



المجلس الاستشاري الدولي  
INTERNATIONAL ADVISORY BOARD

EIGHTH SEMI-ANNUAL REPORT  
2014



## Brief summary on the International Advisory Board for the UAE nuclear program

The International Advisory Board (IAB) was a concept first developed by the UAE government to augment the transparency of its peaceful nuclear energy program. Indeed, the commitment to form such a body was among the original commitments undertaken by the UAE government in its original white paper describing its intent to evaluate and potentially deploy peaceful nuclear energy within its borders.

More specifically, the IAB represents an unprecedented collection of internationally recognized experts in various disciplines associated with the nuclear energy sector. The board includes world-class expertise in the areas of nuclear safety, security and non-proliferation, as well as regulation, quality assurance, operations, human resource development and waste management associated with the construction, operation and decommissioning of civil nuclear power plants. Led by Dr. Hans Blix, the former Director General of the International Atomic Energy Agency (from 1982-1997), the IAB is charged with conducting semi-annual reviews of the UAE's entire peaceful nuclear energy program and subsequently preparing a semi-annual report summarizing their observations, findings and recommendations. The decision by the UAE government to make these reports available to the public in hard-copy form and over the internet represents yet another example of the latter's commitment to achieving the highest standards of transparency in its peaceful nuclear energy program.

The IAB, while not invested with any legally binding powers, has nevertheless been designed to be an independent advisory body. As stated above, after each of its semi-annual meetings, the Board will issue a report detailing the consensus views of its members with regard to the progress achieved by the program, as well as any areas of concern that merit special attention. The Government will not seek to edit these consensus IAB views and will undertake to publish them free of modification, as intended by the IAB members. Notably, however, the government and the IAB membership have agreed to work together to make those modifications necessary to avoid the dissemination of any sensitive security-related information to which the IAB may have access.

While the IAB's semi-annual reports may address additional topics, they will always be required to specifically address the issues of:

1. Nuclear safety
2. Nuclear security
3. Nuclear non-proliferation
4. Program transparency
5. Program sustainability

The UAE government, and those entities involved in the UAE will use the Board's semi-annual reports to improve performance and, where necessary, allocate additional resources in order to ensure the successful implementation of the over-all program. It is hoped that the UAE populace and the international community will use the reports as an objective source of information via which they may become more informed about and follow the progress of the UAE's nuclear sector.

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# CHAIRMAN'S PREFACE



Dr. Hans Blix  
IAB Chairman

On behalf of the International Advisory Board I have the honour to transmit to the Government of the UAE the eighth report of the Board and to place on record the appreciation of the Board for the extensive and valuable insights given to the Board on the progress of the UAE peaceful nuclear program.

The Board was happy to see that since its last visit great progress has been made on the plant and that the program remains on time and budget. This report discusses host of items: the updated status of the Barakah Nuclear Power Plant, the model planned for the operating company, the Korean supply chain challenges, regulatory development, emergency preparedness and response readiness, physical protection as well as capacity building.

At its next meeting the Board would appreciate further reports on the faulty components' issue, on waste management, and on social media.

The Board congratulates the UAE on the continued success and progress of the nuclear power program and concludes that the UAE remains fully committed to the principles of safety, security, non-proliferation, transparency and sustainability.

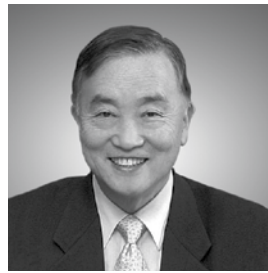
With respect,

Dr. Hans Blix

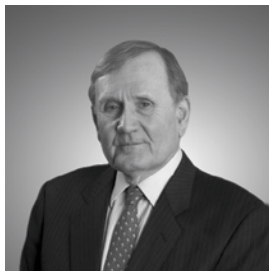
# BOARD MEMBERS



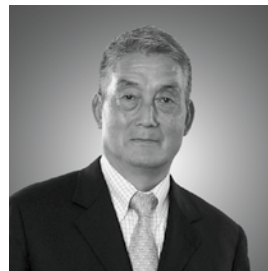
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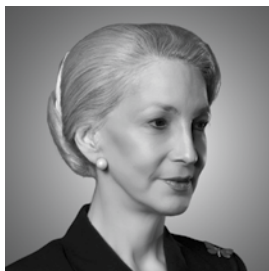
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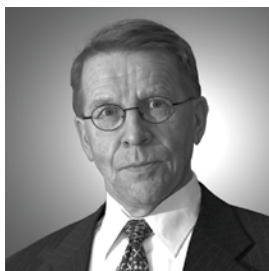
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# INTRODUCTION



The eighth meeting of the International Advisory Board (IAB) for the United Arab Emirates (UAE) nuclear power program was held in Abu Dhabi on October 6th and 7th, 2013. The IAB Chairman, Dr. Hans Blix, presided along with all other members of the Board. The first two briefings were carried out by the Federal Authority for Nuclear Regulation (FANR) and by the Ministry of Foreign Affairs (MOFA) the evening of October 6th at the Shangri-La Hotel. The Board at the Seventh Meeting had requested a visit to the Barakah site and therefore on October 7th, 2013 the briefing by the Emirates Nuclear Energy Corporation (ENEC) and the Critical Infrastructure and Coastal Protection Authority (CICPA) was carried out at the Barakah site.

FANR Director General Dr. William Travers, along with other senior FANR officials, briefed the Board on the major areas in which FANR is currently at work. The main subjects discussed included the status of licensing for the Barakah units and FANR's experience from the regulatory oversight. Ground had recently been broken for Unit 2 and ENEC submitted its application for a construction license for Units 3 and 4 in February 2013. FANR reported on progress in reviewing this application. Preparatory talks will soon be held with ENEC and KEPCO for the Operating License process that is planned to start with submission of application in early 2015. Other subjects presented by FANR included Korean supply chain challenges; regulation development; emergency preparedness and response development; physical protection development for Barakah's nuclear power plants; safeguards and import/export control; as well as FANR's capacity building.

Subsequent to FANR's briefing, Ambassador Hamad Al Kaabi briefed the Board on behalf of MOFA's developments. The subjects addressed by the Ambassador included updates on the UAE's international activities covering several international conferences, re-election of the UAE to the IAEA Board of Governors; preparations for the 2014 Nuclear Security Summit; international cooperation on the safety and security of radioactive sources; IAEA technical cooperation; progress on the export control regime; and international work on comprehensive fuel services.

The following day at the Barakah site, ENEC senior officials delegated ENEC's CEO Mohamed Al-Hammadi, briefed the Board in detail on progress at the Barakah site and related matters. The briefing included an update status of the Barakah Nuclear Power Plants; a description of the model planned for the operating company; emergency preparedness development; security; cyber security; human resources and capacity building including the training of personnel.

The final briefing of the day was carried out by CICPA, led by Musabeh Al Kaabi. The subjects addressed included the development of the Physical Security Protection strategy for the Barakah site with a focus on milestones, potential vulnerabilities, physical security requirements and the strategy for the security forces. Several additional accomplishments were mentioned and current activities related to physical security were described.

The Barakah NPP site has nearly ten thousand construction workers. During the plant tour the Board observed significant progress since their last visit two years ago and noted that the program remains on time and on budget.

# SAFETY

## Safety assessment and recommendations

FANR began their presentation on safety. The first matter discussed was the Construction License Application (CLA) for Units 3 and 4. This CLA was submitted by ENEC on the 28th of February, 2013 and was based on the CLA for Units 1 and 2.

There are approximately 200 differences identified in the Preliminary Safety Assessment Report (PSAR) from Units 1 and 2 including: safety enhancements suggested on the basis of lessons learned from Fukushima; design changes made at the reference plants Shin Kori 3 & 4, during its construction; updated site data; and modifications made as a result of progress on detailed design.

FANR is conducting a full technical review and assessment of all new material in the CLA, while the evaluation of unchanged application material will rely upon the existing safety evaluation for Units 1 and 2. Over 60% of the Safety Evaluation Report (SER) Sections represent draft material approved by FANR.

In order to meet the conditions of the Construction License for Barakah NPP Units 1 and 2, ENEC submitted on January 10, 2013 revision 3 of the PSAR. It embodies all the approved changes from the Unit 1 and 2 reviews. The Barakah NPP Units 1 and 2 SER identified 83 issues that required follow up submittals (conditional acceptance). ENEC committed to these submittals during the review of the CLA for Units 1 and 2 but the delivery has been delayed in several cases. ENEC has requested extensions on due dates for several submittals. To date, FANR has received 35 submittals in response, and expects another 43 by the end of the year. Of the 35 submitted, 7 have been approved and closed, 16 require follow up and 12 are related to the Severe Accident Analysis Report (SAAR). This lack of closure represents real regulatory risk for ENEC. The causes for most delays appear to be related to steps in the procurement process including KEPCO's performance and ENEC's oversight. ENEC has acknowledged the problem and is working to manage future deliverables.

Next FANR turned to the SAAR noting that ENEC and KEPCO have yet to provide a submittal that meets FANR's requirements. To comply with conditions of the Barakah Units 1 and 2 construction license review, ENEC submitted Revision 2 of the SAAR applicable to all 4 units. The FANR review indicated that the revised SAAR was not responding adequately to outstanding request for additional information. FANR suspended its review and requested that ENEC address the problems identified. ENEC is working with KEPCO on a new revision for submittal. The plan was to submit this revision by the end of September 2013. On this matter FANR presses ENEC which in turn presses KEPCO. The problem that exists in this case and others where input for reports is needed from KEPCO is that the respective issues are considered to be adequately proven in Korea because of direct contacts between organizations but the arguments are not written down. When convincing arguments are not given to FANR there are often requests for additional information and clarification.

ENEC has delayed the submission of a report on the electrical grid to which the Barakah NPP will be connected. This report is important because it is necessary to determine grid stability and the potential for the loss of offsite power (LOOP) to the facility. LOOP is a potential initiating event to a Station Blackout (SBO), which would be a highly significant event for safety. ENEC must comply with FANR's requirements for protection against LOOP and subsequent SBO. ENEC and TRANSCO (Abu Dhabi Transmission and Dispatch Company) are studying grid modification alternatives that will best support the UAE's Transmission Code requirements, and hence, maintain the necessary grid stability and reliability. It is also important to study the degree of protection that exists for alternative power sources. FANR regulations require that ENEC understand the operation of the electrical grid as the reliability of offsite power sources is important. All of this is under review by ENEC. The IAB notes that redundant independent external connections of Barakah units to the grid should exist, and hopes to hear about the final determination of the grid connection issues at a future meeting.

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The next subject discussed was FANR oversight of ENEC's performance. The implementation of the 2013 Annual Inspection Plan is well advanced. Fifteen site inspections have been completed while 15-20 were planned for 2013. FANR has also conducted an assessment of ENEC's safety management based on the inspection results from January to June 2013. FANR concluded that ENEC's overall effectiveness in managing safety was acceptable but additional emphasis on ENEC's oversight of KEPCO's activities would be needed. FANR's specific remarks include formal documentation of design control measures by ENEC and more accuracy in translating design and licensing basis information into the specifications written in the procurement documents. In the future, FANR is planning to place more emphasis on review of the ENEC's and KEPCO's supplier oversight process.

The Korean supply chain problems (and their implications for the Barakah project) have become a major public, as well as, a regulatory matter. The chronology in brief for Barakah NPP is as follows:

- KEPCO announced concerns in operating NPP on November 4, 2012;
- KEPCO briefed FANR inspectors (in connection with an already planned inspection a few days after on November 12);
- ENEC briefed FANR on November 25, 2012;
- KEPCO notified ENEC of forged Seismic Certificate Shin Kori 3&4, on December 11, 2012
- A small number of suspect parts were identified at Barakah in April, 2013;
- A cable falsification issue was reported involving six NPPs including Shin Kori 3&4 in June 2013;

- FANR requested a formal report from ENEC on June 13;
- ENEC provided the report requested on July 15, 2013; the review of the ENEC report by FANR is ongoing.

As part of the traditional regulatory review pursuant to the CLA for Units 1 and 2, quality assurance programs had been reviewed. FANR had found that these programs complied with the international recognized standards. No particular concerns were noted with respect to the Korean supply chain in the December, 2010 to July, 2012 timeframe. FANR conducted 15 regulatory inspections of ENEC and its suppliers up to the time of the disclosures in November 2012.

In November 2012, ENEC and KEPCO representations to FANR indicated that only Certificate of Conformance issues for operating NPPs were affected and no concerns were indicated for plants under construction. However, the December 2012 revelations indicated problems with respect to plants under construction. A supplier, who is listed on the Barakah approved safety related suppliers list, was involved and a forged Seismic Qualification (not a Certificate of Conformance) was disclosed.

On December 27, 2012 ENEC formed a Task Force chaired by its CNO. The Task Force began developing an overall strategy and briefed FANR in January, 2013 on its plans.

In April, 2013 ENEC advised FANR of suspected parts at Barakah. A Non-Conformance Report was provided that indicated identification of ten suspect safety related parts called elbows (two were installed and four were staged for installation)



and three non-safety fittings (not installed). The installed elbows were removed and the other suspected components were put under control to prevent installation. Fraudulent action was not suspected at this time. FANR verified the corrective actions during an inspection in June, 2013.

A cable test falsification was revealed in June, 2013 which impacted the Reference Plant. There were allegations that reported the involvement of the business unit of the ENEC prime contractor. FANR requested the formal Report from ENEC on June 13, 2013. This report was submitted to FANR on July 15, 2013. Following the review of the report, FANR requested additional information on July 29, 2013. A partial response was given on August 28, 2013 and a full response by ENEC on September 30, 2013. FANR has indicated the objective of completing its initial review by the end of October, 2013.

FANR concluded that there was a low risk of suspected parts being installed at the Barakah NPP up to present time. The ENEC existing quality assurance program for the supply network provides some level of protection. There has been FANR oversight and inspections and the delivery of South Korean sourced equipment is not yet significant. However, the potential risk for the future is not well understood at this stage. FANR must complete its formal review with field observations and inspections. FANR staff will develop recommendations for any additional regulatory actions.

All information brought up by the Korean regulator will be shared with ENEC. The investigation in South Korea was conducted initially on the basis of a tip that technical failures had been covered up. The Board asked at this point of the presentation, "ENEC relies on South Korea for quality assurance, what percentage of equipment comes from South Korea? Do we have quality assurance for goods coming from elsewhere?" ENEC replied that reactor parts are now made all over the world unlike 20 years ago. The complexity of inspecting supply chains is now greater than in the past as the number of chains has proliferated. This has made quality assurance more difficult. It is likely that in financial terms, perhaps 80% of components for the UAE nuclear project come from South Korea and 20% from elsewhere. FANR stated that in

2010 it had greater confidence in South Korean quality assurance than it has now. ENEC will be taking a larger and more active role in quality assurance going forward.

The Board expressed the view that it would like to have a further briefing on this subject at the next meeting in March, 2014. With the rather public legal and regulatory developments being reported from South Korea it appears that this subject, at least for the short term will increase in importance.

Next on the subject list for FANR was the development of appropriate regulations and obtaining the Operating License (OL) for Barakah NPP. A number of regulations are currently under development:

- Off Site Emergency planning, to be presented to the Board at its next meeting;
- The Operating License Application is being completed and stakeholder comments are under review;
- Operation of a Nuclear Facility, internal review completed. Seeking stakeholder comments;
- Decommissioning, under internal review;
- Export/Import Control of Nuclear Material, Nuclear Related Items and Nuclear Dual Use Items, stakeholder comments under review;
- Pre-disposal management of radioactive waste, internal review completed and to go out for stakeholder comment.

ENEC has stated that it intends to request a license for operation of Unit 1 of the Barakah NPP by end of 2016, and will submit its application in early 2015. Meeting the envisioned timeline would require ENEC to begin the OL application from now. Accordingly, the first meeting for this purpose between ENEC and FANR was held in July 2013. The OL will be granted before the regulated activity of operation, defined as the beginning of the fuel load. There will be a preliminary authorization for import, transport and possession of nuclear fuel. The OL will authorize fuel load, nuclear commissioning, facility operation and the possession, use, handling and storage of regulated material. Barakah NPP units may be licensed individually or jointly and the license period will

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be up to 60 years. The reactor system is being designed for a lifetime of at least 60 years. Some other components will be upgraded to a 60 year life, but most of the plant components are designed for a 40 year life. ENEC expects to use a rigorous maintenance program which includes provisions for repair and replacement that will ensure a 60 year license life. License conditions will be set by the FANR Board.

FANR also addressed the question of emergency preparedness and response. FANR is developing guidance based on IAEA guidelines for protective actions. This guidance will be detailed and will regulate all activities included operational intervention. Furthermore, FANR is preparing for a radiation monitoring network around the Barakah site. ENEC is also developing emergency action levels for precautionary protective actions based on reactor conditions as part of the onsite plan required by FANR's regulations. The necessity for effective communication to the public is recognized. FANR is developing its own

his presentation "The Safety and Security of Radioactive Sources" in Abu Dhabi in late October. Some of the IAEA meetings in which FANR participated recently were:

- Nuclear Security Guidance Committee meeting in May, 2013;
- IAEA Consultancy Meeting on Addressing Current and Emerging Cyber Threats in Security Planning January, 2013;
- IAEA Technical Meeting on Incident Response Planning for Computer Security Planning, March, 2013; and
- IAEA Consultancy Meeting to Develop an Implementing Guide, "Sustaining the Nuclear Security Regime."

ENEC also presented a substantial briefing on safety evaluation conducted at the Barakah NPP site.

A project progress report for Barakah Units 1-4 was presented, including a chart that depicted the Barakah site progress beginning from 2009, the prime contract award, through to Unit 4 completion in 2020. The report clearly illustrates that the project is on schedule. Unit 1 is progressing on schedule – overall progress is on target although construction is slightly behind. A number of critical paths are being mitigated through acceleration plans, sequencing changes, and increased ENEC oversight and management.

Unit 2 is also progressing on time with the first concrete laying milestone being met in April 2013. Lessons learned from Unit 1 are being implemented. Units 3 and 4 also are progressing on schedule with major manufacturing under way and site preparation work proceeding well in advance of the contract. The CLA for Units 3 and 4 is expected in March, 2014. The central focus remains on Unit 1 and power by 2017.

Returning to Unit 1 the present forecasted date for delivering the reactor vessel is by mid - 2014. Plans are in place to increase the number of experienced Korean personnel in critical areas and also provide improved management processes (for example, productivity and quality assurance). Installation of the reactor vessel will initiate enhanced security arrangements consistent with FANR Regulations.



emergency response procedures and building an emergency operations center. An Emergency Preparedness Review mission by IAEA is expected in 2015 and the objective is that the system be fully in place by 2016.

FANR has participated in a number of international conferences and IAEA meetings. FANR presented a paper "Experience of an Embarking Country" at the Conference on Enhancing Global Efforts in Vienna in July and presented two papers at the Conference mentioned by Ambassador Al Kaabi in

Changes in design requirements produced procurement and detailed design delays; predicted deliveries are two months late to support the Energize Switchyard Milestone. Temporary power will be utilized for low load requirements to mitigate delays. KEPCO is working with its subcontractor to identify construction improvements. The Switchyard will remain a critical area for the project.

ENEC, as did FANR, noted that work at ENEC in formulating the OLA for Units 1 and 2 is proceeding ahead. The objective is submittal of the OLA to FANR by early, 2015. ENEC noted with respect to nuclear liability, that operations are beginning to be actively considered, that the UAE is a signatory to the Vienna Convention on Nuclear Liability, including its regulatory framework, and the Joint Protocol. This is the generally accepted arrangement world-wide for nuclear liability.

ENEC confirmed that a report addressing all aspects of the recent lamentable Counterfeit, Fraudulent and Suspect Items issue that has been revealed in South Korea and its effect on the Barakah NPP was submitted to FANR. The report identifies significant steps taken by ENEC and KEPCO to implement additional quality assurance controls beyond the typical quality assurance program elements. This problem originated with certain South Korean components. ENEC has met with KEPCO about this. ENEC reported that KEPCO has done a 100% review in which KEPCO identified about 20 components – all non-nuclear components. ENEC continues to monitor this with KEPCO as well as with recognized quality assurance experts.

On Unit 1 procurement about 80% of the parts have been ordered, other Units are far behind as the focus is on Unit 1. The manufacturing of parts is set up on the basis of four Units. If there is a problem with a part in Unit 1, it will be replaced with a part initially intended for Unit 2 and a new part can be made for Unit 2 without causing major time delays. In addition, a sustainability point, ENEC noted that the project cycle was entering into the peak construction period, 2014-2017; recruitment, capacity building and support services are being prioritized to address Barakah site requirements and Emiratisation.

Continuing the Unit 1 focus, a systematic approach for compliance with respect to construction license conditions is being implemented to lessen the likelihood of violations. ENEC is ensuring that KEPCO is taking proactive measures to mitigate critical areas and issues are promptly resolved or elevated. The same is true for mitigation plans from earlier project issues. Emerging technical, construction and schedule issues are promptly assessed with respect to the impact on the overall Project; examples of this are captive equipment delivery delays and the manufacturing and delivery of the Radiation Monitoring System.

Next came an update on the Operational Readiness Program. There is an office in ENEC whose mandate is to ensure operational readiness and to move ahead and establish the operational company. Significant progress has been made in establishing the structure for delivering the Program over the last five months.

Major challenges exist for senior level recruitment for the Operating Company but this effort nevertheless is progressing well. The focus is now on the next layer of management. While there were 48 new hires in September, staffing the



Training Plan with Emirati talent remains a challenge – but one that is receiving good attention. The hiring rate has increased from 11 to 30 per month to meet the Operational Company growth by 2014. The objective is to adopt the South Korean model and adapt it to the UAE. Training in South Korea and the UAE is different and must be integrated. The adopt/adapt process is intended to create a model of an operating company

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starting a new program in the Middle East. ENEC believes that this program will set the standard for the Middle East and countries with emerging commercial nuclear industries. The Operating Company will use an Integrated Management System methodology. It will be based upon “Best in Class” operating models with a focus on a multi-cultural/multi-national workforce using adapt and adopt philosophy. It is planned that this system be 50 percent developed by the end of 2013 and entirely complete by May, 2014. Korean software is being translated into English. Some 832 operations procedures will be needed by September, 2014 to support simulator acceptance training.

A workshop was held during mid-September involving FANR, KEPCO and ENEC Operating Company personnel to discuss the Operations License Application requirements. Work in preparing for this is proceeding ahead. KEPCO’s responsibility to deliver fuel was reviewed in September, 2013. It is clear that this will be a very complex project involving many different personnel, process and plant requirements and will require considerable management support. The multi-cultural nature of this project is a major issue. Overall the Program Management Office is transitioning from design to operation. Developing the Operating Company and preparing for operations is taking a bit longer than anticipated but this will have no effect on construction. The ENEC CNO will hold that position in the Operating Company as well. The team today is more American in composition but this will be offset by following the FANR model and bringing in more leadership from South Korea as well as Europe. The principal subcontractors for ENEC and KEPCO working together (Hyundai, Samsung, and Doosan) will have the same role with the Operating Company.

ENEC reported that Emergency Preparedness capability is being rapidly developed. The onsite programs contract is now 60% complete. The Onsite Plan and associated implementing procedures spell clear lines of command and control in response to an emergency situation at the Barakah site. The Emergency Director on site will clearly be in charge in case of an emergency. The Incident Commander function has been accepted by the UAE Ministry of Interior. The

responsibility of this official will be only offsite and he will coordinate with the Emergency Director only outside the boundaries of the plant. FANR of course is the regulator but it is not a response organization. Pursuant to its direction there is no formal role for FANR in an emergency situation. It will act only in an advisory role and do oversight and evaluation of actions.

A contract award was made in October, 2013 to construct the Emergency Center. There will be a year and a half for construction and commissioning. A consultant has been hired to act as a project manager for supervision and oversight of the construction and engineering of the Emergency Center. The complex will include the Emergency Operations Facility, the Emergency Operations Center and a Public Information Center. It will be located approximately 50 kilometers from the Barakah site, outside the Urgent Protective Action Planning Zone.



## Security assessment and recommendations

FANR reported that revision 1 of the Physical Protection Plan (PPP) for the Barakah NPP Construction Phase 1 was submitted on April 28, 2013. This was one of the conditions set in connection with Construction License approval (CLA) for Units 1 and 2. This plan will serve for Units 3 and 4 as well and thus is applicable to all four units. Review of the Plan for the CLA for Units 3 and 4 will focus primarily on: different activities among multiple units; cyber security; and the security and safety interface. The PPP Construction phase 2 (before the arrival of nuclear fuel on site) for Units 1 and 2 will be submitted by ENEC in December, 2013.

The Physical Protection Plan (PPP) for operation will be based on the IAEA draft implementing guide. FANR and ENEC have agreed on its content and will have periodic meetings to enable FANR to follow its development. Timelines will be proposed by ENEC and ENEC will submit drafts of part of this Plan to FANR as it develops, on such subjects as identification of target sets, vulnerability assessments and physical protection design.

FANR-Reg-08 requires ENEC to submit a Cyber Security Plan (CSP) as part of the PPP and it was submitted in June, 2013. There are three phases to the CSP, development in 2013, implementation in 2014 and 2015 and maintenance from 2015 onward.

FANR next discussed the issue of Aircraft Impact Assessment (AIA) and Loss of a Large Area (LOLA). ENEC submitted its AIA for CLA 1 and 2 in December, 2010. There were several impact assessment reports as well as a White Paper on LOLA evaluation following the ENEC submission. In February, 2013, ENEC announced that an updated version for the 4 units of the various submittals will be complete by December, 2013. The LOLA assessments will continue through 2014. ENEC expect a final report by the end of 2014 and is planning to submit the report to FANR by early 2015.

The Nuclear Security Inspection Plan for 2014 was mentioned by FANR. It will include access control and physical barriers, the CSP and the organization, training and qualification of the security forces.

The CICPA, along with other relevant governmental entities, is responsible for developing and specifying the Design Basis Threat (DBT) for Barakah NPP. ENEC is responsible for the physical protection of Barakah NPP as implemented by CICPA and FANR reviews the PPPs for Barakah NPP and enforces ENEC implementation of them.

Interactions with the IAEA on security include a meeting on the “Safety and Security of Radioactive Sources” to be held in Abu Dhabi in October, 2013 and meetings at the IAEA during 2013 of the Nuclear Security Guidance Committee, an IAEA consultancy meeting on Current and Emerging Cyber Threats in Security planning and an IAEA Technical Meeting on Computer Security Events.

# SECURITY

ENEC also discussed programs to ensure physical and mental fitness for duty, which is an important part of security. The Fitness Monitoring program during construction will be inaugurated on May 15, 2014 and continue to the end of February, 2015. This program with respect to Unit 1 will begin with the installation of the first item important to security and will remain in effect until commissioning and the start of Cold Hydro-static testing. The second stage will begin with the start of Cold Hydro-static testing and will remain in effect until 30 days prior to receipt of the first fuel. This program through the first two stages is being established pursuant to U.S. regulations. The third phase, Fitness for Duty program for operation will be established pursuant to guidance from FANR. Inspectors will be watching for aberrant behavior, and looking for anyone doing something that could raise suspicions about possible drug or alcohol abuse.

ENEC will implement a Safety and Security Interface policy prior to the end of this year. It will be based on FANR-REG-08 on physical security, the relevant US regulation and CICPA procedures. Interim measures have been established to ensure adequate interface prior to the implementation of a formal program. ENEC has established a Classified Information Protection Program. There will be a physical protection program for system design. All conceptual and detailed design work for the PPPS shall be completed in the UAE, ENEC will grant design team members access to classified information pursuant to approximate procedures. All design documents initially will be controlled as "classified" and subsequently will be reviewed to consider re-classification to unclassified. Any legacy classified documents will remain in the UAE until a process is established that allows documents to be released outside the UAE. KEPCO, ENEC and CICPA will work together to establish PPPS procurement packages that do not contain classified information.

The two security departments of ENEC were consolidated into a single organization in May, 2013. The organization had been restructured into four functional areas, each headed by a Security Director: physical security; site security; personnel security; and information security.

Turning to cyber security, the CSP describes the cyber security program. The scope of the cyber security program, phase one includes; threat assessment; Design Basis Threat (DBT); cyber security plan; gap analysis; implementation plan; and approval of the CSP.

The second phase, or the implementation phase, has four sub phases: identify crucial assets; assess controls; implement controls; and operational readiness. The elements of the implementation phase include: among other things: roles and responsibilities; security in depth strategy; management, operational and technical controls; cyber security assessment review and update; and cyber security culture. It is important to align security culture with the overall safety culture of the organization.

The third phase is the maintenance of the cyber security program.

The CICPA briefing was the last before the Board discussion. This briefing included the development of the physical security strategy for Barakah NPP. Since December, 2012 the CICPA has completed a comprehensive vulnerability assessment, a document on physical security requirements and a Security Defensive Strategy. The overall security protection strategy for Barakah NPP includes the IAEA Security Series, FANR regulations, the Barakah DBT, target set identification and the Vulnerability Assessment (VA).

The VA is a systematic method of designing and evaluating a security posture to determine its overall measure of system effectiveness based on defined assets and threats. It is a process recognized by the U.S. Department of Energy and the IAEA. It allows for the use of non-complex technology thereby minimizing maintenance; it maximizes the efficient and effective use of security forces; and it provides a cost-effective, long term security solution. The VA meets the requirements of the IAEA, FANR and international best practices.



The VA is also tailored to the local environmental conditions at Barakah NPP as well as local security strategy. Modeling is used until the Barakah site is built; U.S. data and real experience is utilized. There is a review of the DBT annually. The final results of the VA are blended with security force strategy. The performance of the plant security personnel will influence the outcome of the exercise, and any remedial action needed. This will be one of the first modeling efforts in security that can show real results after completion.

Security requirements involve a set of detailed requirements for all engineered security features necessary for the physical protection of Barakah NPP including intrusion detection, assessment and surveillance systems specifications and barrier and delay feature designs. International guidelines are available from the IAEA, FANR, international best practices and Fukushima lessons learned. How to make technologies survive at Barakah NPP well above DBT is the objective.

The purpose of Security Force Strategy, as guided by the VA and simulation modeling is to determine security force strength, deployment and capability; identify positions and job tasks; designate training requirements and focus on optional weapons and tactics. Simulations are run to optimize tactics and weapons.

CICPA has implemented the first approved Information Protection Program with an emphasis on protecting sensitive and classified information. It continues its partnership with the U.S. Department of Energy as well as seeking international best practices. It has recently toured nuclear facilities in Finland and a new training center in China. CICPA is developing the Fitness for Duty program for itself consistent with FANR regulations as well as a Nuclear Quality Assurance Program. CICPA is aware that time is moving on at the Barakah site, by 2016 units 1 and 2 will have fuel loaded or being loaded. CICPA has developed a department for emergency response to cover all areas.

CICPA is currently developing a protection strategy with ENEC for Items Important to Safety to be delivered in the first quarter of 2014. It is developing the interim phases of the security strategy to accommodate construction and operations for 2016-2020 and is participating in the drafting of the PPP for Barakah NPP Phase II.

# NON-PROLIFERATION

## Non-proliferation assessment and recommendations

Ambassador Hamad Al Kaabi began the MOFA briefing with a series of quick updates:

- The UAE submitted its 3rd national Report in August pursuant to the Convention of Nuclear Safety
- The Japan - UAE Nuclear Bilateral Agreement was signed in May 2013
- UAE active participation in major meetings was noted:
  - the International Atomic Energy Agency (IAEA) conference on Nuclear Security in June in Vienna
  - the International conference on Nuclear Power in St. Petersburg in June
  - the IAEA General Conference in September in Vienna
- The UAE was elected again for a seat on the IAEA Board of Governor's for 2013-2015: The Board acknowledged Ambassador Al Kaabi for his excellent work and achievement
- The UAE participated in preparations for the 2014 Nuclear Security Summit (NSS). One issue is how to transfer the NSS achievement to a wider group at the IAEA. In 2016 a NSS is to be held in USA. Focus could include efforts to secure radioactive sources as well as nuclear material.

Ambassador Hamad Al Kaabi continued to discuss further international cooperation.

There has been active work among GCC states to develop a Regional Nuclear Emergencies plan. A first draft of such a Plan has now been completed and is under review by Member States. A joint GCC-IAEA meeting was held in Vienna in August 2013 for the IAEA to review and comment on the draft Plan.

An IAEA international conference on the safety and security of radioactive sources was held in October, 2013 in Abu Dhabi.

Preparation was underway in October to host IFNEC meetings in Abu Dhabi. Leasing fuel remains a possibility but IFNEC is now focused on the back end of the fuel cycle. As of now no country is prepared to take back spent fuel unless it provided the fuel. IFNEC has developed a high level paper on comprehensive fuel services (CFS) with a focus on strategies for the back end of the fuel cycle. The paper addresses: existing and potential back end services and scenarios; opportunities for CFS; non-proliferation issues such as managing recycling services and transportation considerations; the emergence of a comprehensive market; and it presents its conclusions and recommendations.

The main conclusions were:

- The allocation of responsibilities should be addressed through the development of international agreements;
- A long term commitment from the country hosting the disposal facility is necessary;
- Bi-lateral and multi-lateral cooperation is important;
- Effective regulatory and legal mechanisms to support an expanded development of CFS is necessary;
- Sharing responsibilities and any commercially based offering must be based on intergovernmental agreements that include the required long term provisions;
- A multinational disposal approach that focuses on regional cooperation is perhaps the most promising opportunity for developing the back end of CFS;
- Back end fuel services must eventually be available globally in a manner that does not adversely affect fair and open competition in the nuclear energy supply and services markets;
- International standards and oversight for safe operations should be developed by international bodies;





- International accepted model transportation and model storage agreements to support commercial – based CFS for the back end of the fuel cycle must be developed.
- Such model agreements should include provisions covering the following:
  - the host country to guarantee the long-term reliability of the disposal service;
  - the exporting countries to actively assist in obtaining necessary assurances regarding the long term safety and reliability of the disposal services;
  - transfers between the exporting country and host country must be clearly defined and address the responsibility/liability between the parties;
  - financing responsibilities and business models should be clearly defined;
  - the regulatory oversight regime also must be well defined;
  - procedures to settle potential disputes must be provided.

In concluding Ambassador Hamad Al Kaabi presented an overview of UAE technical cooperation with the IAEA in the January to August, 2013 time frame noting that there had been a higher focus on nuclear security and on emergency preparedness and a continuing focus on nuclear safety, nuclear power production and general contributions to the work by the IAEA. In addition Ambassador Hamad Al Kaabi outlined progress on the UAE Export Control Regime. He recalled that:

- In 2007, the UAE adopted a stringent export control law;
- In 2008, this law was amended to further strengthen its implementation;
- In 2009, the national nuclear law identified export/import as an activity regulated by FANR;
- In 2010, the UAE ratified the NPT Additional Protocol, which now has 120 parties although the IAEA may target only specific countries;
- FANR has issued a regulation establishing a System of Account for Control of Nuclear Material and Application of the Additional Protocol.

# NON-PROLIFERATION

Ambassador Hamad Al Kaabi noted that there is a streamlined process for implementation and submission of declarations to the IAEA and that the 2008 Nuclear Policy committed the UAE to export/import rules in strict compliance with Nuclear Supply Group (NSG) guidelines for nuclear transfers. A new UAE regulation on export control which adopts the NSG guidelines is in its final stages.

FANR in its presentation reported on various regulations and other actions in the Safeguards area. As mentioned by Ambassador Hamad Al Kaabi a new regulation has been adopted establishing a System of Accounting and Control of Nuclear Material and Application of the Additional Protocol. There have been joint activities with ENEC and the IAEA relating to the installation of IAEA containment and surveillance measures at the Barakah site and additional activities by FANR relative to nuclear material licensing and Safeguards inspections. There also has been broad implementation of FANR export/import regulations at ports, airports and border stations throughout the UAE in cooperation with federal and local customs authorities.

# TRANSPARENCY



## Transparency assessment and recommendations

Director General Travers began the FANR briefing with a discussion of transparency issues. He noted that FANR had conducted public outreach meetings at Ghayathi, Al Ain and Abu Dhabi since the last Board meeting and emphasized the importance of the process. He also mentioned the FANR internal newsletter. Lastly, Director General Travers indicated that FANR had established a social media policy. The Board would like to hear more about this policy at its next meeting in March, 2014.

ENEC conducted two ENEC forum meetings in October in Ras Al Khaimah and at the Abu Dhabi Exhibition Center. This latter meeting was well attended and it was held during the IAB meeting. All the Board members were invited to attend but were just returning from a visit to the Barakah site and most members found it difficult to attend this meeting. However Lady Barbara Judge did attend and during the proceedings was offered the podium to make a short speech and take questions from the audience. The Board hopes that there will be another such opportunity at the March, 2014 meeting.

FANR also reported workshops and meetings with entities involved in transfer of controlled items. These included workshops for shipping companies at Dubai and a first national workshop on transfer of control of nuclear cargos in cooperation with Dubai World.

# SUSTAINABILITY



## Sustainability assessment and recommendations

ENEC provided, as it has done for each meeting of the IAB, an important presentation on sustainability, human relations and capacity building.

The training courses for Barakah NPP personnel currently underway were emphasized. Operations and maintenance personnel as well as engineers are pursuing training courses in ENEC's internal program as well as the Higher Diploma Nuclear Technology (HDNT) degree program. 203 employees are attending internal ENEC training courses and there are 144 students in the HDNT program. The Generic Fundamentals Examination is a FANR required examination, testing knowledge of basic power plant theory. 18 students took the first examination with 15 passing and 22 took the second examination with 15 students passing that one as well. Nuclear development training is available to UAE nationals by scheduling attendance in the Westinghouse program in Pittsburgh. This involves four weeks of introduction training on line, four weeks in the classroom and seven weeks of simulator training. Four employees are attending the current program; four are planned to enroll in the program beginning in December, 2013 and three for the program next summer. ENEC is actively planning for the long term in these efforts.

The Oversight Knowledge Package project was also explained in the briefing by ENEC. This project is becoming part of the national ethos of the country and is helping recruitment. The scope involves some 97 areas of knowledge for effective oversight of Barakah NPP processes of engineering, material management, quality surveillance and construction.

Areas of knowledge are first identified and then fields and sources are defined. Presentations involve: regulations, codes and standards, design and engineering manufacturing, shipment, and storage. There are bi-weekly sessions with mentors and monthly, quarterly and bi-annual assessments, involving some 388 presentations over four years. Accredited training and measurable achievement is anticipated.

FANR presented significant information on sustainability issues. FANR described its program for operator certification and training. Nuclear Law Article 5, Provision 25 and Article 36, Provision 4 mandate FANR to ensure that all operating personnel possess the necessary level of competence. FANR regulations provide for the certification of Reactor Operators (RO) and Senior Reactor Operators (SRO). The first group of ENEC candidates, 11 RO and 7 SRO candidates completed generic fundamentals in March, 2013 and are continuing their training. A second group, 7 RO and 14 SRO candidates, began generic fundamental training in June, 2013. Simulator installation and commissioning is currently scheduled for dates between October 2013, and March 2014. FANR has been actively reviewing this program, having conducted a formal review and assessment and approved the training plan in June, 2013. Written evaluations have been provided to ENEC and this fall FANR will conduct an observation of the on the job training part of the training plan in South Korea. Initial observations by FANR are that Korean training practices may not conform to ENEC standards and some FANR requirements – ENEC and FANR may have higher standards – and ENEC and KEPCO are developing training procedures and materials

shortly before they will be needed for implementation. This comment by FANR is of concern and the Board requests that FANR make a further report on this issue at the next IAB meeting.

FANR described its efforts in capacity building. The objectives are to ensure that all FANR employees are skilled and competent as a result of continuous training and development. There is a strong emphasis on training and development of UAE nationals to acquire the competence to effectively contribute to FANR's core functions. This is arranged through the UAE Nuclear Scholarship program, which is a cooperative program among FANR, ENEC and Khalifa University of Science, Technology and Research (KUSTAR). In addition, individual development plans including an internship program and a mentoring program exist at FANR focused on UAE national employees.

The following examples were provided from the achievements of the Education and Training programs of FANR:

- In 2013 two Master degree graduates joined the Nuclear Security Department;
- Six trainees from the Master's program and two other trainees will graduate from the Liverpool, UK John Moores University and Risktec Solutions (Risk and Safety Management) in December of this year;
- One trainee graduated with a Master's degree in Science, Radiation and Environmental protection from the University of Surrey, United Kingdom;
- One student graduated and two will graduate in February 2014 with a Master's degree in international nuclear safety from the KINS-KAIST Master's program;
- Twenty FANR employees completed the four months long training program of Gulf Nuclear Energy Infrastructure Institute established in cooperation with Khalifa University, Sandia National Laboratory and Texas A&M University;

The Employee Development program at FANR is tailored to new FANR employees to help familiarize them with their roles and responsibilities at FANR. Both Emirati and expatriate employees are attending numerous FANR in-house training courses. There are knowledge sharing efforts at FANR aimed at sharing across the department. There is also a secondment program to enable a FANR employee to work at another UAE government agency for up to six months. Knowledge sharing is important to: minimize the risk of knowledge loss due to employee mobility; develop harmonized approaches to build the experience necessary to continually improve FANR regulations; optimize costs; and to assure knowledge transfer from one generation to another to ensure sustainability of the UAE nuclear program for the long term.

The Board noted that it did not receive answers to the questions listed by ENEC with respect to the future of ENEC Operating Company and hope to receive those at the next Board meeting.

The Board commented there was not a presentation on waste management this time and looks forward to a discussion of this issue at the next meeting.

It was also noted with satisfaction that fuel had already been contracted for seven years into the future.

Remarkable progress was observed at this visit to the Barakah NPP site since the last visit that took place two years ago. Living arrangements for personnel on site are a critical matter on the road toward long term management of an operational the Barakah NPP site. There must be family housing, schools, etc.

Emiratization is an important issue. One aspect of this about which there has been little discussion on the Board heretofore is Emiratization of supply. Local industry is capable of making steel, concrete, wires etc. at competitive prices. Localization of supply for a newcomer nation is normally slow. This was the case in Japan, for example, but the UAE has emphasized speed throughout the program because of the expected energy shortfall in 2017. Therefore it is important to keep a strong emphasis on Emiratization of supply as well. It was

# SUSTAINABILITY

mentioned that there are three permanent local companies already supplying the Barakah NPP site. These are: Emirates Steel Industries; Arkan (for concrete) and Ducab (for cabling). It would be instructive to the Board to learn more about these and other such companies in the UAE during the next meeting.

The Board also emphasized that there must be good coordination between the Ministry of Interior and the Emergency Administration on site with respect to safety. An important feature of Barakah NPP on-site emergency management plan is the independence of decision making from government interference – it is consistent with international best practices, an important lesson learned from Fukushima. The exclusion zone around the site where no one is permitted to enter without permit will be one kilometer in all directions. The Board understands that the next zone around the plant is the non-development zone with a radius of three kilometers. The Board would like to have more information on the zones and respective controls of entry and permitted activities, as well as a review of the criteria for establishing the boundary of the exclusion zone, at the next meeting.

The Board extends its compliments to the UAE on a truly successful multinational program. The Board compliments are extended as well to the UAE for such extensive participation in IAEA activities. The middle to long term vision of the role of the UAE nuclear program is that it will be a key industry for the region. The Board also compliments the UAE on a successful worker safety program as well.

At the next meeting the Board would like to hear more on the faulty components issue. This is an important issue which the Board wishes to fully understand. Lastly, FANR mentioned that it is developing a social media policy. The Board requests a briefing on this subject during the next meeting.

The Board is grateful to the UAE and the supporting entities for outstanding presentations and informative meeting. The Board congratulates the UAE on the continuing success and progress of the nuclear power program and finds that the UAE in its program remains fully committed to the principles of safety, security, non-proliferation, transparency, and sustainability.



## **ACKNOWLEDGEMENT**

The International Advisory Board would like to thank all who were involved in developing this report.