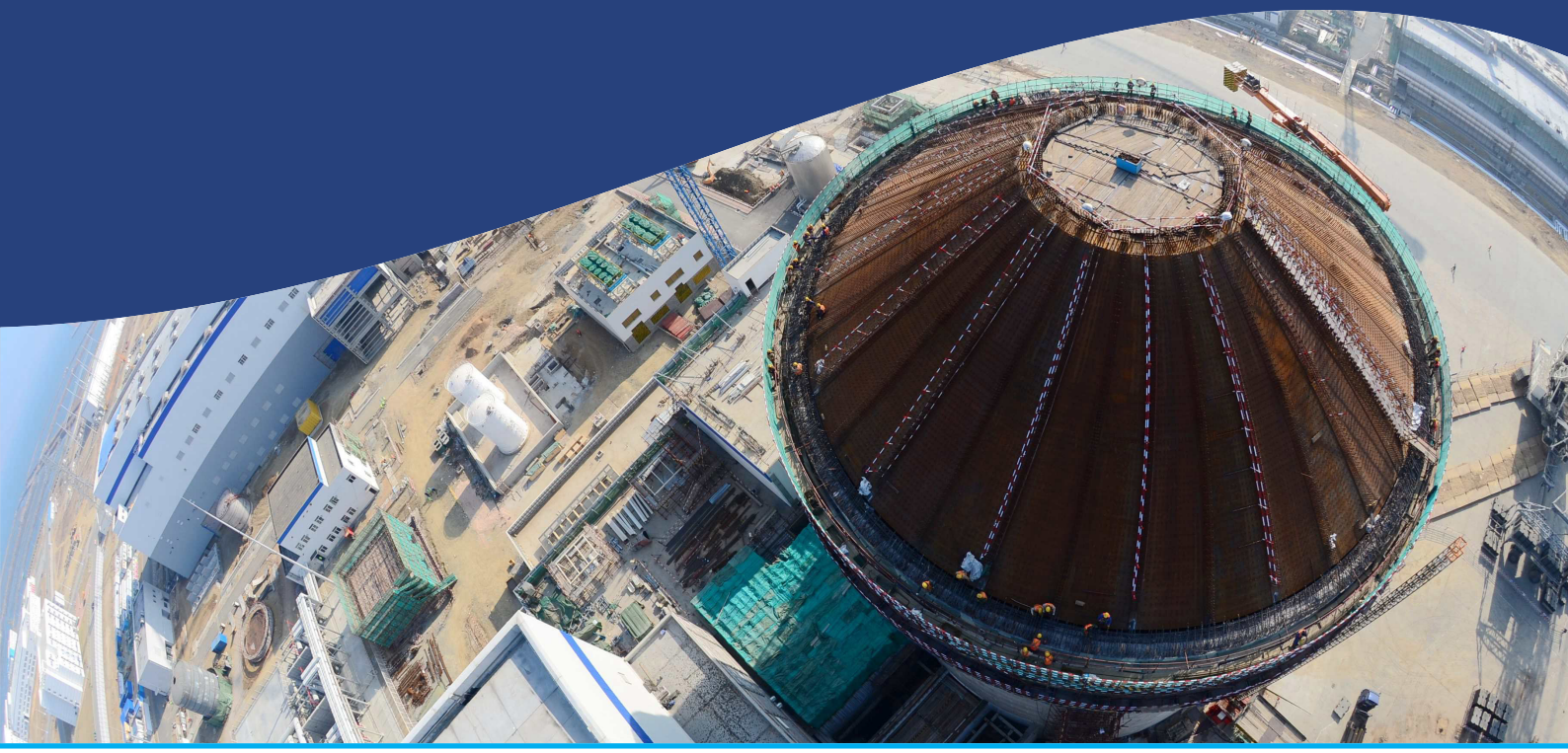
MULTINATIONAL DESIGN EVALUATION PROGRAMME

Annual Report

April 2014-April 2015

June 2015



NEA

NUCLEAR ENERGY AGENCY

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MDEP Policy Group Meeting, Bethesda, Maryland, United States, 13 May 2014.

MDEP Steering Technical Committee Meeting, Visit of Barakah APR1400 construction site, United Arab Emirates, 17 February 2015.

FOREWORD FROM THE POLICY GROUP CHAIRMAN

In January 2015, I was honoured to become the new Chairman of the MDEP Policy Group. I have participated in many activities of the programme since its beginning. It is a great pleasure now to assume this role with an initiative I know has been very successful in providing a forum for regulators involved in activities related to new reactors so as to efficiently co-operate and share information and practices.

Over the last year, significant progress was achieved toward those goals. The three latest design-specific working groups formed within MDEP, where design issues related to APR1400, VVER and ABWR reactors are being discussed, have started to work on specific technical issues with the inception of eight new technical experts' subgroups. The EPR and AP1000 working groups, foundation of MDEP since its creation, have stepped into the preparation of commissioning activities as the construction of new reactors is ongoing in several countries.

The design-specific working groups of MDEP continued to assess the lessons learnt from the TEPCO's Fukushima Daiichi accident. The EPRWG has updated its common position addressing Fukushima Daiichi related issues with technical appendices such as the management of the containment pressure during a severe accident. The other groups are aiming to release common positions in the coming year.

New milestones were reached by issue-specific working groups. The first multinational inspection was carried out under the framework set up by the Vendor Inspection Co-operation Working Group, and the feedback will be set in the form of best practices. The Codes and Standards Working Group has finalised its technical reports and common positions documenting the full picture and experience of the regulators on the harmonisation of pressure boundary components codes and standards. This group has now given the keys for converging those codes to the industry and standard development organisations, and plans to support them. The Digital Instrumentation and Controls Working Group is progressing toward the completion of its set of common positions, with ten published and three remaining.

MDEP is regularly interacting with its stakeholders, international organisations of regulators, industry or standard development organisations. In May 2014, MDEP organised its third conference on new reactor design activities, when 150 participants could have a fruitful open discussion with MDEP. Their opinions are and will be taken into account in order to improve the efficiency of the international co-operation in the whole range of MDEP objectives.

This year MDEP will have to think about its future as it is meeting challenges posed by the recent expansion of its membership and scope, such as the management and transfer of knowledge. To inform those strategic discussions to be held in June 2015, member regulators have answered, in late 2014, a questionnaire on MDEP's achievements and mid- and long-term development. I value MDEP activities and I believe even more benefits will be visible next year as MDEP continues to act as one of the major driving forces of the international initiatives to increase the safety of new reactors as well as the effectiveness of regulatory reviews.

Finally, I would like to acknowledge the useful guidance that Dr Allison Macfarlane, former PG Chairman, has given to MDEP. It is to be recognised that she played a key role in leading the programme to meet its successful accomplishments over the last couple of years.

Petteri Tiippana
MDEP Policy Group Chairman

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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 shortly be, undertaking the review of new reactor power plant designs. The MDEP members are national regulators from the following countries: Canada (CNSC), People's Republic of China (NNSA), Finland (STUK), France (ASN), India (AERB), Japan (NRA), Korea (NSSC), the Russian Federation (Rostechnadzor), South Africa (NNR), Sweden (SSM), the United Kingdom (ONR) and the United States (US NRC). In addition to these members, the national regulators of Turkey (TAEK) and the United Arab Emirates (FANR) have been accepted as associate members. The International Atomic Energy Agency (IAEA) also takes part in the work of MDEP and the OECD Nuclear Energy Agency (OECD/NEA) performs the Technical Secretariat function in support of MDEP. MDEP incorporates a broad range of activities including enhancing multilateral co-operation within existing regulatory frame-works, and increasing multinational conver-gence 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.

Working groups are implementing the activities in accordance with programme plans with specific activities and goals, and have established the necessary interfaces both within and outside of MDEP. This report provides a status of the programme after its seventh year of implementation.

Significant progress is being made on the overall MDEP goals of increased co-operation and enhanced convergence of requirements and practices. In addition, the lessons learnt from the 11 March 2011 events at the Fukushima Daiichi nuclear power plant (NPP) continue to be appropriately incorporated into MDEP activities in the design-specific working groups' (DSWGs) programme plans. On this topic, the EPR Working Group (EPRWG) has revised its common position and has published two new appendices to it, with one to be added before the end of 2015. Other DSWGs are in the process of drafting such common positions.

Five DSWGs are facilitating the MDEP programme goal of enhanced co-operation. The EPRWG consists of the regulatory authorities of China, Finland, France, India, Sweden, the United Kingdom and the United States. The AP1000 Working Group (AP1000WG) consists of the regulatory authorities of Canada, China, Sweden, the United Kingdom and the United States. The APR1400 Working Group (APR1400WG) includes the regulatory authorities of Finland, Korea, the United Arab Emirates and the United States. The VVER Working Group (VVERWG) includes the regulatory authorities of Finland, India, Russia and Turkey. The ABWR Working Group (ABWRWG) includes the regulatory authorities of Finland, Japan, Sweden, the United Kingdom and the United States. The DSWGs have been successful in sharing information and experience on the safety design reviews with the purposes of enhancing the safety of the design and enabling regulators to make timely licensing decisions, and of promoting safety and standardisation of designs through MDEP co-operation.

The Vendor Inspection Co-operation Working Group (VICWG) continues to achieve its short-term goals and with the completion of the first multinational inspection in 2014, completed a major step towards achieving its long-term programme goals. The VICWG continues to focus on maximising information sharing, joint inspections (multiple regulators inspecting to the regulatory requirements of one country), and witnessing of other

regulators' inspections. A total of ten multi-national, witnessed and joint inspections were conducted through MDEP in 2014. The VICWG is also interfacing with Standards Development Organisations (SDOs) to encourage and explore harmonisation of quality standards.

The Digital Instrumentation and Controls Working Group (DICWG) has issued ten common positions based on the existing standards, national regulatory guidance, best practices, and group inputs using an agreed upon process and framework. These common positions describe methods and evidence that all DICWG member states find acceptable to support safety justification for digital I&C systems. In addition, the DICWG members jointly research and comment on proposed IEC, IEEE, and IAEA standards that are relevant to the regulatory review of digital instrumentation and controls systems.

The Codes and Standards Working Group (CSWG) continues to work closely with SDOs and the World Nuclear Association's working group on Co-operation in Reactor Design Evaluation and Licensing (CORDEL) to attempt code requirements harmonisation and reconcile code differences. The CSWG has issued a technical report on the essential performance guidelines for the design and construction of pressure boundary components, which is the last report as initially planned in the group's programme of work. The CSWG has pushed the industry and the SDOs to move forward and work co-operatively and will continue to support their initiatives by regularly interacting with them.

On 14-15 May 2014, MDEP held its third conference on new reactor design activities in Bethesda, Maryland (US). The purpose of this conference was to provide a forum where MDEP could share the results obtained with its stakeholders, and provide them opportunities to present ongoing activities related to new reactor licensing as well as give their feedback on MDEP activities and future. A total of 150 people attended the conference. Representatives from a broad range of national regulators, international organisations, nuclear industry, including vendors, designers, licensees and applicants, and standard development organisations, participated in the two-day conference. Seven expert panel sessions, covering major topics of interest among member regulators were conducted. In each of these sessions, the accomplishments and status of MDEP and related international initiatives were discussed. MDEP stakeholders stressed the need to continue the work on harmonisation of the regulation and international practises and to anticipate upcoming new reactor reviews to be undertaken in the future, notably by taking benefit from knowledge already acquired through MDEP. Messages from the stakeholders will be considered by MDEP to inform its future.

Accomplishments to date provide confidence that the MDEP membership, structure and processes provide an effective method of accomplishing increased co-operation in regulatory design reviews. The interim results for 2014 and early 2015 include:

- ten MDEP-co-ordinated vendor inspections including a multinational inspection with participation by the US NRC, France ASN, and the UK ONR, two joint inspections with participation by the United States and Korean regulators, and seven additional witnessed inspections;
- completion of the first multinational inspection of a vendor using the common Quality Assurance/Quality Management (QA/QM) requirements;
- completion of all five planned documents for the CSWG with issuance of its technical report on the "essential performance guidelines for the design and construction of pressure retaining components";
- common position on digital instrumentation and controls for new reactors in the area of the "selection and use of industrial digital devices of limited functionality";

- a paper on “insights from Probabilistic Safety Assessment (PSA) comparison in evaluation of EPR designs”, presented by the Chairman of the EPR technical experts subgroup on PSA at the PSAM12 June 2014 meeting;
- common positions on the EPR:
  - containment heat removal system in accident conditions,
  - in-containment refuelling water storage tank (IRWST) pH control in accident conditions,
  - containment mixing;
- a survey on the regulatory approaches and criteria used in the analysis of accidents and transients in MDEP EPRWG member countries;
- a revision of the EPR common position addressing Fukushima Daiichi related issues for the EPR design, with the addition of two appendices on the:
  - pressure management of containment during severe accidents;
  - reliability and qualification of severe accident management instrumentation;
- a workshop between the US NRC and NNSA and several exchanges of letters containing questions and responses related to design and construction issues for the AP1000 in China and the United States, all opened to MDEP members;
- establishment of an AP1000 Digital I&C technical expert subgroup that began exchanging information on the standard design safety review, licensing, testing, and construction of the digital I&C systems for AP1000 projects;
- an updated table of post-Fukushima Daiichi actions for the APR1400, and a design differences table comparing the design of the APR1400 in Europe, Korea, the United Arab Emirates, and the United States;
- establishment of ABWR technical expert subgroups on the topics of severe accident prevention and mitigation, and instrumentation and controls;
- a comparison matrix of the key design features of the various ABWR designs;
- establishment of VVER technical expert subgroups in the areas of severe accidents, Fukushima Daiichi lessons learnt, and reactor pressure vessel and primary circuit specificities;
- a comparison table of differences in the VVER designs.

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, and overseeing those construction and commissioning activities. MDEP is primarily focused on design evaluation, but also includes inspection activities and generic issues. A key concept throughout the programme is that MDEP will better inform the decisions of regulatory authorities through multinational co-operation, while retaining the sovereign authority of each regulator to make licensing and regulatory decisions.

Working groups are implementing the activities in accordance with programme plans with specific activities and goals, and have established the necessary interfaces both within and outside of MDEP. 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 the MDEP membership, structure and processes provide an effective method of accomplishing increased co-operation in regulatory design reviews.

MDEP was established in 2008 as a multinational initiative for a five-year period. It was extended for another five-year period in 2012 by the Policy Group based on the value gained by the members. This report provides a status of the programme after its seventh year of implementation.

2. PROGRAMME GOALS AND OUTCOMES

The main objectives of MDEP effort 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 independently develop new regulatory standards, but to build upon the similarities already existing, and current harmonisation in the form of IAEA and other safety standards. In addition, the common positions developed in MDEP will be shared with the International Atomic Energy Agency (IAEA) for consideration in 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 benefited 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 of the member regulators,

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.

3. PROGRAMME IMPLEMENTATION

3.1 Membership

Participation in the Policy Group (PG) and Steering Technical Committee (STC) is intended for mature, experienced national safety authorities of interested countries that already have commitments for new build or firm plans to have commitments in the near future for new reactor designs. Full MDEP members are CNSC (Canada), NNSA (China), STUK (Finland), ASN (France), AERB (India), NRA (Japan), NSSC (Korea), Rostechnadzor (Russia), NRR (South Africa), SSM (Sweden), ONR (United Kingdom) and the US NRC (United States). In addition, the IAEA takes part in the work of MDEP.

MDEP associate members are national regulatory authorities without previous licensing experience that have been invited by the MDEP 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 taken a firm commitment in the near term to proceed with safety design review activities 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 sharing and experience in relevant design safety reviews. Associate members include the Turkish Atomic Energy Authority (TAEK) and the United Arab Emirates' Federal Authority for Nuclear Regulation (FANR). The latter participates in the APR1400 working group and TAEK participates in the VVER working group.

3.2 Organisational structure

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

The PG provides guidance to the STC on the overall approach; monitors the progress of the programme; and determines participation in the programme. In January 2015, the chairmanship of the Policy Group was transferred to Mr. Petteri Tiippana, the director general of the Finnish Radiation and Nuclear Safety Authority, STUK.

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;
- 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 members 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 vendor inspections, pressure boundary component codes and standards, and digital instrumentation and controls. Membership in issue-specific working groups is open to all MDEP participating regulators and the IAEA representatives. The following criteria are used to evaluate whether a proposed activity should be undertaken as part of MDEP:

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

3.3 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 development and maintenance of the MDEP library on a secured password protected website. The website provides two levels of access which are: 1) general access open to every member, and 2) restricted area for each DSWG with access to member regulators participating in that specific group. Publicly available documents related to MDEP are available on the MDEP page of the NEA website (www.oecd-nea.org/mdep/). The STC, through the secretariat, manages the maintenance of the library and makes enhancements to improve the effectiveness of the library.

In order for MDEP to be successful at fulfilling its goal of leveraging the work of peer regulators in the licensing of new NPP 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 for the use only by the participating national regulatory authorities. 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. The members of the DSWG also have a communication protocol to share new information related to new reactors with other members in advance of its release to the public.

3.4 Common positions

MDEP has developed a process for identifying and documenting common positions on specific issues among the member regulators which may be based on existing standards, national regulatory guidance, best practices, and group member inputs. Design-specific common positions document common conclusions that each of the working group members have reached during design reviews. Discussions among the members and sharing of information in these areas help to strengthen the individual conclusions reached.

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 IAEA, and other standards organisations, for consideration in standards development programmes.

After a common position is agreed upon a working group, it is presented to the STC for endorsement. Upon endorsement by the STC, the proposed 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 the MDEP. There is no obligation on the part of any regulatory body to follow them. If a regulatory body chooses to adopt a common position, it would be through that country's normal processes.

4. INTERACTIONS WITH OTHER ORGANISATIONS

MDEP strives to maintain an awareness of, and interactions with, other organisations that are implementing programmes to facilitate international co-operation on new reactors. Interactions are focused on ensuring that MDEP does not duplicate efforts, benefitting from the outputs of these organisations, and communicating MDEP activities and results to other organisations. To ensure that efforts are not duplicated between the groups, MDEP scope is focused on short-term activities related to specific design reviews being conducted by the member regulators, and 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 new nuclear reactors. The current focus areas of the WGRNR are construction experience, siting issues and licensing structure of regulatory staff and regulatory licensing process. The WGRNR co-ordinates its work with the work performed by MDEP such that it utilises its outputs, does not duplicate its efforts, and extends the results of MDEP to other CNRA members. To avoid overlap of activities between the groups, the WGRNR focuses on generic activities, procedures and guidance, while MDEP focuses on design-specific issues.

In 2014, MDEP and CNRA agreed to a proposed framework regarding commissioning activities (hot-functional and start-up testing), in which MDEP addresses activities specific to a design and WGRNR tackles generic ones. Lessons learnt from MDEP commissioning activities will be transferred to WGRNR for it to pursue the work on a generic basis, with participation open to a wider range of regulators. A joint MDEP/WGRNR workshop on commissioning activities will take place early 2016.

Also, when a new generic issue is raised and an international response is deemed of interest, MDEP and WGRNR share their views and discuss the best way to achieve the goals.

MDEP interacts with the CNRA WGRNR and working group on Inspection Practices mostly through the NEA staff who also serves as the technical secretariat for the CNRA. WGRNR is the focal point of interactions between MDEP and the CNRA and its working groups. The NEA technical secretariat 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 meetings. In addition, the generic common positions developed in MDEP are shared with the IAEA for consideration in its standards development programme.

The World Nuclear Association CORDEL group acts as one of the industry counterparts to MDEP. CORDEL has initiated task forces to address many issues, including those being addressed by the MDEP issue-specific working groups. Members of the MDEP STC meet with CORDEL yearly, and CORDEL has been invited to participate in meetings of the MDEP CSWG, VICWG and DICWG. In February 2015, CORDEL has published a position paper to express its views of MDEP including proposals on the future of MDEP and its interaction with CORDEL.

MDEP has interacted with the Generation IV International Forum to keep informed of multinational co-operative activities in the area of advanced reactors.

The MDEP STC meets periodically with a representative of the Western Europe Nuclear Regulators Association (WENRA) to discuss the development of WENRA safety objectives and reports. The WENRA Reactor Safety Working Group welcomes MDEP input when developing its documents.

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

- The CSWG interacted with a committee of standards development organisations (SDOs) (ASME, JSME, KEPIC, AFCEN, and CSA) in a code comparison project.
- The EPRWG meets regularly with representatives of the EPR operators owners' group to discuss similarities and differences among the EPR designs being licensed in each country.
- The AP1000WG meets with Westinghouse and the AP1000 applicants and licensees.
- The APR1400WG met with representatives of the licensee for the Barakah NPP, a site with four APR1400 reactors under construction in the UAE.
- The ABWRWG meets with ABWR Plant makers, such as GE-Hitachi, Hitachi-GE and Toshiba.
- The DICWG interacts frequently with applicable SDOs. IEC and IEEE representatives attend MDEP DICWG meetings, and are involved in the development of common positions.
- The VICWG met with SDOs and WNA representatives to discuss QA/QM standards for manufacturing nuclear components.

With effective communications in mind, MDEP held its third conference on New Reactor Design Activities in May 2014 in the United States. The goal of the conference was to communicate to a wide spectrum of stakeholders worldwide the programme of work and accomplishments of MDEP, and to solicit feedback and input from these stakeholders regarding recommendations on co-operating more efficiently on new reactor design reviews, and encouraging standardisation and harmonisation in regulatory requirements and practices. Another key goal of this conference was to allow the various industry stakeholders to share their activities on new reactor designs and standardisation efforts. These stakeholders included non-

MDEP regulators, vendors, licensees, reactor applicants, industry organisations, standards development organisations, etc. Conference sessions included discussions on: MDEP design-specific working groups, commissioning activities, vendor inspections, digital instrumentation and controls, new reactor activities related to the Fukushima Daiichi accident, and codes and standards harmonisation. The approximately 150 participants from external organisation representatives noted the positive impact of MDEP on encouraging harmonisation and voiced support for continuation of MDEP's activities.

5. 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 developed a programme plan which identifies specific activities, schedules and contacts.

Design-specific working groups

The design-specific working groups leverage national regulatory resources by sharing information and experience on the regulatory safety design reviews with the purposes of enhancing the safety of the design and enabling regulators to make timely licensing decisions to ensure safe designs through:

- exchanging experience on licensing process and design reviews, lessons learnt, and design-related construction and commissioning experience;
- working to understand the differences in regulatory safety review approaches in each country to support potential use of other regulators safety design evaluations, where appropriate;
- looking for opportunities to provide input to issue-specific working groups on potential topics of significant interest;
- identifying and understanding key design differences including those originating from regulatory requirements and then documenting the reasons for differences in regulatory requirements;
- documenting common MDEP positions on aspects of the review;
- documenting their activities with technical reports to ensure knowledge transfer;
- communicating and co-ordinating communications on MDEP views and common positions to vendors and operators regarding the basis of safety evaluations and standardisation.

While the design-specific working groups typically address issues specific to each design, and that the members find challenging, some topics are addressed by several working groups who share information amongst themselves. Two such topics are commissioning activities and Fukushima Daiichi lessons learnt.

Commissioning activities

Members of design-specific working groups, especially EPRWG and AP1000WG, have already started discussions and are presently devoting resources to co-operation on commissioning of first of a kind (FOAK) features. Lessons learnt by MDEP will be transferred to WGRNR for it to pursue the work on a generic basis, with participation open to a wider range of regulators. The time frame for getting feedback from this framework is expected to be two years.

Fukushima Daiichi lessons learnt

All the DSWGs have been tasked to discuss lessons learnt from the Fukushima Daiichi accident and the impact on new reactor designs:

- The EPR working group has been the first group to propose a common position "addressing Fukushima Daiichi related

issues" concerning the EPR design. This common position, which includes five technical appendices (from long term loss of offsite power to management of a severe accident), is publicly available (four out of five appendices, the last remaining will be published in 2015).

- The AP1000WG and APR1400WG follow the EPRWG in that they are planning to release common positions following the EPRWG template.
- The ABWRWG is following a different path, believing that the considered ABWR design has to take into account different challenges than the other reactors. A common position is also being prepared.
- The VVERWG has chosen to form a technical experts' subgroup to discuss design enhancements related to Fukushima Daiichi lessons learnt. This group will release a common position on the issue.

When the results of all DSWGs discussions will be available, the STC expects commonalities (if any) to be extracted into a common MDEP position.

5.1 EPR Working Group (EPRWG)

The EPR design-specific working group includes the regulatory authorities of China (NNSA), Finland (STUK), France (ASN), India (AERB), Sweden (SSM), the United Kingdom (ONR) and the United States (US NRC). In 2014, chairmanship of this working group was turned over from STUK to ASN.

Numerous meetings and technical exchanges have taken place to exchange information on the reviews being conducted in each country: Olkiluoto 3, which is under construction in Finland; Flamanville 3, which is under construction in France; Taishan units 1 and 2, which are under construction in China. In the United States, the EPR Design Certification (DC) application review has been suspended following a request from AREVA to the US NRC. The combined license applications have been put on hold as well; and the UK-EPR which has undergone a Generic Design Assessment in the United Kingdom and is planned currently at the Hinkley Point C site, where early preparatory earthworks have started.

The working group currently includes four technical expert subgroups (TESGs) that are addressing information on specific technical issues: Accidents and Transients (A&T), Digital Instrumentation and Controls (DI&C), Probabilistic Safety Assessment (PSA), and Severe Accident (SA). 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.

The EPRWG 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, as well as issues of common interest.

Accomplishments

The PSA TESG is identifying the design differences and modifications affecting risk and the main differences in PSAs from EPR applications in different countries. In 2014, the TESG continued to work on the comparison of selected initiators within the PSA of Olkiluoto 3 NPP in Finland, Flamanville 3 NPP in France, UK EPR design, and US EPR design. The objective of this PSA comparison was to identify differences in the modelling aspects and results of EPR PSAs, as well as to assess the rationale for these differences. The comparison covered various types of initiators challenging a broad scope of safety functions. A paper on the insights from the PSA comparison in the evaluation of EPR designs has been presented by the Chairman of the TESG at the PSAM12 June 2014 meeting, giving an international recognition of the group's accomplishments to date.

The PSA TESG is striving to continue the co-operation with the EPR operators owners' group and other EPRWG TESGs to discuss topics such as: internal hazards, modelling of HVAC systems, modelling of I&C systems, and modelling of a reactor coolant pump seal loss of coolant accident in the EPR PSAs. The TESG seeks also to have a deeper understanding of the main design differences in different countries' EPR designs which can affect the risk. Finally, the TESG will explore results and modelled scenarios within spent fuel pool PSAs.

The A&T TESG is identifying differences in regulatory criteria and approaches among the member countries. It has published a survey of the regulatory approaches to analysis of accidents and transients and issued a report on "approaches and criteria used in the analysis of accidents and transients in MDEP countries". The group is pursuing discussions on inherent boron dilution and failure of electrical systems after a design basis accident.

The MDEP EPR I&C technical expert subgroup has written a technical report on the EPR I&C system designs that includes 1) an overview of the generic EPR I&C design, 2) similarities and differences of the EPR designs in all concerned countries, 3) technical issues and their resolutions, and 4) lessons learnt from interactions. This report is endorsed as an interim report internal to MDEP and the EPR Industry for the time being. When all of the member regulators will have closed their review of the EPR I&C, the report will be updated with the aim of a public release. The EPR I&C subgroup identified a concern with spurious actuations that is considered not specific to EPR, and thus should be considered at a higher level than the TESG. It was transferred to the DICWG to develop a common position. On a design-specific level, once regulators have finalised their assessment of this issue, the DI&C TESG will update its 2010 common position on the EPR I&C.

The SA TESG finalised three common positions, which have been published early 2015, on the following topics:

- containment heat removal system (CHRS) in accident conditions;
- in-containment refuelling water storage tank (IRWST) pH control in accident conditions;
- EPR containment mixing.

Future work for this subgroup includes a comparison of source terms and dose evaluations in case of severe accidents.

An ad-hoc Spent Fuel Pool (SFP) TESG developed a final draft of the Fukushima Daiichi common position appendix on long-term cooling of the spent fuel pools. This common position paper is expected to be published in mid-2015.

In October 2014, all of the four TESGs held their meetings in Beijing, which were followed by a visit of the Taishan EPR construction site. This opportunity was used to carry out joint sessions between some of the TESGs, when some of the issues they discuss are cross-cutting, as well as to ensure maximum interaction with their Chinese expert counterparts.

In August 2013, the EPRWG issued a common position addressing Fukushima Daiichi related issues, specific to the EPR reactors. This paper identifies common approaches to address potential safety improvements for EPR plants as related to lessons learnt from the Fukushima Daiichi accident. In 2015, the EPRWG revised the core of the common position and added two appendices addressing the management of pressure in the containment and the reliability and qualification of severe accident management instrumentation. The last remaining appendix, on the long-term cooling of the fuel pools, will be finalised and published in mid-2015. 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 has been and could be further enhanced to address Fukushima Daiichi lessons learnt.

The EPRWG began co-operating on the oversight of plant commissioning (pre-operational and start-up testing). As several of the licensees from member regulators' countries get closer to the late stages of construction and preparations for operation, MDEP has considered how it can co-operate to share experience in late-stage construction tests (e.g. hot functional tests) leading to fuel load and operations. The working group held a workshop on commissioning co-operation in June 2013 in China that included representatives of AREVA and the EPR operators' owners group. The EPRWG has drafted a report on the consideration of commissioning-related issues in MDEP. This proposal was based on the experiences from the EPRWG and AP1000WG. The report was shared with the CNRA and its WGRNR. An agreement then followed up between the Chairmen of MDEP PG and CNRA, stating that:

- MDEP is the adequate place to tackle design-specific issues including commissioning topics that could have an impact on design and is acknowledged as an international forum where practical issues can be handled in an effective manner and where sharing protected commercial information is possible. MDEP should focus on specific observations related to the commissioning of a first-of-a-kind plant.
- CNRA/WGRNR is intended to undertake generic commissioning-related tasks such as national regulatory practices, oversight and regulation of construction and commissioning phases.

MDEP scope has been extended to include commissioning activities by the PG. This has been reflected in the terms of reference which were updated in April 2014.

The EPRWG is in the process of finalising a common position on First Plant Only Tests (FPOT). This common position is intended to address how a regulator would credit in the commissioning programme proposed for the reactors in its country a test performed on a reactor in another country. The EPRWG has already informed the EPR operators owners' group about the early draft, in order for the Industry to get insights on what to get prepared for in case they want to conduct FPOT.

EPRWG – Olkiluoto 3 site visit, Olkiluoto, Finland, June 2014.

EPR TESG – Taishan Unit 2 EPR construction site visit, China, October 2014.

5.2 AP1000 Working Group (AP1000WG)

The AP1000WG includes the regulatory authorities of China (NNSA), United Kingdom (ONR), United States (US NRC), Sweden, and Canada (CNSC). A total of four AP1000 units are under construction in China at the Sanmen and Haiyang sites. The US NRC has certified the AP1000 design and has received applications for combined licenses for twelve AP1000 units. Four units are under construction in the United States at the Vogtle and Summer sites. In 2011 ONR issued an interim Generic Design Assessment of the AP1000 design, and in March 2015, published revised resolution plans in response to fifty-one outstanding GDA Issues. In Canada, CNSC is performing a pre-licensing assessment of the AP1000, and in June 2013, completed Phase 2 of its pre-licensing design evaluation. Sweden began participation in the working group in 2013.

Accomplishments

The working group members have shared design information, application documents and preliminary findings, and identified the most significant review issues as well as construction challenges. 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. In 2014, the working group discussions focused on issues identified with the design of the plants under construction in the US and China including condensate return design change, and main control room dose and heat up. The working group also shared information and experience on vendor issues such as squib valve design and testing, reactor coolant pump testing, and digital instrumentation and controls. The working group has also exchanged information on how the AP1000 design addresses the findings from the Fukushima Daiichi accident and drafted a common position paper.

The AP1000 working group met regularly with representatives of Westinghouse to discuss similarities and differences among the designs being licensed in each country and to discuss post-Fukushima Daiichi safety reviews. In 2014, the working group toured plants under construction in China and met with the licensee.

The first meeting of the AP1000 Digital I&C TESG was held in China in October 2014. The meeting was successful in exchanging information regarding the standard design safety review, licensing, testing and construction of AP1000 projects. The technical findings, issues, and challenges facing the AP1000 projects in member countries which were shared during the meeting will be valuable for the regulatory oversight of those AP1000 projects.

The US NRC and ONR held bi-lateral discussions to support information exchange associated with closing out issues identified in the Generic Design Assessment Step 4 for the AP1000. These discussions focused on the topics of squib valve design and testing, and Fukushima Daiichi lessons learnt.

The United States and China exchanged several letters containing questions and responses related to design and construction issues in each country. The documents were shared with the other working group members through the MDEP library. This exchange of information was the result of engagement of upper managements of the two regulators. On 3-4 November 2014, the US NRC and NNSA held a workshop to exchange information on topics regarding design changes such as inorganic zinc coating, condensate return, reactor coolant pumps, squib valves, and equipment qualification, as well as discussions on Fukushima Daiichi lessons learnt and prevention and mitigation of severe accidents.

As China and the United States progress in construction and move into the commissioning

phase, they have begun to share information on commissioning. The US NRC provided NNSA inspection procedures and will make inspectors available to observe the commissioning activities. In addition, NNSA has assembled experts in NPP design and commissioning to plan a strategic approach for the commissioning inspections. In July 2013, the working group members from the United States, China and Canada met in China to discuss co-operation on pre-operational testing and initial test program activities. Following this meeting, the US NRC and NNSA continued discussions and correspondence on this issue since then (including at AP1000 working group meetings). A follow-up meeting on pre-operational testing issues is planned for late 2015 in China.

AP1000WG – 10th Meeting, Sanmen construction site visit, China, September 2014.

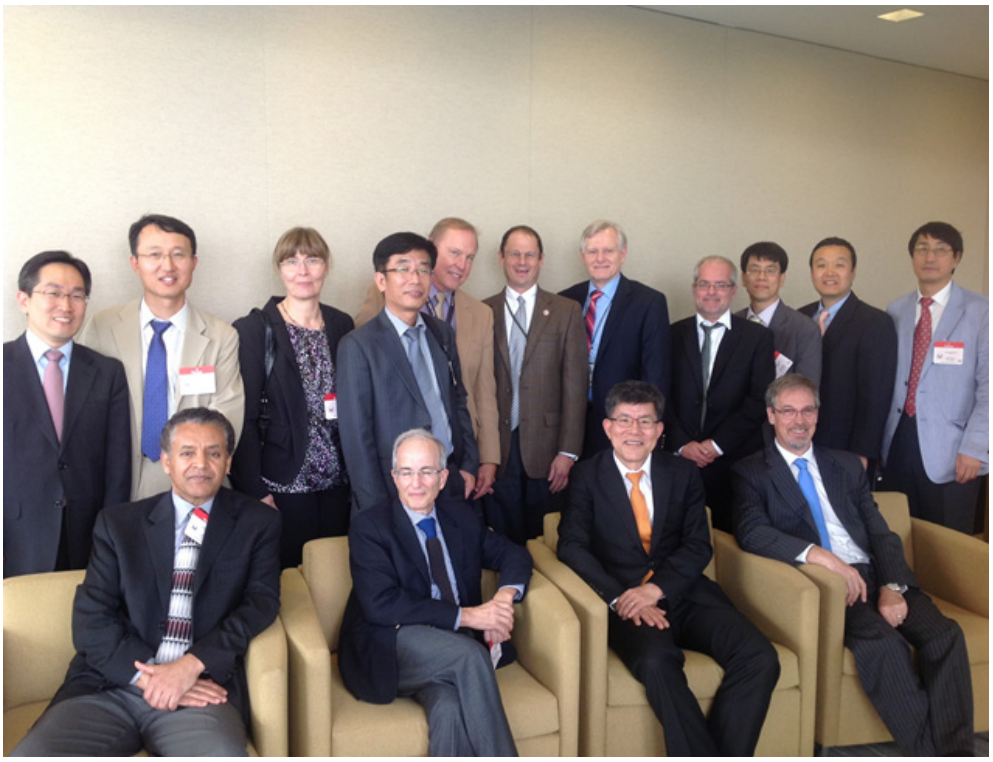
5.3 APR1400 Working Group (APR1400WG)

The APR1400WG was established in August 2012 with participation by the regulators from Korea, Finland, the United Arab Emirates, and the United States. Four APR1400 units are under construction and two additional units are under preliminary safety evaluation report review in Korea. The United States is reviewing an application for design certification that was submitted in December 2014. Two units are under construction in the UAE at the Barakah site. FANR received the construction permit application for the next two units, in 2013. STUK has completed a preliminary safety assessment of the APR1400 which includes information regarding design feasibility, organisational capability, and the plant site.

In 2014, the working group updated its table of post-Fukushima Daiichi actions, and completed a design differences table comparing the design of the APR1400 in Europe, Korea, the United Arab Emirates, and the United States.

The working group established a TESG on severe accidents which held its first meeting in October 2014. The TESG drafted tables showing differences in 1) severe accident regulatory positions of participating regulators and 2) provisions for prevention and mitigation of severe accidents in APR1400 designs proposed or implemented in participating countries.

The working group also includes a TESG to co-operate on accidents and transients. It plans to include discussions of commissioning activities in future meetings.



APR1400WG – 4th Meeting, Rockville, USA, 5 May 2014.

5.4 VVER Working Group (VVERWG)

The VVERWG includes the regulatory authorities of Finland, India, Russia and Turkey. The members are at various stages of review:

- the Russian regulator is reviewing applications for a siting license, operating licenses, and overseeing commissioning activities;
- in Finland, pre-licensing design review is ongoing;
- India is overseeing commissioning activities for two units at Kudankulam (KK-1&2), and reviewing application for construction of two additional units (KK-3&4);
- a siting license is under review in Turkey.

Formation of this working group was approved in 2013 and the working group held its first meeting in January 2014. Two TESGs are co-operating in the areas of severe accidents and Fukushima Daiichi lessons learnt. The TESG on severe accidents is drafting a technical report on the regulatory requirements for severe accidents applicable to the VVER. The TESG on Fukushima Daiichi lessons learnt is drafting a common position on this topic. A TESG on reactor pressure vessel and primary circuit new VVER specificities was formed in early 2015 and held its first meeting in March 2015. The working group drafted a comparison table of differences in the VVER designs.

VVERWG – 3rd Meeting, Issy-les-Moulineaux, France, 18 December 2014.

5.5 ABWR Working Group (ABWRWG)

The ABWRWG includes the regulatory authorities of Finland, Japan, Sweden, the United Kingdom, and the United States. The formation of this working group was approved in 2013 and the first meeting of the working group was held in January 2014. There are four different ABWR designs under consideration by the working group members: GE-Hitachi, Hitachi-GE, US Toshiba and Finnish Toshiba.

Two TESGs are co-operating on the topics of severe accident prevention and mitigation, and instrumentation and controls. The working group developed a comparison matrix of the key design features with input from the vendors, and is drafting a common position on Fukushima Daiichi lessons learnt.

ABWRWG – Shimane Unit 3 site visit, Shimane, Japan, 5 September 2014.

5.6 Vendor Inspection Co-operation Working Group (VICWG)

The goals of the VICWG are to:

- maximise the use of the results obtained from other regulator's efforts in inspecting vendors;
- understand the similarities and differences between MDEP national regulators' Quality Assurance/Management (QA/QM) Requirements in order to reach a consensus on the potential for harmonisation;
- facilitate the adoption of good vendor oversight practices by national regulators;
- harmonise the vendor inspection practices among MDEP regulators for inspections under the MDEP protocol; and
- implement joint and witnessed inspections and perform multinational inspections of vendors according to the common QA/QM requirements.

The working group enhances the understanding of each regulator's inspection procedures and practices by coordinating witnessed inspections of safety related components 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 conduct of VICWG witnessed inspections in their inspection planning.

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.

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 database includes not only the reports of witnessed and joint inspections, but all inspections that may be of interest to the MDEP members.

Accomplishments

The MDEP VICWG continues to achieve its short-term goals. With the completion of the first Multinational Inspection in July 2014 at Valinox Nucléaire, a French steam generator tube manufacturer, VICWG achieved a major step towards its long-term programme goals. For this first multinational inspection of a vendor, the participating regulators used the common Quality Assurance/Quality Management (QA/QM) requirements developed by the VICWG. These criteria were developed in conformity with International Codes and Standards such as IAEA, ISO and others that MDEP members adopted. The core requirements are consistent with both IAEA safety standard and ISO standard, the common requirements in the US 10CFR50 Appendix B used to the survey programme were used as a guideline of essential elements. The VICWG also drafted a report of lessons learnt from this inspection. As the VICWG moves forward, the group will attempt to increase the number of multinational inspections in addition to continuing joint inspections (multiple nations inspecting to the regulatory requirements of one country), and witnessing of other regulators' inspections.

In 2014 the members conducted ten MDEP related inspections. This included the multinational inspection with participation by the US NRC, French ASN, and the UK ONR, two joint inspections with participation by the United States and Korea, and seven additional witnessed inspections.

In November 2014, the group met with representatives for the NSQ-100 quality standard. The representatives explained the status of the standard and their vision of how it could be implemented as a single quality standard for nuclear activities. The NSQ-100 plan calls for certification of suppliers thus reducing the burden for industry to review

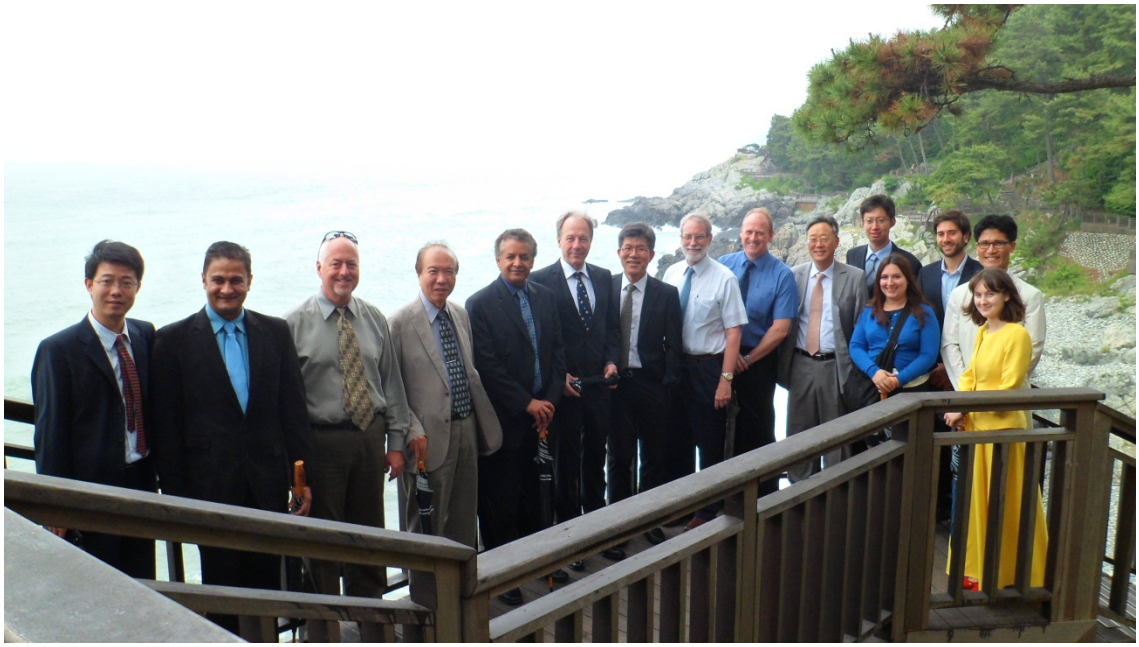
the suppliers programme. It was noted that purchasers would still need to provide oversight of technical requirements related to the qualification of suppliers. The VICWG will continue to work with the Standards Developing Organisations to encourage and explore harmonisation of QA/QM standards.

Next steps

In support of its long-term goal of understanding the similarities and differences between MDEP national regulators' QA/QM Requirements and to facilitate the adoption of good vendor oversight practices by national regulators, the group added two new actions in its Programme Plan:

- Develop a list of good practices for vendor oversight.
- Conduct a survey of vendor inspector training. The group also agreed to add an attribute to its inspection plans to address issues related to Counterfeit, Fraudulent, and Suspect Items (CFSI).

Regarding the future of the working group, the members believe that working group activities are productive and should continue. The current plan is for the co-ordination of inspections to remain within MDEP. The generic process issues and QA standards harmonisation efforts could be transferred to another organisation at some point in the future.



VICWG – 13th Meeting, Busan, Korea, June 2014.

5.7 Codes and Standards Working Group (CSWG)

The goal of the CSWG is harmonisation of code requirements for design and construction of pressure-retaining (pressure-boundary) components in order to improve the effectiveness and efficiency of the regulatory design reviews, increase quality of safety assessments, and to make each regulator stronger in its 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 full scope code comparisons, study the similarities and differences between codes, and develop a strategy and process for achieving code harmonisation and prevention of further divergences. 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 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 (United States) 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. In January 2012, the SDOs from Canada, France, Japan, Korea, and the United States issued their Code Comparison report for Class 1 Nuclear Power Plant Components that was prepared for MDEP. In December 2012, the SDOs published revision 1 that included a comparison with the Russian code.

The work of the CSWG showed that code harmonisation should be sought jointly by SDOs, the industry and the regulatory authorities. As a result of interactions between the CSWG and the SDOs, the SDOs formed a Code Convergence Board whose objective is to limit divergence and achieve convergence on individual requirements where realistic and practical. Although a voting member of the Board, MDEP has observer status and a member of the CSWG attends most meetings. The industry formed task groups within CORDEL to mirror CSWG activities and try to propose converged code provisions (or requirements) to SDOs through analyses of code differences on selected topics. The CSWG is working closely with SDOs and CORDEL to converge code requirements and reconcile code differences.

Accomplishments

The CSWG finalised its fifth document: a technical report on the "essential performance guidelines for the design and construction of pressure retaining components". These guidelines provide qualitative performance descriptions of the rules and practices derived from the codes and standards, which can be considered as essential and are described in most of the codes and standards in the MDEP member countries. These essential guidelines can govern most of the pressure boundary codes and standards but not necessarily all of them. They will therefore be regarded as guides or recommendations. As these guidelines represent commonalities between the codes and standards of MDEP member countries they should not be used as a stand-alone.

The full sets of documents initially planned in the CSWG programme of work are now issued. The CSWG now plans to hold one meeting per year going forward to support the activities of CORDEL and the SDOs in

their code convergence efforts. Indeed, in this area, the effort to achieve concrete harmonisation, convergence or limitation of further divergence lies now in the hands of the industry and SDOs.

This CSWG set of documents is as follows:

- technical report TR-CSWG-01 on the regulatory frameworks for the use of nuclear pressure boundary codes and standards in MDEP countries;
- technical report TR-CSWG-02 on the lessons learnt on achieving harmonisation of codes and standards for pressure boundary components in nuclear power plants;
- technical report TR-CSWG-03 on the fundamental attributes for the design and construction of pressure-boundary components;
- technical Report TR-CSWG-04 on the essential performance guidelines for the design and construction of pressure retaining components.

The working group has successfully completed its goal and mandate to identify the challenges in harmonising codes and standards and to lay ground for a framework destined to facilitate convergence of codes and standards in the near future. The group has pushed the industry and the SDOs to move forward and work co-operatively. The remaining outstanding mandate of the CSWG is continuing to interact with the industry, and provide them with the support they seek from the regulators side and maintain this unique communication channel.

Next Steps

In February 2015, the CSWG completed its stated goals and issued its final reports. The working group will continue to interact with the CORDEL and the SDOs. In the near future, the group will follow-up on CORDEL's initiative as a first step of harmonisation in the field of NDE qualification methodologies.

5.8 Digital Instrumentation and Controls Working Group (DICWG)

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 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.

The IAEA, the International Electrotechnical Commission (IEC) and the Institute of Electrical and Electronics Engineers (IEEE) representatives are invited to participate in working group meetings and activities. Industry is represented via the IEC and IEEE and through specific invitations by the DICWG to share information and give presentations on topics of interest.

Accomplishments

The DICWG identified thirteen topics for generic common positions which were selected based on the safety implications of the issue, and the need to develop a common understanding from the perspectives of regulatory authorities. DICWG generic common positions are not intended to cover all issues associated with the digital I&C technical disciplines, but only those of most value to the members.

The DICWG has published ten generic common positions that describe methods and evidence that all DICWG member states find acceptable to support safety justification for digital I&C systems. The published common positions include generic common positions numbered:

1) treatment of common cause failure caused by software within digital safety systems;

2) software tools for the development of software for safety systems;
3) verification and validation throughout the life cycle of safety systems using digital computers;
4) data communications independence;
5) treatment of hardware description language (HDL) programmed devices for use in nuclear safety systems;
6) simplicity in design;
7) selection and use of industrial digital devices of limited functionality ;
8) impact of cyber security features on digital I&C safety systems;
11) digital I&C system pre-installation and initial on-site testing;
12) use of automatic testing in computer based systems as part of surveillance testing.

These common positions have been made publicly available on the MDEP website. In 2014, the DICWG issued common position 7. This common position, on the selection and use of industrial digital devices of limited functionality, gives insights on how to assess the necessary suitability and correctness of industrial digital devices for their intended functions, to be consistent with the plant safety.

The working group has begun discussions on the topic of spurious actuations in I&C systems that are important to safety. The topic of spurious operation was originally raised in the EPR I&C technical experts' subgroup. However, considering this topic generally affects multiple I&C design centres, it was transferred to the DICWG so that the topic of spurious operation can be handled generically. Members agreed with the potential safety concerns and the need to address the topic generically. The DICWG plans to develop a draft common position on spurious actuations for future work and will collaborate with the MDEP EPR I&C subgroup to address this topic.

The working group continues to implement a formal "Quick Inquiry" process to generate and process inquiries from member regulators 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 DSWG, particularly with the EPR digital instrumentation and controls TESG.

One of the industry counterpart to MDEP DICWG is CORDEL's Digital I&C Task Force. CORDEL's stated objectives for the task force include:

1) management of design changes for digital I&C;
2) development of a common understanding of what is expected by industry and regulators;
3) promotion of the development of international standards. As part of their near term tasks, CORDEL intends to provide white papers on the following topics: safety I&C classifications, diversity and common cause failures, and criterion on the use of Field Programmable Gate Arrays (FPGAs) in nuclear applications.

Next steps

The DICWG has made significant progress in increasing harmonisation of digital I&C standards by developing generic common positions that have been or are planned for incorporation into regulations and regulatory guidance of many member states.
Three common positions are still being drafted and should be finalised in the coming year, on the following issues:

- safety design principles for the overall I&C architecture;
- systematic demonstration of safety for systems important to safety;
- spurious actuations of important to safety I&C systems.

As the planned generic common positions are nearing completion, the working group and STC have considered the DICWG's future. The members desire to continue interaction in some format that provides a forum to share information among the regulators, as well as an interface with standard development organisations (e.g. IAEA, IEC, IEEE) and industry to promote harmonisation.

DICWG – 18th Meeting, Paris, France, March 2014.

6. INTERIM RESULTS

MDEP is considered a long-term programme with interim results. Interim results are those products that document agreement by the MDEP members and are necessary steps in working towards increased co-operation and convergence. The interim results for 2014 include:

- ten MDEP-co-ordinated vendor inspections including a multinational inspection with participation by regulators from France, the United Kingdom and the United States, two joint inspections with participation by the regulators from the United States, and Korea, and seven additional witnessed inspections;
- completion of the first multinational Inspection of a vendor using the common Quality Assurance/Quality Management (QA/QM) requirements;
- completion of all five planned documents for the CSWG with issuance of Technical Report 4 on the "essential performance guidelines for the design and construction of pressure retaining components";
- common position on digital instrumentation and controls for new reactors in the areas of safety design principles and supporting information for the overall I&C architecture;
- a report on insights from the Probabilistic Safety Assessment comparison in the evaluation of EPR designs. Technical report on the EPR I&C system designs that includes similarities and differences of the EPR designs in all member countries, and technical issues and their resolutions. Common positions on the containment heat removal system in accident conditions, and IRWST pH control in accident conditions. A report on "consideration of commissioning related issues in MDEP";
- a workshop between US NRC and NNSA and several exchanges of letters containing questions and responses related to design and construction issues for the AP1000 in China and the United States;
- a revision of the EPR common position addressing Fukushima Daiichi related issues for the EPR design, with the addition of two appendices on the:
  - pressure management of containment during severe accidents;
  - reliability and qualification of severe accident management instrumentation;
- establishment of an AP1000 Digital I&C technical expert subgroup that began exchanging information on the standard design safety review, licensing, testing, and construction of the digital I&C systems for AP1000 projects;
- an updated table of post-Fukushima Daiichi actions for the APR1400, and a design differences table comparing the design of the APR1400 in Europe, Korea, the United Arab Emirates, and the United States;
- establishment of ABWR technical expert subgroups on the topics of severe accident prevention and mitigation, and instrumentation and controls;
- a comparison matrix of the key design features of the various ABWR designs;
- establishment of VVER technical expert subgroups in the areas of severe accidents, Fukushima Daiichi lessons learnt and Reactor Pressure Vessel and Primary Circuit;
- a comparison table of differences in the VVER designs.

7. NEXT STEPS – FUTURE OF THE PROGRAMME

In 2014, at the request of the Policy Group, MDEP conducted a data collection of its members to solicit information on MDEP's added value and their views on the future of MDEP. The results of this effort will be used to help inform the future of MDEP.

The results of the MDEP self-assessment conducted in 2012 indicated that it 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 that it facilitates the co-operation and exchange of information for design reviews. Therefore, MDEP will act quickly to approve the formation of new design-specific working groups as appropriate (consistent with the existing Rule of Three for forming design-specific working groups).

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. At its meeting in May 2014, the PG agreed that MDEP has proved a useful and efficient forum to share information on the review, construction and commissioning of new reactors, and that some kind of interaction at the operation stage may be discussed. In 2015, the STC and PG will explore the pros and cons of extending the MDEP framework to consideration of operating stages for considered reactors.

The current issue-specific working groups will continue until they complete the goals and activities specified in their programme plans. However, the generic aspects of these working groups could eventually be transferred to other organisations such as CNRA or IAEA. The working groups have identified completion strategies that include products, schedules, and recommendations ensuring continuation of the interactions among the regulators, and between regulators and external stakeholders.

Appendix 1
List of abbreviations and acronyms

APPENDIX 1
LIST OF ABBREVIATIONS AND ACRONYMS

AERB	Atomic Energy Regulatory Board (India)
AFCEN	Association Française pour les règles de Conception, de construction et de surveillance en exploitation des matériels des Chaudières Electro Nucléaires (French SDO)
ASME	American Society of Mechanical Engineers
ASN	Autorité de Sûreté Nucléaire (Nuclear Safety Authority from France)
CCF	Common cause failure
CNRA	Committee on Nuclear Regulatory Activities (from the NEA)
CNSC	Canadian Nuclear Safety Commission
CORDEL	Cooperation in Reactor Design Evaluation and Licensing
CSA	Canadian Standards Association
CSWG	Codes and Standards Working Group
DICWG	Digital Instrumentation and Controls Working Group
DSWG	Design-Specific Working Group
FANR	Federal Authority for Nuclear Regulation (United Arab Emirates)
FOAK	First of a Kind
FPGA	Field-Programmable Gate Arrays
FPOT	First Plant Only Tests
GDA	Generic Design Assessment
HDL	Hardware Description Language
I&C	Instrumentation and controls
IAEA	International Atomic Energy Agency
IEC	International Electro Technical Commission
IEEE	Institute of Electrical and Electronics Engineers

IRWST	In-containment refuelling water storage tank
ISWG	Issue-Specific Working Group
JSME	Japanese Society of Mechanical Engineers
KEPIC	Korean Electric Power Industry Code
KINS	Korea Institute of Nuclear Safety
MDEP	Multinational Design Evaluation Programme
NEA	Nuclear Energy Agency
NIKIET	Scientific Research and Design Institute of Energy Technologies (Russian SDO)
NNSA	National Nuclear Safety Administration (China)
NPP	Nuclear power plant
NRA	Nuclear Regulatory Authority (Japan)
NRC	Nuclear Regulatory Commission (United States of America)
NSSC	Nuclear Safety and Security Commission
OECD	Organisation for Economic Co-operation and Development
ONR	Office for Nuclear Regulation (United Kingdom)
PG	Policy Group
PSA	Probabilistic safety assessment
SDO	Standard development organisation
SSM	Strålsäkerhetsmyndigheten (Swedish Radiation Safety Authority)
STC	Steering Technical Committee
STUK	Säteilyturvakeskus (Radiation and Nuclear Safety Authority of Finland)
TAEK	Türkiye Atom Enerjisi Kurumu (Turkish Atomic Energy Authority)
TESG	Technical Experts Subgroup
VICWG	Vendor Inspection Co-operation Working Group
WGRNR	Working Group on the Regulation of New Reactors (from the NEA/CNRA)
WNA	World Nuclear Association

Appendix 2

New and revised MDEP documents

[May 2014-April 2015]

www.oecd-nea.org/mdep/

APPENDIX 2
REVISED DOCUMENTS AND PUBLICATIONS

Revised documents and publications

- Working groups programme plans.
- Common position EPRWG-02 addressing Fukushima Daiichi related issues, with the addition of the two following technical appendices on:
  - the management of pressure in the containment;
  - the reliability and qualification of severe accident management instrumentation.

New documents and publications

- Common position DICWG-07 on the selection and use of industrial digital devices of limited functionality.
- EPR accident and transients technical experts' subgroup technical report on the regulatory approaches and criteria used in the analysis of accidents and transients in MDEP EPRWG member countries.
- EPR probabilistic safety assessment technical experts' subgroup paper on the insights from PSA Comparison in Evaluation of EPR Designs, presented by the Chairman at the PSAM 12 meeting in June 2014.
- Common position EPRWG-03 on the EPR containment mixing.
- Common position EPRWG-04 on the EPR containment heat removal system in accident conditions.
- Common position EPRWG-05 on the EPR in-containment refuelling water storage tank pH control in accident conditions.
- Technical report TR-CSWG-04 on the essential performance guidelines for the design and construction of pressure retaining components.

Appendix 3
Photographs of reactors considered within MDEP

APPENDIX 3

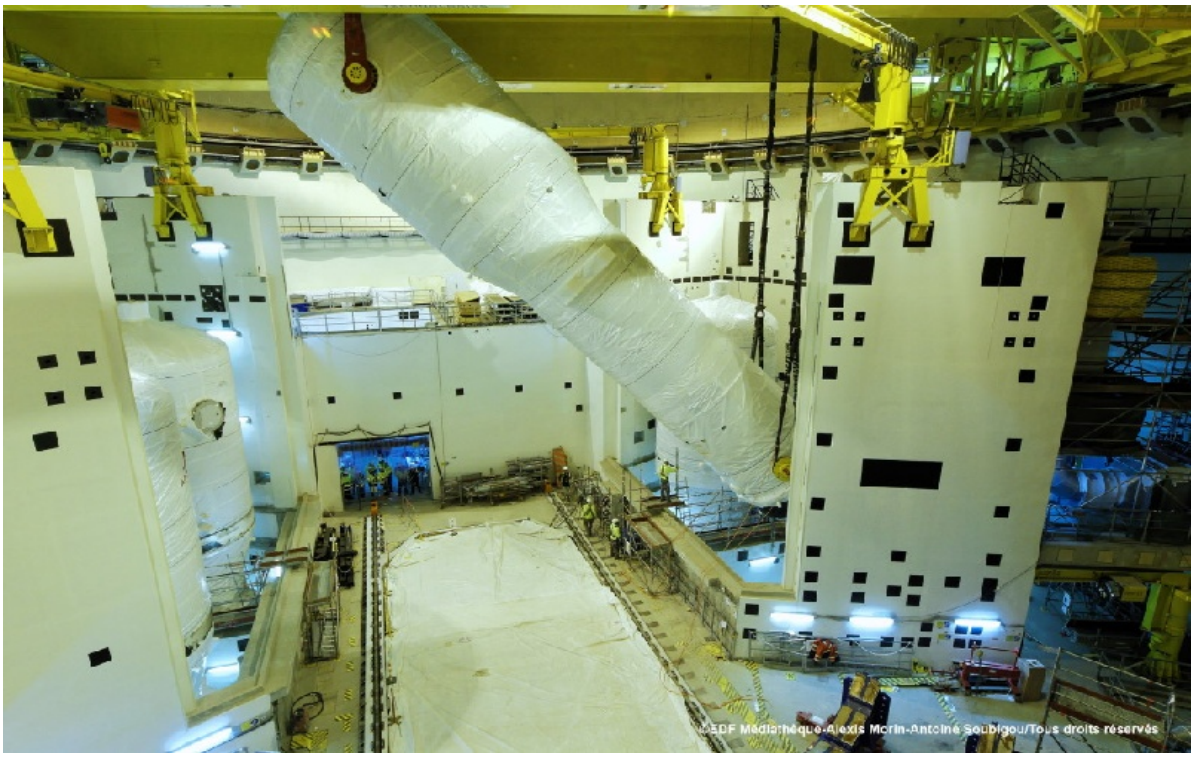
PHOTOGRAPHS OF REACTORS CONSIDERED WITHIN MDEP

Taishan Units 1 and 2 – EPR, China, March 2015 (provided by NNSA).

Taishan Unit 1 – EPR, China, September 2014.
(provided by NNSA).

Taishan Unit 2 – EPR, China, September 2014.
(provided by NNSA).

Flamanville 3 – Construction site from the hill, EPR, France, 24 March 2015 (© EDF Médiathèque Alexis Morin – Antoine Soubigou/All rights reserved. Aménagement Flamanville 3, Communication).

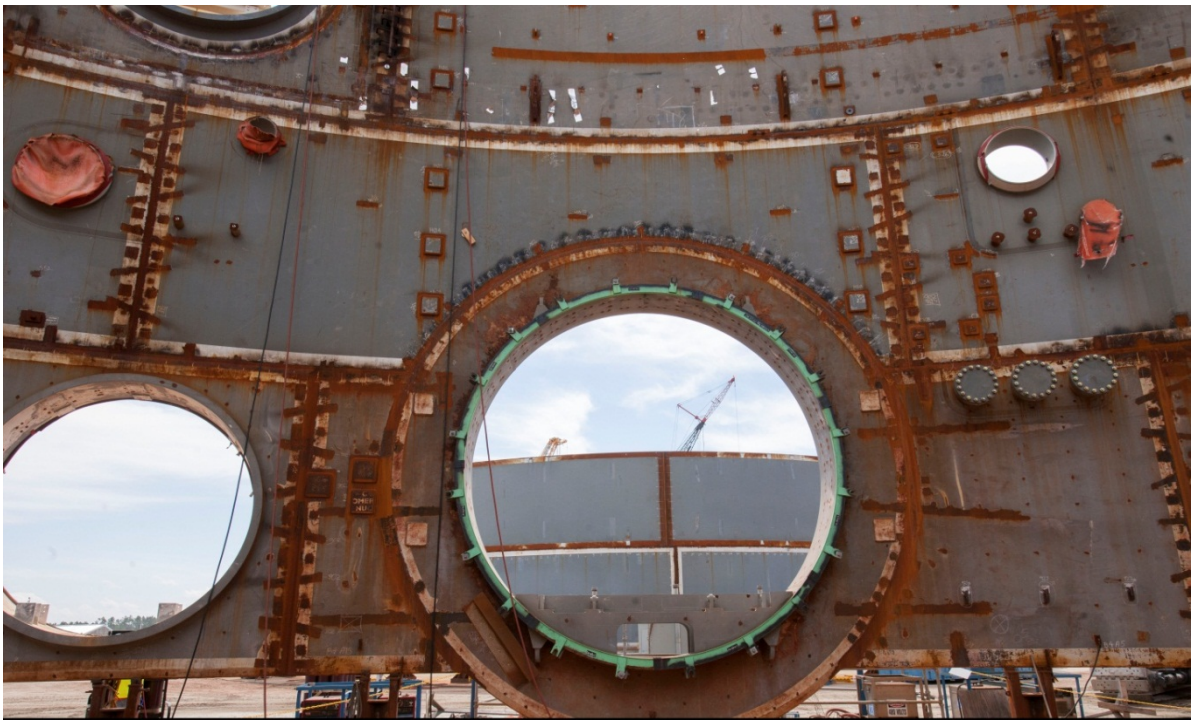


Flamanville 3 – Installation of steam generator 4, EPR, France, 24 March 2015 (© EDF Médiathèque Alexis Morin – Antoine Soubigou/All rights reserved. Aménagement Flamanville 3, Communication).

Olkiluoto 3 – Construction site, EPR, Finland, 23 February 2015 (Hannu Huovila/TVO).

Hinkley Point C – Formation of the southern heavy haul road and construction of the Holford Culvert, EPR, United Kingdom, January 2015 (© EDF Energy 2015).

Vogtle Unit 3 – Nuclear island and cooling tower, AP1000, United States, April 2015 (2015 Georgia Power Company, all right reserved).

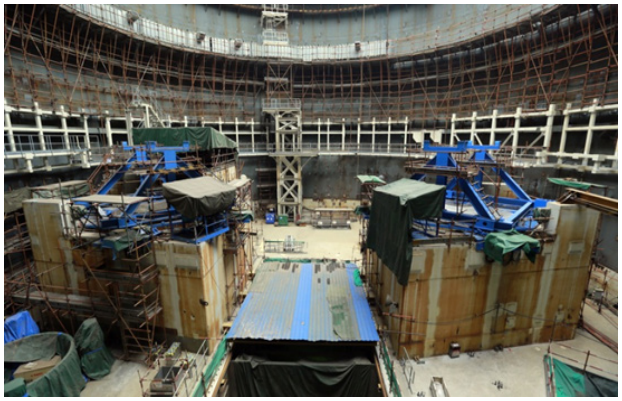


Vogtle Unit 4 – Containment vessel lower ring, AP1000, United States, March 2015 (2015 Georgia Power Company, all right reserved).

V.C. Summer – Units 2 and 3 nuclear construction project, AP1000, United States, December 2014 (SCE&G, all right reserved).

V.C. Summer Unit 2 – Installation of 180k-Pound CA05 Module, AP1000, United States, 6 December 2014 (SCE&G, all right reserved).

Sanmen Units 1 and 2 – Construction site, AP1000, China, 23 October 2014 (provided by NNSA).



Sanmen Unit 2 – Inside nuclear island, AP1000, China, 3 December 2014 (provided by NNSA).

Sanmen Unit 2 – Reactor vessel hoisting, AP1000, China, 25 August 2014 (provided by NNSA).

Haiyang Unit 1 – Construction site, AP1000, China, 13 February 2015 (provided by NNSA).

Haiyang Unit 1 – Steam generator, AP1000, China, 27 December 2014 (provided by NNSA).

Shin Kori Units 3 and 4 – Overview, APR1400, Korea, March 2015 (provided by KINS).

Shin Hanul – Construction site overview, APR1400, Korea, 29 March 2015 (provided by KINS).

Shin Hanul – Factory integrated system test of Shin-Hanul nuclear power plant Unit 1 MMIS, APR1400, Korea, 3 April 2015 (provided by KINS).

Shin Hanul Unit 2 – Setting of reactor vessel, APR1400, Korea, 2 April 2015 (provided by KINS).

Barakah Unit 1 – Overview, APR1400, United Arab Emirates, 18 January 2015 (property of ENEC).

Barakah Unit 1, 2 and 3 – Overview of the construction site, APR1400, United Arab Emirates, 3 February 2015 (property of ENEC).

Leningrad 2 – Overview of the construction site, VVER, Russia, September 2014.

Leningrad 2 – Installation of the 4 ECCS accumulators, VVER, Russia, 9 October 2014.

Novovoronezh 2 – Installation of the Unit 2 dome, VVER, Russia, 15 November 2014.

Novovoronezh 2 – Installation of Unit 2 reactor pressure vessel, VVER, Russia, 30 March 2015.

Kashiwazaki-Kariwa 5, 6 and 7 (from far side), July 2013, ABWR, Japan, Copyright Tokyo Electric Power Company.

Cover photos credit: Haiyang Unit 1 and 2 Overview**,** Haiyang Unit 1 and 2 – Construction site, AP1000, China, 24 December 2013 (provided by NNSA); Hinkley Point C, PC3000 excavator and 100 tonne dump truck, EPR, United Kingdom, February 2015 (© EDF Energy 2015).

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