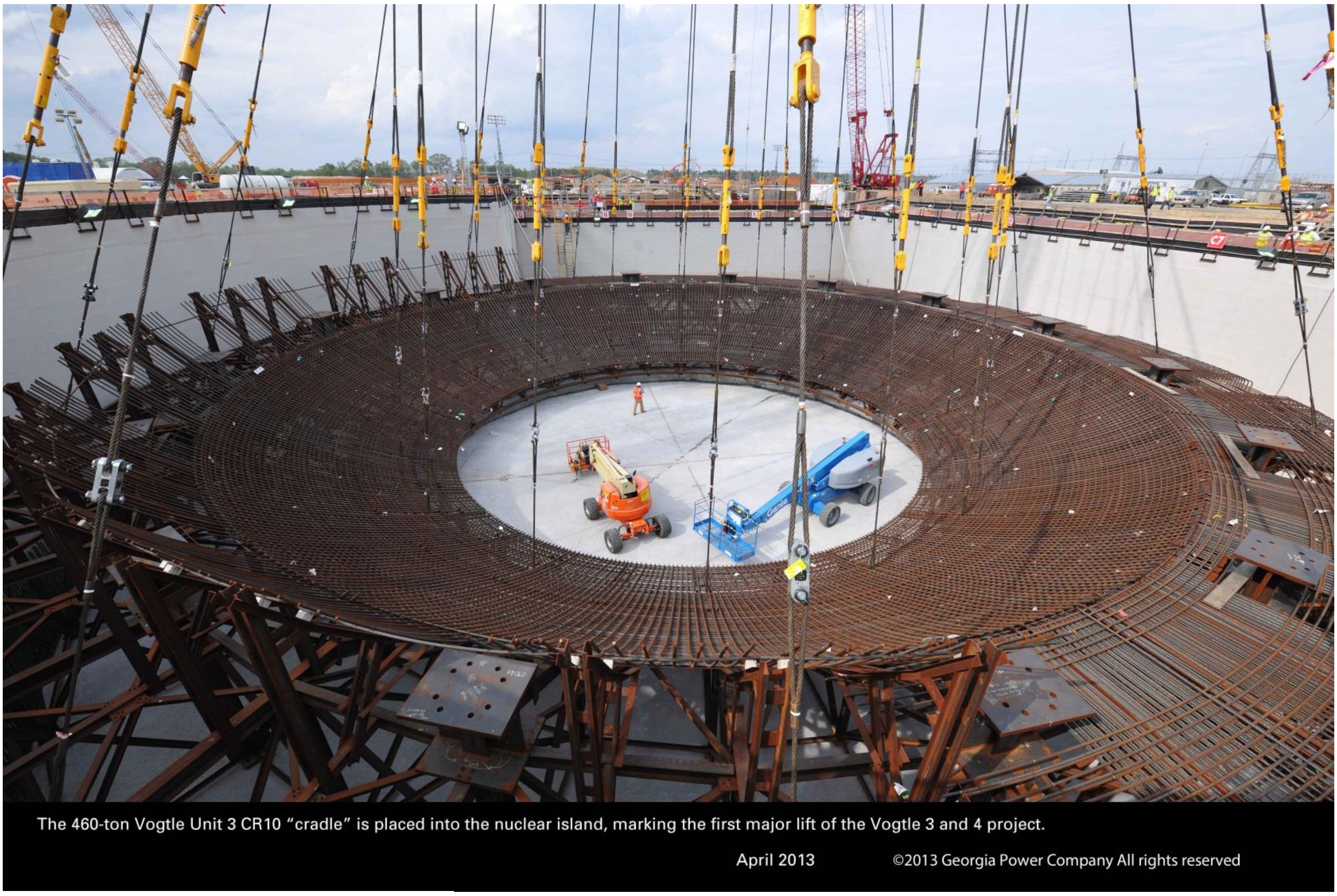
These topics incorporate many of the issues that were addressed by the initial technical expert subgroups.

CNSC's phase 2 design review consists of direct assessment of Westinghouse's submissions by technical staff, and technical discussions with the US NRC via video conference of selected priority focus topics. The US NRC and CNSC held several seminars to discuss areas that CNSC has designated as focus areas for Phase 2 of their review. Seminars have been held in the focus areas of: containment and civil structures important to safety, emergency core cooling and emergency heat removal systems, classification of structures, systems, and components, beyond-design-basis accidents, severe accident prevention and mitigation, and computer code analysis. In addition, working group members from the US observed a quality assurance audit at Westinghouse headquarters conducted by CNSC.

As the working group members move into the construction phase, they have begun to share information on construction experience. Some of the topics that the working group plans to address include start-up testing, and construction lessons learned that feed back into the design.

Haiyang AP1000 reactors, China.

Summer AP1000, unit 2, US: 10 March 2013. Copyright SCE&G.



Vogtle AP1000 reactor, US: April 2013.

Shin Kori, APR-1400 reactors, units 3 & 4, Korea: 2013.

6.3 APR-1400 Design-specific Working Group (APR1400WG)

Background

The APR-1400 design-specific working group was established in August 2012 with the participation of South Korea, Finland, the United Arab Emirates (UAE), and the US. South Korea made the proposal to form the working group at the May 2012 Policy Group meeting. The working group officially came into existence in August 2012, with the PG's approval for the UAE to join MDEP. The APR-1400WG chair is Korea, the country of the design originator; and the UAE, as the second country to begin the construction of an APR-1400, is the vice-chair.

In Korea, four APR-1400 units are under construction and 2 additional units are under preliminary safety evaluation report review. The US expects to receive a design certification application in July 2013 and is planning to start the review of a number of topical reports in early 2013. Two units are under construction in the UAE. On 17 July 2012, FANR issued the FANR Licence for construction and related regulated activities for Barakah units 1 & 2. FANR expects the submission of the construction permit application for the next 2 units, which it presumes will be similar to the construction permit application for the first 2 units in 2013. Finland (STUK) has completed a preliminary safety assessment of the APR-1400, which includes information regarding design feasibility, organisational capability and plant site.

The first meeting of the working group was held in December 2012 at KINS headquarters in Daejeon, South Korea. The working group agreed to prioritise six topics for discussion: design differences between the countries and differences in licensing processes; Fukushima lessons-learned enhancements; long term cooling; DI&C; construction oversight; and probabilistic safety assessment and severe accidents. Additional topics that may be discussed include: seismic and structural analysis; fuel design and design basis analysis; aircraft impact methodology; technical specifications; fire protection; and vendor inspections.

Novovoronezh VVER reactor, steam generator, Russia: 2013.
Provided by Rostechnadzor

6.4 Vendor Inspection Co-operation Working Group (VICWG)

Background

The VICWG was formed because component manufacturing is currently subject to multiple inspections and audits similar in scope and in safety objectives, but conducted by different regulators against different criteria. The primary goal of the VICWG is to maximise the use of the results obtained from other regulators' efforts in inspecting vendors.

Long-term goals of the working group include harmonisation of quality assurance/ management (QA/QM) requirements and standards; harmonisation of vendor inspection practices among MDEP regulators; and performing multinational inspections of vendors according to the common QA/QM requirements. To achieve these goals, the VICWG is working towards the following: identify and document a set of common QA/QM requirements; agree on an acceptable method to assess the implementation of the requirements; and develop an MDEP QA/QM inspection procedure.

The working group enhances the understanding of each regulator's inspection procedures and practices by co-ordinating witnessed inspections of safety-related mechanical pressure retaining components (Class 1) such as pressure vessels, steam generators, piping, valves, pumps, etc., and quality assurance inspections. Witnessed inspections consist of one regulator performing an inspection to its criteria, observed by representatives of other MDEP countries. The benefits to the observing countries include additional information and added confidence in the inspection results. MDEP regulators are using the experience gained during the conduct of VICWG witnessed inspections in their inspection planning.

VICWG – 2012: Witnessed and joint vendor inspections

Vendor	Location (Country)	Inspecting regulator	Participating regulator(s)	Scope
MHI	Japan	NRC	JNES NRA (Japan)	Engineering & Design Process (SONGS Follow-Up to AIT)
Enertech	USA	NRC	NNSA	AP-1000 Check Valve Qualification Testing (QME-1)
Target Rock	USA	NRC	KINS	Safety Related Valves
SPX, Copes-Vulcan	USA	NRC	NNSA	Design & Manufacturing of Squib valves
KSB	Germany	KINS	Rostechnadzor	Pumps, QA program implementation
Sempell	Germany	KINS	Rostechnadzor STUK	Valves, QA program & PSAR commitment
Kinectrics	Canada	NRC	CNSC	AP-1000 Containment Electrical Penetrations and Commercial Grade Dedication (CGD) of Relays & Breakers

Joint inspections consist of one regulator conducting an inspection according to its own regulatory framework with the active participation of one or more other regulators. This would allow the participating members to use the results of the inspection that are applicable to their regulations.

A long-term goal of the working group is multinational inspections: inspections conducted by a team of inspectors from multiple countries using common inspection criteria and selected criteria that are unique to their countries.

The working group maintains a list of inspections from the MDEP VICWG regulators for opportunities to witness inspections, and shares inspection results through a database maintained in the MDEP Library. This data base includes not only the reports of witnessed and joint inspections, but all inspections that might be of interest to MDEP members.

Accomplishments

The MDEP VICWG has achieved its short-term goals and continues to make progress towards achieving its long-term programme goals. For the intermediate term, emphasis will be placed on maximising information sharing, joint inspections (multiple nations inspecting the regulatory requirements of one country), and witnessing other regulators' inspections. The VICWG is also working with standards development organisations to encourage and explore the harmonisation of QA/QM standards.

A total of seven witnessed and joint inspections were conducted pursuant to VICWG activities in 2012. One joint inspection of Target Rock was held with KINS and the US NRC as participating regulators. Overall the joint inspection was deemed a success at saving resources and continuing the exchange of information among VICWG members. The table above lists the inspections conducted and the members participating.

Participating members found the witnessed inspections to be beneficial to the conduct of vendor inspections in each of their countries. Russia began witnessing inspections from other regulators for the first time this year under the VICWG framework. As a lesson learned, after witnessing inspections from the US NRC, the Korean regulator decided to make its reports as detailed as the US NRC's reports. In addition, KINS noted that it saved resources by sending fewer inspectors per inspection. After witnessing inspections by KINS, the US NRC is working to focus more on technical requirements to assess how the work inspectors observe meets the design requirements. A more rigorous view of the QA programme implementation was carried out.

MDEP members who don't currently perform direct inspections of vendors have benefitted from the group's activities by learning how to conduct such inspections and receiving information on vendors that they wouldn't otherwise have.

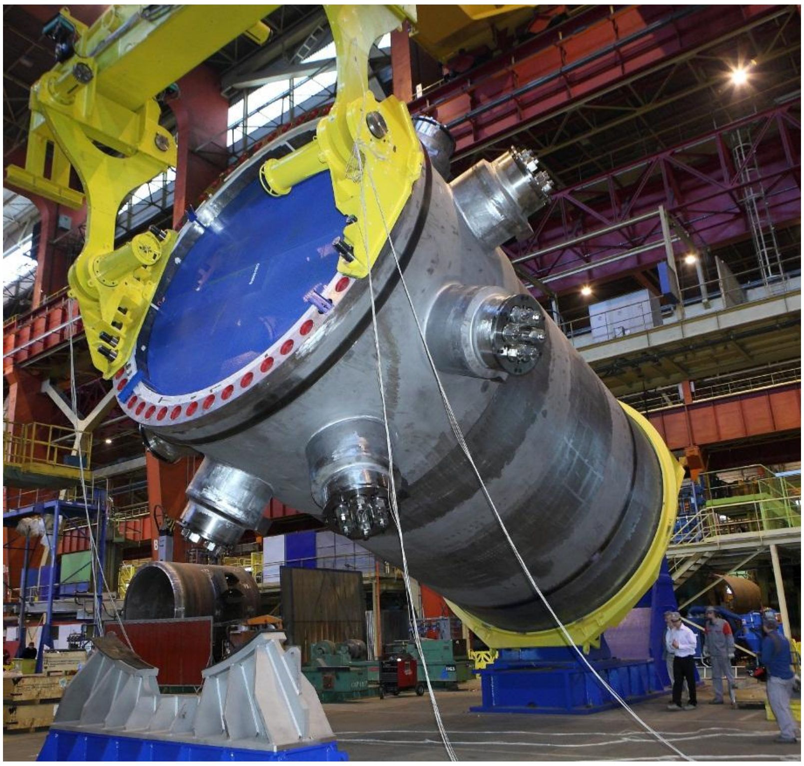
The WG plans to identify common quality assurance requirements that could be acceptable to MDEP regulators. The long-term goal of the WG is to harmonise a significant portion of the quality assurance inspection procedures so that the results of an inspection conducted by one member could be used by the other members, requiring that other member countries only inspect that portion of their requirements not covered by the common inspection procedure. The working group met with some SDOs that deal with QA/QM standards (AFCEN and ISO) and WNA/CORDEL to discuss ideas about the potential harmonisation of standards. The WG plans to work with the SDOs to encourage harmonisation of QA/QM-related standards.

The working group conducted a survey on quality assurance requirements used in the oversight of vendors to identify those areas where the various regulators have common regulatory frameworks. A comparison table was analysed, and a QA/QM Criteria Comparison Report written. Using this comparison, the WG will identify MDEP Core QA requirements. This activity supports the identification of common QA requirements that could be acceptable to VICWG regulators and that could eventually support multinational inspections.

Next steps

Participating regulators have gained much experience in each other's inspection processes through the MDEP witnessed inspections conducted since 2008. Therefore, the working group will continue to co-ordinate witnessed inspections and will increase its focus on joint inspections in 2013. This will continue to enhance the exchange of information between the regulators and provide better understanding of the inspection scopes and safety findings and how these findings may be utilised. The working group's goal is to hold at least two joint inspections per year.

The issue of conducting multinational inspections (defined as inspectors from multiple regulators actively undertaking an inspection of a vendor against a common set of requirements) is under discussion by the WG. Conducting joint inspections and formulating common QA/QM criteria inform issue of conducting multinational inspections.



Preparation for hydraulic test of the reactor vessel for the EPR reactor of Flamanville 3, France: August 2010. Copyright AREVA, Tracy Faveyrial.

6.5 Codes and Standards Working Group (CSWG)

Background

The goal of the Codes and Standards Working Group (CSWG) is the harmonisation of code requirements for the design and construction of pressure-retaining (pressure boundary) components in order to improve the effectiveness and efficiency of the regulatory design reviews, increase the quality of safety assessments, and strengthen each regulator's ability to make safety decisions.

The CSWG recognised early on that the first step to achieving harmonisation is to understand the extent of similarities and differences amongst the pressure-boundary codes and standards used in various countries. The CSWG encouraged SDOs to conduct code comparisons, study the similarities and differences between codes, and develop a strategy and process for achieving code harmonisation. The SDOs formed a steering committee, composed of the representatives of ASME, JSME, KEPIC, AFCEN, CSA, vendors, and utilities, which performed a comparison of their pressure-boundary codes and standards to identify the extent of similarities and differences in code requirements and the reasons for their differences. The CSWG was represented on the steering committee by the representative from the US NRC. The SDOs compared requirements of their pressure-boundary codes and standards including JSME's S-NC1 Code (Japan), AFCEN's RCC-M Code (France), KEA's KEPIC Code (Korea), CSA's N285.0 standard (Canada) and NIKIET's PNAE G-7 Code (Russia) against the requirements of Section III of the ASME Boiler and Pressure Vessel Code (US) for Class 1 vessels, piping, pumps and valves. The results enabled the CSWG to understand from a global perspective how each country's pressure-boundary code or standard evolved into its current form and content.

The CSWG will work closely with SDOs and WNA/CORDEL to converge code requirements and reconcile code differences. The CSWG is also working with the SDOs to develop a strategy to prevent, minimise, or limit future code divergences.

The WG also conducted work separate from SDOs code comparison and SDO/CORDEL code convergence, which includes exploring ways to evaluate acceptability of components that are designed and manufactured using foreign codes and standards, and evaluating the differences in codes applications on the quality and safety of nuclear power plants.

Accomplishments

On 27 January 2012, the SDOs from the United States, France, Japan, Korea and Canada issued their Code Comparison Report for Class 1 Nuclear Power Plant Components that was prepared for MDEP. The report was made publicly available on the ASME website (in the form of an ASME Standard Technical Publication). This report includes a comparison of JSME's S-NC1 Code (Japan), AFCEN's RCC-M Code (France), KEA's KEPIC Code (Korea), and CSA's N285.0 standard (Canada) against the requirements of Section III of the ASME Boiler and Pressure Vessel Code (United States) for Class 1 vessels, piping, pumps and valves. On 31 December 2012, the SDOs published revision 1 of the report that included a comparison with the Russian code.

The results provided a significant amount of information about the comprehensiveness and technical adequacy of each country's pressure-boundary codes and standards and produced a wealth of useful information about the technical and programmatic similarities and differences among each country's codes including the reasons for these differences. Consequently, the results will enable regulators as well as other users of the Code-comparison report to determine the impact of those differences and their safety significance as well as provide insights into the level of effort needed to reconcile those differences. The SDOs' Code Comparison report does not make any conclusions about the comparisons. The CSWG evaluated the report and made conclusions on the code-comparison and harmonisation of pressure-boundary codes and standards.

The SDOs formed a Code Convergence Board with the objective to limit divergence and achieve convergence on individual requirements where realistic and practical. Although not a voting member of the Board, MDEP has observer status and a member of the CSWG attends most meetings.

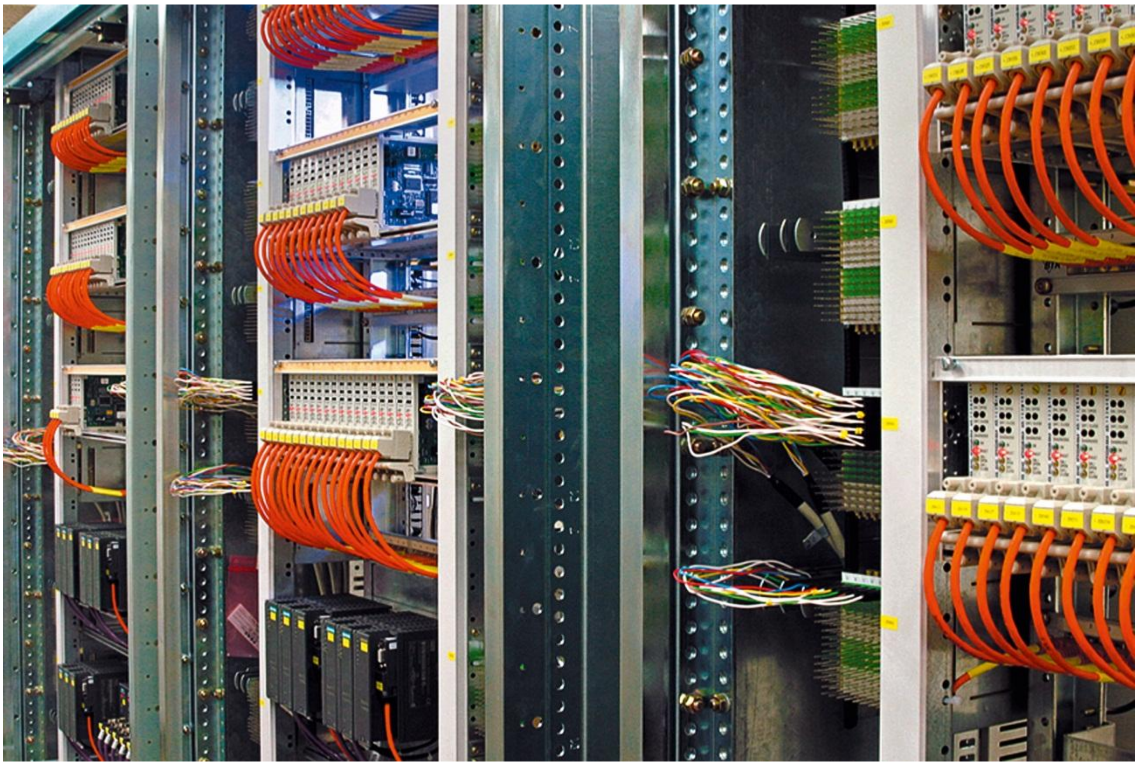
The working group finalised two reports in 2012. Technical Report 1, "Regulatory Frameworks for the Use of Nuclear Pressure Boundary Codes and Standards in MDEP Countries" was written to consolidate information shared and accomplishments achieved by the member countries. This report documents how each MDEP regulatory authority utilises national or regional mechanical Codes and Standards in its safety reviews and licensing of new reactors. The preparation of this report, together with code comparison, could be an appropriate starting point for exploring potential harmonisation efforts.

Common Position 1, "Lessons Learned on Achieving Harmonisation of Codes and Standards for Pressure Boundary Components in Nuclear Power Plants" documents the findings and overall conclusions of the CSWG pertaining to (1) the safety of several MDEP-member country's pressure-boundary codes and standards and (2) the potential for harmonisation of those pressure-boundary codes and standards based on the code-comparison work performed by the SDOs from April 2008 to March 2012. This report also documents a strategy and process proposed by the SDOs for achieving code harmonisation.

The working group has drafted two additional common positions on Fundamental Attributes for the Design and Construction of Pressure Boundary Components, and Essential Performance Guidelines for Pressure Boundary Components. These two documents are currently under MDEP internal review.

Next steps

The results of the code-comparison project enabled the CSWG to take the next steps towards harmonisation of codes and standards. The CSWG has been interacting with WNA/CORDEL. As part of its plan to achieve international standardisation of reactor designs, the CORDEL Group identified an urgent need for the international harmonisation of standards and codes. CORDEL is supportive of the CSWG's long-term goals and the SDOs' code-comparison effort and proposed to take harmonisation to the next level by trying to converge on some selected Code differences. CORDEL has proposed a pilot project regarding exploration of potential harmonisation among the various codes. Based on the results of the SDOs' code-comparison, CORDEL and the SDOs are planning to select a few specific code rules where differences have the most important industrial impact and convergence is relatively easy to achieve. CORDEL plans to choose independent technical experts to propose a "harmonised" version of the Code differences or to demonstrate the equivalence of these differences. The proposed pilot project will be co-ordinated and funded by CORDEL, and will be conducted in co-ordination with the CSWG. CORDEL will seek the CSWG's recognition of potential code changes proposed in their pilot project.



I&C Teleperm X5. Erlangen, Germany: 2009.
Copyright Areva.

6.6 Digital Instrumentation and Control Working Group (DICWG)

Background:

The DICWG works to increase collaboration, co-operation, and knowledge transfer among members and with other stakeholders to achieve the following primary goals:

- Facilitate timely and efficient mechanisms for sharing of knowledge and experience among members, thus allowing knowledge transfer and more effective safety reviews;
- Work jointly to develop common positions among members for issues of significance, which may be based on a review of the existing standards, national regulatory guidance, best practices, and group inputs.

All MDEP members participate in the DICWG. In addition, the IAEA, the Institute of Electrical and Electronics Engineers (IEEE) and the International Electrotechnical Commission (IEC) representatives are invited to participate in working group meetings and activities. Industry is represented via the IEC and IEEE standards organisations and through specific invitations by the DICWG to share information and give presentations on topics of interest. Both the IEC and IEEE allowed a number of their standards relevant to DI&C to be made available in the MDEP Library for use by the working group members. In addition, the IEC formalised an agreement with the OECD to facilitate co-operation between the two organisations.

Accomplishments

The topics for DICWG generic common positions were selected based on the safety implications of the issue, and the need to develop a common understanding from the perspectives of regulatory authorities. The original list of topics was developed following an examination of the regulatory requirements of the participating members, and of relevant industry standards and IAEA documents. DICWG generic common positions are not intended to cover all issues associated with the DI&C technical disciplines, but only those of most value to the members. The DICWG follows a formal process for the proposal, evaluation, and development of new generic common positions. Any member can propose generic common positions and can assume the lead role for the development of the generic common positions. The table on the next page lists both the published (highlighted in bold)[5] and planned DICWG generic common positions to date.

[5] Available on www.oecd-nea.org/mdep

Issue	Issue Leader
1. Treatment of Software Common Cause Failure in Safety Systems	USA
2. Software Tools	UK
3. Verification and Validation Throughout the Life cycle of Safety Systems Using Digital computers	Japan
4. Data Communication Independence	Korea
5. Treatment of Hardware Description Language (HDL) Programmed Devises for Use in Nuclear Safety Systems	France
6. Simplicity in Design	USA
7. Qualification of Industrial Digital Devices of Limited Functionality for Use in Safety Applications	IAEA
8. Impact of Cyber Security Features on Digital I&C Safety Systems	USA
9. System Architecture Considerations for Systems Classified at the Highest Safety Level	IAEA
10. Configuration Management for Software	Finland
11. Factory Acceptance Test and Site Acceptance Test	Russian Federation
12. Use of Automatic Tests to Perform Surveillance for Digital Systems	Korea

The DICWG has published five generic common positions that describe methods and evidence that all DICWG member states find acceptable to support safety justification for DI&C systems. The five published common positions include: Software Tools, Communication Independence, Simplicity in Design, Verification and Validation, and Impact of Cyber Security Features on DI&C Safety Systems. These common positions have been made publicly available on the MDEP website. Seven additional common positions are under development. The key principles of each of these five generic common positions are summarised below.

Generic Common Position 2, "Software Tools for the Development of Software for Safety Systems," provides criteria on the selection, qualification, and use of software tools used for the development of safety system software in nuclear power plants. This common position applies specifically to tools that directly support the development of safety systems, such as those that support the capture of requirements and support the transformation of requirements into the final system code and data (there may be many intermediate steps), or those that are used to directly support the performance of verification, validation and testing. This common position does not apply to tool support for complex programmable logic devices (e.g. FPGAs), or off-line tools (e.g. tools that calculate important variables used during the design and analysis of safety systems), or office administration tools used to support tasks not directly concerned with software development (e.g. word processors).

Generic common position 2 recommends that tools be used to support all aspects of the I&C lifecycle where benefits result through their use. However, the benefit and risk of using tools should be balanced. This common position asserts that the important principle in choosing tools is to limit the opportunity for making errors and introducing faults, but maximise the opportunity for detecting faults. As such, tools should be verified and assessed in a way that is consistent with the tool reliability requirements, the type of tool, and the potential of the tool to introduce faults.

Generic Common Position 3, "Verification and Validation Throughout the Life Cycle of Digital Safety Systems," provides criteria for Verification and Validation (V&V) activities for digital safety systems throughout their life cycles. To address the differences in terminology among DICWG members for activities in each phase of the life cycle, this common position included a typical representation of DI&C systems' development life cycles. This typical representation is derived from the draft IAEA safety guide for DI&C. In general, this common position refers to verification as the confirmation that the products of each development phase fulfil the requirements or conditions imposed by the previous phase, and validation confirms that the finished product is in compliance with the system's functional performance and interface requirements. One key point in this common position is that although the DICWG member countries may have different regulations governing third party verification of the system, the member countries all agree that V&V should be performed by an independent group who has not been engaged in the design & development of the system.

Generic Common Position 4, "Principle of Data Communication Independence," provides agreed-upon principles for maintaining data communications independence among different safety systems to ensure that errors in one channel or division or lower class systems will not cause the failure of another channel or divisions or higher class systems. This common position describes the types of communication protocols and communications network topologies that should be used for data communication between different safety divisions. For communication between higher classified safety systems and lower safety class systems, this common position recommends that the communications flow should only be uni-directional from higher classified safety systems to lower safety class systems. In cases where it can be shown that data flow from lower to higher classified safety systems is of safety benefit, then it must be demonstrated that the safety functions of the higher category cannot be adversely affected by such a connection.

Generic Common Position 6, "Principle on Simplicity in Design," provides principles on ensuring that safety systems are designed to be as simple as they are practical. Since complexity can generate additional faults in design, difficulty in detecting and correcting faults, introduction of failure modes and effects that are not present in simpler design, and challenge in demonstrating conformance to safety system design criteria such as independence, testability and reliability, the design of safety systems should avoid including unnecessary functions (e.g. those that have no safety benefit) in safety systems. Any additional features included in design should not violate other design principles of safety (e.g. independence, redundancy, diversity).

Generic Common Position 8, "Impact of Cyber Security Features on DI&C Safety Systems," provides principles on the implementation of cyber security features such that these features do not adversely impact safety functions. Although, it is recognised that the implementation of a cyber security programme may vary based on site specific requirements and each country's regulatory frameworks, the general understanding is that, independent of specific implementation, the cyber security programme shall not adversely impact the performance and dependability of safety functions. One of the key principles in this common position is that implementation of cyber security features directly in the safety system should be avoided when practical. Adding cyber security features to safety I&C system may increase system complexity and may introduce potential failure modes to the system that would challenge its ability to perform its safety function in a reliable manner. For this reason, inclusion of cyber security features should be carefully evaluated and only implemented when it is not practical or otherwise feasible to accomplish an equivalent measure of cyber security protection by other means. In addition, a cyber security feature, when challenged, should not inhibit or deactivate safety functions.

The working group reviewed the published common positions with the regulators new to MDEP, the UAE and India, and incorporated their comments.

The working group continues to implement a formal "Quick Inquiry" process to generate and process inquiries from member countries to promote an efficient and structured information exchange and provide for storing this information in a retrievable database. The DICWG maintains frequent communication with the design-specific working groups, particularly with the EPR DI&C subgroup.

The DICWG is working with the IAEA, the IEC, and IEEE to pursue harmonisation of relevant standards, and to share with these organisations relevant regulatory perspectives and lessons learned. The DICWG has obtained agreement from the IEC and IEEE to increase co-operation and consider MDEP common positions when updating or developing new standards. The DICWG has reviewed and provided input to proposals for new standards. As generic common positions are developed, the DICWG will make recommendations to these organisations on key areas where standards should be developed or enhanced.

The IEC and IEEE have agreed to work together to develop joint logo standards in specific areas. The MDEP DICWG fully supports this initiative as a vehicle to facilitate harmonisation and provides support to these types of efforts. In addition, the IAEA is considering MDEP common positions as part of their DI&C work and has invited the DICWG to provide comments to the DI&C safety guide.

Next steps

The working group has prioritised the remaining issues and has identified schedules for the development, review, and issuance of each common position.

The working group will communicate specific suggestions to the standards organisations and the IAEA for consideration of harmonisation in a timely manner when they are identified during its activities. For example, MDEP may be able to help co-ordinate the development of cyber security standards by serving as the focal point for harmonising IAEA, ISO, the IEC, and IEEE cyber security standards development.

The working group will continue to engage DI&C vendors and utilities to share experience and insights toward developing common positions that are based on a broad spectrum of inputs.

7. INTERIM RESULTS

MDEP is considered a long-term programme with interim results. Interim results are those products that document agreement by the MDEP member countries and are necessary steps in working towards increased co-operation and convergence. The interim results for 2012 included:

- preparation of a comparison report of the differences in probabilistic safety assessment modelling and results for the EPR;
- preparation of technical reports on the differences among the designs in each country in the arrangement and configuration of the severe accident heat removal system injection lines into the core catcher, and the pH control for the in-containment refuelling water storage tank for the EPR;
- development of a common position addressing Fukushima-related issues for the EPR;
- co-operation on six witnessed vendor inspections and one joint inspection;
- interacted with the SDOs to complete and issue comparison tables of the ASME Boiler and Pressure Vessel Code, and the codes of France, Japan, Korea, Canada and Russia for Class 1 pressure vessels, piping, pumps, and valves; evaluation of the report and drawing conclusions on the code-comparison and harmonisation of pressure-boundary codes and standards;
- finalisation of common positions on DI&C for new reactors in the areas of: Software Tools for the Development of Software for Safety Systems, Principles of Data Communication Independence , and Principles on Simplicity in Design;
- establishment of the APR-1400 design specific working group and prioritisation of four topics for future discussion;
- bringing the new members, India and the UAE, to pace and started to incorporate their views into the already issued MDEP products;
- holding several seminars to discuss areas that Canada has designated as focus areas for their review of the AP1000;
- finalisation of a Technical Report on "Regulatory Frameworks for the Use of Nuclear Pressure Boundary Codes and Standards in MDEP Countries" a Common Position on "Lessons Learnt on Achieving Harmonisation of Codes and Standards for Pressure Boundary Components in Nuclear Power Plants".

8. NEXT STEPS – FUTURE OF THE PROGRAMME

At its meeting in May 2012, the MDEP Policy Group endorsed the extension of the planning window for MDEP activities from March 2013 to March 2018. MDEP still remains a mid and long term programme that focuses on interim results. The PG members stressed that they will review this issue in three years to determine if the planning window is still appropriate.

The results of the MDEP self-assessment indicated that MDEP should maintain a relatively small number of topics and keep them closely connected to topics relevant to new reactor designs. It was also recognised that the most effective aspect of MDEP is the co-operation and exchange of information it facilitates for design reviews. Therefore, MDEP will act quickly to approve the formation of new design-specific working groups (consistent with the existing Rule of Three for forming design-specific working groups). At its meeting in May 2012, the Policy Group discussed a request by the Russian regulator to start a VVER design-specific working group. A decision on this working group is pending approval by the Policy Group. The Russian regulator provided information regarding the design reviews that are being pursued by the regulatory authorities of Russia, India, and Turkey, the members proposed to take part in such a group, and documentation regarding the main differences between the designs in each country. To form such a group, Turkey would have to follow the process of becoming a member or an associate member of MDEP.

The self-assessment also addressed the issue of how long the working groups should continue. Both the internal and external responders believe that there is a benefit to maintaining some type of co-operative arrangements after one or more WG members completes its design review. Therefore, the design-specific working groups will continue co-operation and exchanging feedback on design issues at least through the construction phase.

After design review activities are completed for a majority of members, the working group format and goals may change to a type and level of activity that would be appropriate to continue to exchange information.

It was determined that the current issue-specific working groups should continue until they complete the goals and activities specified in their programme plans. However, the work of the issue-specific working groups should eventually be transferred to other organisations such as the CNRA or the IAEA. The working groups will identify completion strategies (including final products, recommendations to SDOs or other organisations for follow-up activity) in the working group programme plans and will identify end users of MDEP products early and interface with them throughout development so that the products will be useful to stakeholders and can easily be transitioned to another organisation.

No new issue specific working groups were proposed for MDEP in 2012. The following criteria are used to evaluate whether a proposed activity should be undertaken as part of MDEP in the future:

the activity is of generic interest and of safety significance to the licensing of new reactors in MDEP member countries;

1. the approach followed by the MDEP regulators is not completely similar;
2. successful completion of the activity would likely result in increased harmonisation/ convergence in regulatory practices or increased co-operation within a reasonable timeframe and resource expenditures;
3. any new MDEP activity should not duplicate similar efforts that are already on-going or are planned to be undertaken by other more appropriate organisations such as the CNRA/WGRNR (or other NEA WGs), IAEA, GIF, WENRA, etc. except where MDEP could contribute to the ongoing work of these groups;
4. each new activity should have a lead country willing to take an active leadership role, and should have a defined product.

Novovoronezh VVER AES 2006 Phase 2, Russia: 2013. Provided by Rostechnadzor.

Appendix A
Table of Acronyms

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AFCEN	*French Society for Design and Construction and in-Service Inspection Rules / Association Française pour les règles de Conception, de construction et de surveillance en exploitation des matériels des Chaudières Electro Nucléaires*
ASME	*American Society of Mechanical Engineers*
CNRA	*Committee on Nuclear Regulation (NEA)*
CNSC	*Canadian Nuclear Safety Commission*
CORDEL	*Co-operation in Reactor Design Evaluation and Licensing*
CSA	*Canadian Standards Association*
DI&C	*Digital Instrumentation and Control*
EDF	*Electricity of France/Electricité de France*
FANR	*Federal Authority for Nuclear Regulation*
GIF	*Generation IV international Forum*
GSR-3	*IAEA Safety Standards/the Management System for Facilities and Activities/Safety Requirements*
IAEA	*International Atomic Energy Agency*
IEC	*International Electro-technical Commisstion*
IEEE	*Institute of Electrical and Electronics Engineers*
INSAG	*International Nuclear Safety Group*
ISO	*International Standards Organisation*
JSME	*Japan society of Mechanical Engineering*
KEA	*Korean Electronic Association*
KEPIC	*Korea Electric Power Industry*
MDEP	*Multinational Design Evaluation Programme*
MHI	*Mitsubishi Heavy Industries*
NEA	*Nuclear Energy Agency*
NIKIET	*Russian Research and Development Institute of Power Engineering*
NNSA	*National Nuclear Safety Administration (China)*
NPEC	*Nulcear Power Engineering Committee*
NRC	*Nuclear Regulatory Commission (United States)*
ONR	Office for Nuclear Regulation (UK)

OECD	*Organisation for Economic Co-operation and Development*
OL3	*Olkiluoto-3*
PNAE G-7	*Russian Rules for Design and Safety Operation of Equipment and Piping of Nuclear Installations*
PG	*Policy Group (MDEP)*
PSA	*Probabilistic Safety Assessment*
QA	*Quality Assurance*
RCC-M	*Design and Construction Rules for Mechanical Components of PWR Nuclear de Conception et de Construction des Matériels mécaniques des îlots nucléaires des REP*
RHWG	*Reactor Harmonisation Working Group*
SDO	*Standards Development Organisations*
STC	*Steering Technical Committee (MDEP)*
STUK	*Finnish Radiation and Nuclear Safety Authority*
TOR	*Terms of Reference*
WENRA	*Western European Nuclear Regulators Association*
WNA	*World Nuclear Association*
WGRNR	*Working Group on the Regulation of New Reactors (NEA)*

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