MULTINATIONAL DESIGN EVALUATION PROGRAMME: 10 YEAR-ACHIEVEMENTS

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Abstract

The Multinational Design Evaluation Programme (MDEP) celebrated recently the 10th anniversary of its creation. In the past ten years, MDEP’s reputation as an effective organisation for leveraging the resources and experiences of multiple nations for regulatory review of new reactors has grown significantly. As a result, the portfolio of new reactor designs that are being addressed has increased from two to five, with a possibility of adding more new reactor designs. Presently, the five design specific working groups activities are supported by three issue specific working groups. MDEP’s membership has grown from the original 10 national regulators to 15.

Over the past 10 years, 25 common positions and 13 technical reports have been published by MDEP. In 2016, two generic common positions were issued at the level of the Steering Technical Committee: one on First Plant Only Tests and one addressing Fukushima Daiichi Nuclear Power Accident.

In 2015, the Policy Group extended the cooperation period from the end of 2017 to the end of 2022, focusing on its core mission of collaborating on new reactor design-specific activities. The scope of MDEP has been extended in 2016 to incorporate commissioning and early phase operation as an MDEP area of cooperation. MDEP maintains the cooperation with its main stakeholders, namely the industry representatives and other international organisations.

1. INTRODUCTION

MDEP is a multinational initiative that develops innovative approaches to leverage the resources and knowledge of national regulatory authorities who are, or will shortly be, undertaking the review of new reactor power plant designs. MDEP is primarily focused on design evaluation, but also includes inspection activities and generic issues.

2. BACKGROUND

2.1. Inception and membership of a first of a kind programme

In the early 2000’s, nuclear regulatory organisations from Finland and France were shaping bilateral co-operation on the matter of design review of a new type of reactor, the EPR. In 2004, a first informal discussion among several experienced nuclear regulators took place in Paris. In March 2005, a second informal discussion was held in Washington DC, including the OECD Nuclear Energy Agency (NEA), the Generation IV International Forum (GIF), the US Department of Energy and the International Atomic Energy Agency (IAEA). In July 2005, the US NRC formulated a proposal of initiative on multinational co-operation on new reactor design reviews. Several meetings led to the drafting of project plans, of a working approach and, finally, of terms of reference mid-2006. In September 2006, the first “Policy Group” meeting to approve the project took place. In January 2007, MDEP was launched for a two-year pilot project. At that time, members included regulatory authorities from Canada, China, Finland, France, Japan, Korea, Russia, South Africa, United Kingdom and the United States. The IAEA has also taken part in the work of MDEP since the inception and the NEA was designated to fulfil the Technical Secretariat function in support of MDEP. Since then, MDEP membership has expanded to 15 by adding regulators from India and the United Arab Emirates in 2012, Sweden and Turkey in 2013, and lastly Hungry in 2015.
A key concept throughout the work of MDEP is that national regulators retain sovereign authority for all licensing and regulatory decisions.

2.2. An organisation with reactor design evaluation at its core

MDEP is governed by a Policy Group (PG), made up of the heads of the participating regulators. Succeeding to Mr André-Claude Lacoste (France, ASN) and to Ms Allis on M. Macfarlane (USA, NRC), the PG chairmanship was transferred to the Director General of the Finnish nuclear regulator, STUK, in January 2015. The PG provides guidance to the Steering Technical Committee (STC) on the overall approach. The STC consists of senior staff representatives from each of the participating national safety authorities, plus a representative from the IAEA. The STC, chaired by the Deputy Director General of the French nuclear regulator, ASN, manages the design-specific and issue-specific working groups, approving their programme plans.

Five Design Specific Working Groups (DSWGs) are facilitating the MDEP goal of enhanced cooperation. The EPR Working Group (EPRWG) held its first meeting in 2008. It consists of the regulatory authorities of China, Finland, France, India, Sweden, the United Kingdom and the United States. The AP1000 Working Group (AP1000WG) was established in 2009 and consists of the regulatory authorities of Canada, China, Sweden, the United Kingdom and the United States. The APR1400 Working Group (APR1400WG) was created in 2013 and includes the regulatory authorities of Korea, the United Arab Emirates and the United States. The VVER Working Group (VVERWG) was initiated in 2014 and includes the regulatory authorities of China, Finland, Hungary, India, Russia and Turkey. The ABWR Working Group (ABWRWG) was the last group, created in 2014, and includes the regulatory authorities of Japan, Sweden, the United Kingdom and the United States. The DSWGs have been successful in sharing information and experience on the safety design reviews with the purposes of enhancing the safety of the design and enabling regulators to make timely licensing decisions, and of promoting safety and standardisation of designs through MDEP co-operation.

The five DSWG are supported by three Issue Specific Working Groups (ISWGs): the Vendor Inspection Co-operation Working Group (VICWG), the Digital Instrumentation and Controls (I&C) Working Group (DICWG) and the Codes and Standards Working Group (CSWG). As these groups’ activities are cross-cutting and can support any design review, the 15 MDEP members take part in the ISWGs. In addition to that, the DSWG have established Technical Expert Subgroups to provide them with design-specific expertise on topics of their needs. The current structure of MDEP is as follows:

![Organisational structure of the Multinational Design Evaluation Programme Chart as of March 2017.](image)

2.3. MDEP stakeholders

MDEP strives to maintain an awareness of, and interactions with, other organisations that are implementing programmes to facilitate international co-operation on new reactors. Interactions are focused on ensuring that MDEP does not duplicate efforts, benefitting from the outputs of these organisations, and communicating its activities and results to other organisations.
MDEP established and maintains high-level relationships with the IAEA, Western European Nuclear Regulators Association (WENRA), the NEA Committee on Nuclear Regulatory Activities (CNRA), the World Nuclear Association’s Working Group on Cooperation in Reactor Design Evaluation and Licensing (CORDEL) and GIF. It is worth highlighting that one of the aims pursued in the creation of CORDEL was to set up an industry counterpart and interlocutor to MDEP.

Working groups have established the necessary interfaces both within and outside of MDEP. The DSWG s are in contact with the vendor(s) and Owners and Operators Group (OOG) of the design they review. In addition to IAEA, the International Electrotechnical Commission (IEC) and the Institute of Electrical and Electronics Engineers (IEEE) are represented at the DICWG meetings. The DICWG members jointly review and comment on proposed IEC, IEEE and IAEA standards that are relevant to the regulatory review of digital I&C systems. The CSWG is working closely with standards development organisations (SDO) and CORDEL to converge code requirements related to pressure boundary components and to reconcile code differences.

To ensure that efforts are not duplicated between the groups, the MDEP 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.

2.4. A five-year renewed mandate to sharpen goals and scope of activities

The main objectives of the MDEP effort are to enable increased co-operation and establish mutually agreed upon practices to enhance the safety of new reactor designs. The enhanced co-operation among regulators enables to improve the effectiveness and efficiency of the regulatory design reviews, which are part of each country’s licensing process. The goal of MDEP is not to independently develop new regulatory standards, but to build upon the similarities already existing, and existing harmonisation in the form of IAEA and other safety standards.

MDEP members work together and weigh each word to develop common positions on topics of common concern. Common position papers are approved by all member regulators in the working group. Working groups also develop technical reports to document different views on a topic. In addition to the work performed within the working groups, MDEP has provided each regulator with peer contacts who share information, discuss issues informally, and disseminate information rapidly.

MDEP has made improvements in communicating information regarding the members’ regulatory practices through the development of an MDEP library, managed by NEA, which serves as a central repository for all documents associated with the programme.

Based on the value gained by the MDEP members during the five first years of the programme, it was extended for another five-year period in 2012 by the PG. Based on a thorough evaluation of data collected from member regulators in 2014, the PG made another decision to extend the co-operation period from the end of 2017 to the end of 2022, focusing on its core mission of collaborating on new reactor design-specific activities. At the same time, it decided that issue-specific working groups will be terminated in MDEP with the aim of continuing the work under NEA so as to benefit more member countries.

In addition to the original objectives of the programme, the lessons learnt from the Fukushima Daiichi nuclear power plant accident are being appropriately incorporated into MDEP activities in the DSWG s’ programme plans. Recently, although the PG has determined that the full operational stage should not be included in the scope of MDEP, the scope has been expended to commissioning and early phase operation of about one year.

3. ACHIEVEMENTS

Accomplishments to date provide confidence that the MDEP membership, structure and processes offer an effective method of accomplishing increased co-operation in regulatory design reviews. All published MDEP documents are available in the MDEP website [1].

3.1. STC undertakes special projects

3.1.1. Safety goals and self-assessment
In 2011, the STC published a paper that reviews the high level goals used in MDEP countries and the relevant work of international groups. This paper was supplemented by a common position shared with IAEA on Safety Goals.

The STC also regularly reviews its processes to identify lessons learnt and improvements. In 2013, the STC issued a self-assessment report based on more than 100 survey collected.

### 3.1.2. Fukushima Daiichi nuclear power plant accident lessons learnt and Vienna declaration

Lessons learnt from the Fukushima Daiichi nuclear power plant accident are discussed by all of DSWGs and have been incorporated in their programme plans. MDEP recognises that other ongoing international initiatives are focused on operating plants. Therefore, MDEP considers important to address such issues for new reactors. The five DSWGs have completed their evaluation and published their findings in a common position. These papers identify common approaches to address potential safety improvements as related to lessons learnt. Thus, the STC developed an integrated MDEP common position on the lessons learnt from Fukushima Daiichi nuclear power plant accident that integrates the common positions from all five DSWGs into a single MDEP position paper. This common position was published in September 2016 [2]. It includes a high-level statement on Vienna declaration identifying topics that may be addressed by design-specific working groups.

### 3.1.3. First Plant Only Tests

In 2014, the EPRWG initiated the draft of a common position addressing First Plant Only Tests (FPOT) on the EPR design. The aim of the common position is to provide guidance for licensees wishing to credit a test conducted during commissioning of the first unit of a design to characterise the performance and behaviour of a system or component on follow-on units constructed in another country. The member countries’ requirements for crediting FPOT described in the appendices of the draft common position were found to be applicable to all designs. As a consequence, the draft EPR common position was reviewed by the other DSWGs and turned into a generic MDEP common position. This common position was published in May 2016 [3]. Its appendices provide an early insight to the licensees on what requirements they will have to fulfil to make a FPOT acceptable. The first implementation of FPOT is well underway with the EPR Taishan unit 1 reactor pressure vessel internals vibration FPOT.

### 3.2. Design Specific Working Groups accomplishments

In addition to the work mentioned above, the DSWGs have published ten common positions and several technical reports during the ten past years. To be noted is for instance the AP1000WG common position on squib valve design or the EPRWG common positions on the DI&C design of the EPR or on the EPR containment mixing (cf. paper addressing this issue), containment heat removal system in accident conditions or in-containment refueling water storage tank pH control in accident conditions.

### 3.3. Issue Specific Working Groups accomplishments

The Vendor Inspection Co-operation Working Group achieved its generic goals with the completion of a number of common positions and technical reports on quality assurance/quality management criteria, vendor inspection good practices and multinational vendor inspection. The working group also established a protocol for joint or witnessed vendor inspection. The VICWG has performed numerous joint or witnessed inspections since its creation and two multinational vendor inspections, the last one having been performed at the Areva Le Creusot plant. The VICWG is also interfacing with standards development organisations to encourage and explore harmonisation of quality standards.

The Digital Instrumentation and Controls Working Group has issued twelve common positions so far based on the existing standards, national regulatory guidance, best practices, and group inputs using an agreed upon process and framework. These common positions describe methods and evidence that all DICWG member countries find acceptable to support safety justification for digital I&C systems. The DICWG common positions
published are mentioned in the figure below and have been classified according to I&C architecture and design; quality and verification & validation; and hazards and reliability categories [4].

The Codes and Standards Working Group 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 achieve some harmonisation and identify the challenges in harmonising codes and standards. The group has encouraged and pushed the industry and the SDOs to move forward and work co-operatively. The working group has finished its work, with its only outstanding mandate of continuing to interact with the industry. Amongst CSWG’s products found to be helpful are the Pressure boundary code comparison (with industry cooperation) and technical reports on the regulatory frameworks for pressure-boundary codes and standards, on the lessons learnt on achieving harmonisation, on the fundamental attributes for pressure boundary components and on the essential performance guidelines for pressure boundary components.

4. PERSPECTIVES AND CONCLUSION

MDEP achievements have proven to be significantly beneficial to MDEP members. For this reason, the programme is continuing on beyond 2017. The design-specific working groups will continue co-operation and exchanging feedback on design issues through the construction and commissioning phases and will 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, transfer of their generic activities to the NEA is being worked out. Completion strategies that include products, schedules and recommendations for ensuring the continuation of the interactions among the regulators, and between regulators and external stakeholders when these activities are transferred, are being developed. As for DSWGs, the programme is open to considering adding more new reactor designs if regulators from at least three countries express interest in working together.

At the important milestone of its 10th anniversary, MDEP is hoping to gather feedback on its current activities and discuss its future. To this end, MDEP is organising its fourth MDEP conference to be held in September 2017 in London, United Kingdom [5]. The event will provide a forum for MDEP stakeholders (including industry representatives, standard development organisations and other international organisations) to share the results of their engagement with the programme and to deliver presentations on ongoing activities related to new reactor licensing.

REFERENCES