MULTINATIONAL DESIGN EVALUATION PROGRAMME
ANNUAL REPORT
MARCH 2013-MARCH 2014

April 2014

NEA
NUCLEAR ENERGY AGENCY

MDEP for new reactors
Multinational Design Evaluation Programme

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Appendices

7th Policy Group meeting, 15 March 2013, Washington, DC, United States.

20th STC meeting, May 2013, Helsinki, Finland.

FOREWORD FROM THE POLICY GROUP CHAIRMAN

Washington, D.C., 16 April 2014

I am pleased to report that after my first full year as Chairman of the MDEP Policy Group, the organization continues to be a positive force in assisting countries involved in nuclear new build activities to leverage the experience of multiple nations to support their regulatory activities. The contents of this report demonstrate another successful year for MDEP, in which the program continues its collaborative work on both design-specific and generally-applicable issues.

We are now three years removed from the Fukushima Daiichi accident. Nuclear regulators from around the world remain engaged in addressing the lessons learned from this event. To the extent that there are design lessons to be learned from this experience, the MDEP community must continue to ensure that we share the lessons learned and collaborate to address these lessons in our work on new plant designs. I am pleased to note that the design-specific working groups are working diligently to that end and specifically to highlight the EPR Working Group's common position on Fukushima lessons learned.

There are a number of important initiatives underway that are providing direct benefit to all MDEP countries. The design-centered working groups continue to provide for increased cooperation and improved convergence of requirements and practices. During the past year, MDEP initiated two new design-specific working groups, one for the VVER design and one for the ABWR design. The growing family of designs being addressed under MDEP illustrates the continuing interest in new reactor design and construction worldwide. Additionally, this highlights the importance that countries considering nuclear power are placing on the experience of MDEP member nations.

In the past year, MDEP has welcomed two new members. We have gained insight from the Swedish Radiation Safety Authority, which has already begun participating in its first MDEP activities. We have also welcomed the Turkish Atomic Energy Agency (TAEK) as an Associate Member. TAEK's participation, and in particular, the creation of a new design-specific working group to address issues specific to the VVER reactor design, demonstrates a strong interest in MDEP on the part of countries with emerging nuclear power programs.

Over the last year, we have had a number of successes. For example, the members cooperated on twelve witnessed vendor inspections and one joint inspection, developed common quality assurance criteria for a multinational vendor inspection, issued several technical reports on harmonization of codes and standards for pressure boundary components, and issued four new common positions on digital instrumentation and controls for new reactors.

In the coming year, we expect this good work to continue. We will continue our cooperation on lessons learned from the Fukushima Daiichi accident, which has direct impact on both operating and new reactor programs. We will continue to benefit from sharing information in the design-specific working groups as construction of these designs moves into the commissioning phases. MDEP has begun to explore how we can learn from each other during oversight of pre-operational and startup testing and commissioning. I see benefits in continuing cooperation through all phases of new reactor development. In addition, MDEP is prepared to conduct its first multinational inspection in 2014.

MDEP outreach to other international organizations, standards development organizations, and industry groups such as the World Nuclear Association CORDEL group has proven beneficial to both MDEP and these groups.

Overall, MDEP continues to function smoothly, in no small measure due to the support of the NEA as the MDEP secretariat. We owe a significant debt of gratitude to Mr. Luis E. Echávarri who recently retired from his position as Director General of the NEA, a post he held for over sixteen years, in which he achieved considerable success. I wish him well in retirement.

Dr Allison Mcfarlane
MDEP Policy Group Chairman

EXECUTIVE SUMMARY

The Multinational Design Evaluation Programme (MDEP) is a multinational initiative to leverage the resources and knowledge of national regulatory authorities who are, or will shortly be, undertaking the review of new reactor power plant designs. The MDEP members are national regulators from the following countries: Canada (CNSC), People's Republic of China (NNSA), Finland (STUK), France (ASN), India (AERB), Japan (NRA), Republic of Korea (NSSC), Russian Federation (Rostechnadzor), South Africa (NNR), Sweden (SSM), the United Kingdom (ONR) and the United States (US NRC). In addition to these members, the national regulators of the United Arab Emirates (FANR) and Turkey (TAEK) have been accepted as associate members. The International Atomic Energy Agency (IAEA) also takes part in the work of MDEP and the OECD Nuclear Energy Agency (OECD/NEA) performs the Technical Secretariat function in support of MDEP. MDEP incorporates a broad range of activities including enhancing multilateral cooperation within existing regulatory frameworks, and increasing multinational convergence of codes, standards, guides, and safety goals. A key concept throughout the work of MDEP is that national regulators retain sovereign authority for all licensing and regulatory decisions.

Working groups are implementing the activities in accordance with programme plans with specific activities and goals, and have established the necessary interfaces both within and outside of the MDEP members. In the past year, MDEP has expanded to include cooperation on the VVER and ABWR designs and additional members have begun participating in the programme to share their experiences on these design reviews.

This report provides the current status of the programme. Significant progress is being made on the overall MDEP goals of increased cooperation and enhanced convergence of requirements and practices. In addition, the lessons learnt from the 11 March 2011, events at the Fukushima Daiichi nuclear power plant are being incorporated into MDEP activities through the programme plans of design-specific working groups (DSWG). On this topic, the EPR Working Group has issued a common position which will be supplemented by five technical appendices by the end of 2014. Other DSWG are in the process of drafting such common positions.

Five DSWGs' are facilitating the MDEP programme goal of enhanced cooperation. The EPRWG consists of the regulatory authorities of People's Republic of China, Finland, France, India, Sweden, the United Kingdom and the United States. The AP1000 working group consists of the regulatory authorities of Canada, People's Republic of China, Sweden, the United Kingdom and the United States. The APR1400 working group includes the regulatory authorities of Finland, Republic of Korea, the United Arab Emirates and the United States. New working groups were established in 2013 for the VVER design (members include regulators from Finland, India, Russian Federation and Turkey) and the ABWR design (members include regulators from Finland, Japan, Sweden, the United Kingdom and the United States). The DSWGs have been successful in sharing information and experience on the safety design reviews with the purposes of enhancing the safety of the designs and enabling regulators to make timely licensing decisions, and of promoting convergence of technical requirements. The EPRWG and the AP1000WG have actively started to cooperate on commissioning activities, holding meetings in People's Republic of China and sharing the regulators' views and requirements. Both groups have met with the vendors and utilities to discuss commissioning programmes and issues such as FPOT (first plant only tests) and FOAK (first of a kind) tests. The other DSWGs have worked on identifying the technical topics which need in-depth discussions involving subject matter experts, such as digital I&C and severe accidents.

The Vendor Inspection Cooperation Working Group (VICWG) has achieved its short-term goals and continues to focus on maximising information sharing, joint inspections (multiple regulators inspecting to the regulatory requirements of one country), and witnessing of other regulators' inspections, as well as preparing for the first multinational inspection (multiple regulators inspecting to a common set of quality assurance requirements). A total of twelve witnessed and joint inspections were conducted through MDEP in 2013. The VICWG is also interfacing with Standards Development Organisations (SDOs) to encourage and explore harmonisation of quality standards. The working group continues to make progress towards achieving its long-term programme goal of harmonising a significant portion of the quality assurance inspection procedures.

The Digital Instrumentation and Controls Working Group (DICWG) has identified twelve topics for which it is pursuing the development of common positions based on the existing standards, national regulatory guidance, best practices, and group inputs using an agreed upon process and framework. To date, the DICWG has published nine generic common positions that describe methods that all DICWG member states find acceptable to support safety justification for digital I&C systems. In addition, the DICWG members jointly research and comment on proposed IEC, IEEE, and IAEA standards that are relevant to the regulatory review of digital instrumentation and control systems.

The Codes and Standards Working Group (CSWG) is working closely with SDOs and the World Nuclear Association's working group on Cooperation in Reactor Design Evaluation and Licensing (CORDEL) to attempt code requirements harmonisation and reconcile code differences. The CSWG has issued technical reports on lessons learnt on achieving harmonisation of codes and standards, the regulatory framework for use of codes, and fundamental attributes for the design and construction of pressure-boundary components, as well as a common position on findings from code comparisons and establishment of a global framework towards pressure-boundary code harmonisation.

Accomplishments to date provide confidence that the MDEP membership, structure and processes provide an effective method of accomplishing increased cooperation in regulatory design reviews. The interim results for 2013 and early 2014 include:

- Commissioning workshops within the EPR and AP1000 working groups to begin considering how to cooperate on pre-operational testing and commissioning oversight.
- Common position addressing Fukushima related issues related to the EPR design.
- A series of phone seminars with US NRC and CNSC on selected topics of their Phase two review, to learn from the already completed NRC design certification review.
- Exchanges of letters between US NRC and NNSA containing questions and responses related to design and construction issues for the AP1000 in each country.
- Establishment of VVER and ABWR DSWGs and prioritised topics for future discussion.
- Cooperation on twelve witnessed vendor inspections and one joint inspection.
- Technical Report on "Common QA/QM Criteria for the Multinational Vendor Inspection".
- Technical Reports on "Regulatory framework for the use of nuclear pressure-boundary codes and standards in MDEP countries", "Lessons learnt on achieving harmonisation of codes and standards for pressure boundary components in nuclear power plants" and "Fundamental attributes for the design and construction of pressure boundary components".
- Common position on "Findings from code comparisons and establishment of a global framework towards pressure-boundary code harmonisation".
- Four common positions on digital instrumentation and controls for new reactors in the areas of: treatment of common cause failures resulting from software, treatment of Hardware Description Language (HDL) programmed devices for use in nuclear safety systems, digital I&C system pre-installation and initial on-site testing, and use of automatic testing in computer based systems as part of surveillance testing.
- Revision of several common positions related to digital I&C to take into account recent developments and new members' views.

1. INTRODUCTION

The Multinational Design Evaluation Programme (MDEP) is a multinational initiative that develops innovative approaches to leverage the resources and knowledge of national regulatory authorities who are, or will shortly be, undertaking the review of new reactor power plant designs. MDEP has evolved from primarily a design evaluation programme for two new reactor designs to a multinational cooperation programme involving several new reactor designs and issues related to new reactor challenges.

A key concept throughout the programme is that MDEP will better inform the decisions of regulatory authorities through multinational cooperation, while retaining the sovereign authority of each regulator to make licensing and regulatory decisions.

Working groups are implementing the activities in accordance with programme plans with specific activities and goals, and have established the necessary interfaces both within and outside of the MDEP members. Significant progress has been made over the past year on the overall MDEP goals of increased cooperation and enhanced convergence of requirements and practices. Accomplishments to date provide confidence that the MDEP membership, structure and processes provide an effective opportunity for increased cooperation in regulatory design reviews.

2. PROGRAMME GOALS AND OUTCOMES

The main objectives of MDEP effort are to enable increased cooperation and establish mutually agreed upon practices to enhance the safety of new reactor designs. The enhanced cooperation among regulators will improve the effectiveness and efficiency of the regulatory design reviews, which are part of each country's licensing process. The goal of MDEP is not to independently develop new regulatory standards, but to build upon the similarities already existing, and existing harmonisation in the form of IAEA and other safety standards. In addition, the common positions developed in MDEP are shared with IAEA and SDOs for consideration in their respective standards development programme.

MDEP is meeting its goal of enabling increased cooperation through the activities of the working groups. MDEP has been very successful in providing a forum for regulatory bodies to cooperate on design evaluations, construction overview and inspections. In addition to organising working groups, MDEP has provided each regulator with peer contacts who share information, discuss issues informally, and disseminate information rapidly. For example, the design-specific working group members have benefitted significantly from the sharing of questions among the regulators, resulting in more informed, and harmonised, regulatory decisions. MDEP members have also been highly successful in coordinating vendor inspections in which the regulators share observations and insights. MDEP has made improvements in communicating information regarding the members' regulatory practices through development of an MDEP library which serves as a central repository for all documents associated with the programme.

MDEP is meeting its goal of convergence of regulatory practices by establishing common positions in both the issue-specific and design-specific working groups. The working groups are making comparisons of the regulatory practices in the member countries, identifying differences, and developing common positions. The working groups are also working with codes and standards organisations to identify differences and propose areas of convergence.

MDEP has been successful in meeting the expected outcomes as defined in the MDEP Terms of Reference by: increasing knowledge transfer; identifying similarities and differences in the regulatory practices; and enhancing the ability of regulatory bodies to cooperate in reactor design evaluations, vendor inspections, and construction oversight, leading to more efficient and more safety-focused regulatory decisions. In 2012, MDEP performed a thorough self-assessment of the programme and identified several recommendations. In 2013, MDEP began implementing the recommendations by taking the following actions:

- It Developed an agreed upon definition of convergence to be used for MDEP activities, in the form of a revision to the Terms of Reference.
- It developed a communication plan that identifies stakeholders and specific communication products.
- It enhanced interactions with IAEA counterparts to identify areas in which MDEP can provide useful input to IAEA safety standards under development.
- It identified completion strategies for the issue-specific working groups.

- It developed plans to continue the activities of the DSWGs through the construction and commissioning phase.
- It acted quickly to implement new DSWGs (consistent with the existing Rule of Three for forming design specific working groups).

3. PROGRAMME IMPLEMENTATION

3.1 Membership

Participation in the Policy Group (PG) and Steering Technical Committee (STC) is intended for mature, experienced national safety authorities of interested countries that already have commitments for new build or firm plans to have commitments in the near future for new reactor designs. Full MDEP members are: Canada, People's Republic of China, Finland, France, India, Japan, Republic of Korea, Russian Federation, South Africa, Sweden, United Kingdom and the United States. In addition the IAEA takes part in the work of MDEP.

MDEP associate members are national regulatory authorities without previous licensing experience that have been invited by the MDEP PG to participate in selected MDEP design-specific activities based on evidence that the organisation is actively involved in new reactor design review activities relevant to MDEP. Such a regulatory authority would be from a country that has taken a firm commitment in the near term to proceed with safety design review activities and is willing and ready to contribute to specific MDEP activities. It is expected that the associate member would be in a position to exchange information with MDEP members to enhance information sharing and experience in relevant design safety reviews.

In December 2013, the PG invited the Turkish Atomic Energy Authority (TAEK) to join MDEP as an associate member. As such, TAEK participates in the newly formed VVER working group, observes meetings of the STC and is invited to participate in the MDEP issue-specific working groups (ISWGs).

3.2 Organisational structure

The programme is governed by a PG, made up of the heads of the participating organisations, and implemented by a STC and its working groups. The STC consists of senior staff representatives from each of the participating national safety authorities as well as a representative from the IAEA.

The PG provides guidance to the STC on the overall approach; monitors the progress of the programme; and determines participation in the programme. In March 2013, the chairmanship of the PG was transferred to the Chairman of the US NRC, Dr. Allison M. Macfarlane.

The STC manages and approves the detailed programme of work including: defining topics and working methods, establishing technical working groups, and nomination of experts; approving procedures and technical papers developed by the working groups; establishing interfaces with other international entities to benefit from available work and avoid duplication; developing procedures for the handling of information to be shared in the project; reporting to the PG; identifying new topics for the programme to address; and establishing subcommittees of the STC to study specific topics.

The OECD Nuclear Energy Agency (OECD/NEA) performs the Technical Secretariat function in support of MDEP.

Two lines of activities have been established to carry out the work.

- **Design-specific activities.** Working groups for each new selected reactor design share information on a timely basis and cooperate on specific topics regarding reactor design evaluations, construction, and commissioning activities. Participants in these working groups are the regulatory authorities that are actively reviewing, preparing to review, or overseeing construction of the considered reactor design. A DSWG is formed when three or more MDEP member countries express interest in working together. Under the DSWGs, expert subgroups are formed to address specific technical issues.

- **Issue-specific activities**. Working groups are organised for the technical and regulatory process areas within the programme of work. These currently include vendor inspections, pressure-boundary component codes and standards, and digital instrumentation and control. Membership in ISWGs is open to all MDEP participating regulators, their technical support organisations and the IAEA representatives. The following criteria are used to evaluate whether a proposed activity should be undertaken as part of MDEP.

(1) The activity is of generic interest and of safety significance to the licensing of new reactors in MDEP member countries.

(2) The approach followed by the MDEP regulators is not completely similar.

(3) Successful completion of the activity would likely result in increased harmonisation / convergence in regulatory practices or increased cooperation within a reasonable timeframe and resource expenditures.

(4) Any new MDEP activity should not duplicate similar efforts that are already ongoing or are planned to be undertaken by other more appropriate organisations such as the NEA Committee on Nuclear Regulatory Activities (CNRA) Working Group on the Regulation of New Reactors (WGRNR) (or other NEA working groups), the IAEA, Generation IV International Forum (GIF), the Western European Nuclear Regulators Association (WENRA), etc. except where MDEP could contribute to the ongoing work of these groups.

(5) Each new activity should have a lead country willing to take an active leadership role, and should have a defined product.

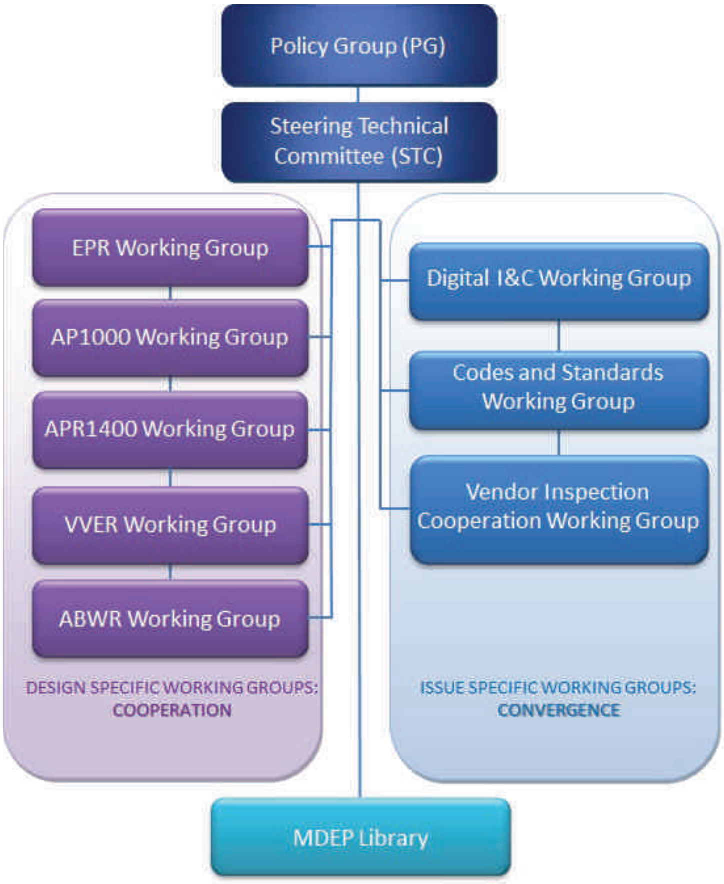

Figure 1. MDEP organisational structure

3.3 MDEP library

MDEP information is communicated among the members through the MDEP library which serves as a central repository for all documents associated with the programme. NEA provides the technical support for development and maintenance of the MDEP library on a secured password protected website. The website provides for two levels of access which are: (1) general access open to every member, and (2) restricted area for each DSWG with access to member countries participating in that specific group. Publicly available documents related to MDEP are available on the MDEP page of the NEA website (http://www.oecd-nea.org/mdep/). The STC, through the secretariat, manages the maintenance of the library and makes enhancements to improve the effectiveness of the library.

In order for MDEP to be successful at fulfilling its goal of leveraging the work of peer regulators in the licensing of new NPP designs, a framework was developed to facilitate the sharing of technical information among MDEP participants which at times may include the sharing of proprietary and other types of sensitive information. As a general rule, the information exchanged as part of the MDEP in meetings and the MDEP library is for the use only by the participating national regulators. The members of the DSWG also have a communication protocol to share new information related to new reactors with other members in advance of its release to the public. A large portion of the information shared may not be proprietary or sensitive; however, all participating members must protect and properly handle the information that an originator claims to be proprietary or sensitive.

3.4 Common positions

MDEP has developed a process for identifying and documenting common positions on specific issues among the member countries which may be based on existing standards, national regulatory guidance, best practices, and group member inputs. Design-specific common positions document common conclusions that each of the working group members have reached during design reviews. Discussions among the members and sharing of information in these areas help to strengthen the individual conclusions reached. Because of the need to issue these statements more quickly, and because responsibility for these decisions rests with the regulators who are performing the design reviews, design-specific common positions require only agreement by the working group members.

Generic common positions apply to more than one reactor design. Generic common positions document practices and positions that each of the working group members find acceptable. The common positions are intended to provide guidance to the regulators in reviewing new or unique areas, and will be shared with IAEA, and other standards organisations, for consideration in standards development programmes. After a generic common position is agreed to by a working group, it is presented to the STC for endorsement. Upon endorsement by the STC, the proposed generic common positions are made publicly available on the NEA MDEP website for external stakeholder information and comment. Those common positions will become best practices, recommended by the MDEP. There is no obligation on the part of any regulatory body to follow them. If a regulatory body chooses to adopt a generic common position, it would be through that country's normal processes.

4. INTERACTIONS WITH OTHER ORGANISATIONS

MDEP strives to maintain an awareness of, and interactions with, other organisations that are implementing programmes to facilitate international cooperation on new reactors. Interactions are focused on ensuring that MDEP does not duplicate efforts, benefitting from the outputs of these organisations, and communicating MDEP activities and results to other organisations. To ensure that efforts are not duplicated between the groups, MDEP scope is focused on short-term activities related to specific design reviews being conducted by the member countries, and efforts to harmonise specific regulatory practices and standards.

The WGRNR examines the regulatory issues of siting, licensing and regulatory oversight of new nuclear reactors. The current focus areas of the WGRNR are construction experience, siting issues and licensing structure of regulatory staff and regulatory licensing process. The WGRNR co-ordinates its work with the work performed by MDEP such that it utilises its outputs, does not duplicate its efforts, and extends the results of MDEP to other CNRA members. To avoid overlap of activities between the groups, the WGRNR focuses on generic activities, procedures and guidance, while MDEP focuses on design-specific issues.

MDEP interacts with the WGRNR and Working Group on Inspection Practices mostly through the NEA staff who also serves as the technical secretariat for the CNRA. The WGRNR is the focal point of interactions between MDEP and the CNRA and its working groups, and will assist in coordinating communications and requests between the two activities.

The IAEA participates in the work of MDEP through participation in the PG and STC meetings, and issue-specific working groups. In addition, the Generic Common Positions developed in MDEP are shared with the IAEA for consideration in the IAEA standards development programme.

The WNA CORDEL group acts as one industry counterpart to MDEP. CORDEL has initiated task forces to address many issues, including those being addressed by the MDEP issue specific working groups. Members of the MDEP STC meet with CORDEL periodically, and CORDEL has been invited to participate in meetings of the MDEP Codes and Standards, Vendor inspection cooperation and digital I&C working Groups.

MDEP has interacted with the Generation IV International Forum to keep informed of multinational cooperative activities in the area of advanced reactors. In January 2014, representatives of GIF met with the MDEP STC to discuss its Safety design criteria for generation IV sodium-cooled fast reactor.

The MDEP STC met with a representative of WENRA to discuss the development of WENRA safety objectives and a recent report on the safety of new nuclear power plant designs (issued on March 2013).

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

- The Codes and Standards Working Group interacts with a committee of SDOs (ASME, JSME, KEPIC, AFCEN, NIKIET and CSA) in a code comparison project.
- The EPR working group meets regularly with representatives of AREVA, EDF, and other EPR-licensees, applicants, and potential applicants to discuss similarities and differences among the EPR designs being licensed in each country.
- The AP1000 working group meets regularly with Westinghouse and the AP1000 applicants and licensees.
- The APR1400 working group met with representatives of the licensee for the Barakah NPP, an APR1400 under construction in the United Arab Emirates.
- The DICWG interacts frequently with applicable standards organisations, IEC and IEEE, by inviting their representatives in MDEP meetings, attending IEC and IEEE meetings, and involving them in the development of common positions.
- The VICWG meets with SDOs and WNA CORDEL representatives to discuss QA/QM standards for manufacturing nuclear components.

5. CURRENT ACTIVITIES

The current activities of MDEP are being implemented through design-specific and issue-specific working groups. The members of the DSWGs share information and cooperate on specific reactor design evaluations and construction oversight. Issue-specific working groups are organised for the technical and regulatory process areas within the programme of work. Each working group has a lead and co-lead country designated, and has developed a programme plan which identifies specific activities, schedules and contacts.

Design-specific working groups (DSWGs)

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

- exchanging experience on licensing process and design reviews, lessons learned, and design-related construction, commissioning, and operating experience;
- working to understand the differences in regulatory safety review approaches in each country to support potential use of other regulators safety design evaluations, where appropriate;
- looking for opportunities to provide input to ISWGs on potential topics of significant interest;
- identifying and understanding key design differences including those originating from regulatory requirements and then documenting the reasons for differences in regulatory requirements;
- documenting MDEP common positions on aspects of the review;
- communicating and coordinating communications on MDEP views and common positions to vendor and operators regarding the basis of safety evaluations and standardisation;
- discussing design changes following lessons learned from the Fukushima accident and documenting them in common positions specific to each design.


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A – Reactor Building (Inner/outer concrete shell)
B – Safeguard building division 1
C – Safeguard building division 2
D – Safeguard building division 3
E – Safeguard building division 4
F – Fuel building
G – Nuclear auxiliary building
H – Radioactive waste processing building
I – Emergency diesel generator building div. 3 – 4
J – Access building
K – Turbine building
1 – In-containment refueling water storage tank
2 – Corium spreading area
3 – Main control room
4 – Emergency feedwater pool
5 – Safety injection accumulator tank
© AREVA - Image et Process

5.1 EPR Working Group (EPRWG)

The EPR design-specific working group includes the regulatory authorities of People's Republic of China (NNSA), Finland (STUK), France (ASN), India (AERB), Sweden (SSM), the United Kingdom (ONR), and the United States (NRC). Finland is chairing the working group and France is the vice-chair. Numerous meetings and technical exchanges have taken place to exchange information on the reviews being conducted in each country: Olkiluoto 3 which is under construction in Finland; Flamanville 3 which is under construction in France; Taishan units 1 and 2 which are under construction in People's Republic of China; the US version of the EPR which is under review for design certification in the United States and is referenced by three combined license applications; and the UK-EPR which has undergone a Generic Design Assessment in the United Kingdom and is planned at the Hinkley Point C site.

The working group currently includes four technical experts' subgroups (TESG) that are addressing information on specific technical issues: Accidents and Transients, Digital Instrumentation and Controls, Probabilistic Safety Assessment, and Severe Accident. The subgroups meet regularly to exchange information on relevant aspects of the design review status, share relevant evaluations when they become available, produce technical reports to identify and document similarities and differences among designs, regulatory safety review approaches and resulting evaluations.

The EPRWG meets regularly with representatives of AREVA, EDF, and other EPR-licensees, applicants, and potential applicants to discuss similarities and differences among the EPR designs being licensed in each country.

Accomplishments

The Probabilistic Safety Assessment (PSA) TESG is working on identifying the design differences and modifications affecting risk and the main differences in PSAs. In 2013, the group has moved forward with the comparison of selected initiators within the PSA of Olkiluoto 3 NPP in Finland, Flamanville 3 NPP in France, UK EPR design, and US EPR design. The objective of this PSA comparison was to identify differences in the modelling aspects and results of EPR PSAs, as well as to assess the rationale for these differences. The comparison covered various types of initiators challenging a broad scope of safety functions.

The outcomes and lessons learned from the EPR PSA comparison have been used to facilitate the regulatory reviews and assessment work of various EPR designs and to enhance the scope, level of detail, and quality of EPR PSA models and documentation. An internal comparison report will be issued in 2014, as well as a public version not including any proprietary information.

The Accidents and Transients TESG is working on identifying differences in regulatory criteria and approaches among the member countries. It has conducted a survey of the regulatory approaches to analysis of accidents and transients and drafted a Report on "Approaches and Criteria used in the Analysis of Accidents and Transients in MDEP Countries". The subgroup also developed an appendix related to the "management of primary circuit residual heat removal and sub-criticality" to the EPR common position addressing Fukushima-related issues.

The MDEP EPR I&C TESG has drafted a technical report on the EPR I&C system designs that includes (1) an overview of the generic EPR I&C design, (2) similarities and differences of the EPR designs in all member countries, (3) technical issues and their resolutions, (4) lessons learned from interactions, and (5) summary and conclusions. The technical report also includes common positions on several EPR I&C design issues. Besides, the I&C TESG has come up with an appendix related to "long-term loss of electrical power" to the EPR common position addressing Fukushima-related issues.

The severe accident TESG has submitted a report on ''Containment Heat Removal System (CHRS) / Severe Accident Heat Removal System (SAHRS) in accident conditions." The subgroup also developed a technical report on IRWST pH control in accident conditions. The Severe Accident and Accidents and Transients technical expert subgroups collaborated on a draft common position on "Containment gas mixing" and shared presentations related to the post-Fukushima strategies for EPR. The group has been tasked by the EPRWG to draft two appendices to the EPR common position addressing Fukushima-related issues, on "Management of pressure in containment during severe accidents" and "Reliability and qualification of instrumentation and control in severe accident conditions". The first one has been drafted.

In July 2013, the EPRWG issued a common position paper addressing Fukushima-related issues. This paper identifies common preliminary approaches to address potential safety improvements for EPR plants as related to lessons learned from the Fukushima Daiichi accident or Fukushima-related issues. The common position has been updated in early 2014 including appendices 1 on long-term loss of electrical power and 5 on management of primary circuit residual heat removal and sub-criticality. Additional appendices will be added as the EPRWG TESGs finalise their relative positions and the working group will update this paper periodically as regulators complete their reviews. To develop this position paper, the EPRWG held several discussions on the response by each of the member countries to the Fukushima accidents. The working group also met with AREVA and the EPR applicants (also known as the EPR Family) in each country to discuss their common approach to Fukushima lessons learned. After the safety reviews of the EPR design applications that are currently in review are completed, the working group plans to update the common position to reflect their safety conclusions regarding the EPR design and how the design has been and could be further enhanced to address Fukushima lessons learned.

The EPRWG began cooperating on oversight of plant commissioning (tests aiming at confirming that the construction and operation meet the design regarding safety). As several of the member countries get closer to the late stages of construction and preparations for operation, MDEP will consider how it can cooperate to share experience in late-stage construction tests leading to fuel load and operations. Tasked by the PG with a pilot project on commissioning activities, to explore the value of considering commissioning as part of MDEP, the working group held a workshop on commissioning cooperation in June 2013 in People Republic of China with part-time participation of representatives of the EPR family. The commissioning workshop consisted of discussions on 8 topics:

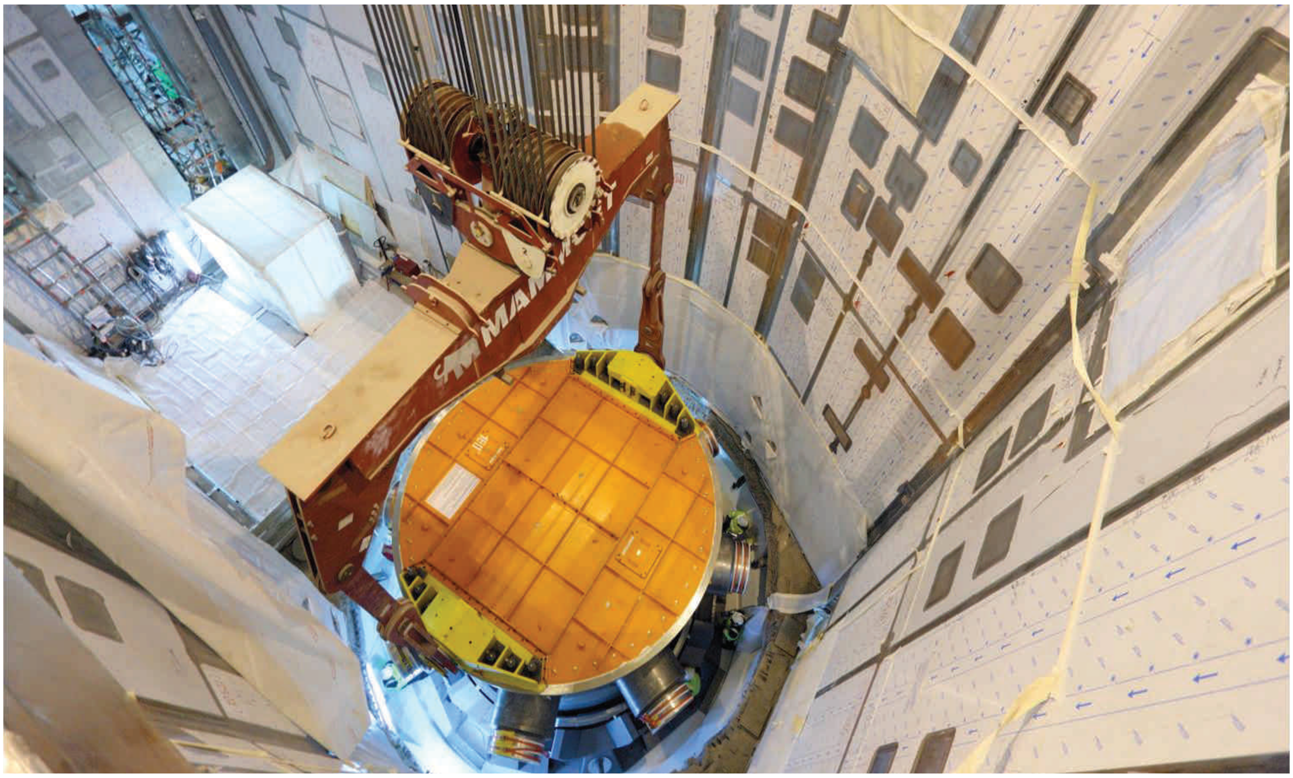
- vendor role;
- operating organisation role;
- national regulations in force for commissioning;
- link between assessment of commissioning tests and safety assessment already performed;
- regulatory organisation to oversee performance of commissioning tests;
- specific EPR issues already identified and potential initiatives to ease experience feedback exchange;
- regulatory organisation to oversee commissioning test preparation: documents submitted by licensee, hold points, inspections;
- regulatory process to incorporate commissioning tests results in the licensing process (potential updates) and verify compliance with the licensing basis;

The EPRWG has drafted a report on “Consideration of Commissioning Related Issues in MDEP”. This proposal is based on the experiences from the AP1000 WG and EPRWG and experience from the other DSWG will be sought to complement it. The report proposes that the MDEP DSWGs address commissioning activities related to issues specific to DSWGs considered designs, when one or more countries enter the commissioning phase. The following topics should be discussed: phasing of the commissioning proposed by the plant vendor and inspection programmes; first plant only tests and test of first of a kind features; major tests which should be closely watched by other countries; and lessons learned during commissioning that could result in changes to design, commissioning procedures or regulatory practices.

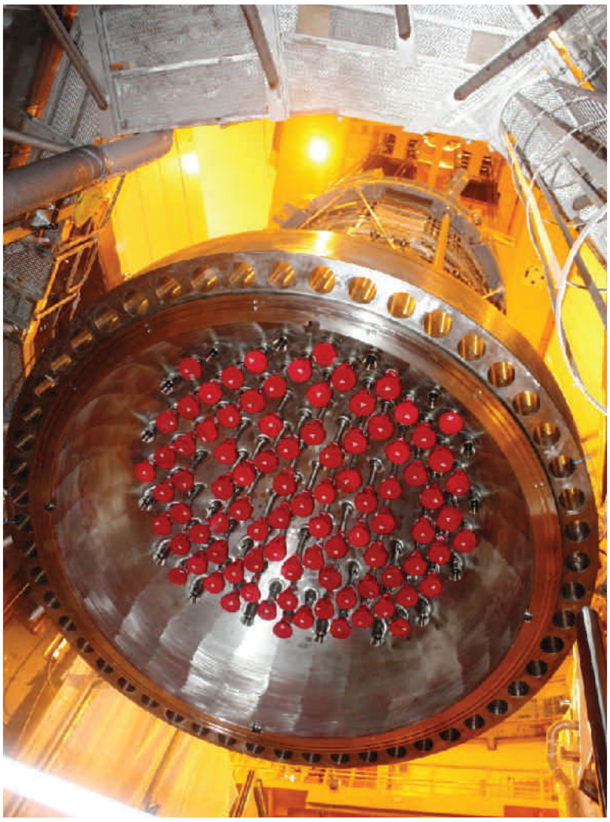
Flamanville site—EPR construction (unit 3) and 2 1300MW operating units, France, August 2013 (EDF, Alexis Morin).

Flamanville Unit 3—EPR, France, February 2014 (EDF, Alexis Morin).

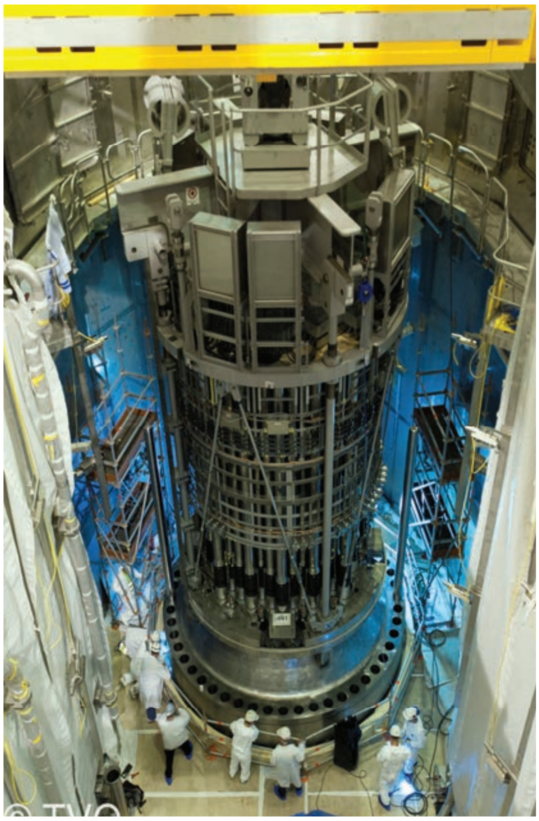
Flamanville Unit 3—Reactor vessel arrival, EPR, France, January 2014 (AREVA, DIKDAK).



Flamanville Unit 3—Reactor vessel installation, EPR, France, January 2014 (EDF, Alexis Morin).



Olkiluoto Unit 3—Reactor Vessel Head from below, EPR, Finland, August 2013 (AREVA).



Olkiluoto Unit 3—Fitting of reactor pressure vessel closure head equipped with control rods mechanisms, EPR, Finland, August 2013 (TVO).

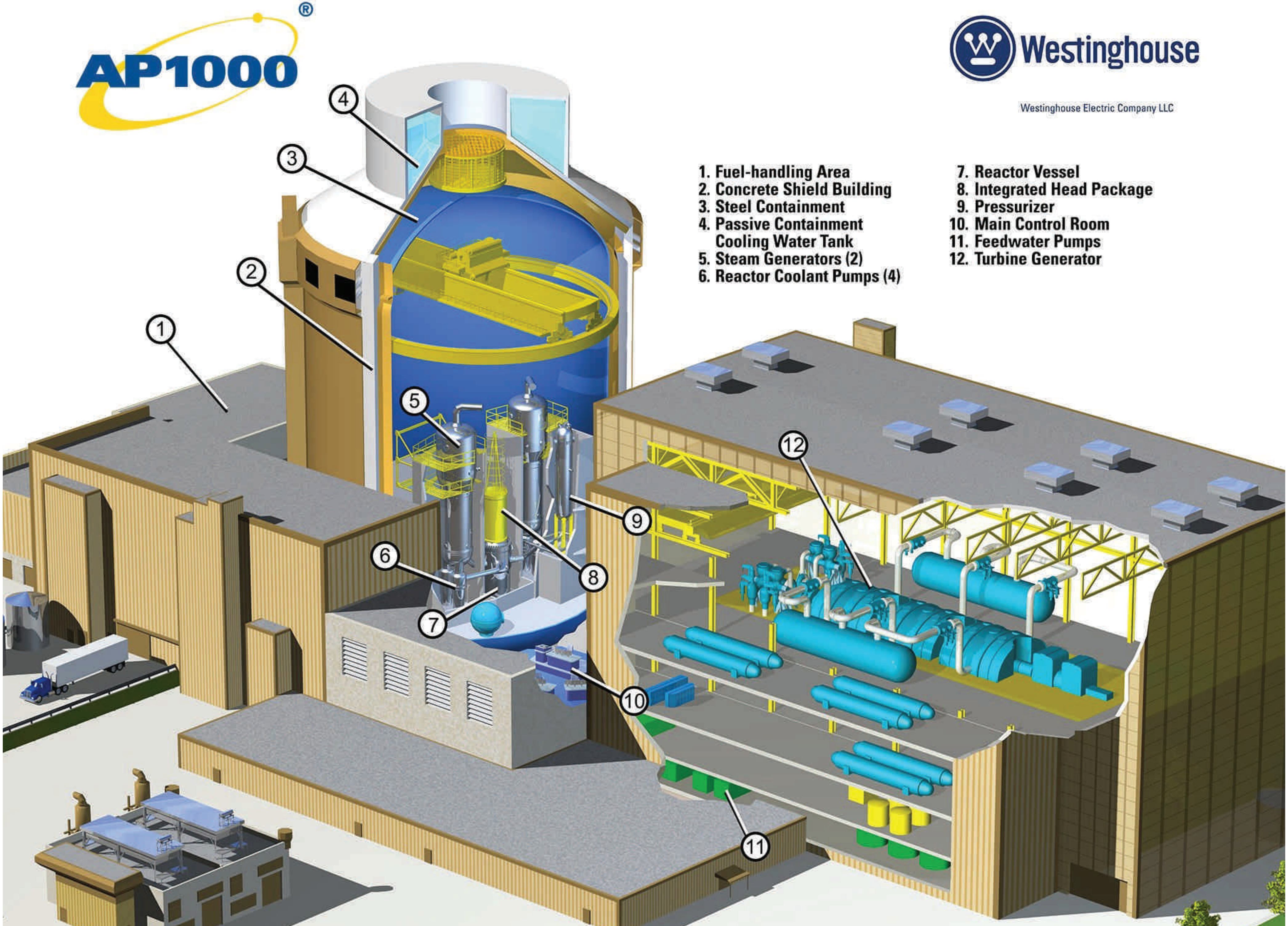
Olkiluoto Unit 3—Turbine island, EPR, Finland, June 2013 (TVO).

Olkiluoto Unit 3—Reactor building and RPV pool, EPR, Finland, December 2013 (TVO).

Taishan Unit 1—EPR, China, August 2013.

Taishan Unit 1—Pumping Station, EPR, China, August 2013.

Taishan Unit 1—Turbine installation, EPR, China, October 2013.



The above illustration is an artist rendering of the AP1000® PWR and may not depict actual design and layout

5.2 AP1000 Working Group (AP1000WG)

The AP1000 design-specific working group includes the regulatory authorities of Canada (CNSC), People's Republic of China (NNSA), Sweden (SSM), the United Kingdom (ONR), and the United States (NRC). The United States is chairing the working group and People's Republic of China is vice-chair. A total of four AP1000 units are under construction in China at Sanmen and Haiyang sites. The NRC has certified the AP1000 design and is reviewing applications for combined licenses for six AP1000 units. Four units are under construction in the United States at Vogtle and Summer sites after receiving combined licenses. ONR issued an interim Generic Design Assessment of the AP1000 design in 2011, and in January 2014 began preparing for a potential continuation of its review of the AP1000 for licensing in the United Kingdom. CNSC is performing a pre-licensing assessment of the AP1000. In June 2013, CNSC completed Phase 2 of its AP1000 pre-licensing design evaluation.

Accomplishments

The working group members have shared design information, application documents, and preliminary findings, and identified the most significant review issues as well as construction challenges. As the working group members transitioned to different stages of their design reviews, the group re-evaluated the scope of the working group topics, and the issues to be addressed. In 2013, the working group discussed several technical topics including: squib valve design and factory testing; containment condensate return to the IRWST design change; and reactor coolant pump testing. The working group has also exchanged information and began drafting a common position on how the AP1000 design addresses the findings from the Fukushima accident.

The AP1000WG meets regularly with representatives of Westinghouse to discuss similarities and differences among the designs being licensed in each country and to discuss post-Fukushima safety reviews. In 2013, the working group toured plants under construction in United States and People's Republic of China and met with the licensees.

The US NRC held a series of phone seminars with CNSC on selected topics of their Phase 2 review to learn from the already completed NRC design certification review. The seminars helped alleviate some of the challenges the unique AP1000 passive design presented to the CNSC reviewers under a compressed review schedule. The phone seminars have added high value to CNSC because large chunks of NRC AP1000 review were able to be credited by CNSC specialists. This reduced their workload and also the discussions provided additional insight to the CNSC staff on AP1000 design. CNSC plans to continue the phone seminars in the future during their Phase 3 and construction license application reviews.

There have been several exchanges of letters between US NRC and NNSA containing questions and responses related to design and construction issues in each country. The documents were shared with the other working group members through the MDEP library. This exchange of information was the result of engagement of upper managements of the two regulators.

Since the September meeting, the NRC has held bi-lateral exchanges with SSM on specific technical issues. SSM, as a relatively new member of the working group, is becoming fully integrated in the group's activities. SSM plans to send two inspectors to the NRC in fall 2014.

As the working group members move into the construction phase, they have begun to share information on construction experience. Because Sanmen Unit 1/2 and Haiyang Unit 1/2 are the first four AP1000 units in the world, NNSA will pay particular attention to the commissioning of Sanmen Unit 1 which is scheduled to start in 2014. The commissioning tests will be key to verifying the AP1000 safety performance. The US NRC provided NNSA with NRC's inspection procedures and will make inspectors available to observe the commissioning activities. In addition, NNSA has assembled experts in NPP design and commissioning to plan a strategic approach for the commissioning inspections.

In July 2013, the NRC, NNSA, CNSC, and NEA met in People's Republic of China to discuss cooperation on pre-operational testing and initial test program activities. The outcomes of the workshop included:

- extensive discussions on the licensing and inspection of AP1000 commissioning activities, including pre-operational testing and the development of pre-operational testing procedures;
- NRC shared with NNSA recently developed inspection procedures to inspect the pre-operational test programme and its implementation;
- NRC explained the inspector planning tool developed to inspect commissioning activities and provided a copy at the next meeting in September 2013;

- timely exchanges of information related to AP1000 component manufacturing and design issues;
- NNSA offered to share NNSA inspection findings from both construction and operating plants;
- detailed discussion of the use of Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) during preoperational testing to help focus the inspection effort;
- continued exchanges of inspectors.

The 8th meeting of the AP1000WG was conducted in Atlanta, Georgia, USA at the headquarters of NRC's Region II that has oversight responsibility for the AP1000s reactors under construction at the Vogtle and Summer sites. The AP1000WG met with Westinghouse, the AP1000 licensees and applicants and toured the construction activities at the Vogtle site. The AP1000WG also met with the resident inspectors to better understand how the NRC oversees construction activities.

A follow-up meeting on pre-operational testing issues is planned for September 2014.

Haiyang Unit 1—Dome Installation, AP1000, People's Republic of China, December 2013.

Haiyang Unit 1—Dome Installation, AP1000, People's Republic of China, December 2013.

Haiyang Unit 1—Installation of CB20 module, AP 1000, People’s Republic of China, March 2014.

Haiyang Unit 1—Installation of CB20 module, AP 1000, People’s Republic of China, March 2014.

Vogtle Unit 3—Setting of CA20, AP 1000, United States, March 2014 (GA Power).

Vogtle Unit 4 turbine island.

April 2014

Summer Unit 2—Reactor Vessel delivery, AP1000, June 2013, United States (SCANA).

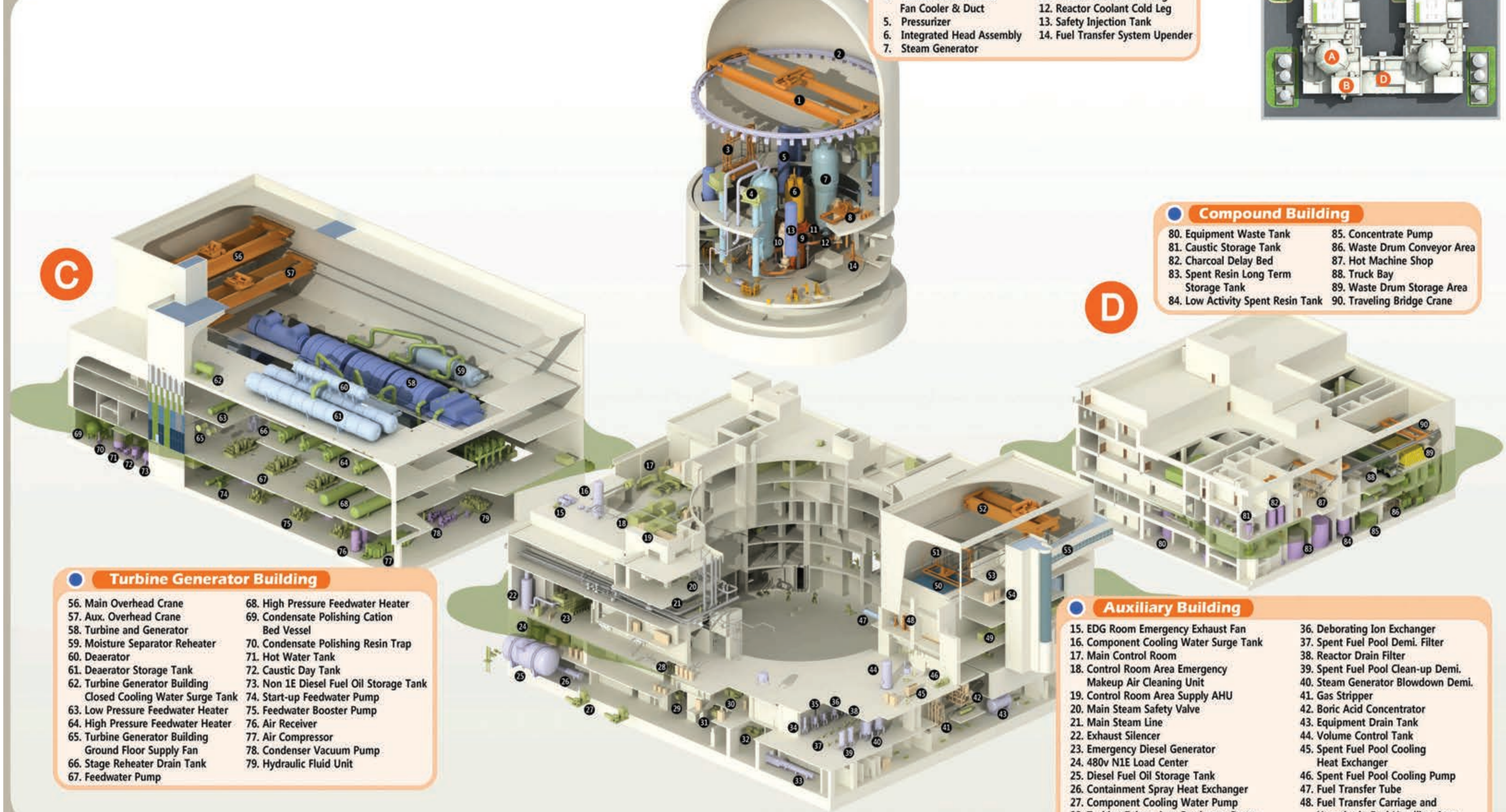
Summer Unit 2—Nuclear Island circa, AP1000, United States, November 2013 (SCANA).

Summer Unit 3—Basemat concrete placement, AP1000, United States, November 2013 (SCANA).

Sanmen site—AP1000, People's Republic of China, February 2014.

Sanmen Unit 2—AP1000, People's Republic of China, February 2014.

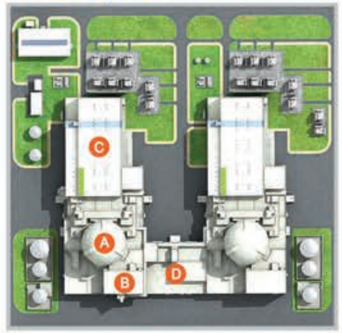
SHIN-HANUL NUCLEAR POWER PLANT UNITS 1&2



Reactor Containment Building

1. Polar Crane
2. Crane Rail
3. CEA Change Platform
4. Reactor Containment Fan Cooler & Duct
5. Pressurizer
6. Integrated Head Assembly
7. Steam Generator
8. Refueling Machine
9. Reactor Vessel
10. Reactor Coolant Pump
11. Reactor Coolant Hot Leg
12. Reactor Coolant Cold Leg
13. Safety Injection Tank
14. Fuel Transfer System Upender

Site Key Plan



Compound Building

80. Equipment Waste Tank
81. Caustic Storage Tank
82. Charcoal Delay Bed
83. Spent Resin Long Term Storage Tank
84. Low Activity Spent Resin Tank
85. Concentrate Pump
86. Waste Drum Conveyor Area
87. Hot Machine Shop
88. Truck Bay
89. Waste Drum Storage Area
90. Traveling Bridge Crane

Turbine Generator Building

56. Main Overhead Crane
57. Aux. Overhead Crane
58. Turbine and Generator
59. Moisture Separator Reheater
60. Deaerator
61. Deaerator Storage Tank
62. Turbine Generator Building Closed Cooling Water Surge Tank
63. Low Pressure Feedwater Heater
64. High Pressure Feedwater Heater
65. Turbine Generator Building Ground Floor Supply Fan
66. Stage Reheater Drain Tank
67. Feedwater Pump
68. High Pressure Feedwater Heater
69. Condensate Polishing Cation Bed Vessel
70. Condensate Polishing Resin Trap
71. Hot Water Tank
72. Caustic Day Tank
73. Non 1E Diesel Fuel Oil Storage Tank
74. Start-up Feedwater Pump
75. Feedwater Booster Pump
76. Air Receiver
77. Air Compressor
78. Condenser Vacuum Pump
79. Hydraulic Fluid Unit

Auxiliary Building

15. EDG Room Emergency Exhaust Fan
16. Component Cooling Water Surge Tank
17. Main Control Room
18. Control Room Area Emergency Makeup Air Cleaning Unit
19. Control Room Area Supply AHU
20. Main Steam Safety Valve
21. Main Steam Line
22. Exhaust Silencer
23. Emergency Diesel Generator
24. 480v N1E Load Center
25. Diesel Fuel Oil Storage Tank
26. Containment Spray Heat Exchanger
27. Component Cooling Water Pump
28. Turbine Driven Aux. Feedwater Pump
29. Containment Spray Pump
30. Motor Driven Aux. Feedwater Pump
31. Safety Injection Pump
32. Shutdown Cooling Pump
33. Shutdown Cooling Heat Exchanger
34. Boric Acid Condensate Ion Exchanger
35. Purification Ion Exchanger
36. Deborating Ion Exchanger
37. Spent Fuel Pool Demi. Filter
38. Reactor Drain Filter
39. Spent Fuel Pool Clean-up Demi.
40. Steam Generator Blowdown Demi.
41. Gas Stripper
42. Boric Acid Concentrator
43. Equipment Drain Tank
44. Volume Control Tank
45. Spent Fuel Pool Cooling Heat Exchanger
46. Spent Fuel Pool Cooling Pump
47. Fuel Transfer Tube
48. Fuel Transfer Carriage and Upender in Fuel Handling Area
49. Fuel Handling Area Emergency Exhaust Air Cooling Unit
50. Spent Fuel Pool
51. Spent Fuel Handling Machine
52. Fuel Handling Area Overhead Crane
53. Observation Room
54. Observation Elevator
55. Walkway

KHNP
KEPCO E&C

5.3 APR1400 Working Group (APR1400WG)

The APR1400 design-specific working group was established in August 2012 with the participation of Republic of Korea (NSSC), Finland (STUK), the United Arab Emirates (FANR), and the United States (NRC). The APR1400 DSWG chair is Republic of Korea, the country of the design originator; and United Arab Emirates, as the second country to begin the construction of an APR1400, is the vice-chair.

Four APR1400 units are under construction and two additional units are under preliminary safety evaluation report review in Republic of Korea. USNRC received a design certification application in September 2013 and started the review of a number of topical reports in early 2013. Two units are under construction in the United Arab Emirates at the Barakah site. FANR received the construction permit application for the next 2 units, in 2013. STUK has completed a preliminary safety assessment of the APR1400 which includes information regarding design feasibility, organisational capability, and the plant site.

In 2013, the working group agreed on the formation of a technical expert subgroup to focus on severe accidents evaluation. The working group also drafted a Post-Fukushima action table and a design differences table comparing the design of the APR1400 in Europe, the Republic of Korea, the United Arab Emirates, and the United States. The group held its third meeting in Abu Dhabi in order to visit Barakah construction site.

Barakah site—APR1400, United Arab Emirates, April 2013 (ENEC).

Shin-Hanul site—APR1400, Republic of Korea, February 2014, (KHNP).

Barakah unit 1—CLP installation, APR1400, United Arab Emirates, November 2013 (ENEC).

Shin-Hanul Unit 1—Reactor Vessel Hydrostatic Test, APR1400, Republic of Korea, March 2014 (KHNP).

NUCLEAR ENGINEERING INTERNATIONAL
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ATOM ENERGO PROM
ROSATOM

AES-2006 (VVER-1200)

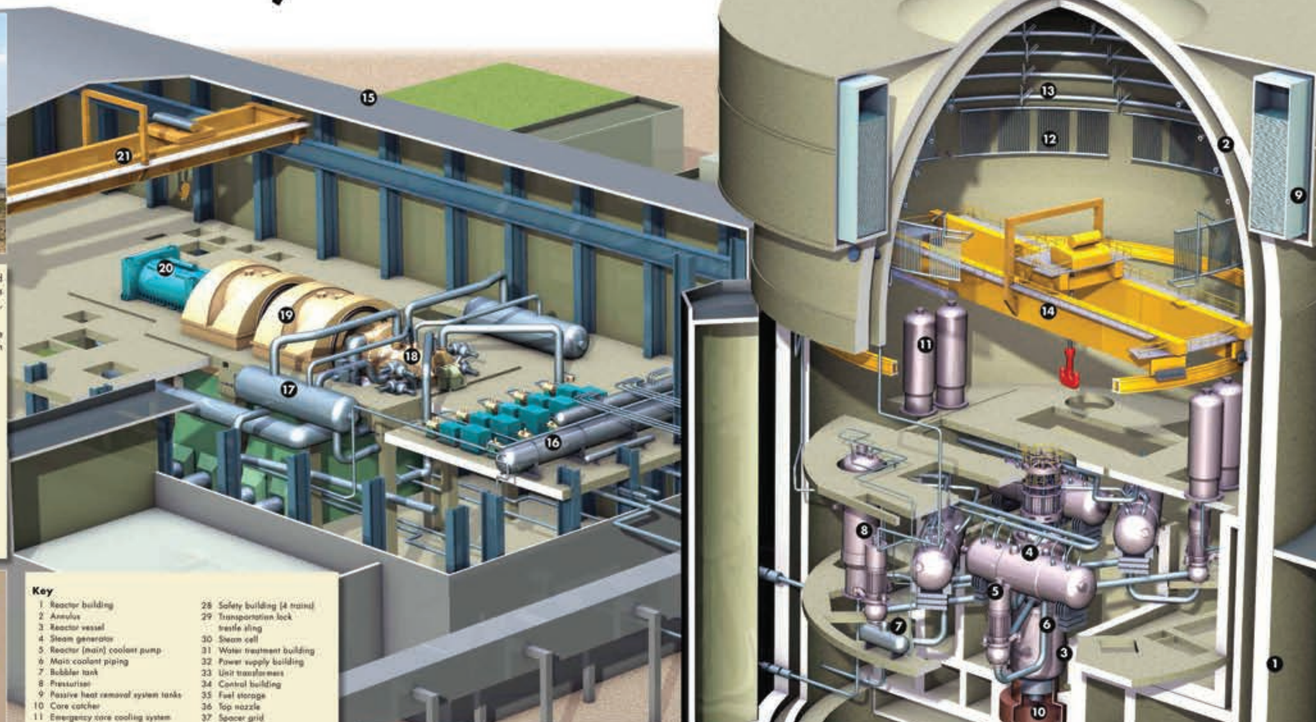
Leningrad phase II under construction

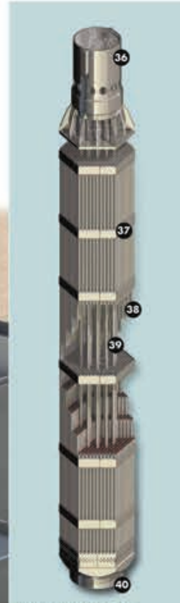
Building on extensive experience with VVER pressurised water reactors in Russia and elsewhere, and referenced to the landmark AES-91 Tianwan plant in China, the AES-2006 (VVER-1200) power plant shown here has been developed under the leadership of St Petersburg Atomenergoproekt/VNIPIET (part of Atomenergoprom, which in turn is a subsidiary of Rosatom (Russian state nuclear energy corporation)).

With some variations in the layout and design details this type is under construction at Leningrad phase II (pictured above), Kaliningrad (Baltic project) and Ostrovets (Belarus). It is also proposed for Temelin 3 & 4 (Czech Republic) and Hanhikivi (Finland).

Key features:

- **Maximum use of well-proven solutions and equipment (an evolution from the AES-91 design)**
- **Main equipment service life is at least 60 years**
- **Enhanced fuel utilisation**
- **In line with modern fuel cycle practice, period between refuellings is 12–18 months**
- **Double containment**
- **Four trains of active safety systems**
- **Separate passive systems to provide all fundamental safety functions**
- **BDBA (beyond design basis accident) management engineering measures based mainly on passive principles**





Detail of fuel assembly

Bird's eye view (typical plant)

Key

1 Reactor building
2 Annulus
3 Reactor vessel
4 Steam generator
5 Reactor (main) coolant pump
6 Main coolant piping
7 Bubbler tank
8 Pressuriser
9 Passive heat removal system tanks
10 Core catcher
11 Emergency core cooling system accumulators
12 Passive heat removal system heat-exchangers
13 Sprinkler system
14 Polar crane
15 Turbine building
16 Deaerator
17 Moisture separator reheater
18 HP cylinder
19 LP cylinder
20 Generator
21 Gantry crane
22 Vent stack
23 Treatment plant
24 Unit diesel generator building
25 Nuclear service building
26 Auxiliary building
27 Emergency diesel generator station
28 Safety building (4 trains)
29 Transportation lock trestle sling
30 Steam cell
31 Water treatment building
32 Power supply building
33 Unit transformers
34 Control building
35 Fuel storage
36 Top nozzle
37 Spacer grid
38 Fuel rod
39 Guide tube
40 Bottom nozzle
41 Cooling tower
42 Spray ponds
43 Steam header
44 Feedwater inlet
45 Feedwater header
46 Heat exchange tubes
47 Main coolant inlet
48 Main coolant outlet
49 Control and protection system drives
50 Vessel head
51 Outlet nozzle
52 Inlet nozzle
53 Core baffle
54 Fuel assemblies

Main data:

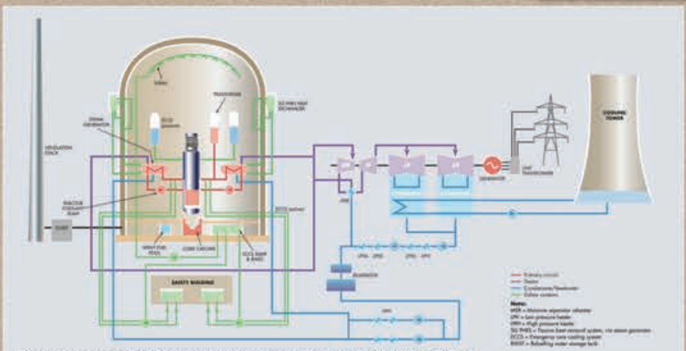
Rated thermal power of the reactor (MWt)	3200
Installed capacity per unit (MWe, gross)	1190-1270
Thermal efficiency (%)	~37
Primary circuit loops, with one steam generator per loop	4
Coolant flow rate through the reactor (m³/h)	86 000
Coolant temperature, reactor inlet (° C)	298.2
Coolant temperature, reactor outlet (° C)	328.9
Reactor coolant pressure (MPa)	16.2
Steam pressure, steam generator outlet (MPa)	7.0
Number of fuel assemblies	163
Number of control rods	121

Safety systems

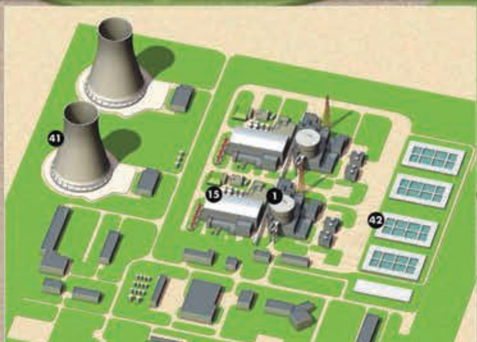
Internal containment	Prestressed concrete
Number of safety trains	4
Reactor trip	Passive
Emergency injection	Active
Emergency core cooling	Active
Emergency containment cooling	Active

Beyond design basis accident management

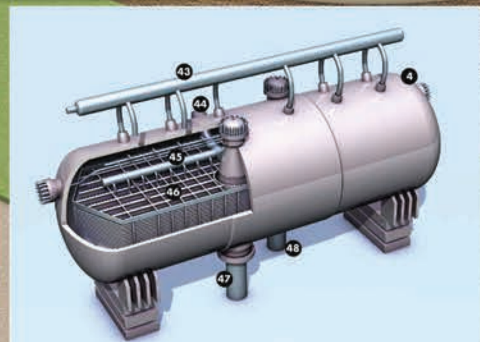
Core catcher	Yes
Passive heat removal from steam generator	Yes
Passive heat removal from the containment	Yes
Hydrogen removal system	Yes



Schematic diagram, simplified (eg, only two steam generators out of the four are shown)



Typical site plan



Detail of steam generator

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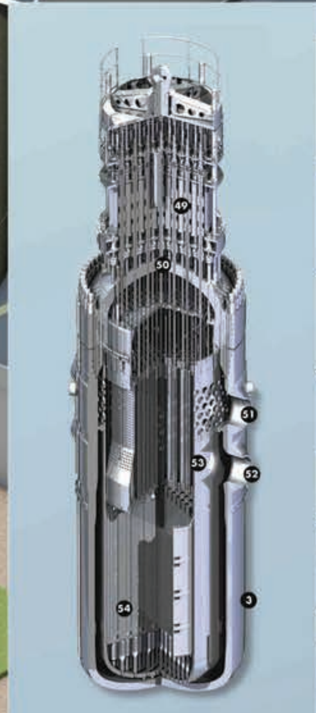


Detail of reactor

5.4 VVER Working Group (VVERWG)

The VVER Working Group includes Finland (STUK), India (AERB), Russian Federation (Rostechnadzor) and Turkey (TAEK).

In 2013, the PG officially endorsed the formation of a working group to share information and cooperate on the VVER Russian reactor design. At the same period, Turkey has been welcomed as a new associate member of MDEP to join this group.

The kick-off meeting was held in Moscow on 21-22 January 2014, when Rostechnadzor's representative was elected as chair of the group and TAEK's representative as vice-chair. Representatives of the Russian designer and utility organisations participated in part of the working group meeting and provided descriptions of the different recent VVER designs being built or reviewed. The members provided recommendations for topics to be addressed by technical subgroups. The major areas of cooperation for this newly formed group were narrowed to severe accidents, safety systems and reactor pressure vessel and primary circuit. The group also explore ways of ensuring full exchange of information regarding potential proprietary and protected commercial information. In 2014, the working group will decide on subgroup discussion topics and finalise a comparison table of the technical differences among VVER designs in each country.

Akkuyu NPP Project—VVER, Turkey (TAEK).

Akkuyu NPP Site—VVER, Turkey, (TAEK).

Novovoronezh II – VVER, Russian Federation, February 2014 (Rosatom).

Kudankulam—VVER, India, August 2013 (NPCIL).

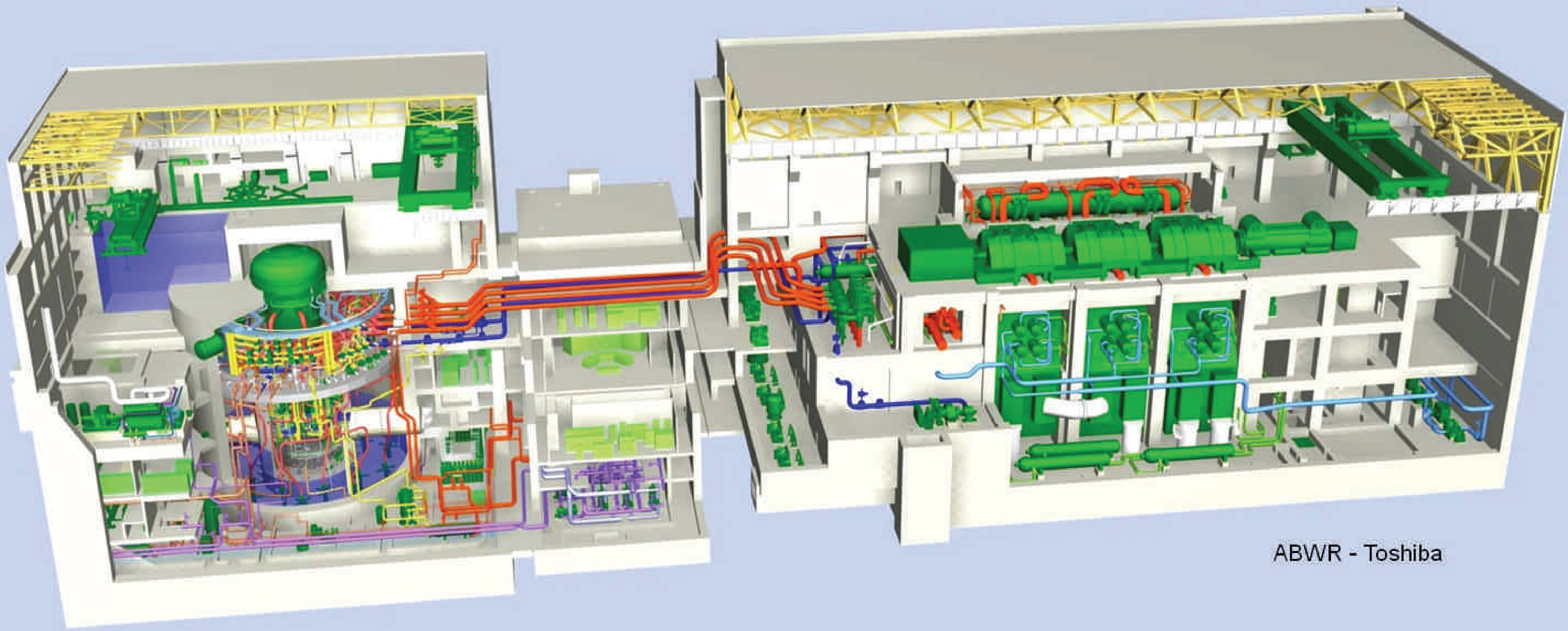
Leningrad II—VVER, Russian Federation, March 2014 (Rosatom).

Novovoronezh II—VVER, Russian Federation, March 2014 (Rosatom).

Novovoronezh II—Arrival of reactor vessel, VVER, Russian Federation, November 2013, (Rosatom).

Novovoronezh II—Gateway installation, VVER, Russian Federation, November 2013 (Rosatom).

VVERWG—First meeting, Moscow, Russian Federation, January 2014.



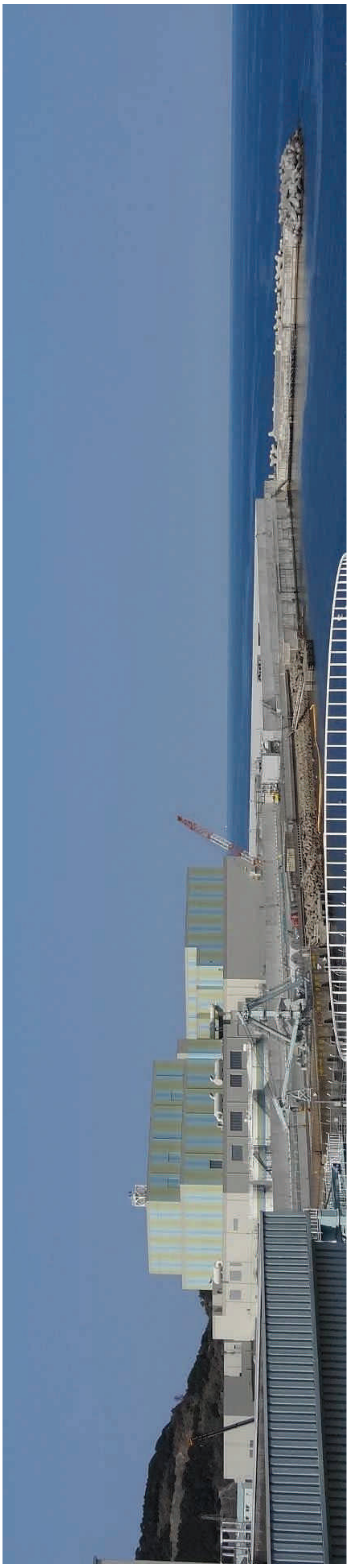
ABWR - Toshiba

5.5 ABWR Working Group (ABWRWG)

The ABWR working group includes the regulatory authorities of Finland (STUK), Japan (NRA), Sweden (SSM), the United Kingdom (ONR), and the United States (NRC). The formation of this working group was approved in 2013 and its first meeting was held in January 2014. The United Kingdom will chair and the United States was selected as the vice-chair. There are four different ABWR designs under consideration in members' countries: General Electric (GE)-Hitachi, Hitachi-GE, US Toshiba and Finnish Toshiba. The working group developed a comparison matrix of the key design features with input from the vendors. The following topics were identified for formation of technical subgroups: Fukushima lessons learned, instrumentation and controls, and severe accidents. The vendors will be invited to a future meeting to discuss the use of proprietary information by the members.

ABWRWG—First meeting, Issy-les- Moulineaux, France, January 2014.

Ohma unit 1—ABWR, Japan, March 2014 (J-Power).



Shimane unit 3—Chugoku electric power company, ABWR, Japan, February 2014.

5.6 Vendor Inspection Cooperation Working Group (VICWG)

Background

The goals of the VICWG are to:

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

The working group enhances the understanding of each regulator's inspection procedures and practices by coordinating witnessed inspections of safety related components and quality assurance inspections. Witnessed inspections consist of one regulator performing an inspection to its criteria, observed by representatives of other MDEP members. The benefits to the observing countries include additional information and added confidence in the inspection results. MDEP regulators are using the experience gained during conduct of VICWG witnessed inspections in their inspection planning.

Joint inspections consist of one regulator conducting an inspection according to its own regulatory framework with the active participation of one or more other regulators. This would allow the participating members to use the results of the inspection that are applicable to their regulations.

The working group maintains a list of inspections from the MDEP VICWG regulators for opportunities to witness inspections, and shares inspection results through a database maintained in the MDEP library. This database includes not only the reports of witnessed and joint inspections, but all inspections that may be of interest to the MDEP members.

Accomplishments

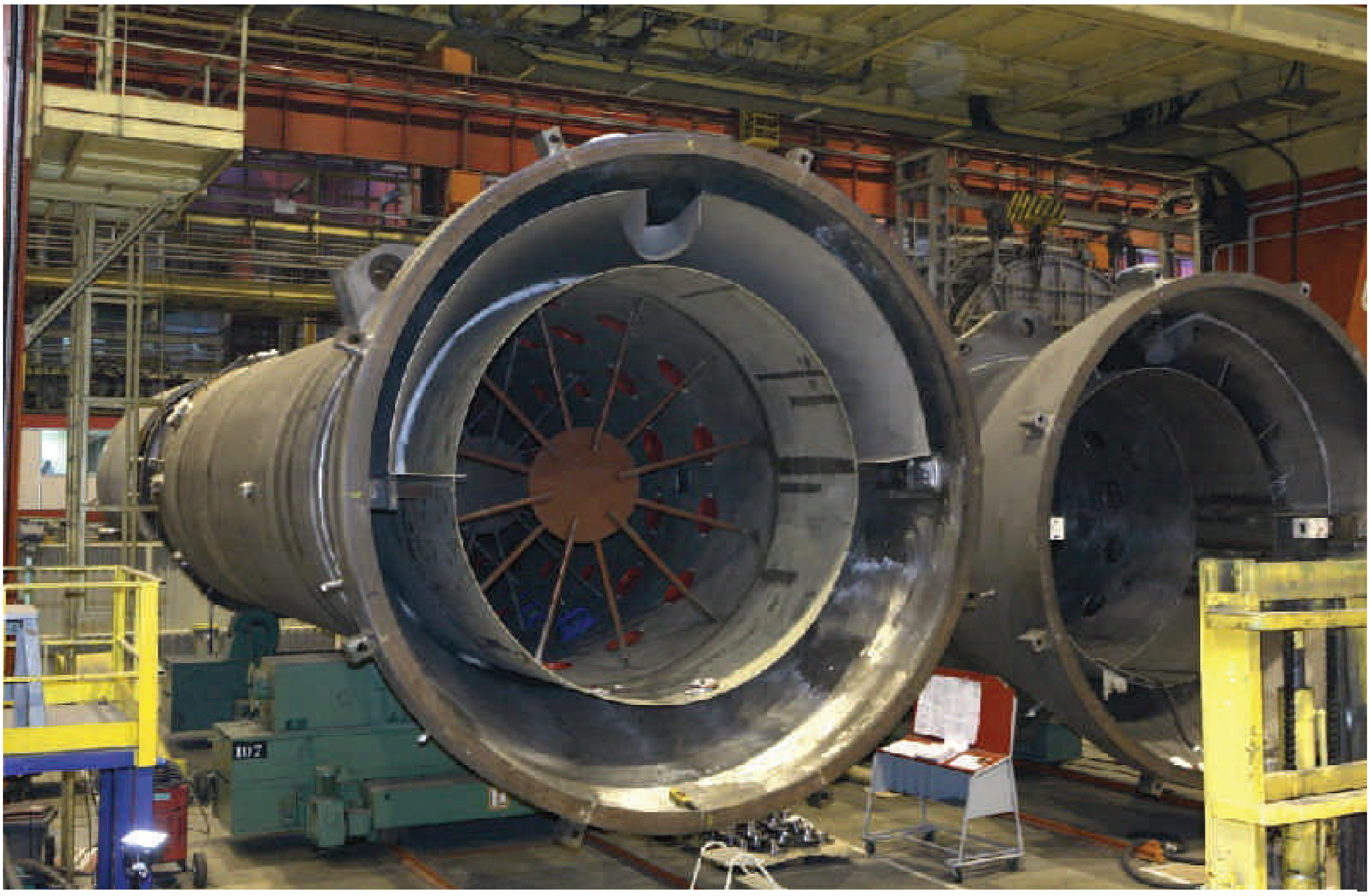
In 2013, the working group focused on maximising information sharing, joint inspections, and witnessing of other regulators' inspections. The VICWG also worked with SDOs to encourage and explore harmonisation of QA/QM standards.

A total of twelve witnessed and joint inspections were conducted pursuant to VICWG inspection protocol in 2013, as detailed in table 1. In the last year, there has been an increase in the number of joint and observed inspections, primarily driven by the United Arab Emirates and Republic of Korea collaboration on inspection of components for APR1400 reactor.

VICWG 12th Meeting—Paris, 5-7 November 2013.

Table 1. 2013 Witnessed and joint inspections

Vendor	Location (Country)	Inspecting regulator	MDEP type of inspection: witnessed(W) or joint(J)	Date	Participating regulator(s)	Scope
WEC	USA	FANR	W	October 2013	KINS	Verify implementation of the Westinghouse quality assurance programme. Inspection scope primarily focused on the test Control (during Reactor Coolant Pump [RCP] prototype testing)
EC	USA	FANR	W	October 2013	KINS	Verify implementation of the Westinghouse (Cranberry) Quality Assurance
EDF	France	ASN	W	October 2013	STUK	Verify storage conditions and preparation to welding of pressure equipments at Flamanville 3 construction site
Doosan	Republic of Korea	FANR	W	September 2013	KINS	Verify implementation of the Doosan's Quality Assurance, Handling
QualTech NP	USA	NRC	J	June 2013	KINS	Mechanical and Electrical EQ, Seismic Qualification, CGD
B&W Canada	Canada	NRC	W	June 2013	CNSC	Replacement steam generators for Davis Besse/ MHI Follow-up
UAE and Republic of Korea	BNPP site, HSJV, KEPCO	FANR	W	May 2013	KINS	Structural steelwork fabrication, Containment liner fabrication, Control of Processes, Design Control, Corrective Action
Hyosung Goodsprings	Republic of Korea	FANR	W	April 2013	KINS	Organisation, QAP, Design, Procurement, Purchased Items and Services, Control of Items, Special Processes, Nonconforming Items, Corrective Action
Stern Labs	Canada	NRC	W	March 2013	CNSC	Design certification testing (NuScale)
UAE and South Korea	UAE	FANR	W	January 2013	KINS	Structural steelwork fabrication, Containment liner fabrication, concrete placement, Control of Processes, Packaging, shipping, receiving, storage and handling of items, QA records, Instructions, procedures and drawings
WEC	USA	CNSC Canada	W	January 2013	NRC	Canada Design Review



Saint-Marcel manufacturing plant—Steam generator fabrication, Introduction of the wrapper, EPR, Chalon, France, 2007 (AREVA, Moreau Charlene).

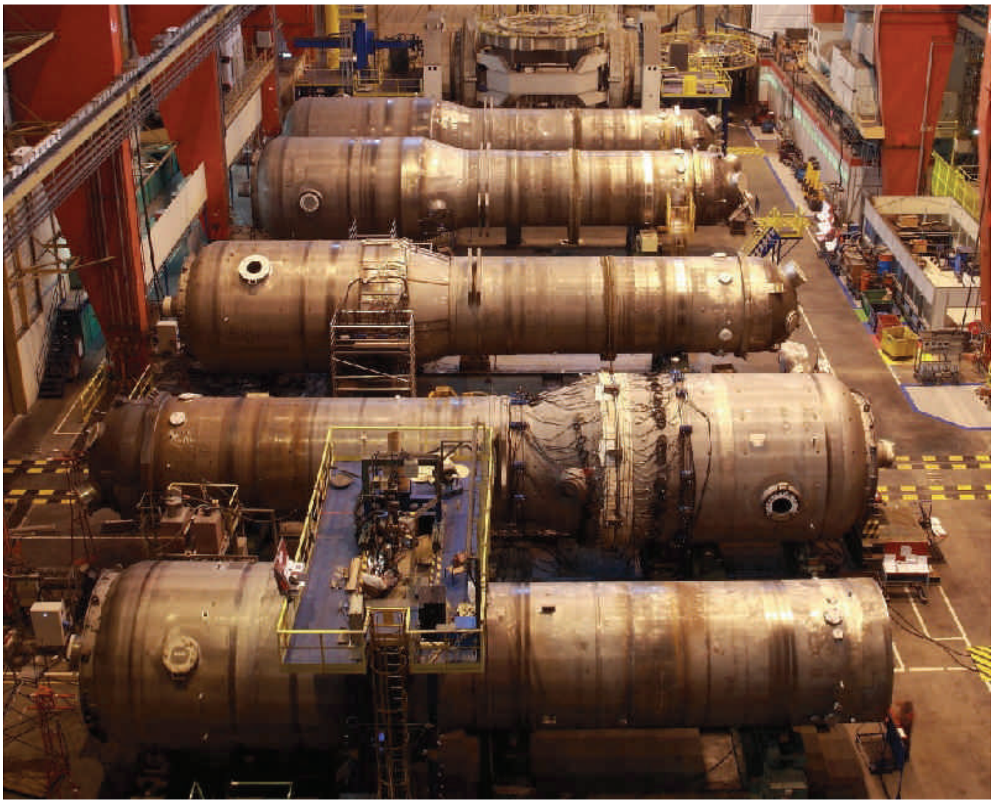
In 2013, the working group has completed a technical report on “Common QA/QM Criteria for the Multinational Vendor Inspection.” This VICWG document provides the “Common QA/QM Criteria” which will be used in multinational vendor inspections. These criteria were developed in conformity with international codes and standards such as IAEA, ISO and others that MDEP member countries adopted. As a result of the information obtained, a comparison table between codes and standards (IAEA GS-R-3, ISO 9001:2008,10CFR50 Appendix B and ASME NQA-1) has been developed to inform the development of “Common QA/QM Criteria.”

Future actions

The United Kingdom, the United States and France are preparing for the first multinational inspection to be conducted in 2014. Multinational inspections are conducted by a team of inspectors from multiple countries using common inspection criteria and selected criteria that are unique to their countries. A draft inspection plan has been prepared.

In support of its long term goal of understanding the similarities and differences between MDEP national regulators’ QA/QM Requirements and to facilitate the adoption of good vendor oversight practices by national regulators, the group added two new actions in its Programme Plan: (1) develop a list of good practices for vendor oversight and (2) conduct a survey of vendor inspector training. The group has incorporated an attribute to its inspection plans to address issues related to Counterfeit, Fraudulent, and Suspect Items (CFSI).

In the area of harmonisation of quality standards, the VICWG members accepted a task to review a proposal by CORDEL to identify barriers to NSQ-100 as a potential internationally acceptable quality standard.



Saint-Marcel manufacturing plant—Heavy component assembly bay, AREVA, Chalon, France, January 2012 (AREVA, Sirand Tracy).

Flamanville unit 3—Preparation for hydraulic test of the reactor vessel, EPR, August 2010 (AREVA, SIRAND Tracy).

5.7 Codes and Standards Working Group (CSWG)

Background

The goal of the Codes and Standards Working Group (CSWG) is harmonisation of code requirements for design and construction of pressure-retaining (pressure-boundary) components in order to improve the effectiveness and efficiency of the regulatory design reviews, increase quality of safety assessments, and to make each regulator stronger in its ability to make safety decisions.

The CSWG recognised early on that the first step to achieving harmonisation is to understand the extent of similarities and differences amongst the pressure-boundary codes and standards used in various countries. The CSWG encouraged SDOs to conduct full scope code comparisons, study the similarities and differences between codes, and develop a strategy and process for achieving code harmonisation and prevention of further divergences. The SDOs formed a steering committee composed of the representatives of ASME, JSME, KEPIC, AFCEN, CSA, vendors, and utilities which performed a comparison of their pressure-boundary codes and standards to identify the extent of similarities and differences in code

The SDOs compared requirements of their pressure-boundary codes and standards including JSME's S-NC1 Code (Japan), AFCEN'S RCC-M Code (France), KEA's KEPIC Code (Korea), CSA's N285.0 standard (Canada) and NIKIET's PNAE G-7 Code (Russia) against the requirements of Section III of the ASME Boiler and Pressure Vessel Code (United States) for Class 1 vessels, piping, pumps and valves.

The results enabled the CSWG to understand from a global perspective how each country's pressure-boundary code or standard evolved into its current form and content. In January 2012, the SDOs from Canada, France, Japan, Republic of Korea, and the United States issued their Code Comparison report for Class 1 Nuclear Power Plant Components that was prepared for MDEP. In December 2012, the SDOs published revision 1 that included a comparison with the Russian code.

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

Accomplishments

In September 2013, the CSWG issued its first technical report TR-CSWG-01 on the "Regulatory Framework for the Use of Nuclear Pressure-Boundary Codes and Standards in MDEP Countries" This document describes each MDEP country's pressure-boundary code or standard, the regulations and national practices governing the use of nuclear pressure-boundary codes and standards in each MDEP country, and what regulatory practices might be needed for foreign nuclear codes and standards to be used.

The CSWG issued a technical report on "Lessons Learnt on Achieving Harmonisation of Codes and Standards for Pressure Boundary Components in Nuclear Power Plants". This report documents the findings and overall conclusions of the CSWG pertaining to (1) the sufficiency in ensuring NPP safety of several MDEP member country's pressure-boundary codes and standards and (2) the potential for harmonisation of those pressure-boundary codes and standards based on the code-comparison work performed by the SDOs from April 2008 to December 2012. This report also documents a strategy and process proposed by the SDOs for achieving code harmonisation.

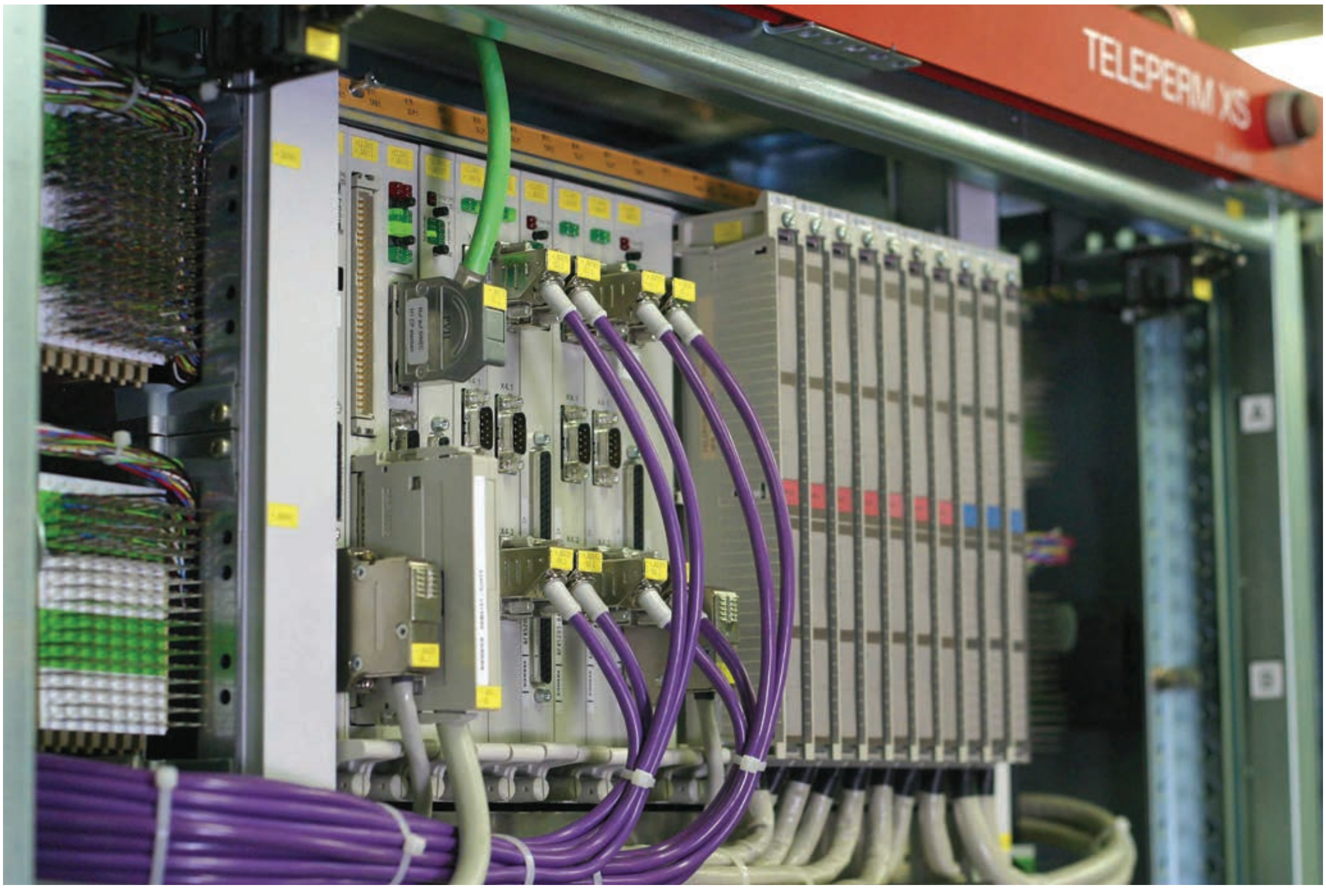
The working group issued a common position CP-CSWG-01 on "Findings from Code Comparisons and Establishment of a Global Framework towards Pressure-Boundary Code Harmonisation." The document is a compilation of common positions identified by the CSWG in its pursuit of harmonising the requirements in codes and standards governing the design, materials, fabrication, examination, testing and over-pressure protection requirements of pressure-boundary components such as vessels, piping, pumps and valves typically found in large, light-water-reactor NPPs.

Finally, the working group has issued a technical report TR-CSWG-03, on "Fundamental Attributes for the Design and Construction of Pressure-Boundary Components." This document establishes fundamental attributes that are high-level guidance for pressure-boundary codes and standards used in the design and construction of nuclear components.

Next steps

In 2014, the CSWG plans to continue its initial stated goals and work on code harmonisation and on issuance of its final reports. The working group will continue to interact with CORDEL and SDOs and support their respective aforementioned initiatives. The CSWG will work with CORDEL to continue efforts with its pilot project to achieve convergence of selected code gaps or differences and ensure that the Industry and SDOs can follow-up on this effort.

Flamanville unit 3—Reactor vessel for site, Welding of the final weld, manufacturing plant, EPR, Chalon St Marcel, France, June 2010 (AREVA, SIRAND Tracy).



Instrumentation and control Teleperm XS—Erlangen,Germany, 2009 (AREVA).

5.8 Digital Instrumentation and Controls Working Group (DICWG)

Background

The DICWG works to increase collaboration, cooperation and knowledge transfer among members and with other stakeholders to achieve the following primary goals:

- Facilitate timely and efficient mechanisms for sharing of knowledge and experience among members, thus allowing more effective safety reviews;
- Work jointly to develop common positions among members for issues of significance, which may be based on a review of the existing standards, national regulatory guidance, best practices, and group inputs.

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

18th meeting—DICWG, Paris, France, March 2014.

Accomplishments

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

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

- Generic Common Position 1—Treatment of Common Cause Failures Resulting from Software
- Generic common position 2—Software Tools for the Development of Software for Safety Systems
- Generic Common Position 3—Verification and Validation Throughout the Life Cycle of Digital Safety Systems
- Generic Common Position 4—Data Communications Independence
- Generic Common position 5—Treatment of Hardware Description Language (HDL) Programmed Devices for Use in Nuclear Safety Systems
- Generic Common Position 6—Simplicity in Design
- Generic Common Position 8—Impact of Cyber Security Features on Digital I&C Safety Systems
- Generic Common Position 11—Digital I&C System Pre-Installation and Initial On-Site Testing
- Generic Common Position 12—Use of Automatic Testing in Computer Based Systems as part of Surveillance Testing

These common positions have been made publicly available on the MDEP website. In 2013, DICWG revised common positions 2, 3 and 6, and issued common positions 1, 5, 11, and 12.

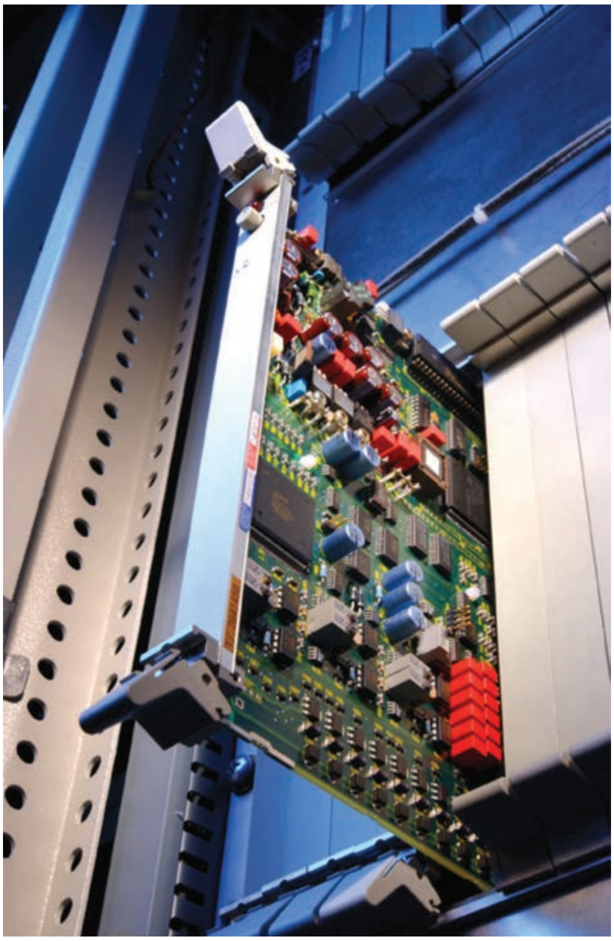
Generic Common Position 1, “Treatment of Common Cause Failure (CCF) caused by software within digital safety systems” states that NPPs should be protected from the effects of common cause failures caused by software in DI&C safety systems. This common position provides guidance for the assessment of the potential for CCF for software.

Generic Common Position 5, "Treatment of Hardware Description Language (HDL) programmed devices for use in nuclear safety systems" provides principles for the design process and selection of pre-developed items for HDL-Programmed Devices.

Generic Common Position 11, "Digital I&C system pre-installation and initial on-site testing," provides principles on performing both pre-installation and initial on-site testing for digital I&C systems and details the aspects that should be included in the pre-installation testing stage and the initial on-site testing stage.

Generic Common Position 12, "Use of automatic testing in Digital I&C systems as part of surveillance testing" provides principles on the use of automatic testing and special considerations when automatic tests are used in lieu of or to reduce the frequency of manual tests.

The working group continues to implement a formal "Quick Inquiry" process to generate and process inquiries from member countries to promote an efficient and structured information exchange and provide for storing this information in a retrievable database. The DICWG maintains frequent communication with the DSWG, particularly with the EPR digital instrumentation and controls TESG.



Instrumentation and control Teleperm XS—Erlangen, Germany, 2009 (AREVA).

Next steps

Three additional common positions are under development. The working group has prioritised the remaining issues and has identified schedules for development, review, and issuance of each common position, which is described in the DICWG programme plan.

The working group will communicate specific suggestions to the SDOs and IAEA for consideration of harmonisation in a timely manner when they are identified during its activities.

The working group will continue to engage digital instrumentation and control vendors and utilities to share experience and insights toward developing common positions that are based on a broad spectrum of inputs.

Under its current schedule, the working group plans to complete the identified common positions in 2017.

6. INTERIM RESULTS

MDEP is considered a long-term programme with interim results. Interim results are those products that document agreement by the MDEP member countries and are necessary steps in working towards increased cooperation and convergence. The interim results for 2013 and early 2014 include:

- Commissioning workshops within the EPR and AP1000 working groups to begin considering how to cooperate on pre-operational testing and commissioning oversight.
- Common position addressing Fukushima related issues related to the EPR design.
- A series of phone seminars with US NRC and CNSC on selected topics of their Phase 2 review to learn from the already completed NRC design certification review of the AP1000.
- Exchanges of letters between US NRC and NNSA containing questions and responses related to design and construction issues for the AP1000 in each country.
- Establishment of VVER and ABWR design specific working groups with prioritisation of technical topics for future discussion.
- Cooperation on twelve witnessed vendor inspections and one joint inspection.
- Technical Report on “Common QA/QM Criteria for Multinational Vendor Inspection”.
- Common position on “Findings from Code Comparisons and Establishment of a Global Framework towards Pressure-Boundary Code Harmonisation”.
- Technical report on the “Regulatory Framework for the Use of Nuclear Pressure-Boundary Codes and Standards in MDEP Countries”.
- Technical report on “Lessons Learnt on Achieving Harmonisation of Codes and Standards for Pressure Boundary Components in Nuclear Power Plants”.
- Four common positions on digital instrumentation and controls for new reactors in the areas of: treatment of common cause failures resulting from software, Treatment of Hardware Description Language (HDL) Programmed Devices for Use in Nuclear Safety Systems, Digital I&C System Pre-Installation and Initial On-Site Testing, and Use of Automatic Testing in Computer Based Systems as part of Surveillance Testing.

7. NEXT STEPS – FUTURE OF THE PROGRAMME

At its meeting in May 2012, the MDEP Policy Group endorsed the extension of the planning window for MDEP activities from March 2013 to March 2018. MDEP still remains a mid and long term programme that focuses on interim results. The PG members stressed that they will review this issue at least within three years to determine if the planning window is still appropriate.

The results of the MDEP self-assessment indicated that MDEP should maintain a relatively small number of topics and keep them closely connected to topics relevant to new reactor designs. It was also recognized that the most effective aspect of MDEP is the cooperation and exchange of information it facilitates for design reviews. Therefore, MDEP will act quickly to approve the formation of new design specific working groups (consistent with the existing Rule of Three for forming design specific working groups).

The DSWGs will continue cooperation and exchanging feedback on design issues at least through the construction phase. After design review activities are completed for a majority of members, the working group format and goals may change to a type and level of activity that would be appropriate to continue to exchange information. Meanwhile, they continue to work on technical topics as they identify such items needing discussions. Several technical reports are presently being drafted. The impact of the Fukushima accident on new reactor designs will continue to be discussed within DSWGs meetings and Common positions addressing Fukushima-related issues will be issued, following the EPR one.

The current ISWGs will continue until they complete the goals and activities specified in their program plans. However, the work of the ISWG should eventually be transferred to other organisations such as CNRA or IAEA, as their widely recognised added value and work should not be lost when they stop. The working groups have identified completion strategies (including final products, recom-mendations to SDOs or other organisations for follow-up activity) which will be added in their working group programme plans.

Appendix 1

List of abbreviations and acronyms

AERB	*Atomic Energy Regulatory Board (India)*
AFCEN	*Association Française pour les règles de Conception, de construction et de surveillance en exploitation des matériels des Chaudières Electro Nucléaires* (French SDO)
ASME	American Society Mechanical Engineers
ASN	*Autorité de Sûreté Nucléaire (Nuclear Safety Authority from France)*
CCF	Common Cause Failure
CNRA	Committee on Nuclear Regulatory Activities (from the NEA)
CNSC	Canadian Nuclear Safety Commission
CORDEL	Cooperation in Reactor Design Evaluation and Licensing
CSA	Canadian Standards Association
CSWG	Codes and Standards Working Group
DICWG	Digital Instrumentation and Controls Working Group
DSWG	Design-Specific Working Group
FANR	Federal Authority for Nuclear Regulation (United Arab Emirates)
I&C	Instrumentation and Control
IAEA	International Atomic Energy Agency
IEC	International Electro technical Commission
IEEE	Institute of Electrical and Electronics Engineers
IRWST	In-containment Refueling Water Storage Tank
ISWG	Issue-Specific Working Group
ISO	International Organization for Standardization
ITAAC	Inspections, tests, analyses and acceptance criteria
JSME	Japanese Society of Mechanical Engineers
KEPIC	Korean Electric Power Industry Code
KINS	Korea Institute of Nuclear Safety
MDEP	Multinational Design Evaluation Programme

NEA	Nuclear Energy Agency
NIKIET	Scientific Research and Design Institute of Energy Technologies (Russian SDO)
NNSA	National Nuclear Safety Administration (China)
NPP	Nuclear power plant
NRA	Nuclear Regulatory Authority (Japan)
NRC	Nuclear Regulatory Commission (United States)
OECD	Organisation for Economic Development and Cooperation
ONR	Office for Nuclear Regulation (United Kingdom)
PG	Policy Group
PSA	Probabilistic safety assessment
SDO	Standard Development Organisation
SSM	*Strålsäkerhetsmyndigheten* (Swedish Radiation Safety Authority)
STC	Steering Technical Committee
STUK	*Säteilyturvakeskus* (Radiation and Nuclear Safety Authority of Finland)
TAEK	Türkiye Atom Enerjisi Kurumu (Turkish Atomic Energy Authority)
TESG	Technical Experts Subgroup
TOI	Typical optimised informatised (VVER design)
VICWG	Vendor Inspection Cooperation Working Group
WGRNR	Working Group on the Regulation of New Reactors (from the NEA/CNRA)
WENRA	Western European Nuclear Regulators Association
WNA	World Nuclear Association

APPENDIX 2

MDEP documents and publications [March 2013—April 2014]

http://www.oecd-nea.org/mdep/

Revised documents and publications

MDEP Terms of Reference

MDEP Design-Specific Working Groups Terms of Reference

MDEP Issue-Specific Working Groups Terms of Reference

Working Groups Programme Plans

Common Position DICWG-02 on software tools for the development of software for safety systems

Common Position DICWG-03 on verification and validation throughout the life cycle of digital safety systems

Common Position DICWG-06 on principle on simplicity in design

VICWG-01 Witnessed, Joint, and Multinational Vendor Inspection Protocol

New documents and publications

MDEP STC Self-Assessment Report

Common Position DICWG-01 on the treatment of common cause failure caused by software within digital safety systems

Common Position DICWG-05 on the treatment of Hardware Description Language (HDL) programmed devices for use in nuclear safety systems

Common Position DICWG-12 on the use of automatic testing in digital I&C systems as part of surveillance testing

EPRWG Common Position addressing Fukushima-related issues for the EPR design

Technical report TR-CSWG-01 on regulatory frameworks for the use of nuclear pressure-boundary codes and standards in MDEP countries

Technical report TR-CSWG-02 on lessons learnt on achieving harmonisation of codes and standards for pressure boundary components in nuclear power plants

Technical report TR-CSWG-03 on the Fundamental Attributes for the design and construction of reactor coolant pressure-boundary components

Common position CP-CSWG-01 on findings from code comparisons and establishment of a global framework towards pressure-boundary code harmonisation

Technical report VICWG-03: Common Quality Assurance / Quality Management (QA/QM) Criteria for Multinational Vendor Inspection

Cover photos: *Front cover: Olkiluoto Unit 3—EPR, Finland, March 2014 (TVO).*
Back cover: Taishan EPR construction site—EPRWG visit, People's Republic of China, June 2013.
Vogtle construction site—AP1000WG visit, United States, September 2013.

Issued by the OECD Nuclear Energy Agency for the Multinational Design Evaluation Programme
April 2014
www.oecd-nea.org/mdep