



IAEA

International Atomic Energy Agency

Interoffice Memorandum

To: A. Omoto,
DIR-NENP

From: I. Khamis,
NPTDS

Through:

Clearance: A. Rao,
SH-NPTDS

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Subject: Meeting Report on the 1st Technical Meeting of the Technical Working Group of the Nuclear Desalination Group (TWG-ND)

Budget codes 1010/5220/A5010221/185/05ME36820

Place of Meeting Vienna, Austria

Date of Meeting 8 to 10 June 2009

Invited countries Algeria, Argentina, China, Cuba, Egypt, France, Germany, India, Indonesia, Kuwait, Libya, Morocco, Pakistan, Russia, Saudi Arabia, South Africa, Spain and USA.

ATTENDING EXPERTS

| Name | Country/Organization | Date |
|-------------------------|-----------------------------|-----------|
| Mr. A. Belkaid | ALG – CRNB | 8-10 June |
| Ms. M.L. Japas | ARG – CNEA | -- |
| Ms. W. Li | CPR – INET | -- |
| Mr. J.F. Zuñiga Santana | CUB – CUBAENERGIA | -- |
| Mr. S. Dardour | FRA – CEA | -- |
| Mr. G. Tusel | GFR – GFT Desalination GmbH | -- |
| Mr. P.K. Tewari | IND – BARC | -- |
| Mr. A. Sudi | INS – BATAN | -- |

cc:
ARMS
File

| Name | Country/Organization | Date |
|-----------------------|--|-------------|
| Mr. N.M. Al-Awadi | KUW – Kuwait Institute for Scientific Research | 8-10 June |
| Mr. S.M. Ghurbal | LIB – Atomic Energy Establishment | -- |
| Mr. Y. Bouabdellaoui | MOR – COPSAN | -- |
| Mr. A.S. Al-Arifi | SAU – Salinw Water Conversion Corp. | -- |
| Mr. J. Van Ravenswaay | SAF – M-Tech Industrial | -- |
| Mr. F. Alonso | SPA – Empresarios Agrupados S.A. | -- |
| Mr. R. Faibish | USA – Argonne National Laboratory | -- |
| Mr. S. Nisan | NDS international, France (invited consultant) | -- |

1. Background

The International Nuclear Desalination Advisory Group (INDAG) was established by the IAEA in 1996. INDAG played an active role in the past years, contributed to promotion and stimulation of nuclear desalination activities, and provided a forum for Member States to exchange information on the technological developments, operations, and demonstration of integrated nuclear desalination systems. To enhance its functions, the IAEA has reformed INDAG into a Technical Working Group on Nuclear Desalination (TWG-ND) in 2008.

This meeting was the first meeting of the newly formed TWG-ND. The meeting was held from 8-10 June 2009 at the VIC, Vienna, and attended by 15 members.

Mr I. Khamis acted as the Scientific Secretary and Mr P.K. Tewari of India served as the Chairperson.

2. Objectives of the meeting

The objectives of the meeting were to:

- Provide a forum for the exchange of information on nuclear desalination activities in Member States, identify important topics for discussion at SAGNE;
- Review the progress of and provide advice and guidance on the IAEA's activities in nuclear desalination.
- To provide advice on preparatory action by Member States for implementing nuclear desalination demonstration projects;

3. Agenda

1st Meeting of the Technical Working Group on Nuclear Desalination TWG-ND
Vienna, June 8-10, 2009
Room A2774
Agenda

Monday 8 June 2009

1. Opening Session

| | | |
|--|--|-------|
| • Welcome & opening remarks | IAEA | 09:00 |
| • Introduction of TWG-ND Members and Observers | all | 09:10 |
| • Discussion and Finalization of the Agenda | all | 09:20 |
| 2. Status of National & International Programmes on Nuclear Desalination | | |
| • Highlight of the objectives of the meeting, expected outcome, and TWG-ND ToR and Functions | I. Khamis | 9:40 |
| • Algeria Mr A. Belkaid, | The Status of Seawater Desalination in Algeria | 10:00 |
| • Argentina – Ms M.L. Japas | | 10:20 |
| • China – Ms W. Li | Nuclear Desalination in China | 10:40 |
| COFFEE BREAK | | 11:00 |
| • Cuba – Mr J.F. Zuñiga Santana | Information on Nuclear desalination for the IAEA's Technical Working Group | 11:15 |
| • France – Mr S. Dardour | Nuclear Desalination Activities at CEA | 11:30 |
| • Germany – Mr G. Tusel | | 11:40 |
| • India – Mr P.K. Tewari | Nuclear Desalination Activities in India' | 12:00 |
| LUNCH | | 12:20 |
| • Indonesia – Mr S. Ariyanto | Some research topics on improvement of desalination for water supply | 14:00 |
| • Kuwait – Mr N.M. Al-Awadi | Kuwait and the Nuclear Desalination Option: A Point of View | 14:20 |
| • Libya – Mr S.M. Ghurbal | National activities and views on ND | 14:40 |
| • Spain – Mr F. Alonso | | 15:00 |
| • Saudi Arabia – Mr Al-Arifi | | 15:20 |
| COFFEE BREAK | | 15:40 |
| • South Africa – Mr Van Ravenswaay | Overview of Nuclear Desalination in South Africa | 16:40 |
| • USA – Mr R. Faibish | U.S. input to the first meeting of the Technical Working Group – Nuclear Desalination (TWG-ND) | 17:30 |
| • Adjourn Day 1 | | |
| | <i>Evening out (Viennese Wine Tavern "Heurigen")</i> | 19:15 |

Tuesday 9 June 2009_

3. Review of IAEA Activities on Nuclear Desalination

- | | | |
|--------------------------------|-----------|-------|
| • Current & planned activities | I. Khamis | 09:00 |
| • Discussion | all | 10:00 |

| | | |
|---|-------|-------|
| • Road map | | |
| COFFEE BREAK | | 10:40 |
| 4. Discussions on future IAEA activities: | | |
| • DEEP & Toolkit, | | 11:00 |
| • Technical Meetings, Newsletter, CRPs, | | 11:40 |
| LUNCH | | 12:20 |
| • Review of DEEP Economic Parameters | Nisan | 14:00 |
| • .Discussion | | 14:40 |
| | | 15:20 |
| COFFEE BREAK | | |
| • Discussions | All | 16:00 |
| • Draft meeting recommendations | | 16:30 |
| | | |
| • Adjourn Day 2 | | 17:00 |

Wednesday 10 June 2009_

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|------------------------------------|-----|-------|
| • Meeting recommendations | all | 08:30 |
| • Draft meeting report | | 10:00 |
| • Review & finalize meeting report | | 11:00 |
| • Meeting close up | | 12:30 |

4. Summary of the Work done and results achieved

The IAEA Scientific Secretary presented as an introduction to the Terms of Reference of the TWG-ND and discussed its scope, functions, chairmanship, methods of work and deliverables as related to the IAEA Programme on nuclear seawater desalination. Then, he presented a summary of the IAEA activities (those already implemented as well as those foreseen in the future) in the areas of:

- Coordinated Research Programme (CRP)
- Technical Cooperation (TC)
- Forums for information exchange
- Publications on Nuclear desalination
- Upgrade of Desalination Economic Evaluation Programme DEEP
- Development of a toolkit on nuclear desalination
- Budget & Planning (B&P)

The TWG-ND expressed their satisfaction with the IAEA Workplan on nuclear desalination through the supporting recommendations presented in the report.

Algeria (Mr. Belkaid)

The status of seawater desalination in Algeria was presented. Algerian authorities are investigating the option of nuclear desalination through a feasibility study. The study, a technical cooperation project

with the IAEA, began in 2007 with an objective to elaborate a document which will be used to support the government's decision to introduce the nuclear energy in the country.

China (Ms. Li)

The status of nuclear desalination in China was highlighted. The China's nuclear power development goal is to have an installed capacity of nuclear power plants in operation achieves of 40 million kilowatts by 2020. By the end of 2008, China has nine nuclear power plants with 11 units in operation having total capacities of 9.068 million kilowatts. In addition, 22 units (Lingao II, Qinshan II expansion, Hongyanhe I, Ningde I, Fuqing I, Yangjiang I, Fangjiashan) totalling of 22.1 million kilowatts are under construction.

The rapid development of nuclear power, the lack of water resources, as well as the development of desalination technology is expected to be the drivers for the development of nuclear desalination. Nuclear desalination is considered as an option for some NPPs to support the electricity generation and for the plant's residential use. For example, in Liaoning Hongyanhe NPP, the capacity of the desalination plant during phase I, is about 17,000 m³/d, and to be expanded 100,000 m³/d later in future. The capacity of seawater desalination system in Ningde nuclear power plant is 11,000 m³/d, and the desalination water will be used for the nuclear power plant make-up water.

Cuba (Mr. Santana)

The status of seawater desalination in Cuba was presented. Cuba has already completed a feasibility study on desalination of seawater. As presented, nuclear desalination was not considered an option in the study.

France (Mr. Dardour)

The status of nuclear desalination activities in France, in specific in the Commission of Atomic Energy CEA was highlighted. CEA is developing engineering support systems for nuclear desalination studies, and actively collaborating with India and Libya

Germany (Mr. Tusel)

A view on the use of nuclear energy for desalination and innovative combinations was presented. As the world population increases, more and more people will live in areas with freshwater scarcity. Hence, necessary technical means to reduce this scarcity has to be made, where freshwater has to be made available at socially acceptable cost. This could only be achieved if improved desalination processes with sustainable cost efficient energies were realized.

India (Mr. Tewari)

An overview of the seawater desalination programme in India was highlighted with an emphasis on the role of nuclear desalination programme which has already been demonstrated and achieved several milestones such as:

1. Indigenous capability in design, fabrication and operation of nuclear desalination plant has been demonstrated by its successful construction and commissioning. Product water quality has been achieved.
2. Distilled quality water from seawater was produced from MSF.
3. Drinking quality water from seawater was produced from RO.
4. Under Agency's Technical Cooperation Program, a group of three (3) engineers from Algeria have undergone fellowship training in the field of nuclear desalination including NDDP, Kalpakkam. A two weeks scientific visit for a senior official from Algeria was also organised. More fellowship training and scientific visit may be organised in future as and when such requests are received from IAEA.

It is utmost important that IAEA should continue to play the positive role as facilitating agency. Nuclear desalination demonstration projects, cost reduction strategies through technological innovations and environmental considerations may be taken up more vigorously. Seawater intake and outfall, coupling aspects, pre- and post-treatment, energy recovery and reduction, recovery of

valuables from brine, hybrid concepts, waste heat utilization may be further explored based on site specific and technology specific requirements.

Indonesia (Mr. SUDI)

The status and future planning of nuclear desalination development in Indonesia was highlighted. It was clear that Indonesia is planning to utilise nuclear power for not only electricity but also for co-generation purposes. Several studies have been made in Indonesia looking at feasibility of nuclear desalination. These studies include: a pre-Feasibility Study on Nuclear Desalination in Madura Island, BATAN, 2003, study on techno-economics of HTGR co-generation in BATAM Island, BATAN, 2009, and a study on economy of PWR co-generation in Muria Peninsula: Desalination, BATAN, 2009.

Kuwait (Mr. Al-Awadi)

A point of view on nuclear desalination as an option for Kuwait was presented. It was stated that Kuwait had its eyes on nuclear energy for power/water cogeneration since early seventies of the Twentieth century. The cogeneration option is favoured where power/water cogeneration schemes using thermal distillation or reverse osmosis membrane processes is used. It was envisaged that a nuclear power/water cogeneration plants include light water-pressurized water reactor and multiple effect distillation plants such as 1000 MW/140,000 m³/d or 600 MW/48,000 m³/d could be utilized. Kuwait is revisiting the nuclear power and desalination option in the country as a national program as well as joining efforts with other Arab Gulf Cooperation Council Countries (GCC) in developing a nuclear energy program for electrical power generation and water desalination.

Libya (Mr. Ghurbal)

The national activities and some views on nuclear desalination were presented. Libya has retained the desalination of seawater to be one of the major options to augment national efforts for the supply of potable water and decided to conduct certain activities toward capacity building and cost optimization in this field. A brief summary of some activities were highlighted.

Morocco (Mr. Bouabdellaoui)

Status of National Programme on desalination and expected role of nuclear desalination were highlighted. Morocco has reiterated its commitments to promote further the introduction of nuclear power for electricity production and desalination.

Saudi Arabia (Mr. Al-Arifi)

The desalination programme was highlighted as the largest in the world. It was highlighted that Saudi Arabia is very much interested in nuclear desalination and joining efforts with other Arab Gulf Cooperation Council Countries (GCC) in developing a nuclear energy program for electrical power generation and water desalination. ,

Spain (Mr. Alonso)

The status of the national desalination programme and the role of nuclear power were presented. With 40 years of experience on desalination in the Canary Islands, desalination provide approximately 150 cubic hectometres per year in 2001 and 425 cubic hectometres per year in 2008. A number of very attractive R&D projects on desalination geared towards efficiency and sustainability are currently underway.

No national nuclear desalination initiatives have been undertaken in Spain in the past. However, since RO desalination plant processes are electrical energy intensive, a sustainable long-term electric supply service will be considered. For that reason, some Spanish institutes and companies have been participating in international nuclear desalination R&D programmes.

South Africa (Mr. van Ravenswaay)

An overview of nuclear desalination programme in South Africa was highlighted. Currently most desalination systems use fossil fuels as their energy source. As the Pebble Bed Modular Reactor (PBMR), a helium-cooled graphite moderated high-temperature gas-cooled nuclear reactor, is under development in South Africa, nuclear desalination system using the PBMR is considered as an option.

USA (Mr. Faibish)

The U.S vision and highlight of ongoing activities on nuclear desalination was presented. The USA is reiterating its position to continue its involvement in the TWG-ND activities and meetings to the extent possible. The U.S., via Argonne National Laboratory (ANL), has been actively engaged in various techno-economic analyses of possible deployment of nuclear power plants for the cogeneration of power and water. These studies clearly demonstrated the need for making a sound financial case to support the economic feasibility of such projects.

5. Conclusions

1. The TWG-ND highly appreciates past, present and future IAEA nuclear desalination activities.
2. Nuclear desalination is gaining increased importance for member states that are experiencing wide-spread water and power shortages. The goal of these activities is to produce fresh water at socially acceptable cost.
3. The TWG-ND members raised their concern regarding the severe budget cuts in support of nuclear desalination activities at the IAEA.
4. The TWG-ND strongly believes that past and any potential future budget cuts relating to IAEA's nuclear desalination activities is expected to seriously hinder implementation of future activities for the benefit of Member States.
5. The TWG-ND appreciates past extra budgetary contributions by Member States.

6. Recommendations

1. The TWG-ND endorses the IAEA plans (presented by the Scientific Secretary) on the issue of nuclear desalination. Activities of high priority include:
 - a. Studies on economically and technically viable cogeneration options using nuclear power.
 - b. Assembly and dissemination of an online nuclear desalination toolkit for wide use by Member States (currently under development).
 - c. Regional workshops on nuclear desalination-related topics per request from Member States.
2. The TWG-ND members request IAEA's full support (including appropriate funding level and required manpower) for the proposed ND activities. It also recommends the increase of programmatic fund allocations to match or exceed levels of funding of previous P&B 2006/07 cycles.
3. The IAEA should address the efficient use of water in nuclear and related facilities which may involve the use of water desalination.
4. The IAEA should address the use of different qualities of water in other potential facilities which may involve the use of nuclear desalination.
5. Workshops on nuclear desalination including related water management issues should be organized as needed for capacity building and information exchange.
6. The TWG-ND supports the IAEA future activities on upgrade (including the updating of economic data), maintenance, bench-marking and validation of DEEP as needed to ensure an up-to-date software package.
7. To compliment DEEP, the IAEA should consider the development of financial analysis tool with bankable model to evaluate the financial viability of nuclear desalination projects to take into account site specific cost and tariff inputs.

8. The TWG-ND supports the introduction and further study of improvement of existing and future technologies for nuclear desalination such as heat pipes as new and efficient heat exchangers and as an additional safety barrier.
9. The IAEA should explore the possibility of developing an integrated ND simulation (including optimization, design issues, ...etc) tool so as to help in capacity building and addressing some of the safety issues.
10. The IAEA should update relevant documents on nuclear desalination such as the Guidebook on nuclear desalination TRS 400.
11. The TWG-ND endorses the completion of the IAEA Technical report addressing the environmental impact of nuclear desalination (under printing). The document should be updated to include results from new research and feedback of experience.