



2016 Year-End Highlights Report

Vision

WANO and its members will be worldwide leaders in pursuing excellence in operational nuclear safety for commercial nuclear power.

Mission

To maximise the safety and reliability of nuclear power plants worldwide by working together to assess, benchmark and improve performance through mutual support, exchange of information and emulation of best practices.

W A N O

Foreword

Exercising our collective responsibility for delivering the WANO safety mission



Over recent years, the global nuclear industry has seen a shift in its centre of gravity, with rapid expansion and emergence of new entrant members in some regions, and plants facing life extension and decommissioning decisions in other parts of the world. With this in mind, 2016 was very much a year of review and future planning for the World Association of Nuclear Operators (WANO), ensuring that it continued to fulfil its safety mission while meeting the challenges emerging from this significant shift in the nuclear vista.

In 2016, the organisation's leadership agreed a revised strategy that would form the basis of an update to Compass, WANO's long-term plan. This strategy will recognise the need to continue robust support to legacy plants and drive improvement through our traditional programmes and activities, while also acknowledging the need to engage earlier with and support new entrants, and those that are preparing to start up.

By the end of 2016, almost six years have passed since the events at Fukushima Daiichi caused by the Great Eastern Earthquake, and the 12 Post-Fukushima Commission (PFC) projects have been progressed to a point where they have been fully implemented or absorbed into common practice within WANO products and services. A report on the progress of the remaining two of the twelve Post-Fukushima Commission (PFC) projects – Emergency Planning and Design-Informed Reviews – will be presented at the Biennial General Meeting in October 2017 to show their transition from project status to the core work of WANO.

The WANO Assessment process has continued, with nearly 65% of WANO's member plants having received such a rating. This has been a significant step forward in ensuring that there is consistency across the four WANO regions, and has proven to be a beneficial means of communicating with member senior executives.

The members continue to support fundamental changes that allow WANO teams to dig deeper into plant performance and report about their observations. In 2016, the WANO Governing Board approved a recommendation by the executive leadership team (ELT) to include crew performance observations in future peer review activities. Additionally, the ELT recommended the continuation of corporate peer reviews on a six-year frequency post-2017, following an examination into the value of such reviews.

Great pride has been taken in the implementation of the PFC projects and the maturing of WANO, but it is now time to refocus our resources to ensure WANO continues to support its members in achieving operational excellence on a consistent basis.

While this 2016 Year-End Highlights Report details the activities undertaken by WANO in support of its members, it is nevertheless appropriate to briefly review the

performance of the members who make up the global nuclear power industry, as this serves as the backdrop against which the activities and priorities of WANO should be assessed.

Industry performance, as measured by the performance indicators for individual units and members, is presented in the body of this report. There have been some notable improvements in some of these indicators; however, after showing dramatic improvement at a global level for the past decade, several indicators are now no longer on an improving trend.

The fundamental premise of WANO is that, by deploying its products and services, and with the receptive spirit of continuous improvement of the recipients of these services, we should continue to see a rise in the performance of the world's plants. This should, by definition, result in improvement of the performance indicators. Of course, there are a number of factors influencing the performance indicators, which need to be understood and discounted, where necessary; for example, the outages required to implement certain post-Fukushima modifications, and issues relating to significant changes in the electricity markets and generation mix. Nevertheless, WANO is obliged to undertake some analysis of slowing trends, reflecting on the differences that still exist in the regional deployment of its products and services to determine whether there is room for improvement in quality.

It can be said that the level of nuclear safety, in whatever means you desire to measure it, is in an improved position to where it was prior to March 2011; however,

we cannot afford to be complacent. New issues that the nuclear power industry is facing will require members to reinvigorate activities aimed at exercising our collective responsibility for delivering the WANO safety mission.

The evolving nuclear landscape has raised questions as to whether the organisational structure of WANO, and its membership policies, are well suited to accommodate the changing needs of the industry. Approved by the WANO Governing Board in 2016, a working group continue their detailed review of the organisation's structure with the intent that a proposal on potential changes will be presented to the WANO General Assembly at the Extraordinary General Meeting in October 2017.

As mentioned above, there is still clearly room for improving consistency and quality in the delivery of WANO's programmes, with the objective of improving industry performance and reduction of risk. There continues to be evidence from WANO oversight activities that there is room for alignment and improvement in our understanding and deployment of safety culture and the role that corporate and station-level leaders play in daily operations of our facilities.

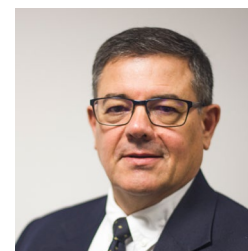
It is against the backdrop of these member performance insights that WANO will be establishing its strategic priorities. These are being designed during 2017, in collaboration with WANO members, to improve the way in which WANO can be of best service to its members and promote excellence in the operations and safety of their plants.



Kwansup Lee
President



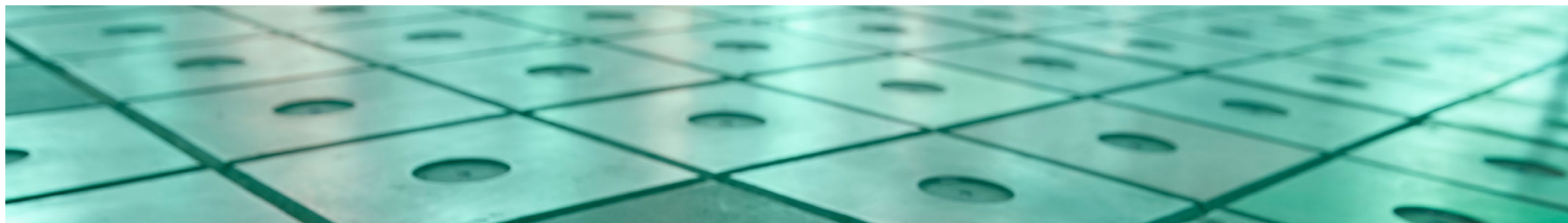
Jacques Régaldo
Chairman



Peter Prozesky
Chief Executive Officer

WANO Programmes

To achieve its mission, WANO offers members a series of high-quality products and services through five programmes



1. Peer Review

Peer reviews help members compare their operational performance against standards of excellence through an in-depth, objective review of their operations by an independent team from outside their organisation. This includes plant peer reviews, pre-startup peer reviews and corporate peer reviews.

In 2016, 54 plant peer reviews and 35 peer review follow-up visits were conducted across the regions, the highest overall number to date. Since 1992, WANO has conducted 730 operating station peer reviews in 32 countries/areas. Regional centres continue to optimise resources and transition all existing stations from a six-year peer review frequency to a four-year frequency.

The London Office continued to observe peer reviews and follow-ups in line with its oversight role. It found consistent process adherence, and was able to identify areas for improvement to the regional centres while sharing best practices with the peer group. Additionally, an exchange peer review was conducted at two nuclear power plants during 2016;

54
OPERATING
PLANT PEER
REVIEWS
CONDUCTED

this was a joint pilot project of WANO Moscow Centre and Paris Centre. In 2016, there were nine pre-startup reviews (PSURs) and six PSUR follow-ups conducted, and 15 corporate peer reviews (CPR) and eight corporate peer review follow-ups. At the end of 2016, 63 of the 80 CPRs to be completed by the end of 2017 in accordance with the Post-Fukushima Commission (PFC) recommendations had been accomplished. Due to careful oversight and monitoring of the CPR schedule and regular and ongoing resource sharing by the four regional centres, the programme is on track to meet the 2017 target.

The WANO Assessment process was established in 2014 and has now become an embedded part of the Peer Review programme with every peer review having a WANO Assessment meeting and the member being given a confidential rating. With nearly 65% of WANO's member plants having received such a rating, this has been a significant step forward in ensuring that there is consistency across the four WANO regions, and has proven to be a beneficial means of communicating with member senior executives.



2. Performance Analysis

In September 2016, the Operating Experience programme was renamed Performance Analysis, with a focus on industry performance analysis and identification of trends, in addition to the screening of event reports and the processing of performance indicator (PI) data. The success of the programme stems from the willingness of WANO members to openly share their operating experience and performance data for the benefit of other operators throughout the world.

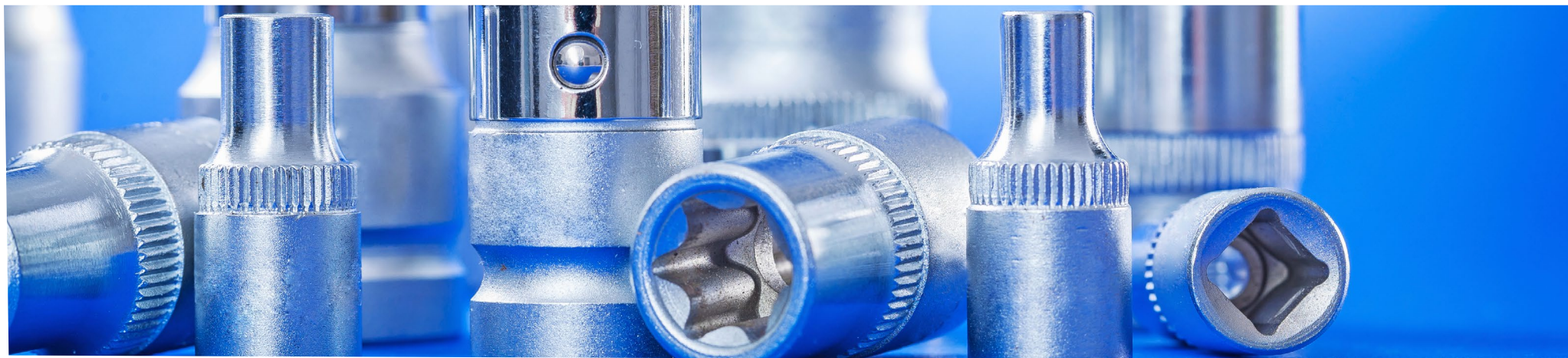
In 2016, 3,419 operating experience reports were provided by members, an 11% increase over reporting in 2015. This brings the number of event reports available in the operating experience database to 22,927. This heightened reporting level reflects an increase in transparency by WANO members and not a negative trend in overall industry performance.

The Performance Analysis team issued two Significant Event Reports, four Hot Topics and two Analysis Reports in 2016, providing important

3,419
OPERATING
EXPERIENCE
REPORTS
PROVIDED

lessons for the industry. Eleven existing Just-In-Time (JIT) briefing sheets were revised, providing workers and contractors at nuclear power plants with practical, timely operating experience for pre-job briefings. The Performance Analysis Central Team continues to issue monthly summaries of all events reported to WANO. This summary is posted on the WANO member website to highlight events of potential significance to other members that may provide meaningful lessons learnt.

PIs are mainly used as a management tool so that each WANO regional centre, member and plant can monitor its own performance and progress, set challenging goals for improvement, and consistently compare its performance with that of other plants or the worldwide industry. At the end of 2016, industry and individual unit performance against the targets saw little change from 2015 results in PI target areas, with stability or modest progress in most areas.



3. Member Support

The Technical Support & Exchange (TS&E) programme has been renamed Member Support.

In 2016, 216 Member Support Missions (MSMs) were conducted, compared to 206 in 2015. MSMs are planned and conducted by WANO regional centres using an experienced team of knowledgeable experts who provide suggestions and recommendations on how to close safety issues and performance-related gaps.

Action continues to focus MSMs on helping members resolve areas for improvement (AFIs) identified during peer reviews, with a target of 60% of MSMs being focused on resolving peer review AFIs, concentrating resources on issues with the most relevance to safety and reliability. The average performance for this target across WANO was 69% for

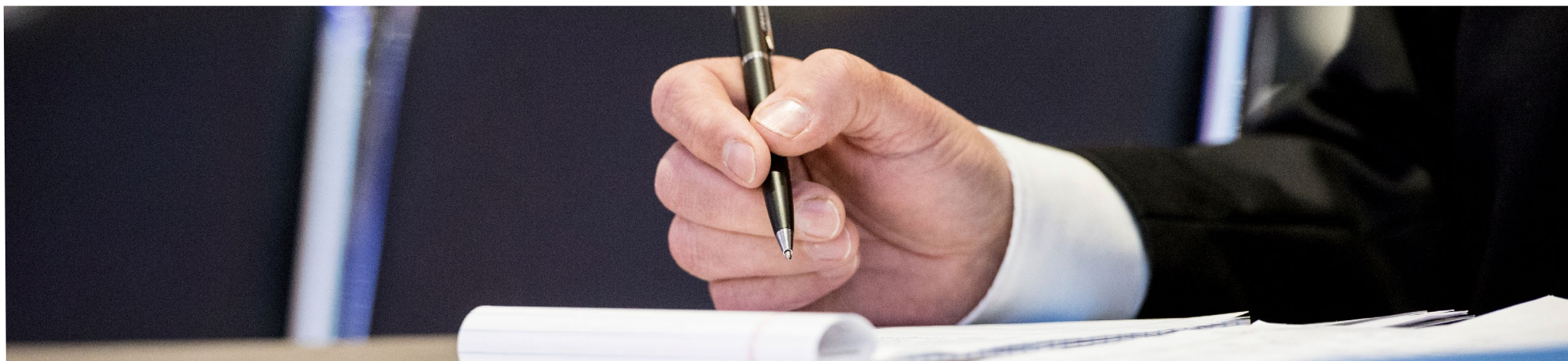
216
MEMBER
SUPPORT
MISSIONS
CONDUCTED

operating units in 2016. This indicator does not account for missions conducted for new units, as they are focused more on the plant requests and safety issues common for new WANO members.

In 2016, 46 New Unit Assistance (NUA) events, including MSMs, workshops, seminars and operational readiness assistance (ORA) missions were conducted, compared to 27 NUA events in 2015.

The Plant of Focus process became operational in each regional centre at the beginning of 2016, with WANO representatives established in each region.

In addition, six Good Practices and four Guidelines were published.



4. Training & Development

In September 2016, the Professional & Technical Development (P&TD) programme was renamed Training & Development (T&D) to reflect an increased emphasis on training. The T&D programme has three main focus areas; workshops and seminars, leadership training, and new build support.

The purpose of the T&D programme is to assist members in improving performance and reducing events primarily using training, workshops and seminars. This is an important tool in addressing common industry issues. With this ideal in mind, the regional centres organised 53 T&D activities in 2016, with leadership and management topics comprising about a quarter of these.

One of the Compass long-term goals is to examine the resource

53
WANO
WORKSHOPS,
SEMINARS
& EXPERT
MEETINGS

implications of developing leadership training for three levels of station personnel: plant managers, mid-level managers, and shift managers. London Office has brought in a specialist to coordinate leadership efforts WANO-wide, and a steering committee comprised of representatives from London and the regional centres has been formed to guide our strategy in this area.

T&D coordinated the 2016 Site Vice Presidents' & Plant Managers' Conference which was held in Budapest, Hungary on 13-14 September. The theme of the conference was Back to the Basics and focused on adverse trends in operator performance noted in peer reviews, pre-startup reviews and plant events. There were 135 participants at the conference.



5. Corporate Communications

In September 2016, the Communications programme was renamed Corporate Communications to reflect a step away from marketing functions and towards more stakeholder engagement.

During the second half of the year, work began on WANO's first stakeholder audit, focusing on the global membership and its experience of WANO's products, services and engagement with its members.

The Corporate Communications team worked with the Information Systems team on the new website for WANO members which was launched in May 2016. The new site has been designed to be responsive, easier to use, and has an improved search function to help WANO members access the information they need much more quickly and efficiently.

The Corporate Communications team worked with the Moscow Centre,

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**NEW WEBSITE
FOR WANO
MEMBERS
LAUNCHED**

Euroshow, MVM Paks and representatives from the regional centres, in the preparation and execution of the 2016 Site Vice Presidents' & Plant Managers' Conference in Budapest, Hungary.

Three issues of Inside WANO, three issues of WANO News and one issue of WANO Review were published in 2016. Video has also been more broadly used over the last two years, with many being filmed and edited in-house, such as a welcome message from new WANO Chief Executive Officer, Peter Prozesky, which was sent to WANO staff and members at the beginning of 2016.

In 2016, the Corporate Communications team worked alongside colleagues in the WANO Tokyo Centre and Korea Hydro and Nuclear Power to begin preparations for the 2017 Biennial General Meeting which will be held in Gyeongju, South Korea.

Governance & Structure

WANO consists of a WANO governing board, a central office in London and regional centres in Atlanta, Moscow, Paris and Tokyo, each with their own regional governing boards



On 1 January 2016, Peter Prozesky succeeded Ken Ellis as WANO Chief Executive Officer (CEO). Additionally, in November 2016 Dr Seok Cho, former President and Chief Executive Officer of Korea Hydro and Nuclear Power Co., Ltd., retired and Mr Kwansup Lee was elected to the position of WANO President. Mr Lee continues the responsibility for organising the next WANO Biennial General Meeting (BGM) in Gyeongju, Korea in October 2017.

In June 2016, the Paris Centre Regional Governing Board elected Ingemar Engkvist to succeed Ignacio Araluce as the Regional Director for Paris Centre.

Four new governors joined the WANO Governing Board in 2016. In mid-2016 Satoru Katsuno, President and Director of Chubu Electric Power Company, Inc. replaced Makoto Yagi of the Kansai Electric Power Company, Inc. as a WANO Governor; Syed Yusuf Raza, Chief Nuclear Officer of Pakistan Atomic Energy Commission, replaced

4 NEW MEMBERS OF WANO'S GOVERNING BOARD

CHEN Hua of China National Nuclear Power Company as a WANO Governor; GAO Ligang, Chief Executive Officer of China General Nuclear Power Co, Ltd replaced HE Yu of the same company as a WANO Governor; and Bertrand de L'Epinois, Senior Vice President - Safety Standards of AREVA succeeded Pedro de Figueiredo as the Chairman of the Paris Centre Regional Governing Board.

In November 2016, the WANO Executive Leadership Team and regional governing board representatives held a two-day workshop to agree priorities for members as a result of the rapidly evolving industry. This is being developed into a revised strategy that will form the basis of an update to Compass, WANO's long-term plan. It will recognise the need to continue robust support to legacy plants and drive improvement through traditional programmes, while acknowledging the need to engage earlier with and support new entrants, and those that are preparing to start-up.

Membership

WANO: Growing to meet the needs of an expanding industry



127
WANO MEMBERS

At the end of 2016, there were 127 members in WANO's four membership categories.

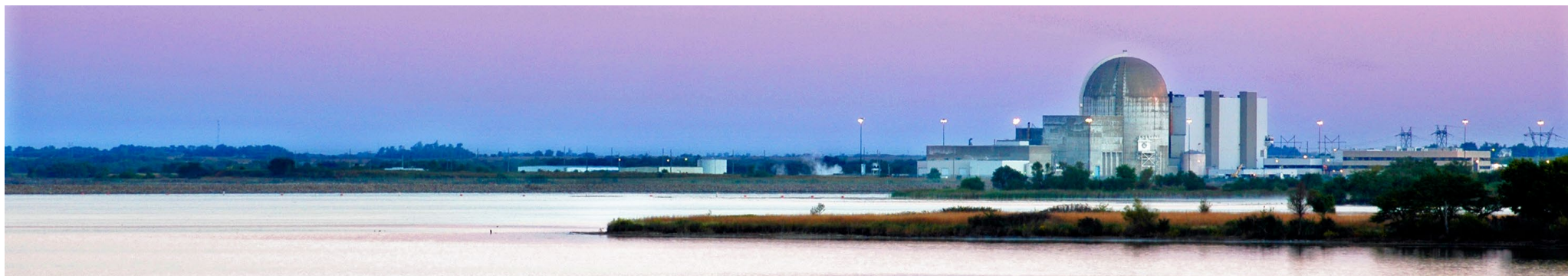
Membership changes in 2016 reflected the broader trend of a shift within Europe and North America for the nuclear industry. In April, the WANO Governors approved one new

application for membership. A Category 1 membership application was submitted by Sydkraft Nuclear Power AB. In June, the WANO Governors approved one new application for membership. A Category 1 membership application was submitted by State Power Investment Corporation.

An agreement was signed between WANO London Office and NuGeneration Ltd in October, based on limited access to WANO programmes and services prior to affiliation with a regional centre.

WANO Members*

* Member data as of 31 December 2016



Wolf Creek Nuclear Power Plant

Atlanta Centre

Ameren Missouri	Energy Northwest	Institute of Nuclear Power Operations	State Nuclear Power Demonstration Plant
Arizona Public Service	Entergy Nuclear	Luminant	State Power Investment Corporation
Bruce Power	Eskom Holdings SOC Limited	Nebraska Public Power District	STP Nuclear Operating Company
CANDU Owners Group	Exelon Corporation	New Brunswick Power	Talen Energy
Centrala Nuclearelectrica Cernavoda	FirstEnergy Corp	NextEra Energy, Inc	Tennessee Valley Authority
China Huaneng Group	Haiyang-Shandong Nuclear Power Company	Ontario Power Generation	Wolf Creek Generating Station
Comision Federal de Electricidad	Horizon Nuclear Power Limited	PG&E Corporation	Xcel Energy Inc
Dominion	Huaneng Shandong Shidao Bay Nuclear Power Co, Ltd	Public Service Enterprise Group, Inc	Emirates Nuclear Energy Corporation (S)
DTE Energy Corporation	Indiana Michigan	SCANA Corporation	WANO Atlanta Centre
Duke Energy Corporation		Southern Nuclear Operating Company	

WANO Members*

* Member data as of 31 December 2016



Leningrad Nuclear Power Plant

Moscow Centre

Haykakan Atomayin Elektrakayan CJSC

CEZ, a.s.

Concern Rosenergoatom

Federal State Unitary Enterprise of Atomic Fleet (FSUE Atomflot)

Fortum Power and Heat Oy

Ignalina Nuclear Power Plant

Jiangsu Nuclear Power Corporation

JSC Atomenergoremont

JSC Atomtechenergo

JSC OKB Hidropress

Kozloduy NPP Plc

MVM Hungarian Electricity Private Limited Company

MVM Paks II Nuclear Power Plant Development Private Company Limited by Shares

MVM Paks Nuclear Power Plant Ltd

NNEGC Energoatom

Nuclear Power Corporation of India Limited

Nuclear Power Production and Development Company of Iran

Republican Unitary Enterprise Belarusian Nuclear Power Plant

Slovenské elektrárne, a.s.

State Specialized Enterprise Chernobyl NPP

VNIIAES

WANO Moscow Centre

WANO Members*

* Member data as of 31 December 2016



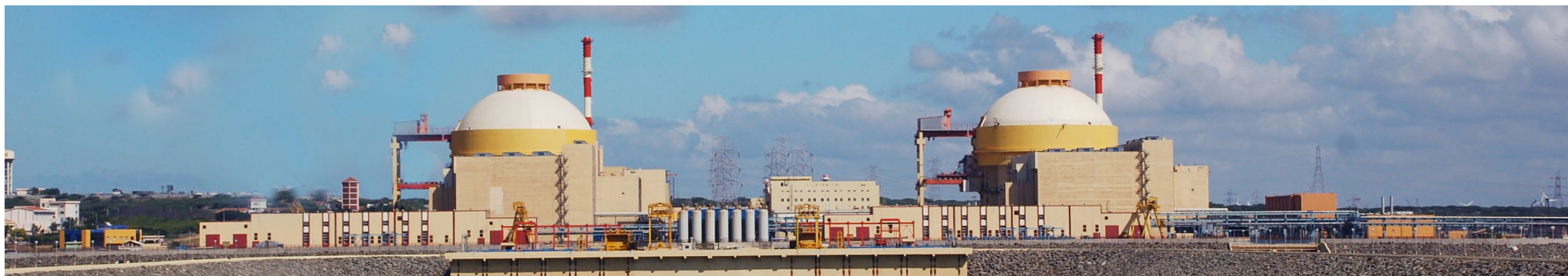
Ringhals Nuclear Power Plant

Paris Centre

AREVA	Eletróbrás Termonuclear - Eletronuclear SA	Magnox Ltd	Swedish Nuclear Fuel and Waste Management Co SKB
Asociación Nuclear Ascó - Vandellós II, AIE (ANAV)	EnBW Kernkraft GmbH	N.V. elektriciteits - Produktiemaatschappij Zuid - Nederland (EPZ)	Swissnuclear
Axpo AG	Engie Electrabel	Nuclear Decommissioning Authority	Sydskraft Nuclear Power AB
BKW Energie AG	Forsmarks Kraftgrupp AB	Nuclenor, SA	Taishan Nuclear Power Joint Venture Co Ltd
CC.NN. Almaraz-Trillo, AIE	Fujian Ningde Nuclear Power Co	Nucleoeléctrica Argentina SA (NA-SA)	Teollisuuden Voima Oyj (TVO)
China General Nuclear Power Corporation (CGN)	Guangxi Fangchenggang Nuclear Power Co, Ltd (FCGNP)	Nuklearna Elektrarna Krško	Vattenfall AB
Daya Bay Nuclear Power Operations and Management Co, Ltd	IBERDROLA Generación Nuclear, SA	PreussenElektra	VGB PowerTech eV
EDF	Kernkraftwerk Gösgen-Däniken AG	Ringhals AB	WANO Paris Centre
EDF Energy	Kernkraftwerk Leibstadt AG	RWE Power AG	Yangjiang Nuclear Power Co, Ltd (YJNP)
	Liaoning Hongyanhe Nuclear Power Co, Ltd	Sellafield Ltd	

WANO Members*

* Member data as of 31 December 2016



Kudankulam Nuclear Power Plant

Tokyo Centre

China National Nuclear Corporation

Chubu Electric Power Company, Inc

Electric Power Development Co, Ltd

Fujian Fuqing Nuclear Power Company Ltd

Hainan Nuclear Power Co, Ltd

Hokkaido Electric Power Company Inc

Hokuriku Electric Power Company Inc

Japan Atomic Energy Agency

Japan Nuclear Safety Institute

Japanese Nuclear Operators (JNO)

Korea Hydro & Nuclear Power Co, Ltd

Kyushu Electric Power Company, Inc

Nuclear Power Corporation of India Limited

Nuclear Power Qinshan JVC, Ltd

Pakistan Atomic Energy Commission

Qinshan Nuclear Power Company Ltd

Sanmen Nuclear Power Company Ltd

Shikoku Electric Power Company, Inc

Taiwan Power Company

The Chugoku Electric Power Company, Inc

The Japan Atomic Power Company, Inc

The Kansai Electric Power Company, Inc

Third Qinshan Nuclear Power Company, Ltd

Tohoku Electric Power Company, Incorporated

Tokyo Electric Power Company Holdings, Inc

WANO Tokyo Centre



ATLANTA
LONDON & HONG KONG
MOSCOW
PARIS
TOKYO