



# MULTINATIONAL DESIGN EVALUATION PROGRAMME

## Annual Report

**Covering Activities  
from July 2023 to June 2024**





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## Foreword from the Management Board Chair



I am very proud and grateful to have chaired the Management Board of the Multinational Design Evaluation Programme (MDEP) for more than two years, since 2022.

Since MDEP was reformed in 2022, different changes have been made in order to improve and enhance effectiveness, as well as to establish comprehensive work to respond to both emerging challenges and the development of modern technologies. With the active support of the initiative member countries, as well as the MDEP secretariat, were taken co-ordinated steps, which ultimately helped to increase interaction between participants and deepen co-operation.

MDEP remains a unique multinational initiative that leverages the resources and knowledge of national regulators in order to review new reactor designs and it is widely recognised as an effective framework for regulatory co-operation and harmonisation. Its role is rising from year to year, taking into account the challenges of new technologies for nuclear safety and security.

The year 2024 has been a turning point within the framework of MDEP's activities, as efforts have been made to expand the work of the Programme and its role will increase in the foreseeable future.

Since the end of 2023, the preparation stage of two new MDEP working groups was launched: the first for high-temperature gas-cooled reactors (HTGR-WG) and the second for light-water small, medium and modular reactors (SMMR-WG).

Representatives from Argentina, China, Russia and South Africa have been working on the creation of the HTGR-WG Programme Plan, which defines the key aspects of the group's areas of activity, as identified by the participating countries based on their respective interests.

To highlight the creation of a new Working Group, as well as to identify the most urgent and relevant topics related to the HTGR, an online workshop on reactors of this type was held in March 2024. The strong interest shown by representatives of regulatory authorities and the nuclear industry has confirmed the relevance and timeliness of the establishment of the new HTGR-WG.

Moreover, at the same time, participants from Argentina, China, Russia and Türkiye carried out the preparation and development of the Programme Plan of the second working group, namely the SMMR-WG. As in the case of HTGR, the participants, with the support of the MDEP secretariat, organised and held a workshop in Ankara, Türkiye. Representatives of regulatory authorities, industry and scientific institutions discussed the importance of the development of these technologies, with applications both on land and water, on vessels and floating power plants. At the same time, great attention was paid to the regulation of this type reactors.

Following the results of the workshop, the sides supported the establishment of a new working group, which should discuss such issues as: SMMR regulatory framework, new material for light-water SMMRs, safety assessment approaches, and implementation of probabilistic safety assessments.

While new working groups are being established, two other groups, which already existed, VVERWG and HPR1000WG, continue their activities, deepening co-operation between countries on harmonisation and moving towards the finalisation of the tasks they face.

MDEP remains in touch with other challenging international initiatives such as the International Atomic Energy Agency's Nuclear Harmonization and Standardization Initiative (IAEA NHSI) and the World Nuclear Association's (WNA's) activities on harmonisation. Such interactions continue to be an integral part of the MDEP work.

The creation of new working groups related to the latest technologies in the field of nuclear energy, as well as the interest shown by a large number of countries, proves the relevance and importance of the work being carried out within the framework of MDEP. Despite the current challenges, difficulties and uncertainties in the world, it is important to simplify the process of information sharing between all stakeholders and to promote products, key achievements and major events and activities in the field of nuclear safety.

**Alexey Ferapontov**  
MDEP Management Board Chair

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## Executive summary

The Multinational Design Evaluation Programme (MDEP) is a multinational initiative whose purpose is to leverage the resources and knowledge of national regulatory authorities that are currently, or will shortly be, undertaking the review of new reactor designs. The current MDEP members are the regulatory authorities of Argentina (ARN), the People's Republic of China (NNSA), Hungary (HAEA), the Russian Federation (Rostekhnadzor), South Africa (NNR) and Türkiye (NDK). 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 co-operative activities including exchanging regulatory experiences and concerns, increasing the multinational convergence of safety goals, safety standards and guides and continuously improving regulatory frameworks and approaches. A key concept throughout the work of MDEP is that national regulators retain sovereign authority for all licensing and regulatory decisions.

The following report encompasses all MDEP activities from July 2023 to June 2024. In addition, the report presents MDEP's organisation, goals, history, working groups, initiatives, results and future perspectives. Appendix 1 and 2, finally, offer a list of abbreviations and acronyms as well as a list of new and revised publications.

Substantial progress has been made on the overall MDEP goals of increased co-operation and enhanced convergence of regulatory requirements and practices. In addition, the topic of lessons learnt from the Fukushima Daiichi Nuclear Power Plant accident has been incorporated into MDEP activities in the Design Specific Working Group (DSWG) programme plans and the relevant issues have been appropriately addressed by all designs under MDEP. The accomplishments to date provide confidence that the MDEP membership, structure and processes offer an effective and efficient method for accomplishing co-operation in regulatory reviews for new reactor designs. At the level of the working groups, the key accomplishments for the July 2023 to June 2024 period are the following:

- The VVERWG was working on a report on safety review findings relevant to the topic of transients and accident analysis and severe accidents, a report on long-term heat removal, and questions for the VVERWG workshop with industry. Furthermore, VVERWG is considering potential new TESSG on Risk-Informed Regulatory Activities (RIRA).
- The HPR1000 is now exploring potential new areas for collaboration: on accidents analysis, supply chain and risk-informed approach.

At the inter-organisational level, MDEP interacts and works closely with national nuclear regulators on exchanging up-to-date regulatory experiences and practices, with the NEA Committee on Nuclear Regulatory Activities (CNRA), the International Atomic Energy Agency (IAEA) and the World Nuclear Association via its Working Group on Co-operation in Reactor Design Evaluation and Licensing (CORDEL) and with various industry groups through a number of initiatives such as Working Group Industry Workshops.



# 1. Introduction

The Multinational Design Evaluation Programme (MDEP) is a multinational initiative that develops innovative approaches to leverage the resources and knowledge of national nuclear regulatory authorities that are, or will shortly be, undertaking the review of new reactor power plant designs. MDEP aims to better inform the decisions of nuclear regulatory authorities through multinational co-operation, while each regulator retains the sovereign authority to make licensing and regulatory decisions.

Working groups are implementing their programme plans with specific activities and goals, and the working groups have established the necessary interfaces both within and outside the MDEP members. MDEP has transitioned to a new framework, with overall goals of increasing co-operation and enhancing convergence of safety requirements and regulatory approaches. Accomplishments to date provide confidence that the MDEP membership, structure and processes provide an effective and efficient method of increasing 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 abundant and significant results gained by the members. In 2015, the Policy Group determined that MDEP should continue in its current form, for at least five more years following 2017. In December 2021, the Policy Group approved the sunset of three MDEP designs (EPR, AP1000 and APR1400) which had completed their Programme of Work, and the transfer of the Vendor Inspection Cooperation Working Group (VICWG) to the NEA Committee on Nuclear Regulatory Activities (CNRA). A new MDEP governance structure was adopted and successfully implemented in 2022. Regardless of this period of transition, working groups focusing on the active MDEP designs (VVER and HPR1000) continued to share the latest information and experience of the safety design reviews with the purpose of enhancing the safety of the design and supporting regulators in making timely licensing decisions.

This annual report encompasses all MDEP activities from July 2023 to June 2024.



## 2. Programme goals and outcomes

The main objectives of the MDEP effort are to enable increased co-operation of national safety authorities within existing regulatory frameworks and establish mutually agreed upon practices to enhance the safety of new reactor designs. The enhanced cooperation among national nuclear 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 new and advanced reactor designs and on regulatory co-operation practices to share up-to-date regulatory approaches and harmonising regulatory requirements. The IAEA safety standards, which offer a general level of harmonisation, both inform and benefit from the MDEP's outcomes.

MDEP is meeting its goal of enabling greater co-operation through the activities of the working groups. It has successfully created a forum for regulatory bodies to co-operate on design evaluations and inspections. Beyond organising working groups, MDEP has facilitated peer-to-peer connections among regulators, enabling the rapid exchange of information and informal discussions on key issues. For example, the DSWG members have benefitted significantly from the questions shared among the regulators, leading to more informed and harmonised regulatory decisions. MDEP interactions have proven valuable in confirming prior findings, enhancing the safety focus of design reviews, identifying previously unnoticed safety issues, and broadening the scope of the review. 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. Moreover, successful interactions with stakeholders through MDEP have built links with regulators, industry, standard development organisations (SDOs) and other international organisations and have been beneficial to the reviews of reactor designs.



## 3. Programme implementation

### 3.1 Membership

To enhance the effectiveness and efficiency of this programme and to guarantee the targeted and actionable outcomes, participation in MDEP is intended for the national nuclear safety authorities and TSOs 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's current members are Argentina, China, Hungary, Russia, South Africa and Türkiye. The IAEA also takes part in the work of MDEP.

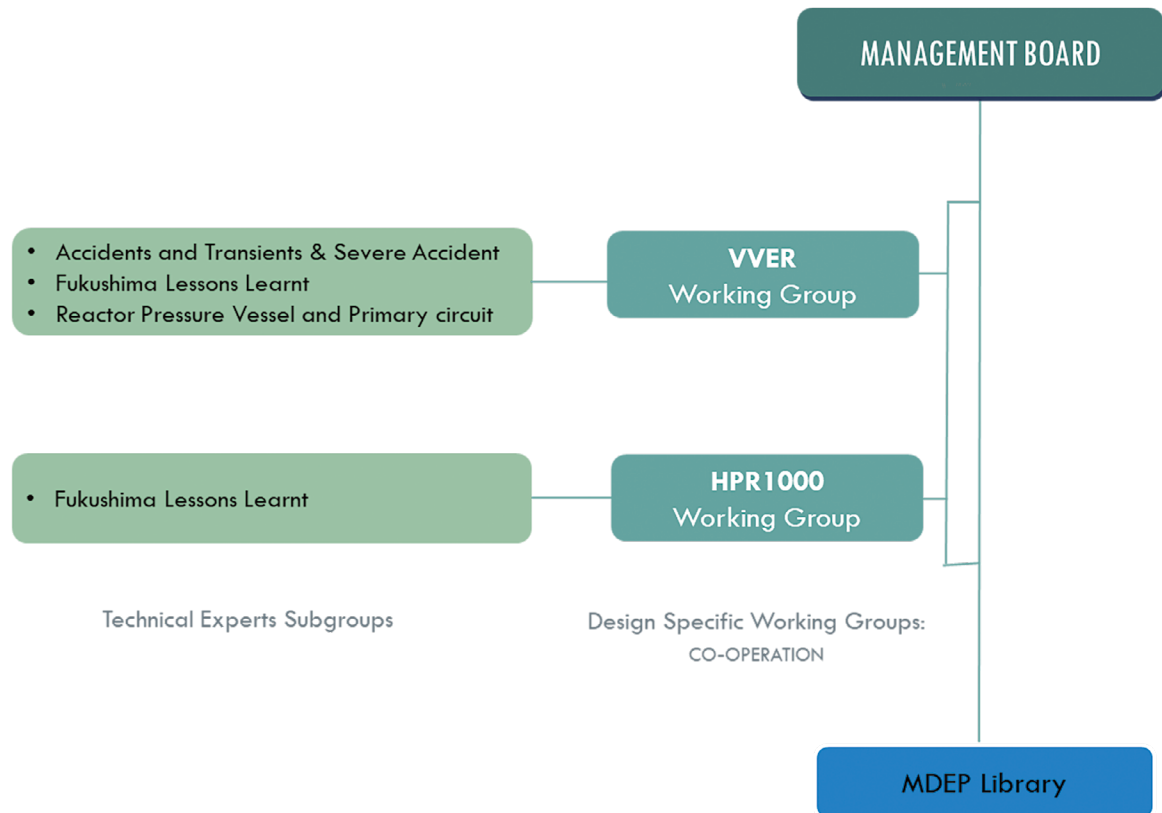
### 3.2 Organisational structure

In 2022 a new governance structure for MDEP was implemented. This structure involves the formation of an MDEP Management Board (MB) as a main governance body, with the Nuclear Energy Agency (NEA) assuming the role of its Technical Secretariat. From July 2023 until June 2024, the Management Board held two meetings: on 28 September 2023 and 9 June 2024. Two ad-hoc meetings were also held on 13 December 2023 and 16 January 2024.

At the 5<sup>th</sup> MB meeting held in September 2023, the MB supported the proposals to start preparations on launching two new working groups via a brainstorming workshop. The first group is to be focused on the safety of High-Temperature Gas Reactor (HTGR) technology, and the second on Light-Water Small, Medium and Modular Reactors (LW-SMMR). Those proposals were based on the recommendations received during the 5<sup>th</sup> MDEP Conference held in April 2023. By the end of the 1<sup>st</sup> ad-hoc meeting, the MB had approved the 2023-2024 budget estimation. At the 6<sup>th</sup> MB meeting, the Board provisionally approved the Programme Plan for the HTGR working group.

The following chart illustrates how the programme is organised.

Figure 3.1: MDEP organisational structure as of June 2024



### 3.3 MDEP Library

MDEP information is communicated among members in part through the MDEP Library, which serves as a central repository for all documents associated with the programme. The NEA provides the technical support for the development and maintenance of the MDEP Library on a secured password-protected website. The website provides two levels of access: i) general access open to every member, and ii) restricted area access for each MDEP working group member regulator 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/mddep](http://www.oecd-nea.org/mddep)). As a general rule, the information exchanged as part of MDEP in meetings and in 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 prior to its public release. A large portion of the information shared may not be proprietary or sensitive; however, all participating members must protect and properly handle the information which an originator considers to be proprietary or sensitive.

MDEP WGs have documented their work and results, including individual close-out reports for the design-specific working groups that are now closed. All these materials are archived in the MDEP Library for future use.

This electronic library is restricted to the national regulatory agencies of the member countries that have been or currently are participating in MDEP. The library is managed by the NEA Secretariat. According to the MDEP Terms of Reference, permission to access the information should be sought through the NEA Secretariat, which handles requests according to an agreed protocol.

In its final meeting, on 14 December 2021, the MDEP PG agreed that the NEA would manage access to the MDEP Library by non-MDEP countries. For access requests to non-proprietary information held in the library, it was agreed that the NEA Secretariat could use its discretion. For access requests to proprietary

information received from non-MDEP countries, the NEA Secretariat must either request permission from the originating country to allow access or direct the requestor to the originating country. In all instances, the NEA Secretariat will advise the CNRA of requests from non-MDEP members for access to the library and the subsequent provision of information. This will ensure that a much wider group of national regulators will benefit from MDEP. The MDEP Library will continue to be a central repository for MDEP.

### 3.4 Common Positions

MDEP has developed a process for identifying and documenting Common Positions on specific issues among member regulators, based on existing international nuclear safety requirements and standards, national regulatory guidance, international best practices and inputs from group members. Design-specific Common Positions document the common conclusions that each of the working group members have reached during design reviews. Discussing and sharing information among members in these areas helps to strengthen the conclusions reached.

Generic Common Positions apply generically to the new type of reactor rather than only to one specific design. Generic Common Positions document the regulatory 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, to be considered in standards development programmes. After a Common Position is agreed within a working group, it is presented to the MB for endorsement. Upon endorsement by the MB, 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 and the up-to-date knowledge gained for the licensing of new types of reactors. 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 will be through that country's regular processes.



## 4. Interactions with other organisations

MDEP strives to maintain an awareness of, and interacts with, other organisations that are implementing programmes to facilitate international co-operation on new reactors. Interactions focus on ensuring that MDEP does not duplicate efforts and benefits from the outputs of these organisations.

A key outcome of MDEP's co-operation with external organisations are the MDEP conferences and workshops. MDEP organised five conferences, and these events have provided 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. In 2024 it also organised two brainstorming workshops. The first was held online on 18-20 March 2024 and was dedicated to the safety of HTGR technology. On 10-11 June 2024, the NEA, with the support of NDK (Turkish Regulatory Authority), held another workshop dedicated to the safety issues of LW-SMMRs in Ankara, Türkiye. Each of the workshops gathered participants from more than 20 countries, the International Atomic Energy Agency, the World Nuclear Association and the Generation IV Forum (GIF).

### 4.1. CNRA

The CNRA also launched a new framework in 2023 and it is currently reviewing the activities of the newly established working groups. It is expected that the CNRA Working Group on Policy and Licensing (WGPL) will be a 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 to ensure that MDEP's efforts take full advantage of the work already being done by the CNRA. The WGPL is focusing on issues related to policy and licensing for operating nuclear reactors and for proposed new reactors (including those under construction) in NEA member and partner countries. The WGPL aims to facilitate an active and timely exchange of commendable practices, as well as lessons learnt to help regulators perform their policy and licensing functions more effectively and efficiently. To avoid overlap of activities between the groups, WGPL focuses on general procedures and guidance, while MDEP focuses on design-specific issues.

### 4.2. CSNI

In 2023, the CSNI Expert Group on Small Modular Reactors (EGSMR) published a technical opinion paper entitled "Research Recommendations to Support the Safe Deployment of Small Modular Reactors". This document served as a key resource for the Management Board (MB) in developing the programmes for two brainstorming workshops focused on HTGR technology and LW-SMMR, aimed at identifying priorities for future activities. Beginning in March 2024, a regular information exchange was established between MDEP and the EGSMR to co-ordinate ongoing and planned activities related to SMRs, ensuring alignment and optimising resource use. To further this collaboration, many EGSMR experts participated in the brainstorming workshops held by MDEP in 2024 as Chairs, speakers and observers, enriching the discussions and offering new regulatory perspectives.

### 4.3 IAEA

The IAEA takes part in the work of MDEP by participating in the Management Board and in any possible future issue specific working group meetings. In addition, the generic Common Positions developed in MDEP are shared with the IAEA for consideration in the IAEA standards development programme.

### 4.4 GIF

In 2024, initial communication with the GIF was established, in particular with the Risk and Safety Working Group. RSWG members took part in both brainstorming workshops as Chairs, speakers and observers, and shared their experience and views on the development of safety criteria and guidance for advanced and innovative technologies. It was agreed that once the HTGR working group is launched a regular information exchange between the two groups would be established.

### 4.5. Industry

The MDEP working groups are interested in understanding the perspectives of the design vendors, codes and standards organisations, and component manufacturers as well as 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 VVER Working Group continues to interact with the Russian nuclear industry, as well as invited representatives of Rosatom, Rosenergoatom and design organisations (such as Atomenergoproekt, Atomproekt, and Hidropress) to take part in the meetings of the VVERWG and its subgroups to acquire additional information about safety-significant design solutions. VVERWG held a second workshop with industry on 27-29 October 2021, via teleconference, during which the following topics were discussed: usage of PSA in nuclear power plant design, supply chains and validation/verification of “first-of-a-kind” (FOAK) equipment. The next workshop will be held in 2025 to discuss issues related to VVER-1200 design differences, FOAK tests and long-term heat removal design solutions.
- The HPR1000 Working Group meets with Hualong Nuclear Power Technology Co., Ltd and the HPR1000 licensees in China. The HPR1000WG also plans to organise a first workshop with industry in 2025.

### 4.5. WNA

The WNA Working Group on Co-operation in Reactor Design Evaluation and Licensing (CORDEL) acts as the industry counterpart to MDEP. Since both MDEP and CORDEL have the goal of furthering harmonisation of reactor designs, regulatory practices and industry and international standards, the MDEP MB 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. CORDEL has been participating in meetings of the MDEP VICWG. And the MDEP Technical Secretariat provided updated information on MDEP activities during the CORDEL regional workshop in 2022.

While MDEP is a regulatory forum and CORDEL is an industry organisation, both parties agree they can benefit from communication and cooperation where the organisations share common goals. 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.

## 5. Current activities

The activities of MDEP have been 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. MDEP also maintained until the end of 2021 one issue-specific working group that scrutinised 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 that 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 purpose 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 adoption 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 safety 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.

Design-specific working groups typically focus on issues that present particular challenges for their members, unique to each design. However, certain topics are addressed across multiple working groups, notably the lessons learnt from the Fukushima Daiichi accident and hydrogen management. The Management Board (MB) also decided that compliance with the first principle of the Vienna Declaration should be a required outcome for each working group dedicated to a specific design or technology.

### 5.1 VVER Working Group (VVERWG)

The VVER Working Group comprises regulatory authorities from China, Hungary, Russia and Türkiye. The members of the working group are reviewing plants at various stages of design and construction. In Russia, Leningrad-II Nuclear Power Plant unit 1 is operational, while unit 2 received its operational licence and reached minimum controlled power levels at the end of August 2020, subsequently entering commercial operation on 23 October 2020. Units 3 and 4 obtained construction licences in 2024. Novovoronezh-II Nuclear Power Plant unit 1 is operational, and unit 2 entered commercial operation at the end of October 2019. Kursk-II Nuclear Power Plant unit 1 is undergoing commissioning licensing, and unit 2 is under construction. Siting licences for Smolensk-II Nuclear Power Plant units 1 and 2 have been issued. In Türkiye, at the Akkuyu Nuclear Power Plant, units 1, 2, 3 and 4 are under construction. In China, four VVER-1000 units are operational at Tianwan Nuclear Power Plant, with VVER-1200 unit 7 under construction. The First Concrete date for VVER-1200 unit 8 was 25 February 2022. Additionally,

two VVER-1200 units at Xudapu Nuclear Power Plant are under construction, with First Concrete dates of 28 July 2021 and 19 May 2022, respectively. In Hungary, a VVER-1200 unit 5 is under construction at Paks Nuclear Power Plant, and the Construction License Application for unit 6 is under review.

Figure 5.1: **3D model of Paks-II Nuclear Power Plant**



Source: JSC Atomstroyexport.

### **Accomplishments and plan of work**

The VVER Working Group (VVERWG) currently includes three Technical Expert Subgroups (TESGs) addressing specific technical issues: the Fukushima Accident Lessons Learned (FUKU TESG), Reactor Pressure Vessel and Primary Circuit Components (RPV&PC TESG), and the joint TESG on Severe Accidents and Accidents & Transients (SA&TA TESG). These groups meet regularly to exchange information and share experiences related to regulatory activities, approaches, and legal frameworks concerning new designs in their respective countries.

In October 2023, the VVERWG published two technical reports: one on the Preliminary Analyses & Comparison of Design Differences between VVER-1000 Reactors, and another on Regulatory Requirements and Practices for Uncertainty Evaluations of Deterministic Safety Analysis. Throughout 2023-2024, the VVERWG also drafted several additional technical reports and began preparations for establishing a new technical subgroup.

The joint TESG on SA&TA shared safety review findings, provided consolidated comments, and drafted a technical report on long-term heat removal. The draft report is expected to be approved by the VVERWG in October 2024. Two additional topics were investigated: long-term heat removal from the containment and approaches to accident management. The group has also outlined questions for the VVERWG's workshop with industry, covering details on technical measures related to long-term heat removal, startup performance tests and design changes compared to the reference plant. For future work, the TESG is considering an investigation into source term evaluation.

The TESG on Reactor Pressure Vessel and Primary Circuit Components (RPV&PC) has been working on a technical report covering topics such as the evaluation of surveillance programmes for RPV integrity, the qualification of a first-of-a-kind (FOAK) component, and the qualification of non-destructive testing (NDT), welding personnel, and special processes.

The TESG on Fukushima Lessons Learned (FUKU TESG) is finalising a Common Position on the Vienna Declaration.

Additionally, the group has initiated preparations for a potential new TESG on Risk-Informed Regulatory Activities (RIRA), with discussions on potential activities and regulatory frameworks planned for the end of 2024.

## 5.2 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 the Hualong Nuclear Power Technology Co., Ltd. HPR1000 design. The HPR1000WG includes the regulatory authorities of Argentina (ARN), People's Republic of China (NNSA) and South Africa (NNR). The United Kingdom (ONR) left the Working Group towards the end of 2022.

Four HPR1000 units are currently operational – Fuqing units 5 and 6 and Fangchenggang units 3 and 4. Twelve HPR1000 units are under construction – Zhangzhou units 1, 2, 3 and 4, Taipingling units 1 and 2, Sanao units 1 and 2, Changjiang units 3 and 4, and Lufeng units 5 and 6. Eight HPR1000 units are approved by the State Council – Ningde units 5 and 6, Taipingling units 3 and 4, Shidaowan Expansion units 1 and 2, and Jinqimen units 1 and 2.

In the United Kingdom, the Generic Design Assessment (GDA) of the UK HPR1000 officially commenced in January 2017 and was finished at the end of 2022.

In Argentina, the decision to build an HPR1000 has been declared in the Secretary of Energy's planning by the current government of Argentina. ARN has developed a Memorandum of Understanding (MoU) where a set of "high-level" requirements complementing Argentina's standards were defined as mandatory for the HPR1000 project. The MoU has been submitted to the Licensee, Nucleoeléctrica Argentina S. A. (NA-SA). The EPC contract was signed on 1 February 2022.

South Africa has not yet decided on a design for its new build programme.

### **Accomplishments and plan of work**

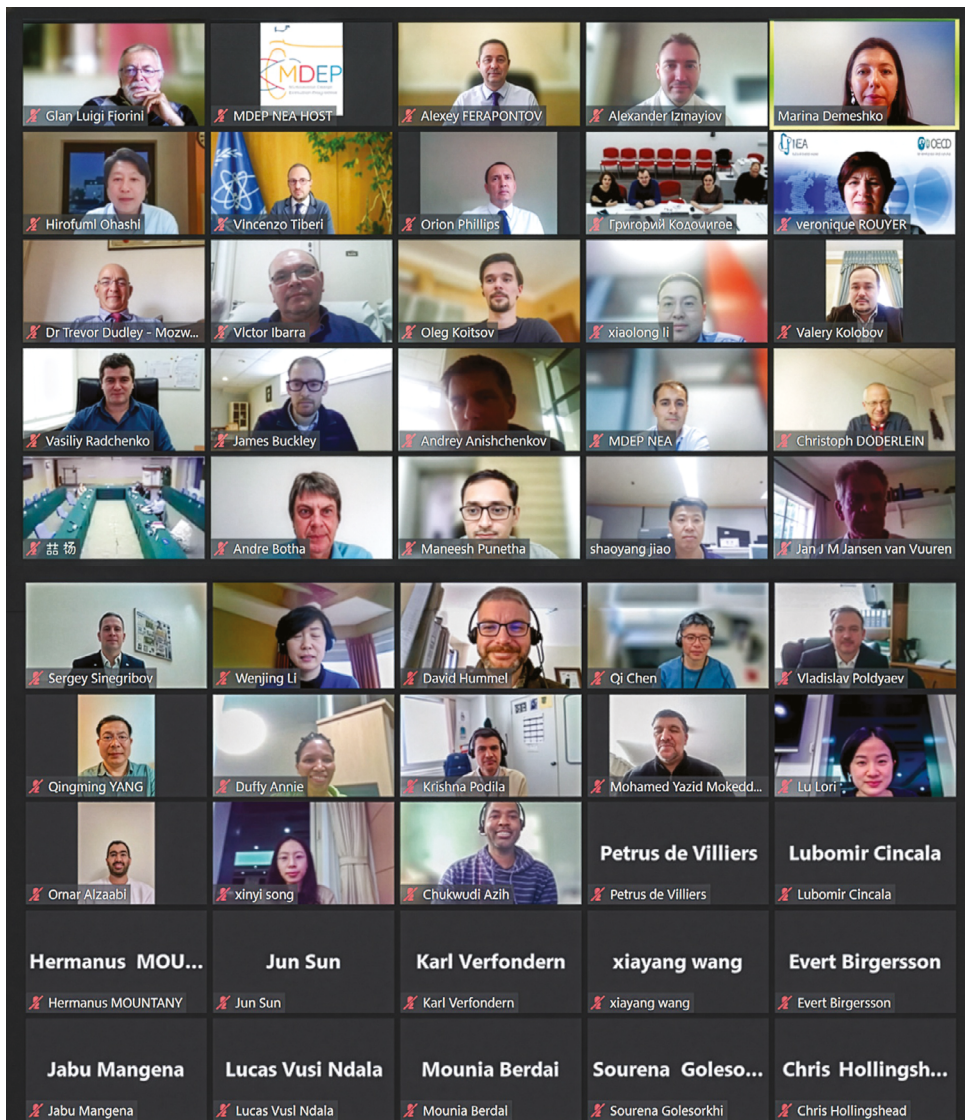
During this reporting period, the HPR1000WG members continued to share information and their experience on regulatory issues and the status of HPR1000 projects in their respective countries. As China progressed in the construction phase, the working group discussed the NNSA safety reviews of design changes and construction events of the HPR1000 units in China.

In October 2023, the HPR1000WG published a Common Position (CP) on the Internal Refuelling Water Storage Tank (IRWST) Strainer Performance and Downstream Effects of the HPR1000 following a loss-of-coolant accident (LOCA); a CP on the In-Vessel Retention strategy for the HPR1000; and a technical report (TR) on Internal and External Hazards. Following these publications, the working group closed the Technical Expert Subgroup (TESG) on external and internal hazards. The group also decided to broaden the scope of severe accident issues to include a wider range of accident analyses, elevating these topics to the working group's attention. Additionally, the HPR1000WG explored new potential activities, with a current focus on topics such as supply chains and risk-informed approaches. These issues will be discussed with the HPR1000 designers during the first HPR1000WG workshop with industry, planned for 2025.

### 5.3 HTGR workshop

In order to launch the new working group on high-temperature gas-cooled reactors (HTGRs), MDEP organised an online brainstorm workshop on 18-20 March 2024. Around 300 registered participants from 29 countries and two international organisations participated in the workshop. The participants mainly came from national nuclear regulators, TSOs, HTGR designers and research institutes. During the workshop, seven design-related topics were discussed: verification and validation (V&V) computer benchmarking for HTGRs, fuel safety, research needs relevant to HTGRs, probabilistic safety assessment (PSA) first-of-a-kind (FOAK) HTGR, defence in depth (DiD) principles applicability to HTGR, materials selection for HTGR reactors and primary and secondary circuit, and existing regulatory frameworks for addressing the specific safety requirements of HTGRs. The inputs from those discussions were used to define the prioritised topics of MDEP. Following the workshop, an HTGR working group programme plan was drafted and received the approval of the Management Board at the 6th MB meeting on 9 June 2024 in Ankara, Türkiye.

Figure 5.2: HTGR brainstorming workshop participants



## 5.4 LW-SMMR workshop

To initiate the new working group on Light-Water Small and Medium Modular Reactors (LW-SMMR), MDEP organised a hybrid brainstorming workshop on 10-11 June 2024 in Ankara, Türkiye, with approximately 40 participants attending in person and 40 joining online. Attendees included representatives from national nuclear regulators, technical support organisations (TSOs), LW-SMMR designers, and research institutes from 23 countries.

Throughout the workshop, eight design-related topics were thoroughly discussed: LW-SMMR designs; the application of the first principle of the Vienna Declaration to LW-SMMRs; research needs relevant to LW-SMMRs; future perspectives on recycling of LW-SMMRs; verification and validation (V&V) computer benchmarking for LW-SMMRs; implementation of probabilistic safety assessment (PSA) for LW-SMMRs; the applicability of Defence in Depth (DiD) principles to LW-SMMRs; and the justification of material selection for LW-SMMR reactors, including validation of the strength and lifetime of materials used in primary and secondary circuits.

The safety issues associated with LW-SMMRs were widely identified during these discussions and will serve as crucial inputs for defining the prioritised topics of MDEP. Currently, the LW-SMMR working group programme plan is under development, building upon the outcomes of the workshop.

Figure 5.2: LW-SMMR brainstorming workshop participants





## 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 publication of the Proceedings of the 5<sup>th</sup> MDEP Conference on New Reactor Design Activities – International Cooperation: Past, Present and Future, held in April 2023.
- The publication by the VVERWG of a technical report (TR) on Preliminary Analyses and Comparison of Design differences between VVER-1000 Reactors and a TR on Regulatory Requirements and Practices for Uncertainty Evaluations of Deterministic Safety Analysis.
- The publication by the HPR1000WG of: a CP of the IRWST Strainer Performance and Downstream Effects of HPR1000 after LOCA; a CP addressing In-Vessel Retention strategy for HPR1000; and a TR on Internal and External Hazards.
- The completion by HTGR-WG of a programme plan and provisionally approved by the 6<sup>th</sup> MDEP Management Board (MB) on 9 June 2024.



## 7. Next steps – Future of the Programme

The Multinational Design Evaluation Programme (MDEP), established in 2006 for a five-year period, has undergone two extensions due to the value it provided to its members. In 2019, the Policy Group decided to transition MDEP's structure by 2022, as certain working groups (EPRWG, AP1000WG and APR1400WG) were nearing completion of their planned activities. The VVER and HPR1000 working groups remain active, continuing under the governance of the MDEP Management Board (MB), while the Policy Group approved the closure of several other groups and transferred oversight of the VICWG to the CNRA.

Since 2022, the VVER and HPR1000 working groups have successfully maintained collaboration under a streamlined MDEP framework, co-ordinated by the NEA as the Technical Secretariat. The 5<sup>th</sup> MDEP Conference, held in April 2023, reviewed the Programme's achievements and assessed new areas for co-operation, especially in emerging technologies. The conference emphasised enhancing early integration of regulators' feedback into design processes, fostering closer industry-regulator collaboration, and promoting MDEP as a platform for new designs.

In 2024, following these discussions, two new working groups were in development. The High-Temperature Gas-cooled Reactor Working Group (HTGR-WG) received in-principal approval for its Programme Plan at the 6<sup>th</sup> MB meeting, with member organisations requested to nominate representatives. Similarly, a Programme Plan for the Light-Water Small and Medium Modular Reactor Working Group (SMMR-WG) is set to be submitted at the 7<sup>th</sup> MB meeting, with nominations expected for this group as well.

MDEP remains open to new members, particularly countries embarking on nuclear power programmes, constructing or planning agreements for MDEP-design reactors, or exploring advanced technologies such as LW-SMMRs and HTGRs. Expanding membership will benefit both current and new participants, fostering broader regulatory collaboration. The primary criteria for joining include a commitment to share expertise and contribute the annual fee. To facilitate this, the MB has reviewed and refined the membership process, which can be initiated either through the Technical Secretariat or an existing member country.

Furthering its scope, MDEP is also exploring the creation of an International Safety Assessment School, with discussions underway regarding collaboration with Khalifa University. These initiatives reflect MDEP's ongoing efforts to evolve, ensuring its relevance in supporting regulatory co-operation for new reactor designs and technologies.



## Appendix 1. **List of abbreviations and acronyms**

CNRA	Committee on Nuclear Regulatory Activities (NEA)
CORDEL	Co-Operation in Reactor Design Evaluation and Licensing
CP	Common Position
DSWG	Design Specific Working Group
EPRWG	EPR Working Group
FOAK	First-of-a-kind
GDA	Generic design assessment
HTGR	High-temperature gas-cooled reactor
IAEA	International Atomic Energy Agency
ISWG	Issue Specific Working Group
LOCA	Loss-of-coolant accident
MDEP	Multinational Design Evaluation Programme
NDK	Nuclear Regulatory Authority (Türkiye)
NEA	Nuclear Energy Agency
NNSA	National Nuclear Safety Administration (China)
ONR	Office for Nuclear Regulation (United Kingdom)
PC	Primary Circuit components
PG	Policy Group
PSA	Probabilistic safety assessment
RPV	Reactor pressure vessel
SDO	Standard development organisation
SMMR	Small medium and modular reactor
TESG	Technical Experts Subgroup
TR	Technical Report
VICWG	Vendor Inspection Co-operation Working Group
VVER	Water-water energetic reactor
VVERWG	VVER Working Group
WNA	World Nuclear Association



## Appendix 2. **Revised or new documents and publications**

### **Working group programme plans**

*Proceedings of the 5<sup>th</sup> MDEP Conference on New Reactor Design Activities. International Cooperation – Past, Present, and Future*, September 2023, [www.oecd-nea.org/mdep/documents/5thMDEPConf2023proceedings\\_FINAL.pdf](http://www.oecd-nea.org/mdep/documents/5thMDEPConf2023proceedings_FINAL.pdf).

## MULTINATIONAL DESIGN EVALUATION PROGRAMME

The Multinational Design Evaluation Programme (MDEP) was established in 2006 to develop innovative approaches to leverage the resources and knowledge of the national regulatory authorities that are currently or will be tasked with the review of new nuclear power reactor designs. MDEP members are the regulatory authorities of Argentina, Canada, China, Finland, France, Hungary, India, Japan, Korea, Russia, South Africa, Sweden, Türkiye, the United Arab Emirates, the United Kingdom and the United States. The Nuclear Energy Agency serves as Technical Secretariat for MDEP. The International Atomic Energy Agency also takes part in the work of MDEP.

## MULTINATIONAL DESIGN EVALUATION PROGRAMME

The OECD Nuclear Energy Agency (NEA) was established on 1 February 1958. Current NEA membership consists of 34 countries: Argentina, Australia, Austria, Belgium, Bulgaria, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Norway, Poland, Portugal, Korea, Romania, Russia (suspended), the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Türkiye, the United Kingdom and the United States. The European Commission and the International Atomic Energy Agency also take part in the work of the Agency.

The mission of the NEA is:

- to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally sound and economical use of nuclear energy for peaceful purposes;
- to provide authoritative assessments and to forge common understandings on key issues as input to government decisions on nuclear energy policy and to broader OECD analyses in areas such as energy and the sustainable development of low-carbon economies.

Specific areas of competence of the NEA include the safety and regulation of nuclear activities, radioactive waste management and decommissioning, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information. The NEA Data Bank provides nuclear data and computer program services for participating countries.



[www.oecd-nea.org/mdep](http://www.oecd-nea.org/mdep)