WORLD NUCLEAR ASSOCIATION

CORDEL Strategic Plan 2019 – 2023

Cooperation in Reactor Design Evaluation and Licensing Working Group

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Cover image: CORDEL Steering Committee members, September 2018

This report reflects the views of industry experts but does not necessarily represent those of any of the World Nuclear Association's individual member organizations.

Contents

Foreword

The World Nuclear Association's Working Group on Cooperation in Reactor Design Evaluation and Licensing (CORDEL) was created in January 2007 with the mission of establishing an internationally accepted nuclear reactor design approval and certification process through the harmonization and worldwide convergence of safety standards for reactor designs.

During its initial period, CORDEL's focus was on stimulating dialogue between the nuclear industry and nuclear regulators (national and international organizations) on the benefits and means of international standardization. Working with its counterpart, the Multinational Design Evaluation Programme (MDEP) and other international organizations, CORDEL succeeded in proving the viability of its concept.

With its first *Strategic Plan* covering activities from 2014 to 2018, CORDEL shifted from a single group of experts discussing broad international industrial perspectives in design and licensing, to a number of smaller task forces analyzing and developing recommendations on specific elements of licensing requirements and international standards. The output from these task forces – including nine reports on topics ranging from NDE personnel certification, I&C system safety classification and a new licensing model for SMRs – have all served to forge common understandings in key areas as input to major decisions on nuclear energy policy.

As it publishes its second *Strategic Plan* covering the period 2019–2023, the CORDEL mission remains compelling and support for it undiminished. Numerous energy projections by bodies such as the International Energy Agency and Intergovernmental Panel on Climate Change envisage large increases in nuclear energy to reduce carbon emissions and to avoid the most damaging consequences of climate change. However, for nuclear's potential as a scalable, reliable, low-carbon energy source to be met, improvements – such as a more internationally consistent approach to regulating nuclear energy, notably licensing new plants – must be made.

In response to the growing international recognition for a low-carbon energy transition, World Nuclear Association in 2016 launched the *Harmony* programme, whose target is for nuclear energy to provide 25% of electricity in 2050, requiring roughly 1000 GWe of new nuclear capacity to be constructed. CORDEL's mission is closely aligned with the *Harmony* programme and the Group implements supportive activities in its work plan.

While the outlook for nuclear energy remains positive, economic and political developments in the past few years have imposed pressures on the existing nuclear fleet in some countries, while placing obstacles in the way of new build in others. Many World Nuclear Association members do not plan new build in the near future and are looking instead at the possibility of operating lifetime extension and modernization for their existing fleets. These changes in priorities led CORDEL to re-evaluate its activities and objectives and to extend its mandate for existing plants.

In September 2015, CORDEL teamed up with the Long Term Operation Task Force to launch a new consultation/outreach initiative in different regions around the world to solicit information on technical and regulatory issues facing nuclear power plants. Workshops were held in Chicago (2016), Moscow (2016)

and Shanghai (2018). The results of these workshops, including in areas such as I&C modernization and fatigue analysis, have been incorporated into this second *Strategic Plan*.

Since 2007, CORDEL has benefitted greatly from close cooperation with MDEP. Characteristic of this was the holding of the 4th MDEP Conference on New Reactor Design Activities in London in 2017 alongside World Nuclear Association's Annual Symposium, allowing greater industry involvement.

Recently, MDEP decided to transfer its activities on digital instrumentation and control and codes and standards to working groups under the Nuclear Energy Agency (NEA)'s Committee on Nuclear Regulatory Activities. Nevertheless, a good collaboration with these committees will be maintained.

Interactions between CORDEL, MDEP and other institutions over the last decade have been beneficial in reviewing different reactor designs, and have also enabled approaches to be developed for code harmonization. However, the complexity of regulations/standards convergence, which include technical, as well as human/cultural challenges, mean much remains to be achieved. The implementation of this second CORDEL *Strategic Plan* will help facilitate the realization of the CORDEL mission.

Executive Summary

Since its creation in 2007, the Cooperation in Reactor Design Evaluation and Licensing (CORDEL) Working Group of the World Nuclear Association has successfully achieved its objectives of promoting the international standardization of nuclear reactor designs and the harmonization of regulatory requirements through the different activities performed by its task forces, as well as through close cooperation with the Multinational Design Evaluation Programme (MDEP), the OECD Nuclear Energy Agency (NEA), the International Atomic Energy Agency (IAEA), the World Association of Nuclear Operators (WANO), and other organizations.

The first CORDEL *Strategic Plan* covered activities from 2014 through to the end of 2018. This second *Strategic Plan* covers the period 2019-2023 and addresses the challenges encountered not only for new build but also for existing nuclear power plants. Moreover, the new Strategic Plan takes into account the evolution of the MDEP. After its successful work for the last ten years, MDEP has decided to transfer the activities of the Digital I&C Working Group (DICWG) and the Codes and Standards Working Group (CSWG) to the NEA's Committee on Nuclear Regulatory Activities (CNRA) as the Working Group on Digital I&C (WGDIC) in 2017 and the Working Group on Codes and Standards (WGCS) in 2018, respectively. CORDEL has ensured a good collaboration with the NEA/CNRA accordingly.

The *Strategic Plan* 2019–2023 comprises:

- Background, mission statement, roadmap, and recent developments.
- Governance and structure.
- Scope of work and activities of task forces.
- Interfaces and cooperation.

To fulfil its mission and to achieve its objectives, CORDEL is working with its six task forces covering a wide range of technical areas:

- Mechanical Codes and Standards Task Force (MCSTF).
- Design Change Management Task Force (DCMTF).
- Licensing and Permitting Task Force (LPTF).
- IAEA Nuclear Safety Standards Task Force (IAEA NSSTF).
- Digital Instrumentation and Control Task Force (DICTF).
- Small Modular Reactors Task Force (SMRTF).

CORDEL cooperates with different working groups within World Nuclear Association and maintains close cooperation with external interfaces and stakeholders such as OECD/NEA, IAEA, MDEP, WANO, and standards development organizations (SDOs).

CORDEL Working Group

Background

Created in January 2007, the Cooperation in Reactor Design Evaluation and Licensing (CORDEL) Working Group of World Nuclear Association commenced its activities by analyzing the benefits that could be realized from internationally accepted standards for the new generation of reactors. This resulted in a discussion paper in January 2008 on *Benefits Gained through International Harmonization of Nuclear Safety Standards for Reactor Designs*. In parallel, CORDEL identified commonalities between different national regulatory philosophies in order to harmonize them further. CORDEL placed particular emphasis on establishing dialogue with national and multinational nuclear regulatory organizations.

The prospect of international standardization of nuclear designs would encourage the sharing of good practice and lessons learned throughout all phases of the nuclear power plant – from design and construction to decommissioning and waste handling. Such sharing can produce benefits in safety, economics, plant quality, predictability of deployment time, and cost. International standardization can also have a positive impact on the perceptions of policy-makers and the general public.

Recognizing the multiple benefits of international standardization, member organizations of World Nuclear Association and CORDEL signed a letter (see Appendix 1) in April 2010 describing the steps needed to facilitate increased cooperation between the industry and regulators.

During its first few years, CORDEL evolved from a group of experts discussing various issues and broad international industrial perspectives in design and licensing aspects, to smaller and more issue-focused sub-groups analyzing and developing recommendations on specific elements of licensing requirements and international standards.

More recently, this strategic change in the work of CORDEL has further evolved in response to those parts of the nuclear industry seeking operating lifetime extension and associated licensing requirements. Furthermore, CORDEL has also expanded its scope of work to support the *Harmony* programme of World Nuclear Association.

This new *Strategic Plan* establishes an overview of CORDEL activities over the five-year period from 2019 to 2023. It includes:

- Background, mission statement, roadmap, and recent developments.
- Governance and structure.
- Scope of work and activities of task forces.
- Interfaces and cooperation.

A more detailed schedule of activities is given in the yearly business plans and biennial programme of work.

The *Strategic Plan* is published on World Nuclear Association's public website. The business plans and programme of work are available to CORDEL members only.

Mission Statement

The CORDEL Working Group's mission is to promote the standardization of nuclear reactor designs. This can be achieved only by the development of a worldwide nuclear regulatory environment, where internationally accepted standardized reactor designs, certified and approved by a recognized competent

authority in the country of origin, can be widely deployed without major design changes due to national regulations. In practice, this would mean that generic design certification and safety evaluations approved by a recognized competent authority in the country of origin would be acceptable in other countries without the need to duplicate or repeat the entire design certification process, and this would lead to international design certification procedures.

A standardized design approval process and standardized nuclear power plant designs would enhance nuclear safety worldwide. They would also boost investment attractiveness and predictability of nuclear new build, both in established nuclear countries and in emerging nuclear countries. Through more efficient sharing of operating experience, enabling more cost effective licensing and safety analysis and providing more effective nuclear power plant monitoring, safety would be improved.

Roadmap

The CORDEL report, *International Standardization of Nuclear Reactor Designs*, published in 2010 proposed a three-phase 'roadmap'. This stepwise integrated approach provides a pathway to full standardization and harmonization with contributions from all stakeholders: industry must bring to bear all the benefits of standardization on nuclear safety and performance; governments and regulators must provide a framework to make this possible; international institutions and other stakeholders must provide their contribution and acknowledge the results.

Step 1. Share design assessment

Once a design is licensed in one country, the approving regulator should share information with other national regulators, conveying its full experience in the safety assessment of the design, and receiving regulators should draw upon this experience. Additionally, if several regulators are concurrently reviewing the same design, they could form a collaborative network and discuss their assessment methodology (including criteria) and share their assessment results. This sharing process, which can be undertaken without any change in existing regulatory frameworks, may itself foster tendencies towards harmonization of licensing standards and procedures. Nevertheless, it would be necessary to take measures to protect the intellectual property when license application documentation and information are shared among regulators through a mutual agreement or within an international framework.

Step 2. Institute common design approval processes

The denomination and objective of the second step was originally formulated as: ***Validate and accept design approval***. Whereas significant progress has been made by CORDEL towards the final objectives, it is recognized that the second step as originally intended is still far away, and, moreover, will not necessarily be reached as an intermediate step to the final objective. The original intention was prescribed as such: if a design is already licensed in one country and is later proposed for other countries, the existing approval could be taken over by the other countries following a simplified validation procedure. This may require some adjustments in regulations and legislation.

The new scope of step 2 covers all activities pursued to institute common design approval processes between competent authorities. Based on the mutual understanding and trust

developed at step 1, authorities set up frameworks to adopt as a basis and validate the assessments and approvals of other authorities. Sometimes, this will involve adaptation of licensing processes under a particular regulatory regime, and/or the convergence of safety requirements at both the industry and regulator level. Depending on the jurisdiction, changes in regulation and legislation may be required to facilitate changes.

Step 3. Issue international design certification

By international or multinational agreement, a procedure could be created whereby a design could be certified by a team of national regulators (from countries with a direct interest in the design). Under the agreement, participating countries would accept this certification with country specific adaptations. Alternatively, such international (or multinational) certification could be facilitated by a designated international (or multinational) organization. Of course, national regulators would remain responsible for assessing the adaptation of the internationally certified design to the local circumstances and for the supervision of construction, commissioning and operation.

Recent Developments

As international recognition for a low-carbon energy transition grows, World Nuclear Association in 2016 launched the *Harmony* programme. Harmony's target is for nuclear energy to provide 25% of electricity by 2050, which would require roughly 1000 GWe of new nuclear capacity to be constructed. Reaching this amount of new build would require a more international approach to licensing. CORDEL's mission is therefore closely aligned with the *Harmony* programme and the Group implements supportive activities in its work plan.

While the outlook for nuclear energy remains positive, economic and political developments in the past few years have imposed pressures on the existing nuclear fleet in some countries, while placing obstacles in the way of new build in others. Many World Nuclear Association members do not plan new build in the near future and are looking instead at the possibility of operating lifetime extension and modernization for their existing fleets. These changes in priorities led CORDEL to re-evaluate its activities and objectives and to extend its mandate for existing plants.

In September 2015, CORDEL teamed up with the Long Term Operation Task Force to launch a new consultation/outreach initiative in different regions around the world to solicit information on technical and regulatory issues facing nuclear power plants. Workshops were held in Chicago (2016), Moscow (2016) and Shanghai (2018). The results of these workshops have led to new work programmes in areas such as I&C modernization and fatigue analysis. These are incorporated into this second *Strategic Plan*.

The relationship with MDEP has evolved in recent years. The activities of the two main issue-specific MDEP working groups – the Digital I&C Working Group (DICWG) and Codes and Standards Working Group (CSWG) – were transferred to two working groups of the NEA's Committee on Nuclear Regulatory Activities (CNRA), namely the Working Group on Digital I&C (WGDIC) in 2017 and the Working Group on Codes and Standards (WGCS) in 2018. CORDEL has managed to maintain a good cooperative relationship with the WGDIC and WGCS.

II Governance and Structure

The following chapters describe the general guidelines and the organizational structure of CORDEL, the roles and responsibilities of CORDEL members and how CORDEL organizes its activities, documents and communicates its outputs. The general management processes used by CORDEL in carrying out its programme of work are also covered.

Management Processes

CORDEL has introduced a number of management processes to organize its work in an efficient and effective way. These include procedures for establishment, classification, traceability and review of CORDEL documentation.

Along with these processes, the main elements towards better organization and operation have been the development and issuance of the *Strategic Plan* and its implementation through yearly business plans and biennial programmes of work.

Organizational Structure

CORDEL originally operated under a flexible organizational structure that allowed it to reach a quick and effective consensus on a number of issues, resulting in several position papers and other publications, such as *Benefits Gained through International Harmonization of Nuclear Safety Standards for Reactor Designs (2008) and International Standardization of Nuclear Reactor Designs* (2010).

Under this structure, CORDEL operated via a plenary group at times and through decisions made by its Steering Committee at other times. In addition, CORDEL created sub-groups in a number of specific areas.

In the first *Strategic Plan* in 2014, CORDEL's organizational hierarchy was structured as follows:

- CORDEL Working Group.
- CORDEL Steering Committee.
- CORDEL task forces.

Roles and Responsibilities

Membership

Membership of CORDEL is through nomination of individual(s) from World Nuclear Association member companies and requires a commitment to devote adequate resources for the mission to be accomplished. Organizations eligible for CORDEL membership are defined in the *Strategic Plan 2014-2018*.

Members have drafting rights on working group documents and can vote on working group decisions, including the selection of the Chair. A member company may have more than one representative in the working group but it may cast only one vote in any decision.

Experts from nuclear organizations including representatives from major codes and standards organizations (*e.g.* ISO, ASME) and international organizations involved or directly interested in nuclear power plant licensing (*e.g.* IAEA, NEA, WANO) may be invited to attend meetings as observers. They may also be given segmented access to the members website and drafting rights on reports.

CORDEL Working Group

The CORDEL Working Group establishes and agrees on the main policy directions, including its programme of work. It also agrees to and approves work and outputs as set out in the CORDEL *Strategic Plan*.

Attendance by members at CORDEL Working Group meetings is not mandatory (although it is recommended at least once a year). Any significant proposal relating to CORDEL activities should be submitted to the Working Group and the decision shall be taken by the Working Group. This decision process can be done by physical meeting or electronic communication means.

Decisions taken at Working Group meetings include:

- Changes to CORDEL's mission.
- Changes in the governance of CORDEL (in particular designation of the Chair and Vice-Chairs).
- Creation or cancellation of a task force.

When required, CORDEL may request the Steering Committee to take some decisions on its behalf.

Chair and Vice-Chair

A Chair and one or more Vice-Chairs shall be nominated by the CORDEL Working Group. Ideally, one reactor vendor company and one utility company should be represented in these positions. The positions are for terms of three years.

The CORDEL Chair and Vice-Chair(s) are also the Chair and Vice-Chair(s) of the Steering Committee.

Steering Committee

The Steering Committee provides leadership to CORDEL activities. It consists of the CORDEL Chair and Vice-Chair(s), and a limited number of CORDEL Working Group members distributed among the members considering:

- Various regions, nuclear capacity, size and expertise.
- Degree of commitment and resources contributed to the work of CORDEL.

The Chairs and Vice-Chairs of the task forces are also members of the Steering Committee, as well as the Staff Directors (*i.e.* the CORDEL Director and Project Managers assigned within World Nuclear Association Secretariat).

The Steering Committee meets regularly throughout the year either in person or by conducting telephone or video conferences to:

- Select and prioritize issues to be dealt with by CORDEL task forces and to set their mandates.
- Identify and communicate goals and metrics suitable for follow-up.
- Identify means for structured engagement with other stakeholders and their initiatives, including other industry associations, regulators and international organizations.
- Identify common positions produced by the working group and task forces prior to their issue or publication.
- Define a communication strategy and identify the means for its implementation.

The Steering Committee, with the advice of the Secretariat, may propose changes in its membership.

Board Mentor

As with all World Nuclear Association working groups, the CORDEL Working Group has one (or more) Board Mentor(s) from the Board of World Nuclear Association, whose responsibility is to monitor developments within the group and advise the group of any guidance from the Board.

Task Forces

Task forces are organized and supported by the Secretariat. A distinction was previously made between task forces and ad-hoc

groups, depending on the duration expected for handling an identified issue or subject. As experience has shown that there were no differences between the two in their operation and governance, the CORDEL Working Group has decided to operate with task forces only.

Task forces are made up of individual experts nominated by their respective CORDEL Working Group members. The task forces may also include invited experts.

Task forces should elect a Chair and a Vice-Chair (or two Vice-Chairs if necessary) to lead and coordinate their work, with the support of the Staff Director(s) assigned within World Nuclear Association Secretariat.

Task forces are established to address specific technical or institutional issues identified by the CORDEL Working Group. They should start their activities by: reviewing the state-of-the-art; assessing the industry's views on the need to enhance harmonization; and identifying future requirements.

Task forces should draw up status reports and present their developments to the CORDEL Steering Committee and during CORDEL meetings on a regular basis.

The CORDEL Working Group should review and renew (if necessary) the status of each task force at least once every three years.

Organization, Documentation and Communication

Organization

In organizing and prioritizing its activities, CORDEL uses the following selection criteria:

- The issue is of relevance to many members.
- International co-operation is essential to address, and possibly resolve the issue.
- The expected outputs will provide significant added value to nuclear safety and further the goals of standardization and harmonization.
- CORDEL is the most suitable place for international co-operation on the specific issue.

Proposing and carrying out work should use the following process:

- All work to be proposed should be submitted formally to the CORDEL Working Group.
- Approval of proposals should be given by the CORDEL Working Group based on the recommendation of the CORDEL Steering Committee.
- Approval of publications, reports, and other output should be given by the CORDEL Working Group, based on the recommendation of the Steering Committee and after a peer review has been carried out.

Where practical, the proposal and approval process should be carried out at CORDEL Working Group meetings. However, where a quick decision is needed and a scheduled meeting would delay the decision, the Steering Committee may expedite the process using electronic means (email, telephone or video conference, *etc*.).

Documentation

CORDEL's output includes:

- Publications, reports, proceedings, *etc*. – produced as required and in accordance with World Nuclear Association guidelines. These should be made available in printed and/or electronic form. Printed copies should be distributed to all CORDEL members.
- Meeting notes and records – produced for all formal meetings of the CORDEL Working Group, the Steering Committee and task forces. These should be made available electronically and finalized no more than one month after the meeting.
- An electronic filing system for documents maintained by the Staff Director(s).

Communication

For the communication of its results, goals and activities, CORDEL will continue to present its work at relevant meetings and conferences.

Presentations should be made by CORDEL members (*e.g.* the Chair of the Steering Committee or of a relevant task force) or by World Nuclear Association staff using a standardized process, including a prior review of the contents.

III Scope of Work and Activities of CORDEL Task Forces

This section describes the scope of work, objectives, achievements and planned activities of the CORDEL task forces over the next five-year period. At the end of this section, on-going cross-cutting activities are described.

These goals and priorities focus on those specific areas or technical issues where better harmonization of licensing requirements and international standards can be achieved within a reasonable time and effort.

A list of publications of the CORDEL Working Group and its task forces is given in Appendix 2.

Mechanical Codes and Standards Task Force

Scope of work and objectives

The Mechanical Codes and Standards Task Force (MCSTF) was established in 2010 with a mandate to pursue harmonization of the mechanical codes and standards used in nuclear component and facility designs.

The work carried out by the MCSTF is based on the initial comparison of requirements defined in the major international nuclear mechanical design codes published by the SDO Convergence Board[1]. The MCSTF focused on:

- Identifying areas of divergence in the different nuclear mechanical design codes.
- Identifying the differences through a detailed comparison of code requirements.
- Proposing a common code with supporting materials.

The task force has focused its efforts on the requirements for Class 1 components. It has taken note of the CORDEL's change in scope to include issues related to operating power plants, and plans to extend the scope of its documents when appropriate.

Main achievements

Activities of the task force focused on key technical issues that should benefit from harmonization. Three reports were published:

- *Certification of Non-Destructive Examination (NDE) Personnel* (2014).
- *Qualification of Welders and Welding Procedures* (2016, published by ASME).
- *Non-Linear Analysis Design Rules – Part 1: Code Comparison* (2017).

Planned activities

- Finalize the international benchmark for vessel nozzles and main coolant line nozzles to help with the application of non-linear analysis design methods.
- Develop a position paper on industrial practices for the use of non-linear analysis.
- Compare the current requirements for fatigue analysis in different nuclear mechanical design codes.
- Maintain close cooperation with the NEA's Committee on Nuclear Regulatory Activities (CNRA) Working Group on Codes and Standards (WGCS) and other international organizations.
- Hold workshops to ensure continued coordination between CORDEL, the SDOs and CNRA.

[1] Group composed of high-level representatives of the standard development organizations from the six main nuclear mechanical design codes, namely ASME, AFCEN, CSA, JSME, KEPIC and NIKIET.

- Harmonize the new Systems Based Codes (SBC) and probabilistic methods to be introduced in design standards.

Design Change Management Task Force

Scope of work and objectives

The Design Change Management Task Force (DCMTF) was established in 2010 with a mandate to analyze and determine potential enhancements to international institutional mechanisms in the industry to maintain standardization throughout the lifetime of a standardized fleet. The enhancements should also reduce the potential for divergence in the design of the current fleets of reactors that were originally of common design. Since the outset, task force's work has focused on investigating options for maintaining design knowledge throughout the lifetime of a plant or fleet.

Main achievements

As part of its work on design change management in nuclear fleets, the DCMTF analyzed the methodology and practices used in the aviation industry on the issues of aircraft design change management and licensing. The findings were presented in its 2013 report, *Aviation Licensing and Lifetime Management – What Can Nuclear Learn?*

A survey was also launched on how utilities on manage design change issues and how the aviation industry has established the process to handle the same issues, through what is called the design authority, in cooperation with the vendors/ responsible designers. This resulted in the 2015 report, *Design Knowledge and Design Change Management in the Operation of Nuclear Fleets.*

The design authority concept and its implementation were detailed in a 2017 supplement to this report, *Implementation of the Design Authority within a Nuclear Operating Organization*.

These reports serve as the basis for future work within CORDEL in cooperation with international organizations including the IAEA and WANO.

Planned activities

The responsibilities of the operators, the concept of design authority, as well as knowledge management in a more broad term are of growing importance.

The task force plans to:

- Maintain safety and reliability in design changes by complying with national requirements and international practices.
- Facilitate the sharing and communication of design change information on common nuclear power plant design among different utilities, owners groups, and international organizations.
- Collaborate with the owners groups to help them develop design change management processes and systems.
- Keep close cooperation with WANO and the IAEA on the responsibilities of operators and how they manage their fleets.
- Focus on knowledge management and transfer within nuclear fleets.

Licensing and Permitting Task Force

Scope of work and objectives

The Licensing and Permitting Task Force (LPTF) was set up jointly by the Law and CORDEL Working Groups in 2011 to identify good practices in licensing and permitting for nuclear new build and to:

- Bring a fresh approach and new solutions to licensing and permitting of nuclear power plants and other nuclear facilities.
- Facilitate communication within the global industry.
- Promote industry-regulator dialogue with a view to develop a clear understanding of the relationship between licensing and project risks.
- Harness opportunities to contribute to licensing processes for new technology and newcomer nuclear countries.

Main achievements

Several reports have been published in cooperation with other task forces, including:

- *Licensing and Project Development of New Nuclear Plants* (2013).
- *Facilitating International Licensing of Small Modular Reactors* (2015).

The task force works with regulators and the NEA Committee on Nuclear Regulatory Activities (CNRA) on licensing issues. The task force takes into account the conclusions of the *"New Build Licensing Conference – Multinational Cooperation in the Licensing of Nuclear Power Plants"* held in Prague in 2015 in developing the task force's activities.

Planned activities

The task force members will continue to work in support and in cooperation with other task forces as well as with other World Nuclear Association technical groups.

Planned activities are to:

- Issue a set of recommendations on the concept of a 'reference plant' and how the acceptance

of a reference plant design by the national safety authority in the country of origin would help licensing in another country.

- Continue to promote cooperation and interaction with regulators through MDEP, relevant NEA standing bodies, and other regulator forums (such as the IAEA Small Modular Reactor Regulators' Forum).
- Continue to benchmark different licensing practices between countries, and to promote more efficient licensing processes (in terms of resources spent and scheduling).
- Collaborate with World Nuclear Association's other relevant working groups on the harmonization of security approaches and requirements.
- Organize workshops to share the outcomes of the task force's activities (*e.g.*, *New Build Licensing Conference – Multinational Cooperation in the Licensing of Nuclear Power Plants*, held in Prague, Czech Republic in April 2015).

IAEA Nuclear Safety Standards Task Force

Scope of work and objectives

The IAEA Nuclear Safety Standards Task Force (IAEA NSSTF) has been commenting on new safety standards and on safety standards under revision at the request of the International Atomic Energy Agency (IAEA), with many of these comments being incorporated into the final documents. Members of this group along with the CORDEL staff regularly attend meetings of the IAEA Nuclear Safety Standards Committee (NUSSC).

The objectives of this task force is to maintain oversight on the work being performed by the IAEA NUSSC to ensure that proper input related to industry concerns is provided. The focus shall continue to be directed on the revision process of the IAEA safety standards documents and other relevant IAEA publications.

The task force's review process of draft IAEA nuclear safety standards starts by distributing the draft to members of the IAEA NSSTF and other relevant CORDEL task forces. Comments provided by members are then collected and analyzed and any conflicting comments would be resolved by the Chair of the task force and the members who submitted those comments. Once these comments are resolved, the final version is submitted to the IAEA.

The CORDEL Secretariat follows all the review process steps, reviews comments and final resolved version to submit, guaranteeing the transparency and avoiding any inconsistence for all the members. Draft safety standards sent by the IAEA for review are distributed not only to members of NSSTF but also to those of other relevant CORDEL task forces in order that industry concerns are better represented in collected comments on draft standards under review.

Main achievements

The task force has provided industry views and technical comments on various draft standards and revisions of safety standards and requirements managed by the IAEA NUSSC.

Planned activities

- Continue providing industry feedback and comments to the IAEA NUSSC.
- Cooperate with the European Nuclear Installations Safety Standards (ENISS) and European Utility Requirements (EUR) on new or revised IAEA safety standards.

Digital Instrumentation & Control Task Force

Scope of work and objectives

The Digital Instrumentation & Control Task Force (DICTF) aims to increase awareness of inconsistencies in the licensing requirements of digital instrumentation and control (I&C) systems and components, and promote the international convergence of those requirements.

The DICTF has identified a number of key issues that should be addressed:

- Nuclear plant safety classification for I&C systems.
- Defence-in-depth and diversity.
- Modernization of I&C systems.
- Cybersecurity.

Main achievements

The task force has established a good level of cooperation with the Working Group on Digital I&C (WGDIC) of the Nuclear Energy Agency's (NEA's) Committee on Nuclear Regulatory Activities (CNRA). The task force also regularly collaborates with IEEE and IEC.

The DICTF has published:

- *Safety Classification for I&C Systems in Nuclear Power Plants – Current Status & Difficulties* (2015).
- *Safety Classification for I&C Systems in Nuclear Power Plants: Comparison of Definitions of Key Concepts* (2017).
- *Defence-in-Depth and Diversity: Challenges Related to I&C Architecture* (2018).

Planned activities

The task force plans to publish reports on:

- Safety classification of support systems.
- Defence-in-depth and diversity: country-specific approaches.

- I&C modernization: current status and difficulties.

The task force will hold a workshop on the progress in modernization of I&C.

The task force will also continue to participate in the development of IAEA technical documents.

Small Modular Reactors Task Force

Scope of work and objectives

The Small Modular Reactors Task Force (SMRTF) was created by CORDEL in September 2013 initially as the Small Modular Reactors Ad-hoc Group, and upgraded to a permanent task force in September 2015. The task force's objective is to establish a path towards harmonized global small modular reactor (SMR) deployment through producing industry position papers and reports on key issues, while maintaining cooperation with the IAEA SMR Regulators' Forum.

Main achievements

In order to facilitate SMR deployment internationally, the SMRTF, in cooperation with the Licensing & Permitting Task Force, has proposed ways to optimize the licensing approach. This was presented in the 2015 report, *Facilitating International Licensing of Small Modular Reactors*.

The task force also participated in forums and conferences, in particular the IAEA SMR Regulators' Forum as well as the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO).

Planned activities

Following its first report (*Facilitating International Licensing of Small Modular Reactors*), the task force is continuing to develop a novel and more efficient licensing process for SMRs. The initial areas of focus are on:

- In-factory certification of modules.
- Inherent safety features and passive safety system capability.
- Changes needed in the regulatory/licensing framework for non-LWR/advanced reactors.
- Security approaches and non-proliferation issues.
- Emergency planning zones (EPZ).

The task force' work scope covers all reactor technologies, (*i.e.*, light water and non-light water cooled reactors) of any size up to 300MWe. However, it does not cover the transport of fuel with reactors.

The task force will also:

- Maintain close cooperation with IAEA SMR Regulators' Forum and other organizations involved in SMR development and deployment.
- Encourage more SMR developers to become members of the task force.
- Make efforts to establish new collaborations with relevant SMR related initiatives.

The task force will also consider suggesting the development of dedicated safety standards for SMRs.

Cross-Cutting Activities

Regional workshops

In 2016, CORDEL and the Long Term Operation Task Force launched a series of workshops in different regions around the world to solicit information on technical and regulatory issues facing nuclear power plants.

The workshops were held in Chicago in June 2016, Moscow in October 2016 and Shanghai in May 2018. CORDEL is planning to organize further regional workshops across the globe.

CORDEL has incorporated the preliminary findings of the workshops into the *Strategic Plan*.

Harmony programme

The *Harmony* initiative of World Nuclear Association is the global nuclear industry's vision of the future of electricity. The goal is to supply 25% of global electricity in 2050 from nuclear energy, which will require the construction of approximately 1000 GWe of new nuclear capacity.

There are three objectives of the *Harmony* programme: to establish a level playing field in the energy market where nuclear is treated on equal terms as other sources of low-carbon generation; ensure harmonized regulatory processes to provide a more internationally consistent, efficient and predictable nuclear licensing regime that allows for standardized solutions; and to create an effective safety paradigm focusing on genuine public wellbeing.

CORDEL is cooperating with the *Harmony* programme, in particular on the development of the harmonized regulatory processes objective.

IV Interfaces and Cooperation

World Nuclear Association's member companies, including CORDEL members, encompass a wide range of expertise on many different topics. Outside of World Nuclear Association, there are many other international and regional organizations that also contribute to the overall goal of promoting nuclear energy, develop codes and standards and improve nuclear safety and operational performance. Maintaining contact and interacting with these groups helps to ensure accuracy while reducing the possibility of duplication, as well as enable information on CORDEL's activities to be widely distributed. The following two chapters describe these interactions.

Interaction within World Nuclear Association

The working groups of World Nuclear Association are forums through which the companies of the global nuclear industry share information,conduct analysis, prepare position statements and reports, and develop and implement strategies to advance their collective interest in the use of nuclear power. Some working groups coordinate World Nuclear Association representation in international forums; others share international knowledge and strengthen industry capabilities on a wide range of topics.

The CORDEL Working Group, through World Nuclear Association and its members, maintains an open flow of communication to optimize resources, share expertise, minimize duplication and communicate results. In particular, CORDEL has been working with the Supply Chain, Law, and Capacity Optimization Working Groups. These joint efforts will continue and, if required, extend to other working groups.

Supply Chain Working Group

The Supply Chain Working Group is devoting increased attention to supporting companies to build the complex supply chains needed to ensure timely construction, while satisfying requirements for the new generation of nuclear power plants. The main goals of this working group are tied closely to those of CORDEL with respect to nuclear safety and optimization of the supply chain.

The Secretariat of World Nuclear Association and the working group members maintain close cooperation with each other by attending meetings, and exchanging results, analysis and good practices.

Law Working Group

The Law Working Group addresses legal issues facing the nuclear industry. It was formed from the earlier Task Force on Nuclear Liability and has a broader scope of work. The working group focuses on key legal, regulatory and procurement aspects of nuclear new build of concern to the nuclear industry. As an additional function, the working group engages with other working groups and offers assistance when necessary.

The working group and the CORDEL Licensing and Permitting Task Force produced a joint report on *Licensing and Project Development of New Nuclear Plants* (2013, reprinted 2015).

Capacity Optimization Working Group

The Capacity Optimization Working Group identifies means by which nuclear power plant operators worldwide can improve the performance of their plants. The working group focuses on areas relevant to plant economics such as availability, reliability, flexibility and capacity. In 2015, it created the Long Term Operation (LTO) Task Force as a forum for sharing and comparing experience on the LTO licensing processes for different countries,

addressing the challenges relating to engineering and asset management, and defining good practice. In 2016, the CORDEL and the LTO Task Force held three regional workshops in a series designed to solicit information on the main technical and regulatory issues facing nuclear power plants. The first was held in June 2016 in Chicago, USA, the second in October 2016 in Moscow, Russia, and the third took place in Shanghai, China, in May 2018. CORDEL will organize further regional workshops in cooperation with the LTO Task Force.

World Nuclear University

The World Nuclear University (WNU) is a global partnership committed to training and education, notably the transfer of knowledge to the next generation of nuclear industry leaders. The WNU's various programmes are designed to close the gap in existing training and education offered by universities and companies. WNU's flagship course, the WNU Summer Institute, is a comprehensive annual programme, which aims to ensure that the future leaders of the nuclear industry gain an understanding of the many diverse areas that are relevant to nuclear throughout the world.

CORDEL has made and will continue to make contributions to the WNU in its training programme and at the Summer Institute.

Cooperation with External Stakeholders

Multinational Design Evaluation Programme and OECD Nuclear Energy Agency

CORDEL aims to cooperate with the Organisation for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA) in the development of state-of-the-art reports and in other areas of common interest.

A key aspect of the initial concept of forming CORDEL was based on industry providing its views and inputs on international harmonization and standardization in particular to regulators. Many of the issues initially covered evolved from discussions with nuclear regulators within the framework of the Multinational Design Evaluation Programme (MDEP)[2]. One of the aims pursued in the creation of CORDEL was to set up an industry counterpart and interlocutor to MDEP. MDEP comprises a group of regulators sharing information and feedback on technology and specific safety and licensing issues. It is a multinational initiative to develop innovative approaches to leverage the resources and knowledge of the national regulatory authorities who are currently or will be tasked with the review of new reactor power plant designs. MDEP comprises 15 countries' nuclear regulatory authorities and is currently structured with design-specific and issue-specific working groups, which meet several times a year. CORDEL has regularly interacted with the MDEP Steering Technical Committee and the CORDEL Codes & Standards Task Force and Digital I&C Task Force have acted as the recognized industrial representatives at the MDEP Codes & Standards Working Group and Digital I&C Working Group, respectively.

Ten years after its establishment, MDEP decided to transfer the activities of its Digital I&C Working Group (DICWG) and Codes and Standards Working Group (CSWG) to the NEA's Committee on Nuclear Regulatory Activities (CNRA) in 2017 and 2018, respectively. CORDEL's corresponding Digital I&C Task Force (DICTF) and Mechanical Codes and

[2] The OECD Nuclear Energy Agency acts as the secretariat for MDEP.

Standards Task Force (MCSTF) now work in close cooperation with the CNRA's Working Group on Digital I&C (WGDIC) and Working Group on Codes and Standards (WGCS).

CORDEL maintains close cooperation with the CNRA's Working Group on Regulation of New Reactors (WGRNR), providing the NEA with information and suggestions based on the industry's expertise and expectations. To help achieve these aims, CORDEL members have participated in WGRNR workshops and have sought WGRNR participation in its own task force meetings.

CORDEL is open to cooperate with other NEA groups such as the Working Party on the Legal Aspects of Nuclear Safety (WPLANS) under the Nuclear Law Committee.

World Association of Nuclear Operators

CORDEL and the World Association of Nuclear Operators (WANO) mutually benefit from exchanging views, ideas and concepts on the topics of design change management, defining the role of the design authority, and assessing the effect of current requirements on existing and new nuclear power plants. WANO and CORDEL have several common aims, such as sharing design events and design changes within owners groups. WANO and CORDEL also benefit from the input from both of their memberships. Whilst WANO's membership includes all utilities running nuclear power plants, CORDEL has additional input from the major international vendors and nuclear engineering companies.

International Atomic Energy Agency

One of the objectives of CORDEL is to ensure cooperation and coordination with the International Atomic Energy Agency (IAEA) in the development of IAEA standards and guides and in other areas of nuclear safety work. The objective is to provide the IAEA with information and suggestions based on the industry's expertise and expectations, which may not be available to the IAEA via other channels.

To help achieve these aims, CORDEL and the IAEA will continue to consult with each other on various programmes under way or planned, cross-participate in relevant committees and task forces, and undertake joint activities as appropriate.

Other Organizations

Several other international and regional organizations exist and contribute to the efforts on harmonization and standardization.

There are several organizations within the European Union dealing with harmonization and standardization issues for reactor designs including the European Commission, European Nuclear Safety Regulators Group (ENSREG), Western European Nuclear Regulators Association (WENRA), European Utility Requirements (EUR), and the European Nuclear Installations Safety Standards Initiative (ENISS). In North America there is the Nuclear Energy Institute (NEI), American Nuclear Society (ANS) and Institute for Nuclear Power Operations (INPO) among others. With its global mission, CORDEL does not concentrate on any specific region, but maintains interaction with many of these stakeholders to ensure mutual understanding and avoid duplication.

CORDEL Mechanical Codes and Standard Task Force (MCSTF) has been collaborating with the Standards Development Organization Convergence Board (SDO Board) on various topics such as non-destructive examination qualification requirements and non-linear codified rules in order to find areas of possible convergence of the various mechanical code requirements, and to work towards minimizing code divergences. The SDO Board comprises six standard development organizations: American Society of Mechanical Engineers (ASME); French Association for the Rules Governing the Design, Construction and Operation of Nuclear Power Plants (AFCEN); Japanese Society of Mechanical Engineers (JSME); Russian Research & Development Institute of Power Operations (NIKIET); Korean Electric Power Industry Code (KEPIC); and Canadian Standards Association (CSA).

CORDEL Digital I&C Task Force (DICTF) has been cooperating with the International Electrotechnical Commission (IEC) and the Institute of Electrical and Electronic Engineers (IEEE).

Abbreviations and Acronyms

ASME	American Society of Mechanical Engineers
AFCEN	Association française pour les règles de conception, de construction et de surveillance en exploitation des matériels des chaudières électro-nucléaires (French Association for the Rules Governing Design, Construction and In-Service Inspection of Nuclear Plants)
CSA	Canadian Standards Association
CNRA	Committee on Nuclear Regulatory Activities
IAEA	International Atomic Energy Agency
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
JSME	Japan Society of Mechanical Engineers
OECD	Organisation for Economic Co-operation and Development
KEA	Korea Electric Association
KEPIC	Korean Electric Power Industry Code
MDEP	Multinational Design Evaluation Programme
NEA	Nuclear Energy Agency
NIKIET	N.A. Dollezhal Scientific Research and Design Institute of Energy Technologies
SDO	Standards development organization (*e.g.* ASME, AFCEN, JSME, KEA, CSA and NIKIET)
WANO	World Association of Nuclear Operators

Appendix 1

World Nuclear Association Proposal on International Standardization of Nuclear Reactor Designs

13 April 2010

Amb Yukiya Amano, Director General, International Atomic Energy Agency (IAEA)

Mr André-Claude Lacoste, Chairman, Policy Group, Multinational Design Evaluation Programme (MDEP)

Mr Luis Echávarri, Director-General, Nuclear Energy Agency of the OECD

Mr Andrej Stritar, Chairman, European Nuclear Safety Regulator Group (ENSREG)

cc: Mr Laurent Stricker, Chairman, World Association of Nuclear Operators (WANO)

Subject: World Nuclear Association Proposal on International Standardization of Nuclear Reactor Designs

Dear Sirs,

The World Nuclear Association, in its role as the international organization of the global nuclear industry, has in recent months begun to focus intensively on the challenge of achieving greater standardization in reactor designs. We believe that steady progress toward this objective is essential if the world is to achieve success in the decades ahead in exploiting the full potential of nuclear power as a large-scale source of clean energy.

The multiple benefits of international standardization include greatly heightened economy, enhanced experience feedback and safety, regulatory efficiency and predictability in new-plant approval and construction. To achieve standardization will require the combined efforts of industry, regulators, national governments and inter-governmental institutions.

Recognizing that industry must play a central role in this interactive process, the WNA has established a Working Group on Cooperation in Reactor Design Evaluation and Licensing (CORDEL). Participants in the CORDEL Working Group include experts from the world's leading reactor vendors and nuclear utilities.

We intend the WNA CORDEL Group to be the industry's representative in a constructive dialogue with relevant stakeholders, and we will devote the resources necessary for the CORDEL Group to be an active and effective participant in this cooperative process.

Specifically, the CORDEL Group will:

- Facilitate cooperation and intensified experience feedback within the global nuclear industry in all stages of new-build: design evaluation, certification, licensing, construction, commissioning, and long-term operation;
- Share industry expertise on these topics with inter-governmental organizations and in support of international regulatory initiatives (especially MDEP);
- Contribute to international cooperation among national regulators in efforts to converge toward design standardization and harmonization of national regulatory regimes.

As a stimulus to dialogue, the enclosed CORDEL Group report, entitled "International Standardization of Nuclear Reactor Designs", available on the WNA website, outlines a three-phase approach to achieving international standardization of reactor designs that can be certified in efficient, transparent procedures to harmonized worldwide standards of nuclear safety.

We look forward, with a great sense of purpose, to working with you and your colleagues in a cooperative process leading to substantial and valuable progress toward the objective of reactor design standardization.

With kind regards,

Signed by

John B Ritch, Director General, World Nuclear Association

Anne Lauvergeon, Chief Executive Officer, AREVA

Hugh MacDiarmid, President and Chief Executive Officer, Atomic Energy of Canada Limited (AECL)

Henri Proglio, Chairman and Chief Executive Officer, EDF

Wulf H Bernotat, Chief Executive Officer, E.ON AG

Christopher Crane, President and Chief Operating Officer, Exelon Corporation

Jack Fuller, Chief Executive Officer, GE-Hitachi Nuclear Energy

Akira Sawa, Director, Executive Vice President, Nuclear Energy Systems, Mitsubishi Heavy Industries (MHI)

Ichiro Takekuro, Executive Vice President and Chief Nuclear Officer, Tokyo Electric Power Company (TEPCO)

Yasuharu Igarashi, Executive Officer, Corporate Senior Vice President, President and CEO, Power Systems Company, Toshiba Corporation

Aris Candris, President and Chief Executive Officer, Westinghouse Electric Company

Appendix 2 List of CORDEL Documents

Reports

Defence-in-Depth and Diversity: Challenges Related to I&C Architecture (April 2018)

Safety Classification for I&C Systems in Nuclear Power Plants: Comparison of Definitions of Key Concepts (September 2017)

Implementation of the Design Authority Within a Nuclear Operating Organization (March 2017)

Non-Linear Analysis Design Rules – Part 1: Code Comparison (February 2017)

Safety Classification for I&C Systems in Nuclear Power Plants – Current Status & Difficulties (September 2015)

Facilitating International Licensing of Small Modular Reactors (August 2015)

Licensing and Project Development of New Nuclear Plants (January 2013, reprinted August 2015)

Design Knowledge and Design Change Management in the Operation of Nuclear Fleets (April 2015)

Certification of NDE Personnel – Harmonization of International Code Requirements (October 2014)

Aviation Licensing and Lifetime Management – What Can Nuclear Learn? (January 2013)

Design Change Management in Regulation of Nuclear Fleets (July 2012)

International Standardization of Nuclear Reactor Designs (January 2010)

Other major documents

CORDEL Strategic Plan 2014-2018 (January 2014)

Position Paper: CORDEL View of the Multinational Design Evaluation Programme (MDEP) (February 2015)

Discussion Paper: Benefits Gained through International Harmonization of Nuclear Safety Standards for Reactor Designs (January 2008)

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The World Nuclear Association's Cooperation in Reactor Design Evaluation and Licensing (CORDEL) Working Group promotes the standardization of nuclear reactor designs. This can be achieved by the development of a worldwide regulatory environment where internationally-accepted standardized reactor designs, certified and approved by a recognised competent authority in the country of origin, can be widely deployed without major design changes due to national regulations.

This Strategic Plan outlines the general scope and direction of CORDEL's activities during the next five-year period. It includes objectives, strategy, priorities and interactions with CORDEL's stakeholders.

World Nuclear Association is the international organisation supporting the people, technology and enterprises that comprise the global nuclear energy industry.

CORDEL Strategic Plan 2019 – 2023