Foreword from the Policy Group Chair

I am honoured to have served as the Chair of the Multinational Design Evaluation Programme (MDEP) Policy Group since January 2015. It is with great pleasure that I now introduce Mr Mark Foy as the new MDEP Policy Group Chair. Mark assumed his role in May 2018 and I am certain that, with his guidance, MDEP will continue to be a very successful forum for regulators to collaborate on a broad range of international activities related to new reactors. The MDEP Annual Report for 2017-2018 provides an opportunity to reflect on the achievements of this unique programme as well as to strategically consider its future. The contents of this report demonstrate another successful and productive year for MDEP and highlight the challenges ahead.

MDEP’s reputation as an effective organisation for leveraging the resources and experiences of multiple nations in the regulatory review of new reactors has grown significantly. As a result, the portfolio of new reactor designs that are being evaluated have increased from two in 2006 to six in 2018, with the addition, in September 2017, of the Hualong One (HPR1000) reactor design. MDEP’s membership continues to grow, as well, to 16 national regulators with the addition of the Nuclear Regulatory Authority (ARN) of Argentina as its newest member.

MDEP continues to strengthen its commitment to regular interactions with its stakeholders, international organisations of regulators, industry, and standard development organisations. In September 2017, MDEP organised its fourth conference on new reactor design activities, where 150 participants had fruitful and open discussions with MDEP on a broad range of new reactor issues. Their opinions are taken into account, in order to improve the efficiency of international co-operation when meeting MDEP objectives, while effectively responding to the needs of all members.

Over the past year, MDEP design specific working groups have increased their focus on reactor commissioning activities as new EPR, APR1400, and AP1000 plants are preparing for commercial operations. The EPR and AP1000 Working Groups are particularly active in this area, as together they are overseeing 12 new reactor constructions worldwide. This reporting period marks a significant milestone for MDEP since it provided a unique opportunity for the regulators involved to demonstrate the efficiency of using common positions to effectively collaborate and share information on First-Plant-Only-Test (FPOT) results conducted in the EPR and AP1000 plants in China. In addition, MDEP has enhanced co-operation in areas of emerging risk in supply chain management and vendor activities, specifically with regards to counterfeit, fraudulent and suspect items (CFSIs). The ongoing co-operation has enabled participating regulators to consider the adequacy of their activities aimed at mitigating the risks of CFSIs entering licensee facilities through vendors.

I am pleased to report that, in line with the MDEP Policy Group’s decision to focus on design specific activities, MDEP and the Nuclear Energy Agency (NEA) have taken steps to transfer MDEP generic activities to the NEA. Last year Digital Instrumentation and Control (D1&C) activities were successfully transferred to the NEA under the Committee on Nuclear Regulatory Activities (CNRA). A second generic issue specific working group, the Codes and Standards Working Group, concluded its programme of work under MDEP in June 2018 and started its new mandate under the CNRA. In both areas, the aim is to broaden the scope to include operating reactors and to expand membership to include other NEA member countries.

MDEP is positioning itself well for meeting the challenges posed by the transition of its generic activities and the resulting reduction in scope expected with the closure of more mature designs such as the ABWR, while it simultaneously accommodates additional memberships and the expansion of the new HPR1000 reactor design. Moving forward, we will continue to build on our achievements to further improve the safety of new reactors through effective international co-operation, management and transfer of knowledge. Overall, MDEP continues to function smoothly, in no small measure as a result of the support of the NEA as the MDEP Secretariat. 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 excellent work of Mr Ho Nieh and Ms Aurélie Lorin to further advance the programme’s main objective of leveraging resources and expertise for the common benefit of all MDEP members and I would like to express my sincere appreciation for their continuous support during my tenure as Chair.

Petteri Tiippana,  
MDEP Policy Group Chair
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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 that are currently, or will shortly be, undertaking the review of new reactor power plant designs. MDEP members are the regulatory authorities of Argentina (ARN), China (CNSC), the People’s Republic of China (NNSA), Finland (STUK), France (ASN), Hungary (HAEA), India (AERB), Japan (NRA), the Republic of Korea (NSSC), the Russian Federation (Rosatom), South Africa (NNR), Sweden (SSM), Turkey (TAEK), the United Arab Emirates (FANR), the United Kingdom (ONR) and the United States (NRC). The Nuclear Energy Agency (NEA) performs the Technical Secretariat function in support of MDEP. The International Atomic Energy Agency (IAEA) also takes part in the work of MDEP. This programme 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.

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 more than a decade 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 accident at the Fukushima Daiichi nuclear power plant (NPP) have appropriately been addressed by all designs under MDEP and incorporated into MDEP activities in the design specific working group (DSWG) programme plans.

Six DSWGs are facilitating the MDEP goal of enhanced co-operation. The EPR Working Group (EPRWG) consists of the regulatory authorities of China, Finland, France, India, Sweden, and the United Kingdom. The AP1000 Working Group (AP1000WG) consists of the regulatory authorities of Canada, China, India, the United Kingdom and the United States. The APR1400 Working Group (APR1400WG) includes the regulatory authorities of Korea, the United Arab Emirates and the United States. The VVER Working Group (VVERWG) includes the regulatory authorities of China, Finland, Hungary, India, Russia and Turkey. The ABWR Working Group (ABWRWG) includes the regulatory authorities of Japan, Sweden, the United Kingdom and the United States. The HPR1000 Working Group (HPR1000WG) includes the regulatory authorities of Argentina, China, South Africa and the United Kingdom. The DSWGs continued to share information and experience on the safety design reviews with the purpose of enhancing the safety of the design and enabling regulators to make timely licensing decisions. Additionally, promoting safety and standardisation of MDEP designs is made possible through successful international co-operation.

The Vendor Inspection Co-operation Working Group (VICWG) continues to implement its programme successfully. During this reporting period, a total of 15 opportunities were identified to co-operate on sharing related information from vendor inspection. Five witnessed inspections (multiple regulators inspecting to the regulatory requirements of one country) were completed involving regulators from the Finland, France, Japan, Korea, Russia, the United States and the United Kingdom. This accomplishment represents a significant step in multinational regulatory co-operation and it clearly demonstrates the benefits of MDEP.

In December 2017, the Digital Instrumentation and Controls (I&C) Working Group (DICWG) successfully completed its transition to CNRA. The 13 common positions (CP) completed under MDEP, as well as any future CPs, will continue to be available to MDEP members. These common positions describe methods and evidence that members find acceptable to support safety justification for digital I&C systems.

The Codes and Standards Working Group (CSWG) is working closely with standards development organisations to converge code requirements related to pressure boundary components and to reconcile code differences. The working group has successfully completed its goal and mandate to identify the challenges in harmonising codes and standards. The group works closely with industry and standard development organisations (SDOs) to continue to advance its goals and seek further progress co-operatively.

Accomplishments to date provide confidence that the MDEP membership, structure and processes offer an efficient method of accomplishing effective co-operation in regulatory reviews of new designs. At the level of the working groups, the key accomplishments for 2017-2018 include:

- The EPRWG published its Common Position addressing the Vienna Declaration on Nuclear Safety in April 2018.
• The ABWRWG completed its comparison matrix of key design features between the eight, existing and proposed ABWR designs. It established that there are 18 noteworthy design differences. These are described within a technical report, "Design Differences Identified from Comparison of International ABWR Designs" (TR-ABWRWG-2). This report was approved by the Steering Technical Committee (STC) in 2017 and is available for use by MDEP members.

• The APR1400WG revised the technical report on design differences between APR1400 plants (TR-APR1400WG-01) and the common position paper on the APR1400 post loss-of-coolant accident (LOCA) strainer performance and debris in-vessel downstream effects (CP-APR1400-02). The group also developed two additional technical reports: a technical report on the comparison of the prevention and mitigation measures against severe accident (TR-APR1400-02) and the technical report on the findings of the review of the Molten Core Concrete Interaction (MCCI) phenomena for the APR1400 (TR-APR1400-03).

• The AP1000WG continued to exchange information about important design changes, construction issues and vendor issues associated with the AP1000 design. During 2018, the members took on actions to complete reports on issues encountered on the design of the AP1000 reactor coolant pumps, condensate return, and squib valves. In addition, the group determined that the documented discussions that had occurred during the design review effort could be put together in a technical report for use by future regulators working with the AP1000 design.

• The VVERWG completed two technical reports – TR-VVERWG-01 on regulatory approaches and criteria used in severe accident analyses and severe accident management and TR-VVERWG-02 on regulatory approaches and oversight practices related to reactor pressure vessel and primary components. These technical reports were approved by the STC and published in November and May 2017, respectively.

• The VICWG continues to focus on maximising information sharing, conducting joint inspections and witnessing other regulators’ inspections. Based on lessons learnt from the second multinational vendor inspection and other opportunities to witness inspections, the VICWG updated the MDEP Common Position on Vendor Inspection Protocol and the Common Position on the Preparation and Performance of Vendor Inspections; which were published in November 2017 and May 2018, respectively.

• The CSWG continued playing an important role as an interface between the regulators, the industry and SDOs to harmonise code requirements. For instance, the CSWG comments have been incorporated in the CORDEL Comparison Report on Non-Linear Analysis Design Rules; and the SDOs Comparison Report on Welding Qualification and Welding Quality Assurance. The CSWG has also been a productive forum for members to exchange information on other topics such as the exploration of strategies for code reconciliation, the effect of code classification on NPP design and construction, and supplementary regulatory requirements to codes or standards.

• The report from the MDEP joint workshop with the Committee on Nuclear Regulatory Activities (CNRA) Working Group on the Regulation of New Reactors (WGRNR) on commissioning activities was published in December 2017. This report focused on proposed commendable practices to help nuclear regulatory organisations (NROs) develop their commissioning oversight arrangements in addition to planning and performing their oversight activities.

• The STC updated the MDEP Terms of Reference (TOR) for the design-specific working groups in May 2018.

• The DICWG completed in December 2017 its transition to CNRA as the Working Group on Digital Instrumentation and Control (WGDIC).

• The newly established HPR1000WG held its first meeting in March 2018 in Beijing, China and developed its programme of work.
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 which are, or will shortly be, undertaking the review of new reactor power plant designs. 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 cooperation, while each regulator retains the sovereign authority to make licensing and regulatory decisions.

Working groups are implementing the activities in accordance with their programme plans with specific activities and goals, and the working groups 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 the MDEP membership, structure and processes provide an effective method of accomplishing increased co-operation in regulatory design reviews for new reactors.

MDEP was established in 2006 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. In 2015, the Policy Group determined that MDEP should continue in its current form, authorised to remain in operation until 2022. Since MDEP is a temporary organisation, the Policy Group has approved the transfer of two of the issue specific working groups to NEA. This report provides a status of the programme after more than 10 years of implementation.

2. Programme goals and outcomes

The main objectives of the MDEP effort are to enable increased co-operation within existing regulatory frameworks 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 programme focuses on co-operation on regulatory practices that aim at harmonising regulatory requirements. The IAEA safety standards, which provide a general level of harmonisation, provide input to the work and can benefit from the final results.

MDEP is meeting its goal of enabling increased co-operation through the activities of the working groups. MDEP has been 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 the development of an MDEP library which serves as a central repository for all documents associated with the programme.
3. Programme implementation

3.1 Membership

Participation in the Policy Group and Steering Technical Committee is intended for 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. MDEP members are: Argentina, Canada, China, Finland, France, Hungary, India, Japan, Korea, Russia, South Africa, Sweden, Turkey, the United Arab Emirates, the United Kingdom and the United States. The IAEA also takes part in the work of MDEP.

3.2 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 Steering Technical Committee consists of senior staff representatives from each of the participating national safety authorities in addition to a representative from the International Atomic Energy Agency (IAEA).

The Policy Group provides guidance to the Steering Technical Committee on the overall focus of MDEP; monitors the progress of the programme; and determines participation in the programme.

The Steering Technical Committee 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 Policy Group; identifying new topics for the programme to address; and establishing sub-committees 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 of MDEP:

- **Design-specific activities.** Design-specific working groups share information on a timely basis and co-operate on the areas of specific reactor design evaluations, construction oversight and the commissioning and early-phase operation of new reactors. Participants in these working groups are the regulatory authorities that are actively reviewing, preparing to review, or regulating the construction of the specific new reactor designs. 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 sub-groups have been formed to address specific technical issues. Non-MDEP regulators could request MDEP membership in order to join a design specific working group.

- **Issue-specific activities.** Working groups have been organised for specific technical and regulatory process areas within the programme of work. These include vendor inspections, codes and standards, and digital instrumentation and controls. Membership in issue specific working groups is open to all MDEP participating countries and the IAEA representatives. These topics were chosen because the activities are of generic interest and of safety significance to the licensing of new reactors in MDEP member countries. The approaches followed by the MDEP regulators are not completely alike, and successful completion of the activities related to the issue specific working groups will likely result in increased harmonisation and convergence in regulatory practices or increased co-operation. In June 2015, the MDEP Policy Group determined that the programme should focus on design specific activities going forward and the issue specific working groups should be closed or transferred to another organisation over the next few years. In 2017, the digital I&C issue specific working group was successfully transferred to the CNRA. During this reporting period, the STC has been working with the NEA to transfer the second issue specific working group, the CSWG to the CNRA. The CSWG transitioned to the CNRA in June 2018. The VICWG has been approved by the PG to remain in MDEP until 2022. The following chart illustrates how the programme is currently organised.
3.3 MDEP Library

In part, 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 access for each MDEP working groups’ 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 in fulfilling its goal of leveraging the work of peer regulators in the evaluation 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 at MDEP meetings and via the MDEP library is for the sole use of the participating national regulatory authorities. The members of the working groups also follow the communications protocol to share new information related to new reactors with other members in advance of its release to the public. 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.
3.4 Common positions

MDEP has developed a process for identifying and documenting common positions on specific issues among the member regulators 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 specific 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 to by 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 in order to keep external stakeholders informed of the work completed within MDEP. Those common positions will become commendable practices, recommended by MDEP. There is no obligation on the part of any regulatory body to follow them. A key concept throughout the work of MDEP is that national regulators retain sovereign authority for all licensing and regulatory decisions. If a regulatory body chooses to formally adopt a common position, it would be through that country's regular 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 focused on ensuring that MDEP does not duplicate efforts, benefits from the outputs of these organisations. Continued communication of MDEP activities and results to other organisations assists these interactions. In order to ensure that efforts are not duplicated between the groups, MDEP's scope is focused on short-term activities related to specific design reviews being conducted by the member countries and efforts to harmonise specific regulatory practices and standards.

4.1. CNRA WGRNR

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 construction inspection issues. 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 procedures and guidance, while MDEP focuses on design-specific issues.

MDEP interacts with the CNRA WGRNR and the Working Group on Inspection Practices (WGIP) through the NEA 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, and will assist in co-ordinating communications and requests between the two activities in order to ensure that MDEP's efforts take full advantage of the work already being done by the CNRA.

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

In March 2016, MDEP and the WGRNR held a joint commissioning workshop in Korea with well-balanced WGRNR-MDEP participation. The workshop consisted of three parallel sessions on commissioning management, commissioning oversight and cross-cutting issues. The report on the workshop results focused on the 11 topics discussed at the workshop and proposed commendable practices to help nuclear regulatory organisations (NROs) develop their commissioning oversight arrangements in addition to planning and performing their oversight activities. This report was approved by the CNRA in December 2017.

In accordance with the Policy Group direction to transfer from MDEP specific working group activities to the NEA, MDEP has been interacting with CNRA leadership to propose the transfer of some of its activities to the CNRA. The benefits of continuing co-ordination among regulators on these topics have been recognised both within and outside of MDEP. Therefore, MDEP has transferred the DICWG activities, in full, as a new working group under the CNRA, and maintaining the same goals and processes during the initial transfer period.

4.2. IAEA

The IAEA takes part in the work of MDEP through participation in the Policy Group meetings, STC meetings and issue-specific working groups. In addition, the generic common positions developed in MDEP are shared with the IAEA for consideration in the IAEA standards development programme.

4.3. Advanced Reactor Fora

Although MDEP is not currently considering the designs of advanced reactors, MDEP interacts with the Generation IV International Forum (GIF) to stay informed of multinational co-operative activities in the area of advanced reactors. MDEP also receives updates, through the NEA, of the work of the Joint CNRA/CSNI Ad hoc Group on the Safety of Advanced Reactors (GSAR), and maintains an awareness of the efforts of the IAEA Small Modular Reactor Forum. While these groups co-operate on the generic issues related to advanced and small modular reactors (SMR), there is an understanding that MDEP may form a design-specific working group if three MDEP member countries begin to consider a specific advanced or SMR design.

4.4. WENRA

The MDEP Steering Technical Committee 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 has welcomed MDEP input when developing its documents.
4.5. Industry

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

- The Codes and Standards Working Group interacted with a committee of standards development organisations (SDOs) (ASME, JSME, KEPIC, AFCEN, NIKIET and CSA) in a code comparison project. After issuing the code comparison report, the SDOs formed a Code Convergence Board to limit divergence and achieve convergence on individual requirements, where realistic and practical. Members of the MDEP CSWG participate in meetings of the Code Convergence Board.

- 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 AP1000 Working Group meets with Westinghouse and the AP1000 applicants and licensees.

- The APR1400 Working Group meets with KHNP and representatives of the licensee for the Barakah NPP, an APR1400 under construction in the United Arab Emirates (UAE).


- The VVER Working Group continues to interact with the Russian nuclear industry, as well as invited representatives of Rosatom, Rosenergoatom and design organisations (Atomenergoiproekt, Atomproekt, and Gidropress) to take part in the meetings of the VVERWG and its sub-groups to acquire additional information about safety-significant design solutions.

- The Digital Instrumentation and Controls Working Group (DICWG) interacts frequently with applicable SDOs, the Institute of Electrical and Electronics Engineers (IEEE) and the International Electrotechnical Commission (IEC), by including representatives of IEC and IEEE in MDEP meetings, attending IEC and IEEE meetings, and involving them in the development of common positions.

- The Vendor Inspection Co-operation Working Group (VICWG) meets with SDO and World Nuclear Association (WNA) representatives to discuss Quality Assurance and Quality Management (QA/QM) standards for manufacturing nuclear components.

4.6. World Nuclear Association

The World Nuclear Association CORDEL group acts as the industry counterpart to MDEP. CORDEL has initiated task forces to address many issues, including those currently being worked on by the MDEP issue specific working groups. Members of the MDEP STC meet with CORDEL periodically, and CORDEL has participated in meetings of the MDEP Vendor Inspections, Codes and Standards and Digital I&C Working Groups. CORDEL plays an important role in code harmonisation. They have established a Codes and Standards Task Force (CSTF) to converge code requirements and technical experts from over ten companies worldwide are working in the CSTF.

Since both MDEP and CORDEL have expressed interest in and have established a goal of furthering harmonisation of reactor designs, regulatory practices, and industry and international standards, the MDEP Policy Group has agreed that co-ordination of efforts with CORDEL is appropriate in some cases. While co-ordinating efforts in areas of mutual interest, MDEP members will always retain their individual and independent regulatory roles and positions.

While MDEP is a regulatory forum and CORDEL is an industry organisation, both parties agree they can benefit from communications and co-operation where the organisations share common goals. Two areas in which CORDEL and MDEP both have programmes of work to increase harmonisation are digital instrumentation and controls and codes and standards.

Both MDEP and CORDEL maintain strong interests in the harmonisation of new reactor designs and design reviews, regulatory safety standards and practices, and related industry and IAEA standards. MDEP values continued interaction to assist in achieving these goals while each organisation functions in a manner consistent with its appropriate roles and responsibilities.
With effective communications in mind, MDEP has regular interactions with CORDEL. The most recent meeting was held in March 2018, in Maryland, United States. During this meeting, MDEP STC members and CORDEL discussed current activities being undertaken at CORDEL and their role in MDEP. Collectively, the group discussed the potential for industry and SDO to work in the area of carbon segregation. During this reporting period, the CSWG has been closely interacting with CORDEL on the topic of carbon segregation.

To celebrate its 10-year anniversary, MDEP hosted a 2-day conference in September 2017 in London, United Kingdom. The conference included sessions on: codes and standards harmonisation; digital instrumentation and controls: current and emerging technical challenges; supply chain regulatory issues and vendor inspection cooperation; influence of MDEP interaction on reactor design safety; commissioning activities; and perspectives for MDEP. Each session was led by a Policy Group member and organised by a working group chair. CORDEL group members participated throughout the conference.
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 a lead and co-lead regulator designated as chair and vice chair, and has developed a programme plan which identifies specific activities, schedules and contacts.

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. Design-specific working groups achieve this goal through:

- Exchanging experiences and lessons learnt on licensing process implementation, design reviews, and design-related construction and commissioning activities;
- 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;
- Identifying and understanding key design differences including those originating from regulatory requirements and then documenting the reasons for differences in regulatory requirements;
- Looking for opportunities to provide input to issue-specific working groups on potential topics of significant interest;
- Documenting common MDEP positions on aspects of a review;
- Documenting the group’s activities in 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 that the members find challenging, specific to each design, some topics are addressed by several working groups. Two such topics are commissioning activities and Fukushima Daiichi lessons learnt.

Commissioning activities

Members of design-specific working groups, especially EPRWG and AP1000WG, are presently devoting resources for co-operation on commissioning of first-of-a-kind (FOAK) reactor testing. 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 MDEP generic common position addressing first plant only tests (FPOT) provides high-level guidance to applicants and licensees that wish to take credit for a FPOT performed during the commissioning of the first unit of a similar type, if accepted by the applicants, licensees and regulators. An FPOT allows a test performed on the very first reactor of a specific design to be credited for the subsequent units of similar design.

- As China AP1000s have moved into the commissioning phase, the Commissioning Activities Technical Expert Sub-group (TESG) shared information on commissioning tests, significant issues related to the testing, and lessons learnt on pre-operational testing. The TESG future activities include drafting a technical report on AP1000 hot functional testing lessons learnt from the Sanmen, Haiyang, and Vogtle sites, and increasing co-operation on pre-operational and start-up testing as more reactors start going through these phases.

MDEP co-operation in operational phases

MDEP was established primarily as a forum to co-operate on design reviews. As the designs are moving into the commissioning and eventually their operational phases, the Policy Group and Steering Technical Committee have discussed the benefits and challenges of continuing co-operation after construction is complete and into the operational stages. MDEP recognises the benefits of continuing the co-operative relationships formed during the design review stage, as well as the benefit to the members of the design specific working groups (DSWG) who are still in the licensing phase. The Policy Group has determined that the operational stage should not be included in the scope of MDEP. However, they stated there should be a means to ensure that operating experience related to design issues is addressed by DSWG. With this in mind, MDEP will continue to share information on construction and commissioning of new reactors, and incorporate feedback from operating experience as it pertains to design.
MDEP members agree that operating experience, when it has an impact on design, should be considered. In particular, information from the first two years of operation may be directly related to commissioning. MDEP members are encouraged to stay and participate in a group after the considered reactor begins to operate in their country to share operating experience.

This issue was raised once more at the STC meeting in June 2017. After an extensive discussion, it was clear that the members value the forum that MDEP provides. The discussion revolved mostly around the transition of a DSWG from MDEP to another area because there is a real value in the structured co-operation and dialogue that MDEP promotes. The STC discussed this challenge extensively and it is considering the Policy Group’s guidance following their September 2017 meeting. The ABWRWG was the first design in MDEP that completed its programme of work, and its functions were ceased in June 2018. The members of the ABWRWG are considering joining an ad hoc BWR regulator’s forum under the CNRA.

**Fukushima Daiichi Nuclear Power Plant Accident Lessons Learnt**

Lessons learnt from the Fukushima Daiichi nuclear power plant accident have been discussed by all of the DSWG’s and each working group has developed a common position that identifies common approaches to address potential safety improvements, as well as common general expectations for new NPPs. As directed by the MDEP Policy Group, the STC and working groups developed an integrated MDEP Common Position on the Lessons Learnt from the Fukushima Daiichi NPP Accident. The STC finalised this document in 2016 and placed it on the MDEP public web page. MDEP recognises that other related international initiatives have been implemented that are focused on operating plants. Therefore, it is important for new MDEP designs, such as the HPR1000, to address lessons learnt from Fukushima Daiichi.

**5.1 EPR Working Group (EPRWG)**

The design-specific EPR Working Group (EPRWG) includes the regulatory authorities of China (NNSA), Finland (STUK), France (ASN), India (AERB), Sweden (SSM) and the United Kingdom (ONR). Numerous meetings and technical exchanges have taken place to share information on the reviews being conducted in each country. The following major construction activities are currently ongoing: the twin unit plant at Taishan in China, Olkiluoto 3 in Finland and Flamanville 3 in France, which are all in the final stages of construction; as well as the twin unit plant at Hinkley Point C which is in the early construction phase in the United Kingdom.

The working group currently includes five technical expert sub-groups that are addressing information on specific technical issues: Accidents and Transients, Digital Instrumentation and Control, Probabilistic Safety Assessment, Severe Accidents and Commissioning Activities. Each of these sub-groups meet regularly to exchange information on relevant aspects of the design review and commissioning 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 and of EPR licensees, applicants, and potential applicants to discuss similarities and differences among the EPR designs being reviewed and licensed in each country. In June 2017, the EPRWG held a meeting in Finland with a visit to Olkiluoto Unit 3. In December 2017, the EPRWG met at NEA headquarters in Paris, France.

**Accomplishments and plan of work**

In 2017, the EPR Working Group continue to work on a draft common position stating how the EPR design addresses the objectives of the Vienna Declaration, especially with regards to avoiding large and early releases and long-term contamination. This common position addresses design basis, design extension and severe accidents. This common position was completed in 2018.

The Probabilistic Safety Assessment (PSA) TESG finalised a technical report identifying the main differences in the modelling of a number of reactor faults in the various EPR designs. The TESG is now engaging on other key PSA insights, for example common caused failures, human errors and digital I&C.

The Accidents and Transients TESG has been discussing the effectiveness of the sump filtration in design basis and severe accidents. They have developed a draft common position on boron dilution issues. In addition, the sub-group led the development of the EPRWG Common Position on the Vienna Declaration. In addition, the sub-group is drafting a document on double-ended guillotine break LOCA. The TESG has also started technical discussions on HVAC.

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The EPR I&C TESG is aiming at revising the EPR Common Position on EPR I&C Designs and supplementing it with a technical report. It will next focus on gathering feedback on I&C components design, manufacturing and installation.
The Severe Accidents TESG developed draft reports on hydrogen management and extended station black out. The TESG also initiated information exchange about Operating Strategies in Severe Accident (OSSA).

The EPR Commissioning Activities TESG (CATESG) continued to share overall commissioning progress with the three lead EPR plants along with the more significant lessons learnt and regulatory processes and activities. The sharing of lessons learnt, for example the observed cracking of the hard facing material on safety related valves, has enhanced the effectiveness of individual regulators.

The CATESG observation of the Taishan Unit 1 Reactor Pressure Vessel Internals vibration First-Plant-Only-Test (FPOT) in March 2017 was highlighted at the 4th MDEP Conference in September 2017 as a positive example of MDEP supporting regulators to work together.

In addition, the CATESG has started preparing a paper on the rational for the decision of regulatory hold points after fuel load.

In 2019, the EPRWG plans to:

- Continue to communicate timelines for sharing regulatory evaluations of the EPR among all EPRWG members.
- Continue to share information among EPRWG members in the areas in which technical experts sub-groups (TESGs) have been formed including Digital Instrumentation and Controls – DI&C (Lead: Finland), Probabilistic Safety Assessment – PSA (Lead: Finland), Severe Accidents – SA (Lead: France), Accidents and Transients – A&T (Lead: United Kingdom) and Commissioning Activities – CA (Lead: United Kingdom). These groups plan to perform the following:
  - the technical expert subgroups will provide a work plan including description and scope of issues to be addressed to the EPRWG and report on the status at every EPRWG meeting;
  - continue to meet regularly and exchange information on relevant aspects of the design and commissioning review status;
  - share relevant evaluations when they become available;
  - produce technical expert subgroup technical reports on subject that the subgroup deems important to safety to identify and document similarities and differences among designs, regulatory safety review approaches and resulting evaluations;
  - produce MDEP EPRWG common positions, especially on important safety evaluation findings;
  - post in the MDEP library evaluations, positions, reports, etc.
- Follow-up on EPR specific commissioning activities regarding:
  - follow-on licensees to submit case to respective regulators for crediting Taishan Unit 1 Reactor Pressure Vessel Internals vibration First-Plant-Only-Test (FPOT) results as appropriate;
  - preservation and maintenance of equipment during the commissioning phase to ensure its qualification is not invalidated;
  - preparation of paper on the rational for the choice of regulatory hold points after fuel load;
  - provide feedback to WGRNR on potential generic issues for their consideration.
- Address important ad hoc topic areas to support design safety review decision making:
  - exchange of information on specific technical issues (carbon properties of nuclear pressure equipment);
  - NPP accident-related issues within the EPRWG and with the vendors and licensees/operators/applicants to ensure follow-up on safety issues.
- When necessary, plan and conduct design-related commissioning inspections to ensure adequate design configuration control, quality assurance and acceptability of structures, systems, and components of the EPR (with appropriate co-ordination with VICWG).
- Provide recommendations, when appropriate, to the STC for considering possible items as topics to address generically.
5.2 AP1000 Working Group (AP1000WG)

The AP1000 design-specific Working Group (AP1000WG) includes the regulatory authorities of Canada (CNSC), China (NNSA), the United Kingdom (ONR), and the United States (NRC). In April 2017, India (AERB) joined the AP1000 WG. India is planning to build six AP1000 units at the Kovvada site. A total of four AP1000 units are under construction in China at the Sanmen and Haiyang sites. As of 30 July 2017, four units were under construction in the United States at the Vogtle and Summer sites. On 31 July 2017, South Carolina Electric & Gas (SCE&E) ceased construction on VC Summer Units 2 and 3. The NRC has issued combined (construction and operating) licences for six other AP1000 units: two each at the Levy, Lee, and Turkey Point sites. The Levy licences were terminated at the licensee’s request on 26 April 2018. On 14 February 2018, the NRC granted Westinghouse an exemption from Title 10 of the Code of Federal Regulations (10 CFR) 52.57(a) to defer by five years the time period during which Westinghouse could submit and the staff could accept Westinghouse Electric Company’s (Westinghouse) renewal application for the AP1000 Design Certification (DC). The renewal can now be requested between February 27, 2023, and February 27, 2025. Westinghouse had requested the exemption to allow for the completion and initial operation of AP1000 units in the United States, and the subsequent incorporation of lessons learnt from those activities into the DC renewal application.

In 2017, ONR completed its review of the AP1000 as part of the four step Generic Design Assessment (GDA) process. In 2011, ONR issued an interim Design Acceptance Confirmations (iDAC) of the AP1000 design, with 51 outstanding GDA issues attached. ONR was engaged in detailed technical discussions with Westinghouse to address these issues and to re-establish the generic AP1000 design proposed for the United Kingdom, cognisant of changes to the AP1000 design (and supporting analyses) introduced in China and the United States since 2011. Westinghouse addressed the 51 issues raised by ONR as part of their GDA process. In March 2017, the AP1000 Design Acceptance Certification was awarded with a number of GDA “assessment findings” attached that would need to be addressed, at the site specific design stage by any future licensee in the United Kingdom. NuGen was planning to build and operate three AP1000 reactors at Moorside in Cumbria; however, it is no longer pursuing the AP1000 design. As a result, ONR has ceased regulatory review activities for the AP1000 design in the United Kingdom.
In Canada, since CNSC completed a pre-licensing assessment of the AP1000 in June 2013 as part of its Phase 2 evaluation, there has been no activity with Westinghouse on further review efforts. The Phase 2 vendor design review is now complete.

**Accomplishments and plan of work**

The working group members have shared design, construction and commissioning information, application documents, evaluations and preliminary findings, and identified the most significant design review issues, as well as construction and vendor challenges. As the working group members transitioned to different stages of their design reviews, the group continued to re-evaluate the scope of the working group topics, and the issues to be addressed. In 2017, the working group continued discussions focused on issues identified with the design of the plants under construction in China and the United States including changes to the containment condensate return system design, hydrogen venting inside containment, 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 design and testing, and digital instrumentation and controls. The working group is developing a common position on IRWST Condensate Return Modelling that was submitted to the STC for approval in October 2018.

As the AP1000s in China moved closer to completion and the first units there started system hot and cold functional testing, the working group began to focus its discussion on the results of these tests through their official communication channels (e.g. working meetings, teleconferences, e-mail exchanges). The group is also discussing how the initial test programme is implemented. The AP1000 Working Group meets regularly with representatives of Westinghouse to discuss similarities and differences among the designs being licensed and constructed in each country and to discuss post-Fukushima safety reviews. In 2017, the working group toured plants under construction in the United States and met with China and US licensees.

The United States and ONR held several bilateral discussions to support information exchange associated with closing out issues identified in the CDA Step 4 for the AP1000. These discussions focused on the topics of squib valve design and testing, human factors engineering, spent fuel pool and lessons learnt from Fukushima Daiichi.

China and the United States 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. The two regulators shared information with the other AP1000WG members on the discussion topics including condensate return, main control room dose and habitability, reactor coolant pumps, squib valves and equipment qualification, as well as, discussions on lessons learnt from the Fukushima Daiichi accident and the prevention and mitigation of severe accidents. During this reporting period, the AP1000WG has been developing a technical report to capture these information exchanges.

As China and the United States progress in construction and move into the commissioning phase, they continue to share information on commissioning tests and activities. The US NRC provided NNSA inspection procedures and has sent inspectors to AP1000 sites in China 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 October 2017, the working group members from Canada, China, the United Kingdom and the United States met in the United States to discuss co-operation on pre-operational testing and initial test programme activities. Following this meeting, the NRC and NNSA continued discussions and correspondence on this issue (including at AP1000WG meetings).

In April 2017, the working group determined that lessons learnt to date by the working group through discussions on construction should be documented in either common positions or technical reports. The members agreed to complete reports on issues encountered on the design of the AP1000 reactor coolant pumps, condensate return, and squib valves during 2018. In addition, the group determined that the documented discussions that had occurred on the design effort could be put together in a report for use by future regulators working with the AP1000 design.

In October 2017 and in May 2018, the working group members from Canada, China, the United Kingdom and the United States met to discuss the status of construction in China and the United States, hot functional testing, and lessons learnt and to work on finalising the planned reports. At the end of the October 2017 meeting, the working group toured the Vogtle plants under construction and met with the site inspection staff.

China and the United States have a robust inspector and technical reviewer exchange programme with a goal of sharing information about regulatory activities such as commissioning, initial test programme and other regulatory responsibilities and roles in each country.
AP1000WG – 16th meeting, Atlanta, Georgia, United States, October 2017.

AP1000WG – Site visit to Vogtle NPP, Georgia, United States, October 2017
5.3 APR1400 Working Group (APR1400WG)

The APR1400 design-specific Working Group (APR1400WG) started in August 2012 with four countries, but Finland decided to leave the APR1400WG in 2015 due to the cancellation of the Olkiluto 4 project. The current participants are the regulatory authorities of the Republic of Korea, the United Arab Emirates, and the United States. The Republic of Korea leads this working group.

Korea issued an operating license for the first APR1400 at Shin-Kori Unit 3 in 2015, and currently Shin-Kori Unit 3 is in commercial operation. In January 2018, it successfully finished the first operational cycle of 389 days without problem. Five additional units, Shin-Kori 4, Shin-Hanul 1&2, Shin-Kori 5&6, are under construction. Four APR1400 units are also under construction at the Barakah site in the United Arab Emirates. The construction licenses for Barakah Units 1&2 and Barakah Units 3&4 were granted in July 2012 and September 2014, respectively. The operating licence application for Barakah NPP Unit 1 was submitted in March 2015 and the new fuel import licence, the fresh fuel transportation licence, and the fresh fuel storage licence were granted in 2016. The United States is reviewing an application for design certification that was submitted in December 2014 by KHNP and KEPCO and docketed in March 2015. The contents of the application include design control documents, the environmental report, technical reports, Inspection, Tests, Analyses, and Acceptance Criteria (ITAAC) and topical reports. The Phase 1 safety evaluation was completed in February 2016 and Phase 2 review was completed in May 2017. The NRC’s Advisory Committee on Reactor Safeguards completed its review in July 2017. The Phase 4 review was completed in May 2018. Phase 5 and phase 6 were completed in July and September 2018, respectively.

Accomplishments and plan of work

The APR1400WG had two meetings in 2017. The Accident and Transient Technical Experts Sub-Group (A&T TESG) met twice and the Severe Accident Experts Sub-Group (SA TESG) met twice, as well in 2017.

In August 2017, the APR1400WG, the A&T TESG and the SA TESG convened meetings at the NEA. At these meetings, regulatory agencies from Korea, the United Arab Emirates, and the United States continued to exchange information related to several significant regulatory review issues. These issues encompassed low power and shutdown risk; set points calculation methodology; inadvertent boron dilution including fresh water isolation valve; and NRC, Chapter 7, set point methodology. Following the request from the STC, regarding the possibility to turn the APR1400 Common Position on Strainer Performance and Debris In-vessel Downstream Effect into a generic common position for MDEP, this topic was also discussed during the APR1400WG meeting.
At the A&T TESG meeting, the members finalised the revision of the Common Position CP-APR1400WG-02: Common Position on the APR1400 Post Loss-Of-Coolant Accident (LOCA) Strainer Performance and Debris In-Vessel Downstream Effects, which was approved with comments by the MDEP STC in June 2017. A revision of the technical report on design description and comparison of design differences between APR1400 plants which was approved with comments by the MDEP STC in June 2017 (TR-APR1400-01) was implemented. They also discussed common position papers on fuel thermal conductivity degradation (TCD) and fuel bundle spacer grid strength irradiation effect and the issue on the leakage of POSRVs.

At the SA TESG meeting, the members discussed the compilation of the three previous tables into a single report containing background information related to the review of the APR1400 severe accident analysis. These tables included: severe accident regulatory requirements applicable to the APR1400 design; severe accident prevention and mitigation features of the APR1400 design; summary of codes, methodologies and counter measures for severe accident analysis at APR1400 units. With regard to the completion of the report on safety review findings related to Molten Core Concrete Interaction (MCCI) to date, the incorporation of the input from the United States was confirmed at this meeting. Issues related to long-term containment performance and equipment survivability were discussed at length as well. In addition to that, the SA TESG completed a survey request regarding hydrogen re-combiners and SBO.

The APR1400WG finished the following reports which were approved with no comment during the MDEP STC meeting in November 2017.

- Technical Report, TR-APR1400-02, on the comparison of the prevention and mitigation measures against severe accident
- Technical Report, TR-APR1400-03, on the findings of the review of the Molten Core Concrete Interaction (MCCI) phenomena for the APR1400

At the MDEP STC meeting, intensive discussions about the feasibility to turn CP-APR1400-02 into a generic CP were held. However, the STC concluded that the MDEP members were not able to commit to a generic CP at this stage; but that the question remains open until all MDEP designs have the opportunity to provide their inputs. Further inputs from AP1000WG and other designs were made at the October 2018 MDEP STC meeting.

The APR1400 design certification review is currently progressing through a 42-month review schedule in the United States; but the practical review process was almost finalised at the end of 2017. Since the publication of the safety review report is the only major work remaining in 2018, it is highly likely that the United States will reduce their active participation in the activities of the APR1400WG. Considering this, the working group has decided to focus on completing the technical reports and common position papers that are currently under development.

5.4 VVER Working Group (VVERWG)

The VVER design-specific Working Group (VVERWG) includes the regulatory authorities of China, Finland, Hungary, India, Russia and Turkey. The working group members are reviewing plants at various stages of design and construction. In Russia, Rostov NPP: Unit 3 is in operation and Unit 4 is under construction. The review for an operating licence for Unit 4 has started. The Leningrad-II NPP Unit 1 is in pilot operation. Unit 1 was connected to the grid on March 9, 2018. Unit 2 is under construction and siting licences have been issued for Units 3 and 4. The Novovoronezh-II NPP Unit 1 is in operation and Unit 2 is under construction. The review for an operating licence for Unit 2 is currently ongoing. The Kursk-II NPP Units 1 and 2 construction licences were issued and they are currently under construction. The Smolensk-II NPP siting licences have been issued for Units 1 and 2. While in Finland, one unit is under review for a construction licence at Hanhikivi NPP. India has two units in operation, two units in the early stages of construction at Kudankulam NPP, and two more units are planned. In Turkey, four units are being considered at the Akkuyu site. A Revised Site Parameter Report was approved by TAEK in February 2017. In China, two units are in operation, one unit is in trial operation and three units are under construction at Tianwan NPP. Hungary is considering two VVER units at Paks-II NPP. The review was completed based on generic design information and a site licence was granted.

Accomplishments and plan of work

The VVERWG continues to discuss a comparison table of differences in the VVER designs. The VVERWG currently includes four technical expert subgroups that are addressing specific technical issues including: Severe Accidents (TESG SA), Fukushima Daiichi Accident Lessons Learnt (TESG FUKU), Reactor Pressure Vessel and Primary Circuit Components (TESG RPV&PC). The VVERWG recently established a new TESG on Accidents and Transients (TESG T&A). The members meet
regularly to exchange information and experience in their countries’ regulatory activities, approaches and legal framework related to new designs.

The eighth VVERWG meeting was held in May 2017 in Paris. At this meeting, the final version of the technical report on regulatory approaches and criteria used in severe accident analyses and severe accident management was discussed, agreed upon and submitted to the STC for review. Also, the Technical Report TR-VVERWG-02: “Regulatory Approaches and Oversight Practices Related to Reactor Pressure Vessel and Primary Components” was discussed, agreed upon and approved by the STC in June 2017. The report covers the following seven topics:

1. regulatory requirements related to application of the leak before break concept;
2. requirements and regulatory oversight on manufacturing of primary components;
3. radiation embrittlement of RPV regarding use of new base materials including influence of Ni and Mn;
4. regulatory requirements related to pre- and in-service inspection of primary components (including hydrostatic pressure test);
5. regulatory requirements related to design basis of primary components (loadings and their combinations);
6. regulatory requirements related to cladding of primary circuit;
7. regulatory requirements related to protection against overpressure of primary circuit.

The ninth VVERWG meeting in November 2017 was held in Beijing. The meeting concluded with a visit to Tianwan NPP Unit 3 under commissioning, where participants discussed nuclear safety and commissioning oversight issues with representatives of the operating organisation. The final version of the Technical Report TR-VVERWG-01: Regulatory approaches and criteria used in severe accident analyses and severe accident management was discussed, agreed upon and submitted to the STC for approval. Also, the preliminary draft common position addressing the Vienna Declaration on Nuclear Safety was discussed. It was agreed that the TESG FUKU will tackle further development of this CP. The participants shared information on organisation and agenda items of the VVERWG workshop which was held in May 2018 in Moscow.

The new TESG on Accidents and Transients had a kick-off meeting on 28 September 2017 in Paris. The members elected the STUK’s representative as a sub-group chair and decided as initial activity to develop a technical report on regulatory approaches related to accidents and transient analyses. The report will cover the following five topics:

1. regulatory requirements for accident and transient analyses;
2. tools and methods used;
3. performances and analyses of passive systems;
4. cooling in spent fuel pool with internal and external hazards;
5. review methods for safety assessments (regulatory review process).

The second TESG T&A meeting was held in February 2018 in Paris. At this meeting, the questionnaires on topics 1, 3, 5 were discussed and detailed presentations on topic 2 were provided by members.

The SA TESG is developing a draft common position addressing ex-vessel melt retention in the core catcher and discussed the answers to questionnaires on passive autocatalytic recombiners and on extended station blackout during its meeting in February 2018 in Paris.

The Fuku TESG started the development of a common position addressing the Vienna Declaration on Nuclear Safety. The content of this common position and the schedule of its development have been discussed. This common position is expected to be developed and submitted to STC for approval in 2019.

The RPV&PC TESG continues to discuss the regulatory approaches and oversight practices related to reactor pressure vessel and primary components. Three additional technical topics were selected for further discussion during the subgroup meeting held in September 2017 in Paris. The RPV&PC TESG future discussions will cover the following topics:

1. Evaluation of surveillance programme for justification of RPV integrity;
2. Qualification of a FOAK component;
3. Qualification of NDT and welding personnel and special processes.

Additionally, the sub-group started the discussion of possible issues for development of a common position related to RPV and primary components during its January 2018 meeting held in Budapest.

VVERWG – Site visit, Tianwan NPP Unit 1, China, November 2017.
5.5 ABWR Working Group (ABWRWG)

The Advanced Boiling Water Reactor design specific Working Group (ABWRWG) includes the regulatory authorities of Japan, Sweden, the United Kingdom and the United States. The working group held its eighth meeting in October 2017 in Liverpool, United Kingdom and its 9th in Stockholm, Sweden in March 2018. The latter meeting completed outstanding actions, considered input for a newly formed CNRA BWR ad hoc working group and identified any additional activities that would be required to finalise recommendations to the MDEP STC and PG regarding the future of the group. A decision on the closure of the ABWRWG is expected during 2018.

Several different ABWR designs, offered by different vendors, have been considered by the working group members during 2017. These are two US ABWR designs offered by GE-Hitachi and Toshiba, UK-ABWR offered by Hitachi-GE and J-ABWRs offered by Hitachi-GE and Toshiba.

Accomplishments and plan of work

During 2017, The ABWRWG achieved the task of compiling a vendor-informed comparison table of design features between the eight existing and proposed designs for an ABWR. The complete comparison table is stored in the ABWRWG portion of the MDEP Library for ABWRWG restricted use and it is covered by the report TR-ABWRWG-1 along with a description of its content and use. This report was approved by the STC in April 2018; but, due to proprietary and commercial considerations, it will be restricted for the use of the ABWRWG only.

A review of the comparison table established that there are 18 noteworthy design differences. These are described within the technical report, TR-ABWRWG-2 “Design Differences Identified from Comparison of International ABWR Designs”. This report was approved in 2017 and is available for use by MDEP members.

Seven noteworthy differences were highlighted as relating to the severe accident design features and as a consequence the ABWRWG recognised that it is important to document the regulatory bases for severe accidents design differences. These bases have been developed by the Severe Accident Technical Sub-group and have been gathered in the technical report, TR-ABWRWG-03, restricted to the use of the ABWRWG only. This report was also finalised and approved in the Spring of 2018.

The conclusions and recommendations of TR-ABWRWG-2 identified areas of potential mutual collaborative interest for future work projects. However, although the United Kingdom has an active assessment programme planned for 2018, the US ABWR Design Certification renewal review will continue in 2018 and Japan has indicated it may conduct conformance reviews in 2018 and beyond. Uncertainty in timescales and resources meant that no sustainable plan for collaborative work within this working group could be established for 2018-2019.

Although no common areas within the scope of MDEP could be identified, the ABWRWG members identified common areas of interest outside the MDEP terms of reference. These they considered could possibly be served by a working group on boiling water reactors within the NEA. No such group existed previously. Consequently, the creation of this group was proposed by CNRA members of the WG to the CNRA, which agreed to consider the proposal. The members of the ABWRWG are now involved in the process for considering the creation of such a group.

As the group is the first of the MDEP DSWG’s to identify that it no longer has a near-term sustainable work programme within MDEP. It is offering significant assistance to the team set up by the MDEP STC for the development of a generic MDEP working group on closure criteria and decision tree to identify a path forward for working groups with diminishing programme plans or requirements for continued collaborative work in the future.

The ABWR severe accident technical expert sub-group continued to collaborate during 2017 on developing the comparison table of key severe accident design features and worked towards the delivery of a final report referred to above.

Other achievements include a sharing of the United Kingdom’s analysis of the outcomes from the ABWR GDA assessment that resulted in the award of a Design Acceptance Certificate for that design and the outcomes of the Japanese regulators review of the KK6/KK7 reactor site.

The ABWRWG closed its activities under MDEP in May 2018, and is now operating under the CNRA.
ABWRWG - 9th meeting, Stockholm, Sweden, March 2018

HPR1000WG – 1st Meeting, Beijing, China, March 2018
5.6 HPR1000 Working Group (HPR1000WG)

The MDEP HPR1000 Working Group (HPR1000WG) was approved by the MDEP Policy Group in September 2017. The group is focused on safety design reviews of Hualong Pressurized Water Reactor Technology Co. LTD HPR1000 design. The HPR1000WG includes the regulatory authorities of Argentina (ARN), China (NNSA), South Africa (NNR), and the United Kingdom (ONR).

The first meeting of the HPR1000WG was held in March 2018 in Beijing, China. A total of four HPR1000 units are currently under construction in China at the Fuqing and Fangchenggang sites. In the United Kingdom, the ONR Generic Design Assessment (GDA) process is currently at GDA Step 2. This stage consists of a high-level assessment of the fundamental aspects of the design. The UK GDA Step 2 officially commenced on 16 November 2017 and it is scheduled to last one year. The Bradwell B HPR1000 NPP project is in the early stages; currently focusing on initial site investigations.

The ARN is preparing to license one HPR1000 NPP but the pre-licensing process has not officially started.

Accomplishments and plan of work

The HPR1000WG developed their programme plan for 2018-2019. They are planning to discuss several technical areas; including, lessons learnt from the Fukushima Daiichi accident, severe accidents, unique design features affecting safety, and treatment of external and internal events. The HPR1000WG is developing a table on similarities and differences among designs.

5.7 Vendor Inspection Co-operation Working Group (VICWG)

The goals of the VICWG are to:

- Support MDEP design specific working groups;
- 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 and Quality Management (QA/QM) Requirements in order to utilise the information to improve regulators own requirements;
- 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;
- Continue joint and witnessed inspections and perform multinational inspections of vendors according to the common QA/QM requirements;
- Focus vendor attention on areas of emerging risks;
- Focus licensee and vendor oversight on effective supply chain performance;
- Focus licensee and vendor attention on positive nuclear safety culture expected within the supply chain;
- Continue to engage with CNRA to consider how to maximise the use of information gathered through VICWG activities;
- Consider the establishment of an NEA working group for vendor oversight, as part of the transfer of ISWGs to NEA.

The working group enhances the understanding of each regulator's inspection procedures and practices by co-ordinating witnessed and multinational inspections of quality assurance arrangements and safety related components.

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.

Multinational inspections consist of one regulator conducting an inspection according to its own regulatory framework with the active participation of one or more regulators. This allows the participating members to use the results of the inspection that are applicable to their regulations. Multinational inspections are a tool to gain vendor performance insights with minimal inspection resources from the participating regulators.

The working group maintains an annual list of planned inspections providing the opportunity to co-operate and fully maximise the results from vendor inspection activity. The inspection results are shared through the MDEP library. The library includes not only the reports of witnessed and multinational inspections; but other inspection reports that may be of interest to the MDEP members.

Accomplishments and plan of work

The MDEP VICWG continues to achieve its goals. The VICWG has completed all major objectives and continues to provide benefits to the associated regulators. The VICWG meetings have proven to be an effective forum for the discussion of inspection issues and for the sharing of inspection resources. Contacts between the members, the mutual understanding of regulatory frameworks, and individual country perspectives are key to the
effective functioning of the VICWG. The VICWG has begun discussions of potential vendors for the third multinational inspection targeted for 2019.

During 2017 and 2018, five witnessed inspections were completed involving regulators from Finland, France, Japan, Korea, Russia, the United Kingdom and the United States. The French and United States regulators also collaborated on inspection results from separately conducted vendor inspections. In total, 15 opportunities were identified to co-operate on vendor inspection related information. Based on the collaboration and opportunities to witness inspections, the VICWG updated the MDEP Common Position on Vendor Inspection Protocol and the Common Position on the Preparation and Performance of Vendor Inspections.

The VICWG routinely engages with standard development organisations (SDOs) to exchange regulatory experience, encourage forward co-operation and influence the future activities of the SDOs. During 2017 and 2018, the working group met with representatives from the World Nuclear Association (WNA) supply chain management task force. This task force supports the nuclear industry in resolving common challenges in the supply chain. Current WNA activities that the VICWG are following are reports from the New Build Lesson Learning Task Force and the development of ISO 19443 Standard for the Application of ISO 9001 and IAEA GS-R by organisations in the supply chain of the nuclear energy sector.

The VICWG has enhanced its co-operation on areas of emerging risk in supply chain management and vendor activity, specifically counterfeit, fraudulent and suspect items (CSFIs). The group effectively co-operated on an emerging issue during 2017 associated with fraudulent material certificates supplied from a Japanese material manufacturer and continued this approach into 2018 as the scope of falsification continued to grow. The ongoing co-operation has enabled participating regulators to consider the adequacy of their activities aimed at mitigating the risks of CSFIs entering licensee facilities through vendors. Of particular note, the French regulator performed a CSFI survey on regulator detection and mitigation approaches. The VICWG has captured the learning from this survey and related efforts from the CNRA working group on operating experience in a new common position on CSFI Procedures and Policies to be issued in late 2018. Forward activities will continue to consider co-operation on areas of emerging risk such as reverse engineering.

Next steps

The VICWG will continue to examine opportunities to co-operate on vendor inspection activity considering the potential for witnessed, joint or multinational inspections. The team will learn from the similarities and differences between MDEP national regulators’ QA/QM requirements in order to utilise the information to improve individual regulators’ own arrangements. The VICWG reviewed its technical report TR-VICWG-03: “Common QA/QM Criteria for Multinational Vendor Inspection”, following experience gained in the first two multinational inspections and changes in international quality standards. Based on this review, the VICWG reached consensus the common QA/QM criteria was useful at the development of the VICWG, but based on lessons learnt, the VICWG has decided to archive the related technical report.

As the VICWG has matured and national vendor inspection programmes have developed, the opportunities for VICWG participation have increased from co-operation on vendor inspection activities to sharing the outcomes from national vendor inspection programmes. The programme plan has been amended to emphasise this additional objective of the VICWG.

The second multinational inspection has been officially completed and a technical report has been generated to influence the planning and organisation of future multinational inspections and to ensure its programme documents and inspection protocols are effectively maintained.

The VICWG will continue to co-operate on areas of emerging risk and share inspection programme outcomes among regulators and with SDOs to influence appropriate mitigating methods including the development of associated international standards and guidance.

To ensure continued alignment with MDEP goals, the VICWG will engage with the design-specific working groups (DSWG) during 2018 and 2019 to assess if it continues to provide effective support for DSWG issues and identify any opportunities for enhancement. The VICWG plans to collaborate with the CNRA Working Group on Safety Culture (WGSC) to develop a common position on safety culture for the supply chain. The VICWG has been supporting the Working Group on Digital Instrumentation & Controls (WGDIC) in considering how existing vendor inspection process could be applied to support Digital I&C Vendor Inspections. Currently, VICWG is considering a proposal for co-operation with WGDIC to develop a common position on digital I&C vendor inspection subject to STC approval. Furthermore, the VICWG has been engaged with the CNRA Working Group on Inspection Practices (WGIP) to provide opportunities to WGIP members to observe vendor inspections and to share VICWG common positions.
5.8 Codes and Standards Working Group (CSWG)

The goal of the Codes and Standards Working Group (CSWG) is to achieve 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 among the pressure boundary codes and standards used in various countries. The CSWG encouraged standards development organisations (SDOs) to compare the requirements in 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 identified the extent of similarities and differences among the national codes, provided insight into background, history, and philosophy of each code, and provided a basis for developing general approach for code harmonisation. The report on code comparison was published in December 2012.

Based on the CSWG findings and the code comparison results, the CSWG established a global framework of a hierarchical structure for achieving code harmonisation. At the top of the hierarchy, the Fundamental Attributes provide overarching requirements for NPP design and construction. At the middle level, the Essential Performance Guidelines recommend basic design and construction rules to be included in codes, and provide guidance for code harmonisation. At the bottom level, code harmonisation is performed which includes convergence and reconciliation of code differences as well as the minimisation of further code divergence. The CSWG proposed a stepwise approach for code convergence and established a regular communication process for information exchange and discussion.

The CSWG plays an important role as an interface between the regulators and industry efforts to harmonise codes and standards. The CSWG interacts with the WNA CORDEL group.
Codes and Standards Task Force (CSTF), consisting of technical experts from over ten companies worldwide (AREVA, Bentley, Rolls-Royce, EDF, EPRI, Westinghouse, TVO, et al.) working to converge code requirements. They proposed a pilot project plan, which is consistent with the CSWG stepwise approach, to harmonise code requirements. CORDEL CSTF has made significant progress in the areas of non-destructive examination (NDE) personnel certification and non-linear analysis. They have compared requirements in the major nuclear design codes, compared the current international industrial certification practices, and recommended a harmonised international alternative for the certification of NDE personnel. They have also thoroughly reviewed the existing non-linear rules in different codes, and compared the scope, methods and availability of material data needed to perform analysis in very technical detail; they are developing universal new rules for non-linear analysis.

After issuing the code comparison report, the SDOs formed a Code Convergence Board to limit divergence on individual requirements, and achieve convergence on individual requirements where realistic and practical. SDOs and CORDEL are working jointly on code convergence of weld qualification. They extensively review worldwide practices in performance qualification, procedure qualification, and quality assurance of welding; and explore strategy to harmonise code requirements on weld qualification. The SDOs are also considering including other significant technical issues with international interest; those that are not currently addressed in the working scope and jointly developing universal code requirements. These include corrosion fatigue, RPV indications, flow-induced vibration in steam generators, small modular reactors, margin under high-seismic loadings and the use of high-density polyethylene piping.

Accomplishments

The CSWG has successfully completed its goal and mandate to achieve some level of harmonisation and identify the challenges in harmonising codes and standards. The group has established a regular communication process for information exchange and discussion, and has encouraged the industry and the SDOs to move forward and work cooperatively. Five documents have been formally issued by the working group. The Fundamental Attributes document and Essential Performance Guidelines document provide high-level and middle-level guidance for code harmonisation, respectively. The Regulatory Frameworks for Use of Codes document describes the regulatory practices in each country in using codes and provides insight on the flexibility of the regulatory framework of MDEP countries in using foreign codes. The Lessons Learnt document provides CSWG’s preliminary findings on achieving code harmonisation and provides general guidance on using foreign codes. The common position proposes a hierarchy structure as a global framework for harmonisation and documents the CSWG common positions on code harmonisation. Despite the challenges of code convergence, with dedicated work and close co-operation among the CSWG, CORDEL CSTF and SDOs, code convergence is happening in several technical areas. For example, one SDO is developing its code based on the SDOs’ Code Comparison Report, and introducing new code areas. A regulatory authority is using the CORDEL/SDO Weld Qualification report to draft proposals for modifying regulatory requirements. An SDO that requires company-based certification has started to modify its code and to accept the international alternative proposed in the NDE personnel certification report.

With the continuation of the close co-operation from the three parties, more achievements are expected in the near future, which will increase the efficiency of design and construction of nuclear power plants, and will enhance the safety of nuclear power plants that may be licensed in multiple countries.

Next steps

The working group will continue to interact with the CORDEL CSTF, and SDOs on: 1) preventing further code divergence; 2) converging code differences; and 3) reconciling code differences.

The CSWG has reviewed three SDO and CORDEL code harmonisation reports and provided comments to the SDOs and CORDEL. The three reports are Comparison Report on Welding Qualification and Welding Quality Assurance, STP-NU-078, Non-Linear Analysis Design Rules, Part 1 Code Comparison, and Non-Linear Analysis Design Rules, Part 3 Benchmark on Nozzles under Pressure, Thermal and Piping Loads. The CSWG is currently conducting a survey to identify potential topics for future code harmonisation.

A code is a living document that is continuously being updated to incorporate emerging technologies, improved understanding and accumulated operational experience. Therefore, the CSWG will continue to encourage SDOs to communicate with each other to minimise divergence of code during code updates. Some countries are considering developing their own codes. The CSWG will encourage these countries to study the existing codes carefully and minimise the potential differences between new codes and the existing codes.
The CSWG will continue to encourage CORDEL and the SDOs to converge code requirements using two methods: 1) modify existing code requirements that are identified as urgent and practical for code convergence; 2) jointly develop universal new code requirements on significant technical issues with international interest that are not currently addressed in codes.

Code convergence is a very challenging work. Even if the effort does not result in change of code requirements, the work is still very valuable for code reconciliation. The CSWG will also continue exploring strategies for reconciling code differences. The CSWG is currently working with NEA to develop a document that highlights the working groups’ scope of work and the benefit(s) the group can provide to CNRA members in case the CSWG is transferred under CNRA.

5.9 Digital Instrumentation and Controls Working Group (DICWG)

The Digital Instrumentation and Controls Working Group (DICWG) works to increase collaboration, co-operation, and knowledge transfer among members and with other stakeholders to achieve the following primary goals: 1) facilitate timely and efficient mechanisms for sharing of knowledge and experience among members, thus allowing knowledge transfer and more effective safety reviews; and 2) 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 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.

Accomplishments

The DICWG identified 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.
Since its creation, the DICWG has published 13 common positions that describe methods and evidence that the DICWG member states find acceptable to support safety justification for digital I&C systems. The published common positions include:

- **Generic Common Position 1** – Treatment of Common Cause Failures Caused by Software within Digital Safety Systems;
- **Generic Common Position 2** – Software Tools;
- **Generic Common Position 3** – Verification and Validation Throughout the Life Cycle of Digital Safety Systems;
- **Generic Common Position 4** – Data Communications Independence;
- **Generic Common Position 5** – Treatment of Hardware Description Language (HDL) Programmed Devices for Use in Nuclear Safety Systems;
- **Generic Common Position 6** – Simplicity in Design;
- **Generic Common Position 7** – Selection and Use of Industrial Digital Devices of Limited Functionality;
- **Generic Common Position 8** – Impact of Cyber Security Features on Digital I&C Safety Systems;
- **Generic Common Position 9** – Safety Design Principles and Supporting Information for the Overall I&C Architecture;
- **Generic Common Position 10** – Hazard Identification and Control for Digital I&C Systems;
- **Generic Common Position 11** – Digital I&C System Pre-Installation and Initial On-Site Testing;
- **Generic Common Position 12** – Use of Automatic Testing in Digital I&C Systems as part of Surveillance Testing;
- **Generic Common Position 13** – Spurious Actuations.

These common positions have been made publicly available on the MDEP website.

The DICWG continued to work on Common Position 14, on qualification of I&C platforms for use in important-to-safety applications. The new common position is intended to provide guidance on the qualification process of the hardware and software of I&C platforms for systems important-to-safety at nuclear power plants. Many I&C platforms and other digital equipment readily available in the marketplace were not designed specifically for use in nuclear facilities and have not been subject to the quality assurance criteria established by national regulators. In order for this equipment to be used in important-to-safety digital equipment (those whose adverse performance could challenge the assumptions in safety analyses), they must undergo qualification in order to demonstrate their suitability for their intended applications.

The DICWG has also worked on updating Common Position 4, on data communications independence. Specifically, the working group has been updating the text to address, among other issues, recent technical developments in the field of data communications.

The working group continues to implement a “Quick Inquiry” process to generate and process inquiries from member countries to promote an efficient and structured information exchange. This process provides a reliable way for storing this information in a retrievable database. The DICWG maintains frequent communication with the MDEP design-specific working groups and the VicWG. For example, the DICWG participated in the October 2017 joint meeting with the AP1000 digital instrumentation and controls technical expert subgroup, in Beijing, China. The working group achieved the desired outcome of the meeting, which was to gain information related to the AP1000 I&C system implementation and testing experience, including specific lessons learnt from the Sanmen AP1000 commissioning activities. Also, the meeting enabled the increased international co-operation of regulators, gain a better understanding of emerging digital I&C issues, understand how lessons learnt from the AP1000 I&C systems implementation and testing can be captured generically in common positions, and work towards convergence of regulatory practices for new reactor design reviews. The DICWG is also working closely with the NEA CNRA Working Group on Inspection Practices on the topic of vendor inspections of digital I&C equipment.

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) develop a common understanding of what is expected by industry and regulators; and 3) promote the development of international standards. As part of their future tasks, CORDEL intends to provide issued papers on: 1) I&C safety classification: comparison of I&C keywords definition provided by MDEP member states; and 2) defence in depth & diversity – challenges related to the I&C architecture. CORDEL plans to continue to engage with the DICWG (now under CNRA as discussed below) for comments on these and related documents.
Next steps

The DICWG has made 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 regulators.

A mandate for the transition of the DICWG to CNRA was approved in September 2017. The DICWG held their first meeting under CNRA, as the Working Group on Digital I&C or WGDIC, in April 2018. The WGDIC will continue to provide periodic updates to the STC on the different work activities such as those discussed above. Under the auspices of CNRA, the WGDIC will continue to develop Common Position 14 and update Common Position 4, as planned. However, this will be the last time the issue specific Working Group on Digital I&C will be included in the MDEP Annual Report, as they have successfully completed their transfer to CNRA.
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 this reporting period include:

- The VICWG has enhanced its co-operation on an area of risk in supply chain management and vendor activity, specifically Counterfeit, Fraudulent and Suspect Items (CFSIs). The group effectively co-operated on issues associated with fraudulent material certificates supplied from a Japanese material manufacturer and continued collaboration in 2018 as the scope of the falsification concerns continued to grow. The VICWG is developing a common position on CFSI procedures and policies. This common position was forwarded to the STC for approval in October 2018.

- The AP1000WG Commissioning Activities technical experts subgroup is actively co-operating on pre-operational testing and initial test programme activities, and agreed to develop a technical report to capture lessons learnt with the AP1000 Hot Functional Testing experience in China and other commissioning test activities.

- The AP1000WG is developing technical reports on “Lessons Learnt with AP1000 Reactor Coolant Pumps (RCPs)”, “AP1000 Squib Valve Design, Construction, Qualification, and Testing Experience”, and on “International Cooperation and Information Sharing during the Design, Construction, and Commissioning of AP1000 Reactors”. They are also developing a common position on “IRWST Condensate Return Modelling”.

- EPR SA TESG is leading cross-cutting activities in the areas of hydrogen management and the use of passive autocatalytic recombiners (PARs) and on the EPR the design approach to extended station blackout (SBO). The EPR SA TESG developed a survey on hydrogen recombiners reliability and effectiveness during plant life. This survey has been shared with other DSWGs to understand the main differences regarding hydrogen management for the different MDEP designs.

- The EPRWG is developing a technical report on PSA and a common position on boron dilution.

- The APR1400WG developed two technical reports and one workshop report for this reporting period. The two technical reports are technical report TR-APR1400-02 on the comparison of the prevention and mitigation measures against severe accident and technical report TR-APR1400-03 on the findings of the review of the Molten Core Concrete Interaction (MCCI) phenomena for the APR1400. The workshop report is the report on regulatory oversight of the commissioning phase for new reactors. This workshop was co-hosted by WGRNR-MDEP and held in Korea.

- The VVERWG continued to exchange information and experience on regulatory activities, approaches and legal framework related to new design NPPs and important-to-safety design differences, especially Leningrad-II, Novovoronezh-II, Hanhikivi, Paks-II and Akkuyu NPPs.

- The VVERWG, with input from the industry, continues to develop a comparison table of VVER designs differences implemented in the member countries.

- The HPR1000WG is developing a table on similarities and differences among designs and is considering the following technical expert topics: Fukushima accident lessons learnt, severe accidents, unique design features affecting safety, and treatment of external and internal events.
7. Next Steps – Future of the programme

The MDEP was established in 2006 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. At its May 2014 meeting, the MDEP Policy Group requested a data collection to be conducted among the members to prepare for a discussion on MDEP’s mid- and long-term strategy. The questions focused on MDEP’s mission and expected deliverables, the use of MDEP products, and the future of MDEP. The results of the data collection indicated that the members continue to receive significant benefits from participation in MDEP and it should continue beyond 2017. The members confirmed that the core activity should be the design specific working groups and identified some recommended improvements in development of the programmes of work, defining the products and ensuring knowledge transfer as reactors begin the operational phase. These findings were shared with the Policy Group at its June 2015 meeting. At this meeting, the Policy Group determined that MDEP should continue in its current form for an additional five-year period after 2017, until the end of 2022. However, the PG stressed that going forward, MDEP should focus on design-specific activities.

As new cross-cutting issues are identified in the future, the STC will consider setting up specific arrangements, such as ad hoc groups, sub-committees or arrangements with other working groups (e.g. the NEA’s CNRA WGDIC, WGRNR and WGIP) to address the issues without duplication rather than creating new issue-specific working groups. The design-specific working groups will continue co-operation and exchanging feedback on design issues through the construction phase and the first two years of initial operations. The Policy Group has determined that the operational stage should not be included in the scope of MDEP. However, there should be a means to ensure that operating experience related to design issues is addressed by DSWGs. With this in mind, MDEP will continue to share information on construction and commissioning of new reactors, and incorporate feedback from operating experience as it pertains to design.

As the current issue-specific working groups are completing the goals and activities specified in their programme plans, the STC and Policy Group have approved the transferring of the generic activities to other organisations. As previously stated, the CNRA has completed the transfer of the Working Group on Digital Instrumentation and Control. The CNRA has also initiated the process to transfer the CSWG activities from MDEP to the CNRA, as a new working group on codes and standards.

MDEP participating countries have also expressed the need and benefits of continuing the ongoing co-operation among members even after a specific design review has concluded. To that end, the STC has begun to explore different options that can be utilised to transition existing co-operation within a design-specific working group outside of the MDEP, once the working group has achieved its mandate under MDEP. For instance, the ABWRWG has identified topics that include generic BWR concerns and recommendations for ensuring the continuation of the interactions among regulators that could be pursued, if these activities are transferred to the CNRA. The CNRA is considering the establishment of a pilot project such as an ad hoc BWR regulators’ forum.
Appendix 1: List of abbreviations and acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ABWR</td>
<td>Advanced boiling water reactor</td>
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<tr>
<td>ABWRWG</td>
<td>Advanced Boiling Water Reactor Working Group</td>
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<tr>
<td>AERB</td>
<td>Atomic Energy Regulatory Board (India)</td>
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<tr>
<td>AFCEN</td>
<td>Association Française pour les règles de conception, de construction et de surveillance en exploitation des matériels des chaudières électro nucléaires (French SDO)</td>
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<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
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<tr>
<td>ASN</td>
<td>Autorité de sûreté nucléaire (Nuclear Safety Authority of France)</td>
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<tr>
<td>BWR</td>
<td>Boiling water reactor</td>
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<tr>
<td>CATESG</td>
<td>Commissioning Activities Technical Experts Subgroup</td>
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<td>CCF</td>
<td>Common cause failure</td>
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<tr>
<td>CNRA</td>
<td>Committee on Nuclear Regulatory Activities (NEA)</td>
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<td>CNSC</td>
<td>Canadian Nuclear Safety Commission</td>
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<td>CORDEL</td>
<td>Co-Operation in Reactor Design Evaluation and Licensing</td>
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<td>CP</td>
<td>Common position</td>
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<td>CSA</td>
<td>Canadian Standards Association</td>
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<td>CSTF</td>
<td>Codes and Standards Task Force</td>
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<td>CSWG</td>
<td>Codes and Standards Working Group</td>
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<td>DICWG</td>
<td>Digital Instrumentation and Controls Working Group</td>
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<td>DSWG</td>
<td>Design Specific Working Group</td>
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<tr>
<td>EDF</td>
<td>Electricité de France</td>
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<td>ENEC</td>
<td>Emirates Nuclear Energy Corporation</td>
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<tr>
<td>EPRWG</td>
<td>EPR Working Group</td>
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<tr>
<td>FANR</td>
<td>Federal Authority for Nuclear Regulation (United Arab Emirates)</td>
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<tr>
<td>FOAK</td>
<td>First-of-a-kind</td>
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<tr>
<td>FPGA</td>
<td>Field-programmable gate arrays</td>
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<td>FPOT</td>
<td>First plant only tests</td>
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<td>GDA</td>
<td>Generic design assessment</td>
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<td>GIF</td>
<td>Generation IV International Forum</td>
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<td>GSAR</td>
<td>Group on the Safety of Advanced Reactors</td>
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<td>HVAC</td>
<td>Heating, ventilation and air conditioning</td>
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<td>HAEA</td>
<td>Hungarian Atomic Energy Authority</td>
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<tr>
<td>HDL</td>
<td>Hardware description language</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>I&amp;C</td>
<td>Instrumentation and controls</td>
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<td>IAEA</td>
<td>International Atomic Energy Agency</td>
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<td>IEC</td>
<td>International Electro Technical Commission</td>
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<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
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<tr>
<td>IRWST</td>
<td>In-containment refuelling water storage tank</td>
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<tr>
<td>ISWG</td>
<td>Issue Specific Working Group</td>
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<tr>
<td>ITAAC</td>
<td>Inspection, Tests, Analyses, and Acceptance Criteria</td>
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<tr>
<td>JSC</td>
<td>Joint Stock Company (AtomStroyExport, Russia)</td>
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<tr>
<td>JSME</td>
<td>Japanese Society of Mechanical Engineers</td>
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<td>KEPCO</td>
<td>Korea Electric Power Corporation</td>
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<td>KEPIC</td>
<td>Korean Electric Power Industry Code</td>
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<td>KHNP</td>
<td>Korea Hydro and Nuclear Power</td>
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<td>KINS</td>
<td>Korea Institute of Nuclear Safety</td>
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<td>LOCA</td>
<td>Loss-of-coolant accident</td>
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<td>MCCI</td>
<td>Molten core concrete interaction</td>
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<td>MDEP</td>
<td>Multinational Design Evaluation Programme</td>
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<td>MHI</td>
<td>Mitsubishi Heavy Industries</td>
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<td>NDE</td>
<td>Non-destructive examination</td>
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<tr>
<td>NEA</td>
<td>Nuclear Energy Agency</td>
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<td>NIKIET</td>
<td>Scientific Research and Design Institute of Energy Technologies (Russian SDO)</td>
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<td>NNSA</td>
<td>National Nuclear Safety Administration (China)</td>
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<td>NPP</td>
<td>Nuclear power plant</td>
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<td>NRA</td>
<td>Nuclear Regulation Authority (Japan)</td>
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<td>NRC</td>
<td>Nuclear Regulatory Commission (United States)</td>
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<tr>
<td>NRO</td>
<td>Nuclear regulatory organisation</td>
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<tr>
<td>NSSC</td>
<td>Nuclear Safety and Security Commission (Korea)</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<td>ONR</td>
<td>Office for Nuclear Regulation (United Kingdom)</td>
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<tr>
<td>OOG</td>
<td>Owners and Operators Group</td>
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<td>PC</td>
<td>Primary circuit components</td>
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<td>PG</td>
<td>Policy Group</td>
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<td>PSA</td>
<td>Probabilistic safety assessment</td>
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<td>QA</td>
<td>Quality Assurance</td>
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<td>QM</td>
<td>Quality Management</td>
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<tr>
<td>RI</td>
<td>Regulatory issue</td>
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<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>RO</td>
<td>Regulatory observation</td>
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<tr>
<td>RPV</td>
<td>Reactor pressure vessel</td>
</tr>
<tr>
<td>SBLOCA</td>
<td>Small-break loss-of-coolant accident</td>
</tr>
<tr>
<td>SDO</td>
<td>Standard development organisation</td>
</tr>
<tr>
<td>SMR</td>
<td>Small modular reactor</td>
</tr>
<tr>
<td>SSM</td>
<td>Strålsäkerhetsmyndigheten (Swedish Radiation Safety Authority)</td>
</tr>
<tr>
<td>STC</td>
<td>Steering Technical Committee</td>
</tr>
<tr>
<td>STUK</td>
<td>Säteilyturvakeskus (Radiation and Nuclear Safety Authority of Finland)</td>
</tr>
<tr>
<td>TAEK</td>
<td>Türkiye Atom Enerjisi Kurumu (Turkish Atomic Energy Authority)</td>
</tr>
<tr>
<td>TESG</td>
<td>Technical Experts Subgroup</td>
</tr>
<tr>
<td>TR</td>
<td>Technical report</td>
</tr>
<tr>
<td>TVO</td>
<td>Teollisuuden Voima Oyj (Finnish Nuclear Power Company)</td>
</tr>
<tr>
<td>UAE</td>
<td>United Arab Emirates</td>
</tr>
<tr>
<td>VICWG</td>
<td>Vendor Inspection Co-operation Working Group</td>
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<tr>
<td>VVER</td>
<td>Water-water energetic reactor</td>
</tr>
<tr>
<td>VVERWG</td>
<td>VVER Working Group</td>
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<tr>
<td>WENRA</td>
<td>Western Europe Nuclear Regulators Association</td>
</tr>
<tr>
<td>WGIP</td>
<td>Working Group on Inspection Practices (NEA/CNRA)</td>
</tr>
<tr>
<td>WGRNR</td>
<td>Working Group on the Regulation of New Reactors (NEA/CNRA)</td>
</tr>
<tr>
<td>WNA</td>
<td>World Nuclear Association</td>
</tr>
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</table>
Appendix 2: Revised or new documents and publications

- Working group programme plans
- Multinational Design Evaluation Programme (MDEP) - Terms of References (TOR)
- Design Specific Working Groups - Terms of References (TOR)
- Technical Report: Design Differences Identified from Comparison of International ABWR Designs (TR-ABWRWG-02)
- Common Position on the APR1400 Post Loss-of-Coolant Accident (LOCA) Strainer Performance and Debris In-Vessel Downstream Effects (CP-APR1400WG-02)
- Technical Report: Background Information relevant to addressing Severe Accidents in the APR1400 Design (TR-APR1400WG-02)
- Technical Report: Regulatory approaches and criteria used in severe accident analyses and severe accident management (TR-VVERWG-01)
Appendix 3: Photographs of reactors considered within MDEP

Barakah Units 1,2,3, and 4 – APR1400 Overview, United Arab Emirates, January 2018 (Property of ENEC)

Barakah Units 1,2,3, and 4 – APR1400 Overview, United Arab Emirates, January 2018 (Property of ENEC)
Fangchenggang Units 3 & 4 - HPR1000, China, 2018 (Provided by NNSA)

Baltic NPP Unit 1 - VVER Overview of construction site, Russia 2016 (Provided by Rostechnadzor)
Flamanville 3 - EPR, France, 2018 (EDF all rights reserved)

Fujing NPP unit 5 & 6 - HPR1000 construction, China, 2018 (Provided by NNSA)
Fuqing NPP unit 6 - HPR1000 internal structure of reactor, China, 2018 (Provided by NNSA)

Haiyang NPP - AP1000 Unit 1 & 2, China, 2018 (Provided by NNSA)
Hinkley Point C - EPR outfall tunnel launch shaft with the first ring & collar placed, United Kingdom, 2018 (EDF all rights reserved)

Hinkley Point C - EPR Steel fixing in the Bylor prefabrication compound, United Kingdom, 2018 (EDF all rights reserved)
Hinkley Point C - EPR View of the Nuclear Island, United Kingdom, 2018 (EDF all rights reserved)

Hanhikivi - VVER site photo, Finland (Provided by Fennovoima material archive)
Kudankulam - VVER Passive Heat Removal System in containment, India, 2018 (provided by Rosatom State Corporation)

Kudankulam Units 1 & 2 - VVER Overview, India, 2018 (Provided by NPCIL)
Novovoronezh NPP-2 Unit 1 - VVER in commercial operation, Russia, February 2017 (Provided by Rostechnadzor and SEC NRS)

Leningrad II Unit 1 - VVER Connection to net, Russia 2018 (Provided by Rostechnadzor and SEC NRS)

Leningrad II Unit 2 - VVER Assembling the containment dome, Russia April 2018 (Provided by Rostechnadzor and SEC NRS)
Novovoronezh NPP-2 Unit 2 - VVER activity on turbine generator installation, Russia, March 2018 (Provided by Rostechnadzor and SEC NRS)

Olkiluoto 3 - EPR, Finland (Provided by STUK)
Olkiluoto 3 - EPR, Finland (Provided by STUK)

Sanmen NPP - AP1000 Units 1 & 2, China, 2018 (Provided by NNSA)
Shin-Hanul Units 1 and 2 - APR1400 Overview, Korea, February 2018 (Provided by KINS)

Shin-Kori Unit 5 - APR1400, Korea, April 2018 (Provided by KINS)
Taishan Units 1 & 2 - EPR, China, 2018 (EDF all rights reserved)

Tianwan Unit 3 & 4 - VVER, China, 2018 (Provided by NNSA)
Vogtle Unit 3 - AP1000 turbine diaphragm installation, United States, October 2018 (Georgia Power Company, all rights reserved)

Vogtle Unit 4 - AP1000 annex and containment, United States, October 2018 (Georgia Power Company, all rights reserved)
Cover page photo credits: Vogtle Unit 3 & 4 - AP 1000 north view, United States, October 2018 (Georgia Power Company, all rights reserved); Tianwan NPP - VVER, China, 2018 (Provided by NNSA)