NEWSLETTER

RADIOACTIVE WASTE MANAGEMENT

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The FNCA 2005 Workshop on RWM to be held in Japan at the last week of September 2005

The FNCA 2005 Workshop on Radioactive Waste Management (RWM) is scheduled to be held at Kagamino-cho, Okayama, Japan from September 27 to October 1, 2005.

The workshop will be hosted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan, in cooperation with Japan Atomic Industrial Forum, Inc. (JAIF)

At the workshop, each representative from FNCA countries will report on the recent progress status of radioactive waste management in each country. As each country report.

Following the country reports, roundtable discussions and sub-meetings focused on following issue will be discussed.

- Safety Assessment of Disposal Facility for Low and Intermediate Level Waste (LILW)
- Site Investigation and Siting Procedures of Disposal Facility
- Update of the RWM Consolidated Report
- Interim Reporting of Decommissioning/Clearance Task Group Activity

Tentative Schedule of the RWM Workshop

Sunday, September 25

Arrival of overseas participants at Kansai Airport, Ohsaka

Monday, September 26

Move to Kagamino-cho (Technical visit on the way to Kagamino-cho)

Tuesday, September 27

The 1st day of the Workshop

- Country Report
- Poster/Mini-Exhibition

Wednesday, September 28

The 2nd day of the Workshop

- Sub-meetings :
  (1) Safety Assessment of Disposal Facility for Low and Intermediate Level Waste (LILW)
  (2) Site Investigation and Siting Procedures of Disposal Facility
- Roundtable discussion (1)
  Update of the RWM Consolidated Report

Thursday, September 29

The 3rd day of the Workshop

- Technical visit to NORM/TENORM related facility

Friday, September 30

The 4th day of the Workshop

- Roundtable discussion (2)
  Interim Reporting of Decommissioning/Clearance Task Group Activity
- Roundtable discussion (3)
  Next year's work plan
- Others

Saturday, October 1

The final day of the Workshop

- Closing Session

Responsible JAIF's Secretariat for the Workshop

Mr. Shinichi Fukuda
Project Manager,
Asia Cooperation Center (ACC),
Japan Atomic Industrial Forum, Inc.
(JAIF)

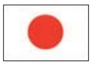
Featured Article "Introduction of New Task Activity of FNCA RWM Project" Decommissioning and Clearance Discussion/Survey Meeting

Followings are shown in this newsletter.

- Japanese Status
- Summary of the visit in the Philippines

Interim report of 2005 visits at Indonesia and the Philippines will be introduced at the RWM Workshop for further discussion among FNCA countries.

Decommissioning and Clearance Status in Japan



Prof. Toshiso Kosako
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Recent Status of Decommissioning Research Reactors in Japan

(1) Decommissioning

In consideration of future decommissioning of nuclear facilities, the basic policy for decommissioning nuclear facilities was established by the Atomic Energy Commission (AEC), resulting in publication as a part of the Long-Term Program for Development and Utilization of Nuclear Energy (Long-Term Program). It states that decommissioning of nuclear facilities should be conducted under the responsibility of their owners in harmonization with local communities ensuring of safety of the public and workers, and that the site of the nuclear power plant should be effectively used for construction of the next nuclear power plant in harmonization with local community.

Table 1 shows present status of research reactors in Japan.

With regard to regulatory aspect, decommissioning of nuclear reactor facilities is covered by the nuclear reactor regulations law (NRRL) named as the law for regulation of nuclear source material, nuclear fuel material and reactors. It requires that prior to starting the decommissioning of a nuclear reactor facility, the licensee should submit an application for decommissioning the facility with its detailed plan to the competent minister. This application must address the decommissioning method, schedule and the means of treatment of nuclear fuels and radioactive wastes.

In consideration of safe decommissioning of reactor facilities, the Nuclear Safety Commission (NSC) issued a safety guide "Basic Concepts for Assuring Safety in Dismantling of Nuclear Facility". This includes requirements and recommendation on actions to be taken which are to ensure that the reactor remains inoperative, maintenance of the facilities during decommissioning, reduction of radiation exposure to the public and workers, treatment of radioactive waste, demonstration of completion, and safety evaluation. This safety guide was first prepared for decommissioning the JPDR (Japan Power Demonstration Reactor), and then it was revised for all nuclear reactor facilities.

(2) Low Level Radioactive Waste Management

Low level radioactive waste are classified into four categories in Japan, relatively high level beta/gamma waste, low level waste (LLW), very low level waste (VLLW), and cleared material. Upper limits of these wastes are provided by law with beta/gamma radioactivity concentration and alpha radioactive concentration.

According to the levels of waste, disposal of waste is made in different way. VLLW is treated as near-surface disposal without engineered barrier (concrete pit type; waste disposal facility in JAERI). LLW is treated as near-surface disposal with engineered barrier (concrete pit type; Rokkasho LLW Disposal Center). Relatively high level beta/gamma waste is treated as sub-surface disposal in depth of from 50 to 100 m.

In order to test VLLW disposal function, a waste disposal facility was constructed at a northern site in the Tokai Research Establishment of JAERI. Figure 1 shows the facility. The disposal pit has external dimensions of approximately 16 m wide, 45 m long, and 3.5 m deep. The disposal pit is divided into six sections by walls, and was equipped with a sliding roof to prevent rain water permeation during the emplacement of waste into it. The wastes were contained in flexible containers, whose total radioactivity was about 228 MBq. The flexible containers were transferred to the facility by truck and were placed in the section by mobile cranes during 1995 to 1996. Approximately 1,700 tons of VLL concrete waste generated from dismantling JPDR was used for the test. The disposal facility should be under 30-year control including surveillance, remedial work, land use control, and so on.

Figure 1 Waste Disposal Facility in JAERI

Current Status of Policy on Clearance System in Japan

It must be useful to prepare the regulatory frame on clearance levels and its monitoring and verification procedures for proper waste management in decommissioning; it makes possible to dispose and/or reuse the waste arising from nuclear energy research and

Table 1 Status of Research Reactors

Reactor		Thermal Output	Status
Kinki University	UTR-KIPKI (1961)	1 W	In Operation
Kyoto University	KUR (1964)	5 MW	In Operation
Tokyo University	YAYOI (1972)	2 kW	In Operation
Rikkyo University	Rikkyo Reactor (1961)	100 kW	Under Decommissioning
Musashi Institute of Technology	Musashi Institute of Technology Reactor	100 kW	Under Decommissioning
Toshiba Corporation	TTR-1 (1962)	100 kW	Under Decommissioning
Hitachi.Ltd.	HTR (1961)	100 kW	Under Decommissioning
JNC	JOYO (1978)	140 MW	In Operation
JNC	FUGEN (1979)	557 MW	Operation Terminated
JNC	MONJU	714 MW	Under Construction

Reactor		Thermal Output	Status
JAERI	JRR-1 (1957)	50 KW	Under Decommissioning
JAERI	JRR-2 (1957)	10 MW	Under Decommissioning
JAERI	JRR-3M (1990)	20 MW	In Operation
JAERI	JRR-4 (1965)	3.5 MW	In Operation
JAERI	NSRR (1975)	300 KW	In Operation
JAERI	JMTR (1968)	50 MW	In Operation
JAERI	JRR-1 (1957)	30 MW	In Operation
JAERI	Mutsu (1974)	36 MW	Under Decommissioning
JAERI	JPDR (1963)	90 MW	Decommissioning Completed

Under decommissioning: Including the facilities that storage only radioactive waste
Operation terminated: Fugen was shut down on March 2003.

decommissioning nuclear facilities.

Recently IAEA reviewed clearance levels and proposed revised ones in the Safety Guide Report RS-G-1.7 in 2004. Reflecting the report, NSC reviewed the clearance levels by using additional scenarios and updated parameter values, and derived revised levels. The resulted levels were not so much different from the revised IAEA values. Then the nuclear regulatory body has determined to adopt the IAEA values taking account of international harmonization.

The clearance system was enforced in registration in March 2005, and ordinance for technical standard of clearance level verification procedure is under discussion to be established near future.

Interim Report on TENORM and Decommissioning / Clearance Discussion and Survey Meeting in The Philippines

Ms. Editha A. Marcelo
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Senior Science Research Specialist,
Radiation Protection Services,
Philippine Nuclear Research Institute
(PNRI)

The TENORM and Decommissioning/Clearance Discussion and Survey Meeting in the Philippines was held at the Philippine Nuclear Research Institute last 15-19 August 2005. Dr. Alumanda M. dela Rosa, PNRI Director welcomed the Task Group and expressed her appreciation for the Task Group visit. The Task Group was led by Prof. Toshiso Kosako and consists of Dr. Takeshi Iimoto, Mr. Tsutomu Ishigami, Dr. Hidenori Yonehara and Mr. Shinichi Fukuda.

TENORM

The objectives of the TENORM Task Group Meeting is to have a deeper understanding on the actual local situation on TENORM issues and to share experiences and exchange of information.

Professor Toshiso Kosako started the meeting by summarizing the previous TENORM Task Group Visits in Australia (2003), Malaysia (2003), Vietnam (2003), China (2004), Thailand (2004) and Indonesia (2005).

The following topics were discussed during the Task Group Meeting on TENORM:

a) International trend of treatment on NORM/TENORM
b) Recent status of NORM/TENORM in both countries
c) Outline of NORM/TENORM guidelines/regulations in both countries
d) Guideline categories for NORM/TENORM in Japan
e) Action steps for NORM/TENORM issues

The TENORM Task Group visited the Philippine Phosphate Fertilizer Corporation in Isabel, Leyte in the Central Visayas Region about 600 km away from Manila last 16 & 17 Aug. 2005 and Cuyab-1 a natural hot spring in Pansol , Laguna about 50 km away from Manila last 19 Aug 2005.

At the Philippine Phosphate Fertlizer Corporation, the Task Group were briefed on plant processes and toured into the different facilities of the phosphate fertilizer plant including the storage area of raw materials and warehouses of finished products. The results of a collaborative study made by the Philippine Phosphate Fertilizer Corporation, local government unit (LGU), non-governmental organization (NGO) and the Philippine Nuclear Research Institute on the phosphogypsum waste, a by-product in the manufacture of phosphate fertilizer were also presented. The objective of the study is to assess the TENORM waste and provide data & recommendations for management of the TENORM waste.

Dose rate at the surface of the raw materials and finished products were measured using a CsI scintillation survey meter. The results of the measurements were within the variation of the dose rate due to global average of natural background radiation. The Task Group concluded that there is no serious problem with respect to radiological protection. However, the Task Group stressed the importance of measurement of activity concentration of the imported raw materials. The Task Group additionally recommended to be aware of the increasing activity of scale attached in the pipeline of the slag and exposure due to inhalation of airborne particles of raw materials.

The Task Group also visited Cuyab -1, a natural hot spring due to volcanic activity of Mt. Makiling , a dormant volcano. The Task Group's interest was to monitor the hot spring for possible presence of radon but the operator of the hot spring explained that pipes were drilled into the spring far away from their place, so that the hot water can be channeled to their place. Monitoring was done in the hot water outlet before going to the pool. The hot water outlet is enclosed in a concrete cubicle about 2m x 3m x 3m with a small open window about 0.5m x 0.5m.

Decommissioning/Clearance

The topics that were discussed during the Decommissioning/Clearance discussion and survey meeting were the following:

a) Recent status of Decommissioning /Clearance in both countries
b) Outline of regulations on Decommissioning /Clearance in both countries
c) Ways of cooperation on Decommissioning /Clearance within the FNCA framework to provide adequate radiation protection

The Task Group visited Philippine Research Reactor PRR-1 and the Radioactive Waste Management Facility.

The PRR-I is an open pool type reactor and started operation in 1963 at 1 MW . The fuel and biological shielding were designed for 3 MW maximum operating power. The reactor was operated for about 20 years without any incidents and modifications . In March 1984, PRR-1 was converted to a TRIGA-type reactor and was restarted and tested at 3 MW in 1988. A few weeks after the TRIGA reactor was tested. The reactor pool lining developed a leak thus the regular operation of the reactor was suspended . The PNRI engineers attempted to repair the cause of the leak by relining half of the reactor pool in 1992. But the deterioration of the reactor was far more extensive than was originally estimated . The reactor is still shutdown. In 1999, the 50 spent fuel elements were shipped back to U.S.A. under the U.S program to recover all spent enriched uranium fuel of U.S. origin, thus the only remaining fuel elements are the TRIGA core.

The Reactor Operations Group has been tasked to prepare a decommissioning plan for PRR-1. As a preparation for this activity, IAEA assistance on radiological characterization of PRR-1 was requested. A one-week workshop (19-23 Sept 2005) will be conducted by IAEA experts for local technical personnel who will be involved in the future decommissioning activities.

After the radiological characterization, a decommissioning plan will be prepared.

The physical protection and security upgrade of the Radioactive Waste Management Facility was funded under the US-DOE Radiological Threat Reduction (RTR) program. The construction of the new trench and installation of security alarm system were completed.

Conclusions

In the final meeting, the Task Group and the PNRI agreed on the following:

a) It is important to balance cost and safety considerations in the management of NORM/TENORM.
b) Guidelines of NORM/TENORM should be harmonized based on international guidelines/standards in order to avoid trade confusion among FNCA countries.
c) Exchange of information and experiences is the most effective means in addressing the issues
d) Manpower development through training programs in FNCA countries with advance technologies/capabilities
e) Practical cooperation in strengthening measurement technology/methods through intercomparison program among FNCA countries

Figure 1 Members from PNRI, PHILPHOS and Japanese Expert Team

News from each FNCA country

Radioactive Waste Repository and Store for Australia

Mr. Lubi Dimitrovski
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Waste Operations & Technology Development,
Nuclear Technology,
Australian Nuclear Science & Technology Organisation (ANSTO)

In May 2003, a site near Woomera in South Australia was selected for a national low-level waste repository. However in July 2004 the Australian Government, following a federal court challenge by South Australia, announced its intentions to drop its plans for the establishment of the national waste repository. This decision resulted from the failure, after 12 years of thorough bipartisan co-operation, to locate and licence a single national facility.

In a counter measure the Commonwealth government, owner of the majority of the existing low-level waste (about 3,700 m^3), said that it would immediately look for a new site on commonwealth land and in due-course co-locate the low-level waste and the intermediate level waste.

In July 2005, following assessment of potential sites on Commonwealth land, both onshore and offshore, the Australian Government announced that three possible locations for the new Commonwealth Radioactive Waste Management Facility (CRWMF) would be considered. The three locations selected are all on Department of Defence sites in the Northern Territory:

- Fishers Ridge located 40km south-east of the Royal Australian Airforce Base near Tindal (near Katherine);
- Mt Everard located approximately 42 km north-west of Alice Springs; and
- Harts Range located approximately 200 km north-east of Alice Springs

The proposed locations are shown in Figure 1 and followed extensive consultation with the Department of Defence.

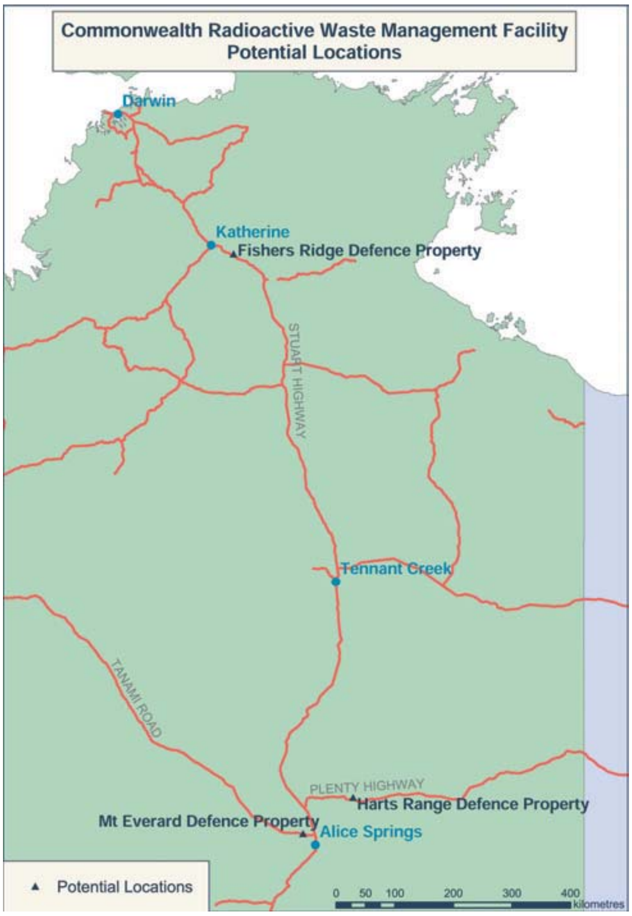

Figure 1 Potential Locations for CRWMF

The new CRWMF will comprise of co-located facilities for low and intermediate level radioactive waste. To determine the suitability of the proposed sites, field assessments and community consultation will be undertaken. The technical assessment of the land will involve evaluation of physical, biological and socioeconomic environments.

The assessment of the physical environment will consider geology, hydrology, geomorphology, meteorology and potential for mineral deposits at the three sites. The biological environment will be assessed for the presence of endangered or significant species. Assessment of the socioeconomic environment will include examination of existing infrastructure and potential incompatibilities between constructing the facility and existing or potential future land uses and population growth. The technical assessment will also involve a combination of desktop studies and on the ground investigations.

It is expected that the field investigations and community consultation will take one year. The anticipated timeframe, assuming that all regulatory approvals are given, it will take six years before the CRWMF is ready to accept radioactive waste.

Once the preferred site is chosen the proposal must go through two regulatory processes including:

- Environmental assessment under the Environment Protection and Biodiversity Conservation Act 1999.
- An environmental impact statement (EIS). If the EIS is successful then licences to site, construct and operate the facility will need to be obtained from the regulator before construction and operation of the facility may commence.

The timeframe of activities is shown in Figure 2.

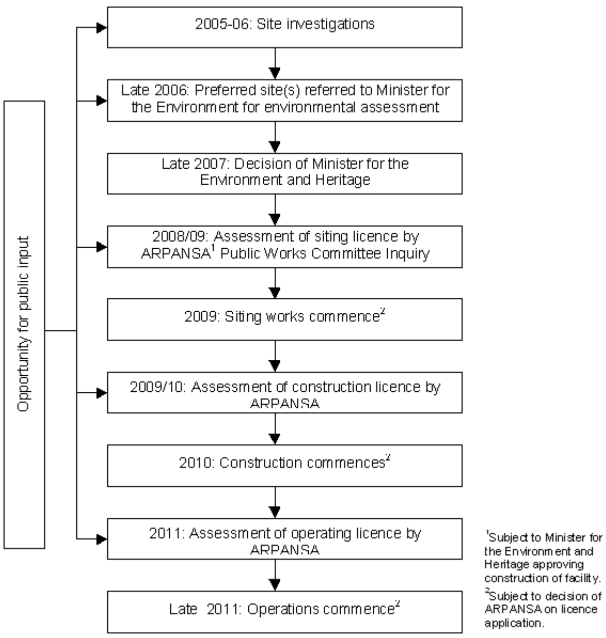

Figure 2 Timeframe for CRWMF

For the low-level and short-lived intermediate level wastes the three locations will be investigated for their suitability to host a near-surface repository at a depth of at least 5 metres. Near surface repositories operate in over 30 countries including Australia. In the event that none of the locations prove suitable for a repository, the low-level waste will be stored in purpose-built storage buildings.

The intermediate level waste will be stored in a purpose-built storage building at the facility pending decisions in the long term on its eventual disposal.

The design of the facility will not be finalised until it is decided whether to dispose of or store the low-level waste, a final site is chosen and all regulatory approvals have been given for siting the facility.

The volume of radioactive waste to be transported to the CRWMF is about 3,700 m^3 of low-level waste and about 400 m^3 of intermediate level waste. Each year a further 40 m^3 of low-level and 2 m^3 of intermediate level waste will be produced for packaging and transport to the CRWMF.

The decommissioning of the HIFAR research reactor at ANSTO will also generate up to 2,500 m^3 and 150 m^3 of low and intermediate level radioactive wastes respectively. The exact amount generated will depend on the decommissioning option chosen.

The majority of the radioactive wastes to be transported to the CRWMF will be from ANSTO's operations in Sydney Australia. The final waste form packages and waste acceptance criteria for the low-level wastes will form the basis of an operating licence approved by the regulator pending a final decision on a repository or a purpose-built above ground storage facility option. Transport options for the low-level waste will include road, sea and rail.

Options for transporting wastes arising from the reprocessing of ANSTO's spent fuel upon it arrival by sea from France or the United Kingdom will also be assessed.

The reprocessed waste returning from France, for example, will be casks weighing approximately in 112 tonne. The capability of Australian ports to handle these casks will need to be examined before deciding on a final transport route.

Figure 3 shows a typical large cask that will contain the reprocessed vitrified intermediate level waste from France.

Figure 3 TN24 family storage cask (112 tonne) for storage vitrified ILW returning to Australia following reprocessing of ANSTO's spent fuel in France

National Legal Instruments for the Physical Protection of Radioactive Sources in Indonesia.

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National Nuclear Energy Agency (BATAN)

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Radioactive Waste Management Development Center - BATAN

The Indonesian Government has established Act No. 10 of 1997 on Nuclear Energy, to anticipate the development of nuclear technology. This Act completely separates the promotional and regulatory functions, and establishes the regulatory body for the control of all applications of nuclear energy. In consequence, the regulatory authority, BAPETEN, or Nuclear Energy Regulatory Agency of Indonesia was then established by Presidential Decree in May 1998 and is now in full operation, while the Nuclear Energy Agency (BATAN) has been already established several decades ago.

Utilization of nuclear energy, as stipulated in Act No. 10/1997, is defined as "any activity related to nuclear energy utilization that includes research, development, mining, fabrication, manufacturing, production, transportation, storage, transfer, export, import, decommissioning and radioactive waste management to enhance people's welfare". The authority and responsibilities of regulatory body, for example, stipulates, "The control of the utilization of all nuclear energy should be implemented through regulation, licensing, and inspection", and aimed:

- Assure the welfare, security and peace of the people;
- Assure the safety and the health of workers and public and environmental protection;
- Prevent any diversion from the purpose of the nuclear material utilization

The Act stipulates that any activity related to the application of nuclear energy is required to be conducted in a manner which observes safety, security and peace, and which protects the health of workers and the public and the environment. This requirement is further implemented by Government Regulation No. 63 of 2000 on Radiation Safety, Government Regulation No. 64 of 2000 on Licensing, and some Technical Regulations. Government Regulation No. 63 of 2000 stipulates that the aim of the regulation is to ensure the safety, security, peace and health of the workers and the people and to protect the environment, while Government Regulation No. 64 of 2000 stipulates that a physical protection system should be in place for those facilities that utilize nuclear materials. Developments in civil nuclear program in Indonesia, as in many countries in the world, have resulted in there being an increasing number of radioactive sources both in use and in storage. Unless thoroughly controlled and protected at national and facility levels, these materials may be vulnerable to theft or sabotage. Three years ago there were around 838 radioactive sources of various kinds temporarily stored as radioactive waste at users' sites, and now most of them has been transported to BATAN.

With regard to waste management, the Act on Nuclear Energy stipulates the following:

"Radioactive waste is defined as any radioactive material and any material as well as equipment that has been contaminated by radioactive material or becomes radioactive due to the operation of a nuclear installation and cannot further be used."

Further,

- Radioactive waste management shall be conducted to mitigate radiation hazards to the workers, the public and the environment (Article 22 (1)).
- Radioactive waste management shall be accomplished by the Executive Body (BATAN), which may designate a state or private company or co-operative to conduct commercial waste management activities (Article 23).
- Users generating low and intermediate level radioactive waste shall be obliged to collect, segregate, or treat and temporarily store the waste before its transfer to the Executive Body (BATAN) (Article 24 (1)).
- The provisions on radioactive waste management, including waste transport and disposal, shall be further implemented by Government Regulation.

Article 25 prohibits the use of any part of Indonesian territory by any foreign country as a radioactive waste repository. Government Regulation No. 26 of 2002 on Safe Transport of Radioactive Materials and Government

Regulation No. 27 of 2002 on Radioactive Waste Management were issued to administer the requirements contained in these articles. Article 27 of Government Regulation No. 27 of 2000 stipulates that storage facilities for low and intermediate level radioactive waste and the final repository facilities for high level radioactive waste should be equipped with a physical protection system. Further, BAPETEN Rule and Procedure No. 03/Ka-BAPETEN/V-99 on Safety of Waste Management (which is now under revision) stipulates that users can temporarily store the radioactive waste at their premises, provided the waste is placed in containers and stored, preferably in a bunker, locked in a room with the radiation symbol (trefoil); this storage must be located far from the working area and surrounded with a fence.

These are all national legal instruments with regard to the physical protection of radioactive sources in Indonesia.

Current Status of Korean Low- and Intermediate-Level Radioactive Waste Repository Project

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Nuclear Environment Technology Institute (NETEC)
Korea Hydro & Nuclear Power Co., Ltd. (KHNP)

Since the new plan for a radioactive waste management facility was notified on 17 December 2004 just after the meeting of the Atomic Energy Committee, which is basically to separate the site for the low- and intermediate-level radioactive waste and the spent fuel interim storage instead of constructing both in one site, a new policy of the low- and intermediate-level radioactive waste management has been publicly announced on 16 June 2005 for its candidate site selection based on the Special Act (local support for the site subscriber).

Under the new procedures, the applicants of 3 cities and 1 country submitted the bids an 31 August, that is, Kunsan, Pohang, Kyongju, and Youngduck since the government promised many incentives with a special act.

Residents will them vote on whether to house a low- and intermediate-level radioactive waste disposal site in their community in November 2005.

To be in the final round, one third of the residents in a candidate city have to vote and more than half of the voters must be in support of the construction.

Key incentives to be offered to the low- and intermediate-level radioactive waste site include 300 billion won in financial support and relocation of the Korea Hydro & Nuclear Power (KHNP) headquarters from Seoul to the site.

Launching of a Commercial Vitrification Program in Korea

The idea of using vitrification technology to process low-and intermediate-level radioactive waste (LILW) was considered by NETEC in the early 1990s. An option study has demonstrated the cost-effectiveness of the solution applied to the waste produced by the Korean Nuclear Power Plants (NPPs). In 1997, NETEC conducted an investigation of high temperature technologies available on the market to process the LILW produced by NPPs. Finally, NETEC has selected the cold crucible melter (CCM) concept as the most promising vitrification technology for conditioning concentrates, ion exchange resins, and combustible solids.

Figure 1 shows all R&D activities what NETEC has been performed up to now. In 1994 and 1995, a feasibility study was performed to assess melter technologies, to examine how innovative high temperature technologies could be implemented to achieve a large volume reduction, and to evaluate and compare these technologies from a technical and economic viewpoint. Technical and economic assessments concluded that the best candidate was the cold crucible process for all combustible waste. A joint NETEC-SGN-MOBIS program was launched in 1997 to develop the industrial application of the CCM for the vitrification of waste produced in the Korean NPPs. The first step of the program, completed in 1998, was dedicated to orientation tests to optimize the processing of the Korean waste in the CCM and to design the off-gas treatment system. The second step of the joint collaboration, completed in October 1999, was devoted to the design and construction of an industrial pilot plant at NETEC. This pilot facility has been in operation since October 1999. All necessary R&D activities were completed by August, 2002.

Thereafter, a commercial vitrification program has

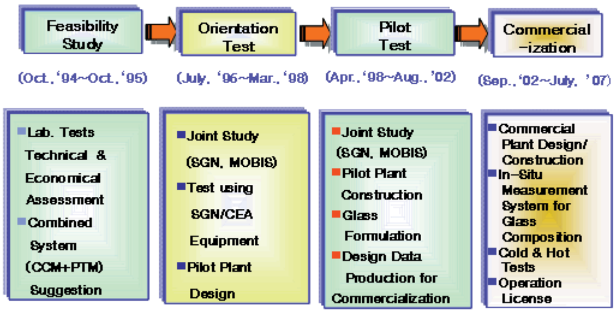

Figure 1 Flow Diagram of R&D Activities

been launched in Korea. The commercial vitrification facility with the cooperation of the Korean government, i.e., MOCIE (Ministry of Commerce, Industry and Energy), is now being built within the radwaste building at the Ulchin NPP site. The capacity of the CCM in the commercial vitrification facility will be about 400 kW/300 kHz. It may be the world first commercial vitrification facility to treat the LILW to be generated from commercial NPPs. In the meantime, the output of the R&D was used to the basic and detailed designs of the commercial vitrification facility. All designs of the vitrification facility were completed by April of 2005. And the procurement and construction will be completed by January of 2007. NETEC plans to begin its commercial operation in 2007 after obtaining its operational license through the hot and cold tests. Therefore, the implementation of the versatile CCM technology in an industrial facility will soon be a reality and utilities will benefit from the important advantages associated with the vitrification of the waste produced in NPPs. Figure 2 shows the bird's eye view of Ulchin vitrification facility.

It is expected that the commercial vitrification facility has a sufficient capacity to vitrify all LILW generated from 4 PWR units of 1,000 MWe each. Therefore, the facility would contribute to remarkable waste volume reduction effect. Accordingly, it is expected that the vitrification technology will not only enhance the safety of the waste disposal repository, but also greatly contribute to the further promotion of Korea's nuclear power generation program.

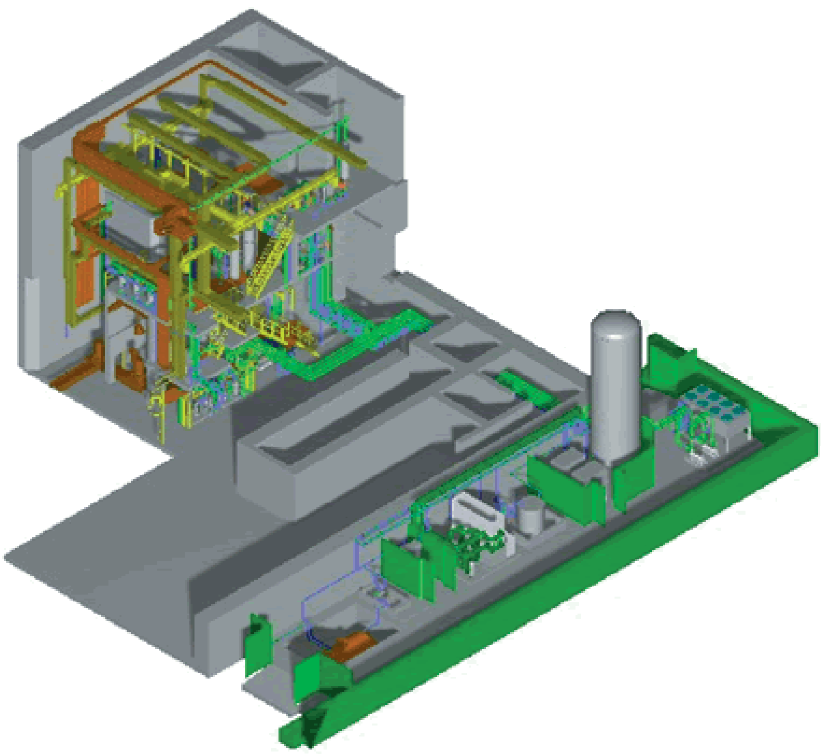

Figure 2 Bird's Eye View of Ulchin Vitrification Facility

Options of Repository Concept for Disposal of Radioactive Waste

Dr. Syed Abdul Malik Syed Zain
FNCA RWM Project Leader of malaysia,
Manager, Radioactive Waste Management Centre,
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Malaysian Institute for Nuclear Technology Research (MINT)

The implementation D&D project of a rare earth processing plant in early this year marks the establishment of Malaysian first radioactive waste repository. Even though, there may be other "repositories" for disposal of historical TENORM in the past, such as in the form of land reclamation, but those "repositories" did not get through the proper licensing process and hence are not considered as proper institutionalised repositories.

This first repository is consisted of what is called the engineered cells. Basically, it is a trench type repository excavated on a hillside. The repository mainly meant for disposal of excavated TENORM (Thorium & Uranium) contaminated soils and construction materials of the plants. Under the plan, the repository comprises two engineered cells in the end. The first Cell is meant for the disposal of contaminated plant materials and soils. The transfer of waste to this Cell has completed (see picture) and the cover of the cell is almost completed.

The next phase of the repository development is a plan for the second engineered Cell. This Cell is for the disposal of thorium waste and other contaminated items which are currently stored (at the nearby facility) in 200L drums and packages. The conceptual design of the Cell for this facility has been submitted to the regulatory authority (the Atomic Energy Licensing Board) and is currently being evaluated. Both types of waste (plant and thorium) are historical wastes resulting from the cessation of operation of the company processing monazite to recover rare earth elements.

Like many other countries, Malaysia also generates another type of radioactive waste from various sectors such as industry, medical, R&D etc. which is refered as institutional waste. To date, the inventory of this waste accumulated by Malaysian Institute for Nuclaer Technology Research (MINT) reaches 600 drums (120 m^3) of solid waste, 2,876 units of disused SRS, 2,400 drums of oil sludge and about 30 m^3 of contaminated solvent. The storage capacity at MINT's facility is expected to run out by the year 2015 and hence MINT is now embarking on a project to develop a national repository for institutional waste.

Table 1 Projected Waste Volume of Institutional Waste

Year	No. of 200L Drums	Volume (m^3)
2005	3460	692
2015	3765	753
2025	4695	939
2065	9360	1872

Through the experience gained in establishing TENORM repository, it provides a good understanding in developing the new repository for this type of waste. Indeed many factors need to be considered in establishing a repository for institutional waste, since the nature and characterization of the waste is different from the TENORM waste. However, due considerations are given to the safety of repository and humans, societal impact, political, economic etc. which have some bearings in determining the overall decision making process. From the economic perspective, the near surface disposal is the most economically feasible option for this country.

An IAEA's expert who was assigned to MINT under the technical cooperation for conceptual repository design visited Malaysia last July. Based on the projected waste till 2065 (Table 1), the expert recommended that Malaysia builds a near surface vault type facility. Accordingly, the repository should comprise of 15 vaults, each having a capacity of 200 m^3 and hence an overall volume of 3,000 m^3. Currently, MINT has come up with the work plan to establish the repository which also include human resource development through training of personnel in various relevant areas, reviewing and updating waste inventory and characteristics, developing waste acceptance criteria and collecting data for the preliminary safety assessment of the site.

Drilling Program for Siting a Low Level Radioactive Waste Repository in The Philippines

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The Interagency Committee on Radioactive Waste Management is now in the process of selecting a preferred site for detailed subsurface characterization using borehole logging techniques, core sampling and analysis. Figure 1 schematically shows the characteristics of one of the candidate sites. The selection process will make use of safety assessment studies to determine which among the three (3) short listed candidate sites will undergo detailed investigation. The scope of the study is assessment of post-closure radiological safety, taking into account current developments in international standards and recommendations including the best international practice as it may properly apply in the country. At this stage only limited information is available on the characteristics of the sites under consideration. The results may also be used to guide further investigations and research relevant to any site which continue as candidate sites for disposal.

The drilling program will give strong emphasis on the conduct of tests and observations in deep boreholes (several tens of meters, depending on the depth to groundwater) to develop an understanding of the lithologies, engineering geological and geotechnical characteristics, and ground water conditions of the site, among others. The technical data that will be gained from the drilling program will be used to develop in sufficient detail, a comprehensive safety assessment and cost estimation. Specifically, the hydro-geological conditions will be analyzed thoroughly to determine the important pathways of radionuclide transport to the human biosphere with respect to different scenarios considered in the safety assessment. The engineering geological and geotechnical data on the other hand will be used to determine the depth and design parameters of the repository, its orientation and the buffer zone allowed by the geological structure or conditions.

All phases of the project will be conducted under the overall guidance of a quality assurance program. This program will ensure that all siting activities will attain the right quality, complete documentation, and traceability of all records. All information that will be generated from this stage will be added to the previous information gathered during the early stage of the siting process and will be utilized to confirm the technical acceptability of the preferred site for locating and constructing the envisioned national radioactive waste repository.

Landform	Scarp	Plateau	Valley	Plateau	Scarp
Profile					
Soil	Soil thin to absent	Thin, residual, clay silts, thckness range from 10 to 70 cm	Thin, residual to transported clay silts, less than 10 cm in thickness	Thin, residual, clay silts, thickness range from 10 to 70 cm	Soil thin to absent
Lithology	Altered and weathered andesite, bedrock estimated at 3 to 5 meters below ground surface				
Hydrogeology	No groundwater indications, may occur at depth with in fractures, if presennt, will move away from the proposed site, run off predominant, local ponding at valley				
Foundation	Bedrock capable of supporting facility, extent of grading and excavation dependent on design and scheme of development				
Hazards/ Slope Stability	Currently stable	Stable	Currently stable, may require stabilization during site grading	Stable	Currently stable

Figure 1 Characteristics of One of the Candidate Site for Low Level Waste Repository

Conditioning of the 4 Curies ^{226}Ra Spent Sealed Source in Thailand

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Office of Atoms for Peace (OAP)

^{226}Ra, an alpha emitter with a half life of ~1600 years was the primary sealed radiation source used in Thailand for more than 50 years in medical applications as brachytherapy, applicators for external betatherapy and teletherapy. The 4 curies ^{226}Ra source was used as a radium therapy unit for cancer treatment (at that time it was called Radium Bomb) at Pramongkutklao Hospital, Bangkok since 1953. The hospital stopped its operation because the sealed 60Co source was more acceptable to be used instead of ^{226}Ra and also ^{60}Co source was safer and easier to handle than those containing radium. The whole radium unit in Figure 1 was sent to OAP as radioactive waste on 10 August 1986. The unfavorable radiological characteristics of ^{226}Ra required special conditioning techniques which result in a safe containment from both radiological and physical security points of view. Therefore, the strategy for safe management of disused radium source was the optimization of conditioning technique which the possibility to retrieve and recondition radium source should be maintained.

The 4 curies ^{226}Ra conditioning, was under International Atomic Energy Agency (IAEA) supervision and budgetary supports, comprised of 6 operational steps : the surface dose rate and the actual dimension of radium unit measurements, the appropriate lead shielding design with IAEA approval, the confirmation of radioactive contamination before conditioning (smear test and radon gas leakage test), the transfer of radium unit into shielding, the confirmation of radioactive contamination and dose rate measurement after conditioning, and the transportation of ^{226}Ra conditioning waste package to OAP interim waste storage.

On 13 December 2003, the 4 curies ^{226}Ra source was taken out from OAP temporary storage for the surface dose rate and the actual dimension measurements behind the 12 inches thickness heavy concrete block. The measured surface dose rate of the ^{226}Ra unit

Figure 1
Ra (4 Ci) Teletherapy Source

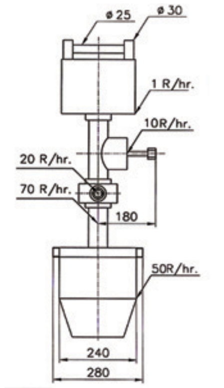

Figure 2
Ra (4 Ci) Surface Dose Rate

were shown in Figure 2, which the maximum value was 70 R/hr.

Special lead container (Figure 3) was designed according to its surface dose rate along the source unit which the maximum permissible dose limit for surface dose rate of waste package after conditioning at 2 mSv/hr was applied. The approved container had total weight of ~ 2.4 ton. The operation of ^{226}Ra 4 curies conditioning was on 2 April 2005. Radium unit was transferred and loaded in designed Pb-shielding (Figure 4) within 2 minutes. The results of smear test before and after conditioning including radon gas leakage test as shown in Figure 5, revealed that there was no radioactive contamination. After conditioning, the surface dose rate measured on the top, bottom were 6, 6 mR/hr and varied from 6 – 50 mR/hr around Pb container. The ^{226}Ra conditioning waste package was transported to store safely in OAP interim waste storage No.1 (Figure 6). Total operational time including the time consumed in radon gas leakage test was ~ 3.5 hr. The radiation dose received by operators, ranged from 1 – 69.84 µSv, where the forklift driver obtained the highest dose. The ^{226}Ra conditioning team in Figure 7, completed this operation safely within the radiation dose limit for occupational exposure of 200 µSv/day.

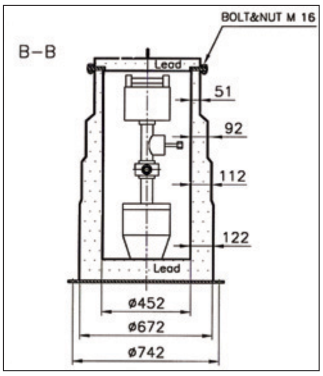

Figure 3
Designed Pb Shielding and source

Figure 4
^{226}Ra (4 Ci) Loading in Pb-Shield

Figure 5
Radon Gas Leakage Test

Figure 6
Package Transportation

Figure 7
^{226}Ra (4 Ci) Conditioning Team

Management of Low Level Radioactive Waste at Institute for Technology of Radioactive and Rare Elements (ITRRE), VAEC

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Institute for Technology of Radioactive and Rare Elements (ITRRE) has task of treatment and management of all kind of radioactive wastes in the North of Viet Nam. Liquid wastes generated from different laboratories and hospitals have been collected and treated at the treatment and temporary storage facility in ITRRE. Solid wastes has been treated by cementation technique after that kept in temporary storage facility.

Activities in research and development from laboratory to pilot scale have generated a rather large amount of radioactive wastes. Activities generating most radioactive wastes includes:

- Experimental treatment of uranium ores in bench scales - from several to few dozen tons of ore each time, for studying the possibilities of uranium recovery from different sources of domestic uranium deposits. The largest amount are waste ores after being processed for recovery of uranium (milling wastes) containing many radioactive elements such as radium; unrecovered uranium, etc. These are low level radioactive wastes but due to technological treatments the radio-nuclides in the ores become more mobile than before and can diffuse into the environment more easily.
- Solid wastes of monazite concentrate after processing for rare-earths recovery in a pilot plant of monazite processing. The waste includes undissolved monazite concentrates and precipitates of thorium, radium and lead separated during the rare earth separation. This waste has a rather high activity, so it need to have suitable conditioning and careful management.

- Radioactive liquid wastes generated from research activities of ITRRE are usually of very low level, and mostly are natural radio-nuclides. Such wastes are collected and treated according to a predefined procedure.

Most of these wastes were produced during the operation of the Institute since 1980, mainly from activities of research, pilot production of uranium concentrate and monazite processing. Amount of 130 tons of low level radioactive wastes have been kept in Phung temporary storage facility. In 2004, our Government has supported us to built a facility for treatment and temporary storage of radioactive wastes.

In the year 2002, ITRRE had treated in the first step the part of rather high level solid waste from monazite processing with the total amount of about 5 tons. Conditioning was conducted with cementation technique.

Radioactive liquid wastes generated from research activities of ITRRE are usually of very low level, and mostly are natural radio-nuclides. such wastes are collected and processed according to a predefined procedure, which includes:

- Collection of radioactive liquid wastes in laboratories and transportation to the treatment section.

- Precipitation of radio-nuclides in the solution, let the precipitates settle down.

- Discard the solution into the sewerage system with suitable dilution. To recover the precipitates and transport to place of storage.

At the same time, some experiments have been conducted in the laboratory for treatment of radioactive wastes in the field of adsorption of uranium and thorium from waste water by zeolite NaA-CN93 made in Viet Nam.

In the year 2004, amount of waste about of 80 tons in temporary vault, which needed to be processed and managed for safety. These wastes almost are mill tailing from uranium processing and sludge from liquid water treatment.

The experiments for treatment of radioactive waste have been conducted in the laboratory for determination of suitable technological flow-sheet. Procedure have been applied for treatment of rad-wastes is cementation technique.

The cement solidification for wastes have been done according to the flow-sheet above. The total of drums is 272.

Dose rate of different drums has been determined and presented below:

Table 1 Typical Dose Rate of Drums before and after Treatment

Samples	Dose rate before treatment	Dose rate after treatment at distance of 1m (µSv/h)
S1	23.8	4.05
S2	28.0	4.80
S3	59.5	7.50

Management of treated radioactive solid waste:

Drums were put in temporary radioactive waste storage facility. Nowadays, in the temporary storage there are 322 drums. The dose rate be determined periodically.

The treatment and management of radioactive wastes have been conducted safely at center of radioactive waste management and environment, ITRRE. Our temporary storage facility has responsibility for management of all kind of radioactive wastes in the North of Viet Nam.

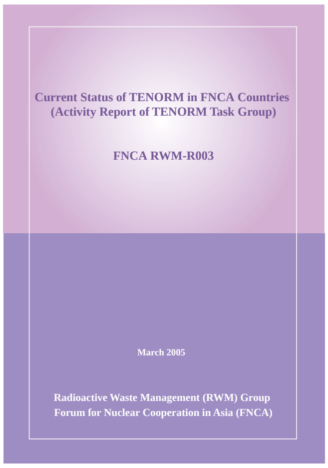
Figure 1 Temporary Radioactive Waste Storage Facility of ITRRE

Introduction of the latest technical outcomes of FNCA RWM Project Group

FNCA RWM-R003

"Current Status of TENORM in FNCA Countries"
(Activity Report of TENORM Task Group)

This report will become available to download from RWM homepage in FNCA web-site soon.



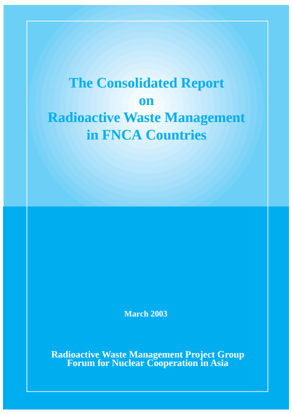
Introduction of past Reports

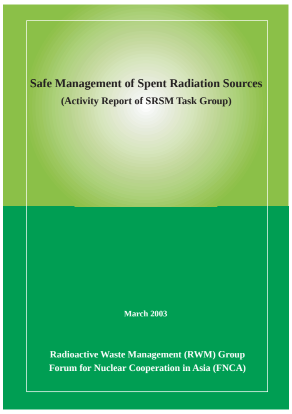
FNCA RWM-R001 (2003)

"Consolidated Report of Radioactive Waste Management"

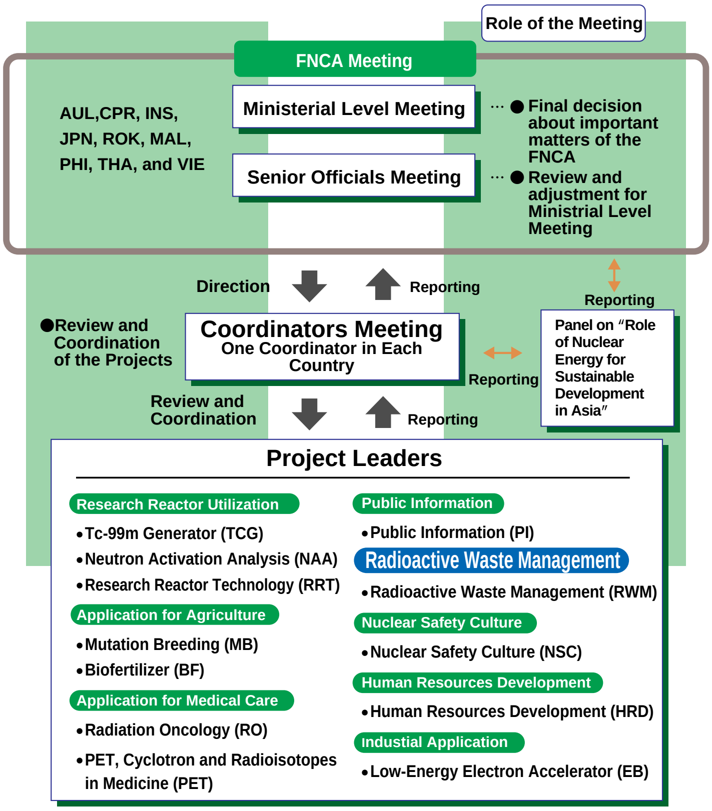
FNCA RWM-R002 (2003)

"Safe Management of Spent Radiation Sources"





The FNCA Framework



Record of Past RWM Workshops

1)	1995 RWM Seminar	Japan (Tokyo)
2)	1996 RWM Seminar	Malaysia (Kuala Lumpur)
3)	1997 RWM Seminar	China (Beijing)
4)	1998 RWM Workshop	Thailand (Bangkok)
5)	1999 RWM Workshop	The Philippines (Manila)
6)	2000 RWM Workshop	Australia (Sydney)
7)	2001 RWM Workshop	Viet Nam (Da Lat)
8)	2002 RWM Workshop	Korea (Daejeon)
9)	2003 RWM Workshop	Indonesia (Jakarta)
10)	2004 RWM Workshop	Malaysia (Kuala Lumpur)
11)	2005 RWM Workshop	Japan (Kagamino-cho, Okayama)

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