NEWSLETTER
RADIOACTIVE WASTE MANAGEMENT

Nov. 2006
No.17
Issued by
Japan Atomic
Industrial Forum, Inc.

The FNCA 2006 Workshop on RWM to be held in Beijing, China for the period of November 20-24, 2006

The FNCA 2006 Workshop on radioactive Waste Management (RWM) is scheduled to be held from November 20 to 24, 2006.

The workshop will be hosted by China National Nuclear Corporation (CNNC) in cooperation with China Atomic Energy Authority (CAEA) as the local host organizations, and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan, in cooperation with Japan Atomic Industrial Forum, Inc. (JAIF)

In the workshop, each representative from FNCA countries will report on the recent progress status related Radioactive Waste Management.

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

- Conceptual Design of Near Surface Repository
- Waste Treatment and Conditioning for Disposal
- Management of Medical Waste

2006's activity on Decommissioning/Clearance Task Group will be reported to the participants for further discussion.

Tentative Schedule of the RWM Workshop

Sunday, November 19

Arrival of overseas participants at Beijing

Monday, November 20

The 1st day of the Workshop

- Country Report "Progress Status of RWM"
- Poster / Mini-Exhibition

Tuesday, November 21

The 2nd day of the Workshop

- Sub-meetings to be open to wider audience
  - (1) Conceptual Design of Near Surface Repository
  - (2) Waste Treatment and Conditioning for Disposal
  - (3) Management of Medical Waste

Wednesday, November 22

The 3rd day of the Workshop

- Technical Visit

Thursday, November 23

The 4th day of the Workshop

- Roundtable discussions
  - (1) Interim Reporting of Decommissioning and Clearance Task
  - (2) Progress of RWM Consolidated Report
  - (3) Plan of 2007 (Host country for 2007 RWM Workshop and Host for 2007 Task activity of Decommissioning and Clearance Task

Friday, November 24

The final day of the Workshop

- Confirmation of the Workshop Minutes
- Adoption of the Workshop Minutes

The Person taking Charge of the RWM Workshop from Local Hosting Organizations

Zhang Jintao
FNCA RWM Project Leader of China
Deputy Director General,
Department of Safety, Protection and Quality,
China National Nuclear Corporation (CNNC)

Present Discussion on Control of NORM/TENORM in Japan

Toshiso Kosako
FNCA RWM Project Leader of Japan
Professor,
Nuclear Professional School,
Graduate School of Engineering,
The University of Tokyo

Takeshi Iimoto
Research Associate,
Department of Nuclear Engineering and Management,
Graduate School of Engineering,
The University of Tokyo

Yuya Koike
Reserch Associate
Radioisotope Center
The University of Tokyo

Various radionuclides which have been in the crust since the Earth's birth or been produced by cosmic rays exist in the natural environment. Substances containing these radionuclides are called "Naturally Occurring Radioactive Materials" (hereafter referred to as "NORM"). NORM with high radioactive concentration include monazite, phosphate ore, titanium ore and other minerals and mineral sands that are widely used as industrial raw materials. Additionally, products made from these materials are applied to a wide range of fields and also used as consumer goods by many people.

The International Commission on Radiological Protection (ICRP) had been considering that radiation exposure due to natural radioactive sources, in principle, would be outside of scope of the radiological protection. ICRP Publ.60 (1990 Recommendations), proposed that operational radon exposure and radiation exposure of workers due to operations with and storage of materials containing significant amount of NORM should be controlled as occupational exposure.

A basic policy for exemption of NORM is not clearly defined by ICRP at present. The policies for the exemption were summarized in the European CommitteeÅfs Report RP-122 "Application of the Concepts of Exemption and Clearance to Natural Radiation Sources" (2001) (hereafter referred to as "RP-122"). With a new category of "Work Activity" for exposure increased by natural radiation sources, this document adopts 0.3mSv/year as a dose criteria for exemption but does not apply 10μSv/year that is used for "Practice" causing exposure from artificial radiation sources.

14 Members of the European Union except Portugal have already revised their national laws according to the European Atomic Energy Community (EURATOM) Directive (adopted in May 1996) into which the same details as in exemption of BSS were incorporated. The same values as BSS exemption levels were introduced for artificial radiation sources, with a few exceptions. A regulation system for NORM has been already employed in most of the member states, but setting of an exemption level, its dose criteria and a regulation method vary with countries.

The BSS exemption level is not adopted in USA

Classification and Proposed Approaches to Materials Containing NORM.

Category	Exclusion, Practice or Intervention	Approaches	Dose Target / Criteria to Take Approaches
Raw materials such as mineral ore without procedure of enhancing concentration. (except categories 2, 3, 4, 5 and 6).	Exclusion	——	——
Waste rock residues from past mine or industrial activities.	Intervention	Action level	(1~10 mSv/y)
Ash, scale, etc. produced by industries (concentration of substances treated as raw materials should be exemption level or below)	Intervention	Action level	(1~10 mSv/y)
Soil from mines currently in operation and industrial residues (disposal)	Practice/ Intervention	•Identify materials possibly exceeding a certain level of concentration •Seek for adequate management in terms of radiological protection on use of special materials depending on doses received by workers or public.	1 mSv/y (examine whether to regulate or intervene if this value is exceeded.)
Raw materials for industrial use (manufacture, energy production and mining) (excluding Category 7)			
Consumer products (usage)	Practice	Apply BSS exemption level basically	10μSv/y
		Examine a system corresponding with type approval	1 mSv/y

while it is adopted in some radioactive nuclides of NORM in Canada. In addition, these two countries and China that has adopted the exemption level have not introduced the regulation system for NORM, with some exceptions.

In Japan, operations involving NORM-containing products and consumer goods were surveyed by the Nuclear Safety Division (Office of Nuclear Reactor Regulation and Office of Radiation Regulation), the Ministry of Education, Culture, Sports, Science and Technology. It is necessary to classify the usage pattern of NORM taking into consideration of artificial aspects and actual exposure potential, possibilities, and regulate them by using of the concepts of exemption or intervention exemption according to their features and exposure doses. Table shows their categories proposed on Oct. 2003 in Japan.

Clearance Level of Natural Origin Nuclide such as U238

The revision Nuclear Reactor Regulation Law was approved by the Diet and the related politics ministerial ordinance was maintained by the Ministry of Economy, Trade and Industry and the Ministry of Education, Culture, Sports, Science and Technology, based on the discussion result on the clearance level in the nuclear reactor facilities by Nuclear Safety Committee.

Radioactive waste and decommissioning task Force, Nuclear Safety Committee, Japan began the discussion of the clearance level in the uranium and the TRU handling facilities on September 14, 2006.

A special session concerning the examination of the clearance level in the nuclear fuel facilities was held, and the standing seeing went out to the hall that 120 people entered in Atomic Energy Society of Japan that had been held in Hokkaido University on Friday, September 29 before this.

It was introduced that the clearance level of a natural nuclide like U238 had been hardly examined in Japan, and it was reported that the fluctuation band of U238 in the soil is about 0-2Bq/g and the fluctuation band of U238 in the rock and consumer goods is about 0-10Bq/g in this session. It was pointed out that there was the problem how to harmonize the restriction value of uranium 238 discharged from the nuclear fuel facilities and uranium U238 in natural by the participant.

The attention of a lot of researchers, operators and the official would gather in the future, because the clearance level of the natural origin nuclide such as U238 might influence on the restriction value of NORM and the density of the radon in air.

Task Group Meeting in Indonesia —Nuclear Faciliy Decomissioning and its Waste Clearance —

Djarot S. Wisnubroto
RWM Project Leader of Indonesia
Director
Radioactive Waste Technology Center
National Nuclear Energy Agency
(BATAN)

As the result of Radioactive Waste Management Workshop in Kuala Lumpur Malaysia, held on 27 September to 1 October 2004, Indonesia proposed to joint two sub group activities, and at that workshop it was decided to give a new task group namely: Task Group on Nuclear Facility Decommissioning and Its Waste Clearance. This would give benefit for Indonesia to share experiences from other FNCA member states, since Indonesia has a program to decommission a yellow cake production facility attached to the PT. Petrokimia Fertilizer Plant in Gresik- East Java in the near future. As well, BATAN is also expecting to decommission some other ageing facilities in the future. Besides, Indonesia also requested to receive better first hand information on NORM and their clearance levels, since previously it was not involved in such Task Group. Indonesia intensified its activity to study the cases of NORM although late start as compared to other neighboring countries having similar NORM situation.

The task group meeting was held from 1-5 August 2005, and the task group meeting was focused on the (1) the decommissioning/clearance and (2) NORM. The meeting was hosted jointly by BATAN and BAPETEN, taking place in Jakarta, Serpong and Gresik. There were different parties invited, namely the Ministry of Health, Ministry of Environment, The Gresik Fertilizer Plant, Reactor Operators, the Radioactive Waste

Figure 1. Japanese and BATAN Participants in front of Serpong Research Reactor.

Center and the Radiation Safety Center.

The meeting adopted the following topics:

(1) NORM
- a) International Trend of Treatment on NORM
- b) Recent status of NORM in both countries
- c) Outline of NORM guideline/regulation in both countries
- d) Guideline categories for NORM in Japan
- e) Action steps for NORM issues

(2) Decommissioning/Clearance
- 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 protection

A one-day visit to the uranium recovery plant at the Gresik Fertilizer plant was made. This plant is located 900 km from Jakarta, and to be decommissioned in the near future. The company had requested BATAN to make a decommissioning program for their facility. This survey in the field showed the whole picture of the plant, and there was a brief discussion about the steps of decommissioning.

As a result of this task group meeting, now Indonesia (BATAN and BAPETEN) is intensifying the study on NORM by observing the whole map of potential NORM site in the country, and in progress for the regulations. Beside, financing system is evaluated for decommissioning of uranium recovery plant at the Gresik fertilizer plant, and BAPETEN has established a team to study the clearance.

Figure 2. Survey in the Gresik Fertilizer Plant.

Decommissioning and Clearance Task Group Discussion/Suvey Meeting in Australia

Lubi Dimitrovski
FNCA RWM Project Leader of Australia
Waste Operations
Australian Nuclear Science & Technology Organisation (ANSTO)

The 2005 FNCA Radioactive Waste Management (RWM) Workshop proposed a 3 Year Task Group activity on Decommissioning and Clearance issues. Australia provided the venue for third country based activity with ANSTO hosting the Australia-Japan Discussion/Survey meeting in Sydney on 24-28 July 2006

The topics addressed at the Discussion/Survey Meeting included:

- The recent status in Decommissioning and Clearance issues within Japan and Australia.
- An outline of the regulations relating to Decommissioning and Clearance in both countries.
- Recent Status on NORM Management.
- Updating of the Consolidated Report on RWM in the FNCA countries - Australian report.
- Review of the potential for cooperation on Decommissioning and Clearance practices within the FNCA framework with an aim in providing optimal protection to all concerned.

The Japanese Task Group comprised of Prof. Toshiso Kosako (Japan Project Leader, RWM, University of Tokyo); Dr Yuya Koike (University of Tokyo); Dr Yoshiaki Sakamoto, (JAEA); Dr Hidenori Yonehara, (NIRS) and Mr Mitsutoshi Odera, (JAIF).

The task group, sponsored by MEXT, held preliminary discussions with a number of technical experts in Australia including representatives from ANSTO and the Australian Radiation Protection & Nuclear Safety Agency (ARPANSA).

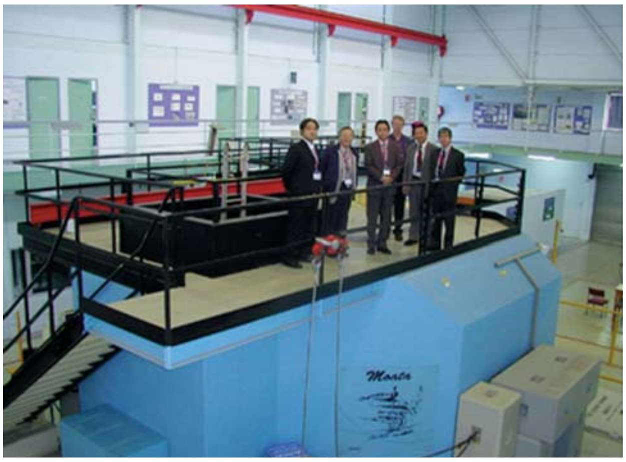
Both countries agreed that an open exchange of information and the sharing of experiences would be a beneficial and effective means in bringing improvements in Decommissioning strategies. It was also agreed that further assessment on the relevant applications of radioactive waste clearance levels and processes in both countries would be beneficial. The strengthening and consistency in the regulations of NORM/TENORM management was also of common interest. Both countries also agreed to provide the findings of the Task Group Meeting to the other FNCA countries for their consideration in the next FNCA 2006 Workshop on RWM to be held in Beijing, China, in November 20-24, 2006.

Task Group Discussions at ANSTO

The Task Group discussions included presentations from ANSTO and Japanese delegates on the following topics:

- Decommissioning status of the ANSTO research reactors;
- Decommissioning status in Japan;
- Clearance of exempt level wastes at ANSTO;
- Current status on clearance systems in Japan;
- Current status on NORM/TENORM management and regulations in both countries;
- Update on the status of the low and intermediate level waste disposal in Australia — the proposed Commonwealth Radioactive Waste Facility (CRWF).

The task group visited the ANSTO MOATA and HIFAR research reactors. The MOATA reactor, a 100 kW research reactor was shut down in May 1995 and is currently under a “care and maintenance” phase. A final decision to fully decommission the reactor will largely depend on the establishment of a low level waste repository (CRWF) in Australia (proposed for operation by 2011).



MOATA 100 kW Research Reactor

A visit was also made to ANSTO’s 10MW HIFAR Research Reactor which is due to be decommissioned in early 2007 after almost 49 years of safe operation.

ANSTO provided an overview of the proposed decommissioning plan for HIFAR with a 3 phase approach being proposed.

- <u>Phase A:</u> Removal of the fuel, Coarse Control Assemblies and the heavy water and preparation for Phase B

HIFAR 10 MW Research Reactor

- Phase B: Care & Maintenance (5 years)

- Phase C: Removal of the reactor block, core, and building. Return to Green Field site.

The second day comprised discussions on waste clearance systems in both countries. Different regulations for exemption exist in the states and territories of Australia. Currently all ongoing waste at ANSTO is assessed for clearance. Exemption levels proposed in IAEA RS-G-1.7 meet all other relevant limits for exemption. Exemption levels given in RS-G-1.7 are considered to be a good starting point for a national debate on clearance levels. Technical issues related to assessment of waste in ANSTO for clearance were also reviewed.

In Japan the Nuclear Safety Commission (NSC) commenced discussions on the clearance levels for nuclear facilities (about ten years ago) and the NSC has calculated values according to general policies pro-

Waste Inspection and Clearance Facility

Low Level Waste Storage Facility

duced in IAEA documents with parameters adjusted to suit the conditions in Japan. After re-assessment of the values and comparison with values proposed in RS-G-1.7, the NSC levels were not significantly different from those of RS-G-1.7. This was appropriate for introduction in Japan and was consistent with international trends. The Regulatory bodies revised the legislation for the introduction of clearance systems for nuclear facilities in 2005. The introduction of clearance systems for medical, general industrial and research facilities wastes is currently under discussion.

The final topic discussed was the International Trend in Safety Standards for NORM Regulation and the status of application of NORM in Japan.

Information and experiences for NORM/TENORM management were exchanged between Australia and Japan.

Both sides agreed that the following aspects were important in resolving NORM/TENORM issues in both countries;

- Recognition of the importance of NORM/TENORM management which must consider a balance between cost and safety in any regulation implementation;
- Harmonization of guidelines of NORM/TENORM based on international guideline/standards in order to avoid confusion in trading among the FNCA countries;

1. The following action steps can be applied as a check list for NORM/TENORM issues in each FNCA country;

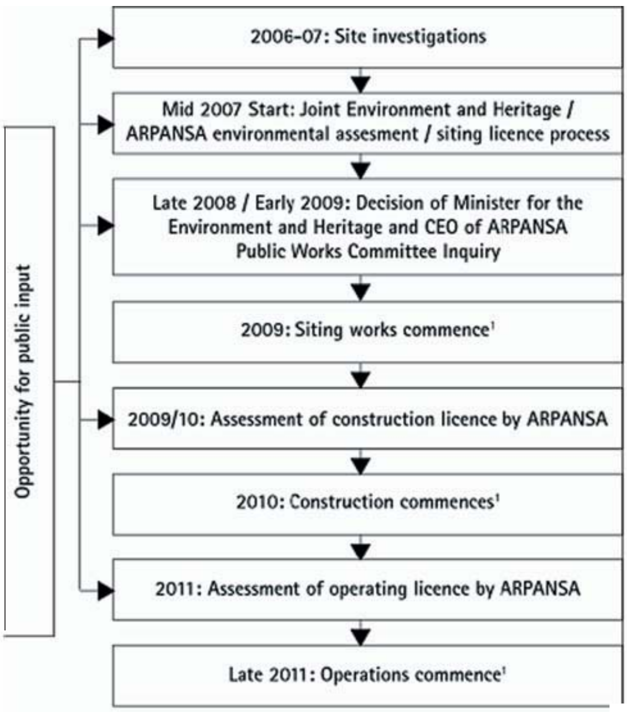
Step 1: Conceptual understanding
Step 2: Fact finding of relevant NORM/TENORM issues
Step 3: Measurement of the level of radiation & radioactivity
Step 4: Characterization of NORM
Step 5: Countermeasures & regulations
Step 6: Application in the field

Both countries recognized the importance of the exchange of information and the provision of technical support, in strengthening the infrastructure on NORM/TENORM and Decommissioning & Clearance issues.

Other major highlights have included:

- The new ANSTO OPAL 20MW research reactor achieved its first criticality on August 12 2006, which represented the end of the initial hot commissioning phase. The OPAL reactor is now undergoing further hot commissioning and is anticipated to be at full 20 MW power in early 2007.

- Work towards the establishment of the Commonwealth Radioactive Waste Facility (CRWF) for low and intermediate level waste disposal is progressing. The approximate timeline for development of the Facility is shown below.



Decommissioning and Clearance Task Group Meeting/Discussion in Malaysia

Syed Abdul Malik Syed Zain
FNCA RWM Project Leader of Malaysia, Manager, Radioactive Waste Management Centre
Malaysian Institute for Nuclear Technology Research (MINT)
Ministry of Science, Technology & Innovation (MOSTI)

Nik Marzukee Nik Ibrahim
Senior Research Officer, Radioactive Waste Management Centre, MINT

A Discussion/Survey Meeting on Decommissioning and Clearance was held in Malaysia from 7th to 10th August 2006. This is the fourth activity of the FNCA Radioactive Waste Management (RWM) Task Group on Decommissioning and Clearance, which started in 2005 JFY. Prof. Toshiso Kosako, FNCA (RWM) Project Leader for Japan, led the FNCA (RWM) Task Group delegation from Japan comprising 6 persons. A courtesy call was made to the Director-General of MINT and Director-General of AELB, where Prof. Toshiso Kosako gave a brief introduction of the mission and summary of previous Task Group results.

Preliminary discussion, presentation and exchange of information regarding topical issues were held in MINT during the first day. Among the issues that were presented and discussed are management of TENORM from oil & gas industry in Malaysia, TENORM management in Japan, regulatory issues and

Courtesy Visit to DG MINT / DG AELB

international trends and guidance related to decommissioning/clearance.

The topics taken up at the Discussion/Survey Meeting on Decommissioning and Clearance in Malaysia were as follows:

- Recent status of Decommissioning/Clearance in both countries
- Outline of regulations on Decommissioning/Clearance in both countries
- Recent Status of NORM/TENORM Management
- Ways of cooperation on Decommissioning/Clearance within the FNCA framework to provide adequate protection

On the 8th August, the FNCA delegation and personnel from MINT and AELB visited the Sabah Shell Sdn. Bhd., Labuan, which is located near the island of

Preliminary Discussion at MINT

Samples of the oil sludge from the nearby oil field

Delegates visit Sludge Farm at LCOT

Group Picture in Front of Labuan Supply Base Office

Sludge Farming (LCOT)

Sludge Farm that has been remidiated

Borneo. Personnel from Sabah Shell briefed the visitors on the operational and safety aspects of the Labuan Crude Oil Terminal (LCOT). They also briefed on the LCOT operations, maintenance, sludge farming process and monitoring at LCOT that constitutes the TENORM management activities at Sabah Shell Sdn. Bhd. A site visit was made to the sludge farming area and relevant personnel briefed the delegation on the operation and the treatment process. On the 9th August, the group visited the Labuan Supply Base (LSB), few kilometers away from LCOT, which was also included in the Sabah Shell TENORM management programme.

This location covers 74 m^2 of open yard and 24 m^2 of covered area. This was followed discussion on issues of TENORM management, decommissioning/ clearance and recommendation related to guides and regulatory aspects.

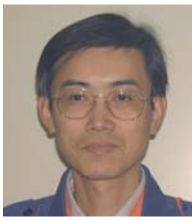
During the final discussion, all parties recognized and the importance of exchanging information and provision of technical and human resources support in strengthening the personnel competency, legislations and infrastructure for Decommissioning, Clearance, NORM/ TENORM issues, which would cover;(1) Improvement of the information exchange in the treatment technology of radioactive waste and legislative bases especially on low and intermediate levels; and (2) Practical cooperation in strengthening measurement technology/methods and human resources support in these issues.

The group expressed their appreciation to the Ministry of Science, Technology and Innovation (MOSTI), Malaysian Institute for Nuclear Technology Research (MINT) and Atomic Energy Licensing Board (AELB) of Malaysia for hosting the meeting and the arrangements of related activities; and to Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Japan Atomic Industrial Forum, Inc. (JAIF) for their support in facilitating the participation of the expert team from Japan. They also expressed their appreciation to Sabah Shell Sdn. Bhd., for participating in the discussion and accommodating the group in the technical visit.

Note : The Malaysian Institute for Nuclear Technology Research (MINT) was renamed as the Malaysian Nuclear Agency (Nuclear Malaysia) in October 2006.

Brick from Pandora's Box ? Come to an agreement about removal of waste rock from uranium mine in Japan

Tomohisa Zaitsu
Deputy Department Manager,
Environmental Research and Development Department,
Ningyo-toge Environmental Engineering Center,
Japan Atomic Energy Agency (JAEA)



Kazuhiko Sato
Environmental Technical Section,
Environmental Research and Development Department,
Ningyo-toge Environmental Engineering Center,
Japan Atomic Energy Agency (JAEA)

On May 31st, Japan Atomic Energy Agency, JAEA (the predecessor of JNC[1)]) reached an agreement that they would remove waste rock which had been piled in Tottori Prefecture after uranium exploration, and produce bricks from the waste rock. As a result, they will put an end to the long-term arguments, which had led a case at the Supreme Court. In 2004, Supreme Court judged that JNC should have removed the waste rock.

The following four people signed the agreement; Mr. Tonotsuka, the president of JAEA that had succeeded the right and responsibility of JNC. Mr. Katayama, the Governor of Tottori Prefecture, where the waste rock exists. Mr. Yoshida, a Mayor of Misasa Town, where the brickÅfs factory is supposed to be built. Mr. Kosaka, the then Minister of Education and Science who is in charge of supervising JAEA.

Eventually about 3,000 cubic meters of the waste rock which was ordered by the law court will be removed from Katamo District in Yurihama Town, according to the agreement. About 2,700 cubic meters of the waste rock will be used for producing bricks. Prior to that, another 290 cubic meters of the waste rock in which uranium concentration is relatively high had been sent to the U.S. for milling. The recovered uranium will be utilized in U.S.

JAEA is planning to start building the factory a year after leasing a site in Misasa Town. They will spend about 5 years to run the factory for making bricks including its construction. The operation will be finished by the end of June of 2011. The factory will be demolished within one year after the shutdown. JAEA will have to level the site and revegetate there, before they return it to Tottori Prefecture. It is supposed that approximately 1,000,000 bricks will be produced and used them in their property such as pavements of sidewalks and materials for gardening.

Simultaneously, JAEA will make a research on the trace radioactivity.

The waste rock had been generated as a result of uranium exploration which had been carried out by JAFC[2] from 1950's to 1960's as a National Project. It was when atomic energy began to get into the limelight. Galleries for the exploration had been excavated to the favorite ore deposits and the generated about 16,000 cubic meters of waste rock had been piled near the entrance of the galleries at this district, in accordance with the mine regulation. JAFC did not need to restore the site to original state at that time according to the lease contract with the landowner.

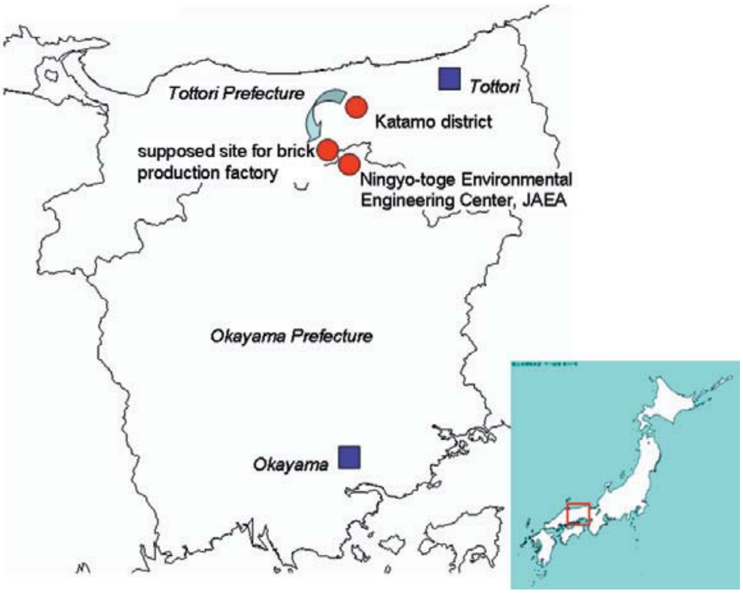


Figure 1. Location of Katamo district and supposed site for brick production factory

In 1989, the mine regulation had been amended in terms of radiation safety. After that, new regulation required that owners of uranium mine should have maintained the site. Consequently, PNC[3] needed to take necessary measures, for example, restriction of entering into the site, if its radiation exposure for public would be above 1mSv/year. PNC also had to revise the lease contract, and in August of 1990, PNC reached an agreement that they would remove the waste rock from Katamo district, under the condition that they could solve the issue in cooperation with local governments concerned.

Photo 1. Four people who signed the agreement about removal and treatment of waste rock piled in Katamo district, Tottori prefecture, Japan; Mr. Yoshida, a Mayor of Misasa Town, Mr. Katayama, the Governor of Tottori Prefecture, Mr. Kosaka, the then Minister of Education and Science, Mr. Tonotsuka, the president of JAEA (from left to right in order)

PNC made several proposals of waste rock removal and treatment both for Tottori and Okayama Prefectures. Neither of them was acceptable for the local governments concerned. PNC could not come up with a solution which was put into practice. In December of 2000, local residents in Katamo District filed a suit against PNC. The local residents demanded that PNC should fulfill the agreement to remove the waste rock from the district. This case was appealed to the Supreme Court.

1) JNC: Japan Nuclear Cycle Development Institute, October, 1998- September, 2005
2) JAFC: Japan Atomic Fuel Corporation, August, 1956- September, 1967
3) PNC: Power Reactor and Nuclear Fuel Development Corporation, October, 1967- September, 1998

Measurement of Carbon-14 Released from Yonggwang-4

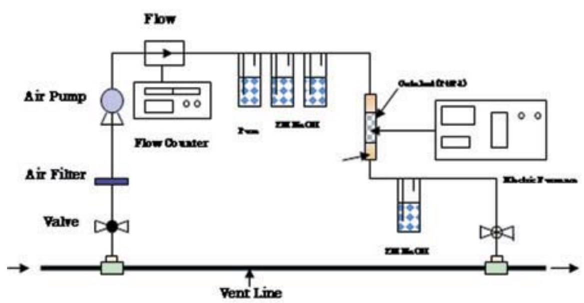
Jong-Hyun Ha
General Manager of Radiation R&D Office,
Nuclear Environment Technology Institute (NETEC),
Korea Hydro & Nuclear Power Co., Ltd. (KHNP)

C-14 is resulting from the activation reaction of oxygen, nitrogen and carbon in the fuel and coolant of PWR. In general, the amount of Carbon-14 released from PWR is small and not easy to detect, it is not used as a main monitoring nuclide released in PWR.

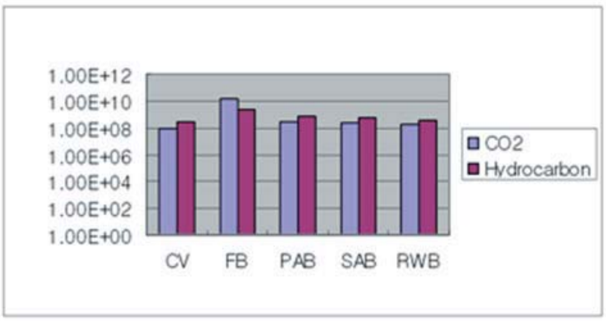
Korea Hydro and Nuclear Power Company (KHNP) monitored Carbon-14 at five main ventilation lines of Yonggwang-4 from 2003 for 2 years. For this, KHNP devised C-14 sampling instrument which can collect CO_2 and hydrocarbons separately. It is composed of three main components, that is, primary CO_2 sampler, a hydrocarbon oxidization assembly and a secondary CO_2 sampler. The primary CO_2 sampler has one water bubbler and two NaOH bubblers.

To analyze C-14 in NaOH, CO_3- ion was precipitated as $CaCO_3$ or $BaCO_3$ using $CaCl_2$ or $BaCl_2$. But it was difficult due to over-precipitation. This problem was solved by pH control using buffer solution (NH_4Cl) and adding some heat to the solution. The collection efficiency was calculated as 92%.

According to the analysis results, the total activity is estimated to be 0.147TBq/GWe.Yr. This activity is about 67% of world's PWR average: 0.22TBq/Gwe (UNSCEAR 2000) The area of highest concentration is the Fuel Building followed by the Reactor Building, the Radwaste Building and the Auxiliary Building. The ventilation time of the Reactor Building is 3.3 hrs per month, and 720 hrs for the others (continuous) In the point of chemical form, the results show CO_2 is dominant chemical form in fuel building, while methane compound is dominant in other areas. The environmental monitoring results in the vicinity of the plant show that there is no typical sign of C-14 accumulation.



The Schematic Diagram of C-14 Sampler



Analysis Result of C-14 by its Chemical Form (2003)

Development of ^{14}C Removal Technology for the Treatment of Spent Resin from Nuclear Power Plants

Ion exchange resins are extensively used in PHWR(Pressurized Heavy Water Reactor) and other reactor to remove ionic contaminants from various coolant streams. Especially, on using to treat waste from heavy water reactors, spent ion-exchange resins may be loaded with ^{14}C radioisotope which has long half-life of 5,730 years. This long lived radioisotope influences the strategy for the disposal of spent. It is recommended that disposal concentration limit of spent rein loaded with ^{14}C is 6 Ci/m^3 according to Korean Atomic Energy Act. Therefore, the removal of ^{14}C from spent resin and its concentration to solid sorbents become a desirable feature which can be disposed of as conventional low level waste. Acid stripping and thermal stripping methods are under development for the removal of ^{14}C from spent resins.

This study was focused to analyze the characteristics of ^{14}C removal from IRN-150 spent ion exchange resin using alkaline solutions. These results would provide a proper treatment option for ensuring increased capacity of spent resin storage at Wolsung PHWR reactor in Korea. In this study, IRN-150 resin is selected as starting material for removal of ^{14}C, which is widely used to purify a coolant circuit at Wolsung reactor with a mixture form of a stoichiometric equivalent of the strongly acidic cation and the strongly basic anion exchange resins. It was identified that a chemical form of ^{14}C contained in spent resin is commonly HCO_3^- species due to pH ranges in ion exchange column in moderator system. The selection of alkaline solutions such as Na_3PO_4 and $NaNO_3$ is based on affinity coefficients of other anion species against with HCO_3^- which can affect driving force for a desorption of HCO_3 ion from spent resin. Initial loading amount of inactive C as HCO_3^- on spent resin ranges from 4 mg-C/g-resin to 12 mg-C/g-resin. Alkaline solutions with a equivalent concentration range of 0.005 mol/l ~ 0.1 mol/l was used for removal of HCO_3 from spent resin, and the optimal ratio of resin amount(m) to solution volume(V) was evaluated. The minimum concentration of alkaline solution for effective removal of ^{14}C over 99% should be three times higher as a basis of equivalent compared to initial loading amount of ^{14}C on spent resin. The influence of solution volume at a constant concentration showed that the optimal m/V is about 200 kg/m^3. It was identified that Na_3PO_4 and $NaNO_3$ alkaline solutions showed over 99% of removal efficiency of ^{14}C from spent resin under optimal conditions. However, on using Na_3PO_4 solution, inert atmosphere should be provided for preventing CO_2 absorption from surrounding air gas.

The New PNRI Radioactive Waste Management and Interim Storage Facility

Editha A. Marcelo
FNCA RWM Project Leaderof the Philippines,
Senior Science Research Specialist,
Radiation Protection Services,
Philippine Nuclear Research Institute (PNRI)

The Philippine Nuclear Research Institute with the technical assistance from IAEA have established a Centralized Radioactive Waste Management Facility operated and maintained by the Radiation Protection Section. The facility receives and manages radioactive waste generated by authorized users of radioactive materials in the country. The radioactive waste management service is provided for a minimal fee intended to recover the cost of managing such waste and is imposed on users requesting for service.

Through a bilateral agreement of the Philippines with the United States of America, the US Department of Energy's National Nuclear Security Administration (NNSA) Office of International Material Protection and Cooperation initiated move to reduce threat of a Radiological Dispersion Device incident. This Radiological Threat Reduction Program funded the upgrading of the physical protection and security of the Centralized Radioactive Waste Management Facility.

The project includes the following:

a) Upgrading of the perimeter fence of the facility incorporating a coiled barbed wire on top of the concrete fence and installation of a new steel gate at the entrance to the facility

b) Upgrading of the existing trench and construction of a new engineered trench, both the existing and new trenches are under one concrete roof filled with topsoil planted with grass.

c) Installation of safety and security alarms

Upgrading of Perimeter Fence of the Facility

Top View of Engineered Trenches

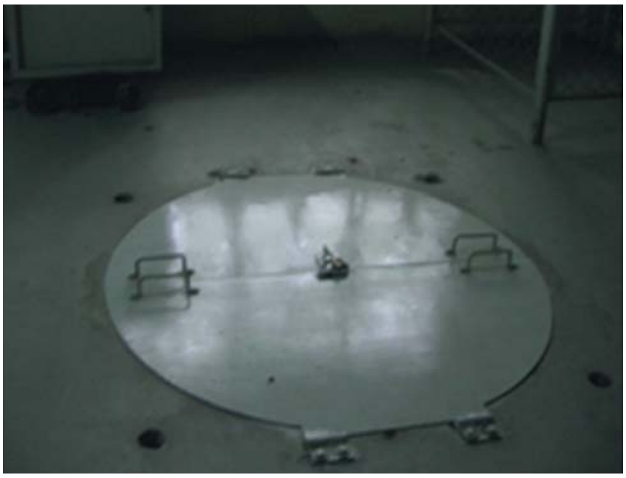
Entrance to Trenches A & B

Upgraded Existing Trench

Sealed Access

New Engineered Trench

Contact Alarm



Access from the ground floor were sealed with steel plate and grills for security reasons

Motion Sensor

The establishment of "Thailand Institute of Nuclear Technology"

Nanthavan Ya-anant
Senior Nuclear Chemist,
Radioactive Waste Management Center,
Thailand Institute of Nuclear Technology (TINT)

Thailand set up the "Office of Atomic Energy for Peace" (OAEP) in 1961, following the enactment of the Atomic Energy for Peace Act (B.E.2504). Later, OAEP has changed its name as Office of Atoms for Peace (OAP) in 2003. Regulatory function of Thailand is conducted by the OAP, Ministry of Science Technology. And the OAP works as secretariat of the Thai Atomic Energy Commission (Thai AEC), as well as regulates the licenses of the production, possession, and utilization of radioactive materials and recently, including X-ray machines

In order to separate the regulatory functional groups and the research groups for the promotion of nuclear technology in Thailand. soon, the OAP will be split to 2 organizations, the new organization; so called "Thailand Institute of Nuclear Technology (TINT)." And the OAP will play as the regulatory body.

The TINT will have the responsibilities on the followings:

- Promotion of Nuclear Technology and Utilization
- R&D in Nuclear Science and Technology, including R&D in Radioactive Waste Management
- Operation and Services (including Waste Management Operations and Services)
- Public Awareness in Nuclear

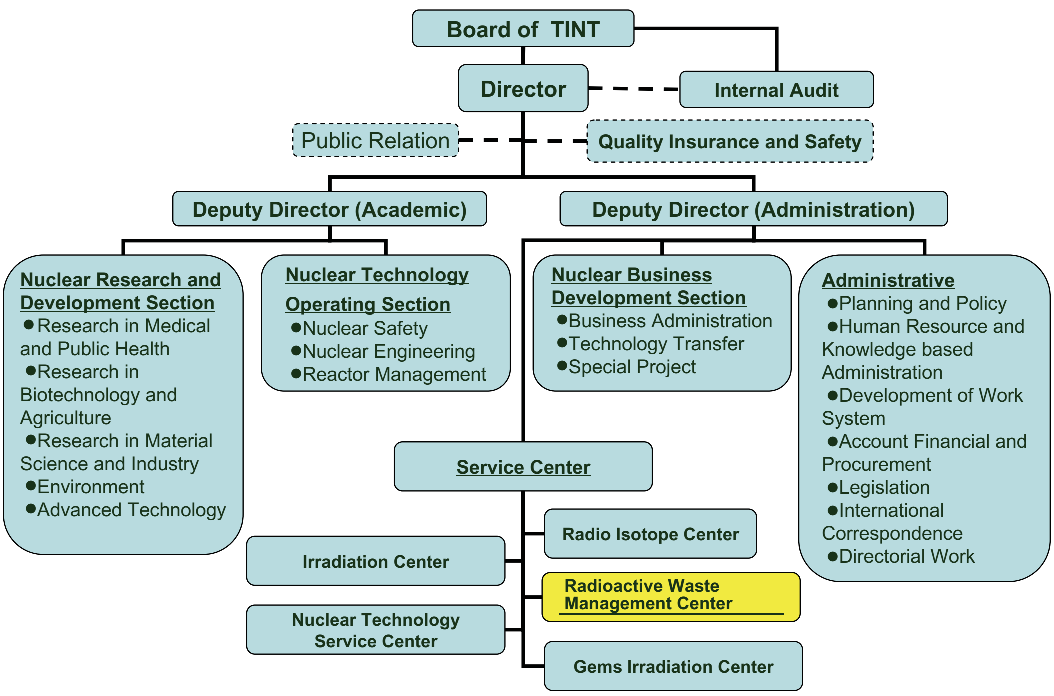
And the OAP will have the responsibilities on the followings:

- Policy and Strategic plan formulation on all nuclear matters
- Nuclear and Radiation Safety Control
- Licensing
- Intermediary Co-ordination Role in Nuclear

The Radioactive Waste Management Program will be transferred to TINT. And it will be called "Radioactive Waste Management Center", as a service center for the country.

Due to the delay of the construction of the new research center, ONRC Project, in Ongkharak District in Nakhon Nayok province, so that the Waste Management Center will be still located at the same place as the present, in the OAP, Bangkok.

TINT Organization Chart



Core Management of the Dalat Research Reactor

Tran Kim Hung
FNCA RWM Project Leader of Vietnam
Director, Department of Planning and R&D Management,
Vietnam Atomic Energy Commission (VAEC)

The fuel assemblies (FA) of the DNRR are of Soviet-designed standard type WWR-M2, enriched to 36% in U-235. Each assembly composes of 3 concentric layers: 2 circular inner tubes and one hexagonal outer tube. The fuel layer with a thickness of 0.7 mm is wrapped between two-aluminum alloy cladding layers of 0.9-mm thickness.

After 10 years of operation with the core of 89-fuel element configuration, in April 1994, refueling work was done by adding 11 fresh fuel assemblies in the core periphery at previous beryllium rod locations. The second refueling work was done in March 2002 by adding 4 fresh fuel assemblies more in the core periphery. In order to provide excess reactivity for the reactor without the need to discharge high burn-up FAs, in June 2004, the fuel shuffling of the core was done. 16 FAs with low burn-up from the core periphery were moved toward the core center to replace 16 FAs with high burn-up in the core center. The 104-FA configuration using reshuffled HEU fuels is remained until now. At present time there are 36 fresh fuel assemblies in the strorage.

The history of the core can be described as follows:

Start-up in November, 1983:	88 fuel assemblies
From 1984 up to April 1994:	89 fuel assemblies
From April 1994 up to March 2002:	100 fuel assemblies
Since March 2002:	104 fuel assemblies
June 2004	Shuffling of the reactor core
No spent fuel assemblies yet	

Vertical irradiation facilities:

Two dry channels at 7-1 and 13-2 cells
Two wet channels at core center and at 1-4 cell
40 holes in the graphite reflector

Calculation of fuel burn-up and burn-up distribution for the reactor were carried out based on cell calculation program WIMS and two diffusion calculation programs HEXAGA and HEXNOD in two dimensional geometry. The codes of WIMS, HEXAGA, HEXNOD have been developed to solve the problem of in-core fuel management optimization basing on the perturbation theory and binary shuffle technique. At present time, three-dimensional calculation of burn-up of fuel elements and burn-up distribution of the reactor core is realized by reactor staff under the national projects.

The maximal actual burn-up calculated presently is approcimately 20%. The calculation code WIMS-D5B (coefficients calculated with 69 neutron groups) and the code HEXNOD are used. The temperatures are calculated by DRSIM (developed code locally by NRI staff).

Regarding the refuelling of the core in the future, there are three versions:

1. Loading the new fuel assemblies (step by step, up to 36 assemblies) into the middle of the core, replacing the fuel assemblies with maximal burn-up.
2. Loading the new fuel assemblies to the peripheral part of the core, putting fuel from there into the middle of the core, replacing the same central fuel elements with maximal burn-up.
3. To rearrange the core by interchanging the (practically fresh) fuel assemblies from the periphery and the relatively used ones from around the neutron flux trap.

A project for conversion of the core from HEU to LEU:

In this project, we assumed that HEU fuel assem-

Table 1. Summary of operating time for incremental insertion of 36 burned HEU FA with 36 fresh HEU or 36 fresh LEU FA beginning in April 2006.

Cycle	HEU or LEU FA inserted per cycle	Total HEU or LEU FA inserted	Full- power- days with HEU FA	Cum. years oper. using HEU	Full- power- days with LEU FA	Cum. years oper. with LEU
1	8	8	143	2.8	183	3.5
2	8	16	265	5.1	344	6.6
3	10	26	413	7.9	546	10.5
4	10	36	547	10.5	733	14.1

blies with the highest burnup would be replaced. Further fuel shuffling will be performed only after all 36 fresh HEU or LEU fuel assemblies are completely replaced in the reactor core. The following sub-sections present calculations were done to compare the reactor parameters and margins of safety when 36 fresh HEU fuel assemblies or 36 fresh LEU fuel assemblies are incrementally inserted over four operating cycles. A total of 36 fuel assemblies were utilized in all four fresh reload operation cycles.

The results of the depletion of the current core using the 36 additional HEU VVR-M2 fuel assemblies indicate that the core could be operated an additional 547 fpd or almost 10.5 years from April 2006 until October 2016. If the proposed 36 LEU VVR-M2 fuel assemblies are used to refuel the core, the calculated lifetime would be 733 fpd or about 14 years from April 2006 until about May 2020. These results assumed that the core will be operated at full power for 1250 hours or 52 full-power-days per year, using the proposed strategy of loading fresh fuel assemblies without shuffling in the next four operating cycles. The fresh LEU WWR-M2 replacement fuel would last longer than the fresh HEU WWR-M2 replacement fuel mainly because the 235U content of the LEU fuel assemblies is higher than the amount needed to simply match the operating lifetime of the HEU fuel assemblies.

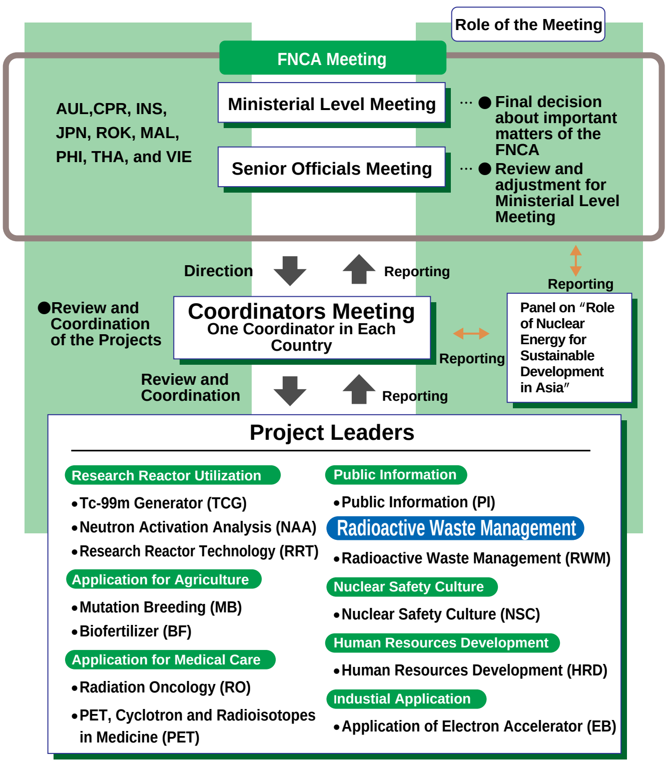
Based on the aboved results, the spent fuels of the Dalat reactor will be estimated as follows:

- With HEU FA used: 8 FAs in December 2008, 16 FAs in May 2011, 26 FAs in January 2014 and 36 FAs in October 2016.
- With LEU FA used: 8 FAs in May 2009, 16 FAs in September 2012, 26 FAs in October 2016 and 36 FAs in May 2020.

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)
12)	2006 RWM Workshop	China (Beijing)

The FNCA Framework



ASIA COOPERATION CENTER
JAPAN ATOMIC INDUSTRIAL FORUM, INC.

2-1-3, Shimbashi, Minato-ku, Tokyo 105-8605 JAPAN

PHONE : +81-3-6812-7104 http://www.jaif.or.jp/english/
FAX : +81-3-6812-7110 http://www.fnca.jp/english/

This Newsletter is issued by the Japan Atomic Industrial Forum, Inc. (JAIF) under the contract of the Ministry of Education, Culture, Sports, Science and Technology (MEXT).