[2007 Annual Report]

Atomic Energy Council Executive Yuan















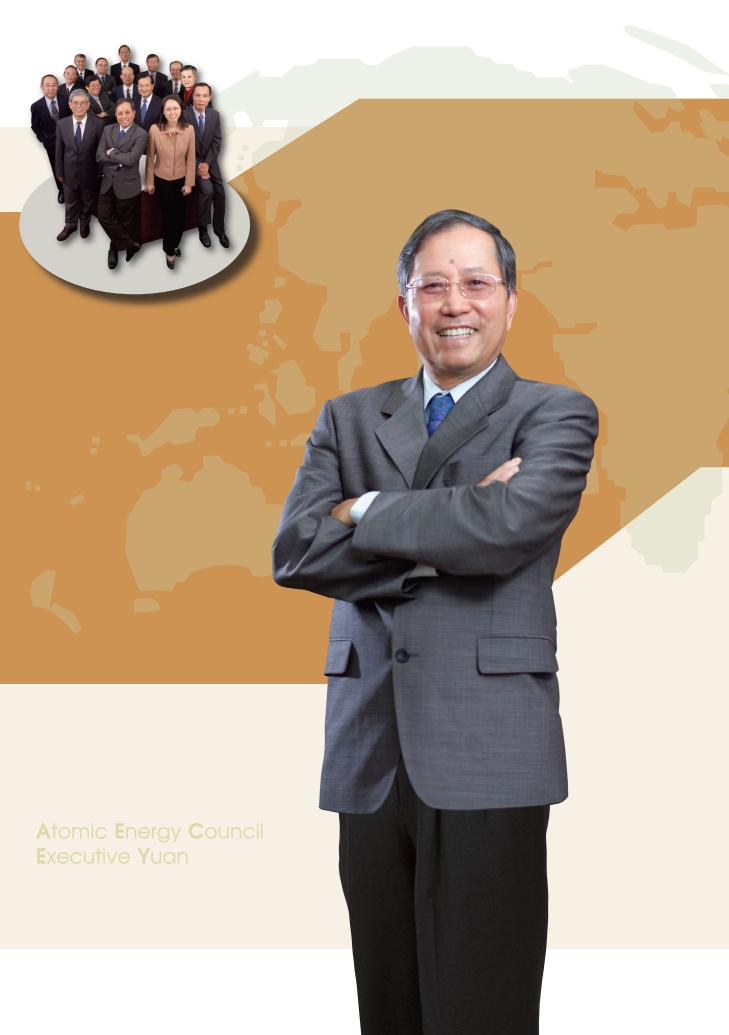












Our Vision

Message from the Minister

The Atomic Energy Council (AEC) was founded in 1955, and serves as the Nation's highest governing authority of atomic energy related affairs. Our responsibilities include ensuring safety of nuclear reators, protecting workers and the general public from unnecessary radiation exposure, closely monitoring radioactive in our environment, and making certain that radioactivity waste is properly managed. In addition, we also take charge of the research, development and transfer of nuclear and related technology for civilian applications.

In recent years, we continue to follow national policies with further implementation of new energy research and development. For a long period AEC has continuously taken responsibility for ensuring nuclear safety and radiation protection so that the public can benefit and prosper from nuclear energy.

Based on our creed "safety first and ready at your service", AEC has the perfect supervising mechanism to ensure the quality and safety of nuclear energy for the public. To keep our duty as the perfect doorkeeper of nuclear energy and radiation safety, and also to apply the technology for the well-being of the public, AEC will continue to uphold the principles of "professional, positive, innovative and service-oriented". Our commitment is set to strengthen our abilities in nuclear and radiation safety,regulation,accident prevention and emergency response, and further innovation in application with nuclear technology.

Overseeing the Taiwan Power Company (TPC) to properly manage its radioactive wastes is one of our tasks of high priority. Another effort is to further enhance transparency on information, to let the public feel more ease and assured.

I encourage all AEC colleagues to be innovative, to devote our energetic vigor to the workplace and to hold optimistic attitude for the future. Most importantly, I sincerely hope that, besides acting in compliance with the laws, our colleagues will be enthusiastic to serve the public by "perfecting problem solving" as our goal. Let's work together to help create a healthy, safe and bright future for our country and society by placing a premium on safety and service.





[2007 Annual Report Atomic Energy Council, Executive Yuan]

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MinisterShian-Jang Su



Deputy Minister
Chao-Yie Yang





Secretaria Huai-Yin Lee Director

- Chief Executive Secretary Syh-Tsong Chiou
- Department of Planning David YaoDirector





Office of Personnel Shao-Mei Jen Director Department of Nuclear Regulation Yi-Bin Chen Director





Office of Accounting Swi-Yu Lee Director Department of Radiation
 Protection
 Routh-Tsann Lee
 Director





Civil Service Ethics OfficeShih-Lai HungDirector Department of Nuclear Technology
 Jeng-Yuan Chen
 Director





Radiation Monitoring Center Ching-Chung Huang



Fuel Cycle and Materials
Administration
Ching-Tsuen Huang
Director

Institute of Nuclear Energy
Research
Taun-Ran Yeh
Director General

Organizational Structure

Minister

Deputy Minister

Chief Executive Secretary

Council Members

Consisting of representationes of relevant ministries or ageneies within the Executive Yuan and experts in related fields. **Department of Planning Department of Nuclear Regulation Department of Radiation Protection Department of Nuclear Technology** Secretariat Office of Personnel Office of Accounting **Civil Service Ethics Office Radiation Monitoring Center Fuel Cycle and Materials Administration** Institute of Nuclear Energy Research Management Board of the Nuclear Emergency Response Fund **Advisory Committees Evaluation Committee on Research and Development Achievements Advisory Committee on Nuclear Facility Safety** Supervising Committee on Nuclear Safety of the Lungmen Station **Advisory Committee on Ionizing Radiation Safety Advisory Committee on Radioactive Materials Safety Advisory Committee on Handing of State Compensation Cases Advisory Committee on Nuclear Legislation Gender Equality Committee**

★not a standing committee

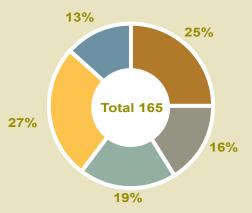
Complaints Committee against Sexual Harassment

Nuclear Emergency Recovery Committee★

Nuclear Accident Investigation and Evaluation Committee★

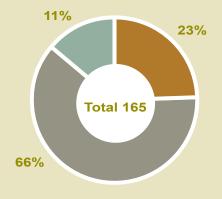
Manpower and Budget

The Atomic Energy Council



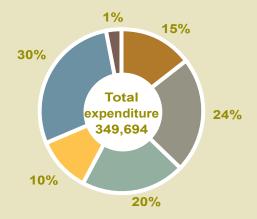
2007 Human Resources Breakdown

- General administration 41 (25%)
- Atomic energy science development 27 (16%)
- Ionizing radiation protection 31 (19%)
- Nucleaar installation safety control 44 (27%)
- Nuclear technology applications 22 (13%)



2007 Employee Ranking Breakdown

- Selected appointment rank 38 (23%)
- Recommended appointment rank 109 (66%)
- Designated appointment rank 18 (11%)

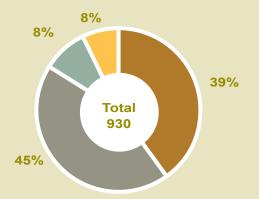


2007 Budget/Expenditure Allocation (Unit: Thousand NTD)

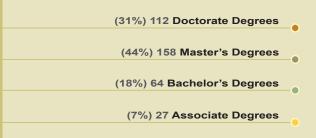
- Atomic energy science development 51,037 (15%)
- Nucleaar installation safety control 84,625 (24%)
- Ionizing radiation protection 71,645 (20%)
- Nuclear technology applications 35,134 (10%)
- General administration 103,323 (30%)
- Equipment/facility acquisition 3,930 (1%)

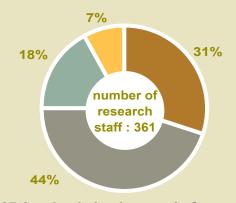
The Institute of Nuclear Energy Research





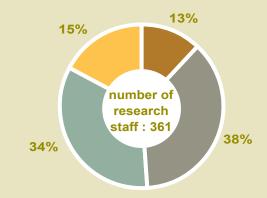
2007 Human Resources Breakdown





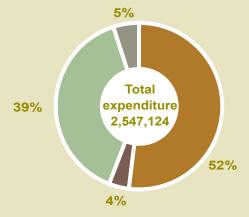
2007 Academic background of research staff





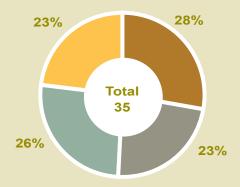
2007 Research Staff Ranking Breakdown



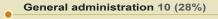


2007 Budget/Expenditure Allocation (Unit: Thousand NTD)

The Fuel Cycle and Materials Administration



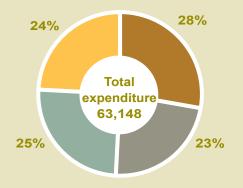
2007 Human Resources Breakdown



Radioactive materials administration 8 (23%)

Safety control of radwaste management 9 (26%)

Safety control of nuclear materials and radwaste from small producers 8 (23%)



2007 Budget/Expenditure Allocation (Unit: Thousand NTD)

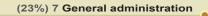
General administration 17,970 (28%)

Radioactive materials administration 14,762 (23%)

Safety control of radwaste management 15,444 (25%)

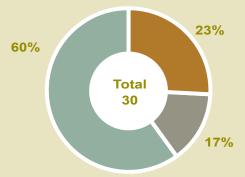
Safety control of nuclear materials and radwaste from small producers 14,972 (24%)

The Radiation Monitoring Center

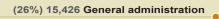


(17%) 5 Natural ionizing radiation monitoring

(60%) 18 Manmade ionizing radiation monitoring

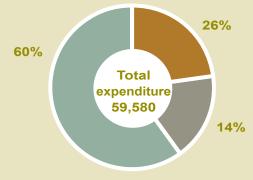


2007 Human Resources Breakdown



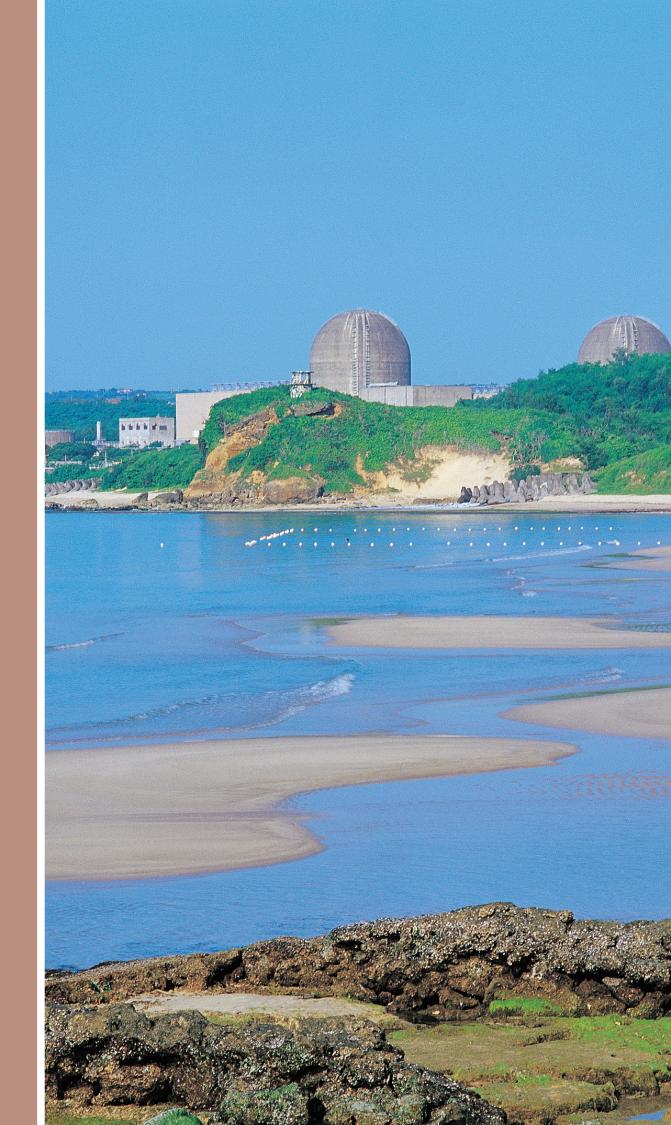
(14%) 8,281 Natural ionizing radiation monitoring

(60%) 35,873 Manmade ionizing radiation monitoring



2007 Budget/Expenditure Allocation

(Unit: Thousand NTD)



Technical Programs

(Major tasks and achievements)

[Department of planning]

Strict monitoring of nuclear safeguards material accounting system and establishment of self-audit mechanism

On May 11th, 2007 the International Atomic Energy Agency (IAEA) announced in its Safeguards Implementation Report 2006 that Taiwan, listed with Austria and 7 other nations, was declared as "no indication of the diversion of declared nuclear material from peaceful nuclear activities and no indication of undeclared nuclear material or activities". The report not only reflects our achievement associated with nuclear safeguards in recent years, but also serves as an enhancement in reputation and image within international community. The conclusion also ends any possible worries to both domestic and international media that Taiwan perhaps might be developing nuclear weapons.





↑ Exclusive interview of Minister Shian-Jang by an environmental protection personage

Active public outreach: Making nuclear energy more friendly by a multi reach out to the public

To bring the correct concept and knowledge to students regarding radiation, not only does AEC regularly addresses lectures "Radiation and Life" at schools but also accept applications and requests openly through the internet. Ten speeches have been given totaling about 4,000 attendees.

We continuously put efforts to strengthen information transporency and public services. In 2007, we have handled about 300 e-mail request cases. To provide timely information and updates related to atomic energy applications and regulations, a total of 12 regular and nonscheduled press conferences were held. In addition, chief executives and related directors received interviews by the media and magazines for a total of 10 times.

Increasing roles of international cooperation

◆ The 2007 TECRO-AIT Joint Nuclear Cooperation Conference

The two-day 2007 TECRO-AIT Joint Nuclear Cooperation Conference was held on October 24th and 25th at the Foreign Service Institute, Taipei. A US delegation of 15 came from 7 organizations, including the Department of State, the Nuclear Regulatory Commission (NRC), Department of Energy and its National Laboratories, and American Institute in Taiwan (AIT) Taipei. Organizations from Taiwan included Coordination Commission of North American Affairs, National Tsing Hua University, TPC, AEC and its subordinate Institute of Nuclear Energy Research, Fuel Cycle and Materials Administration, and Radiation Monitoring Center. Attendees of the conference totaled over 100.

During the conference a total of 18 reports on various topics were released by Taiwan and USA. Discussions were made concerning reactor safety and licensing updates, radioactive waste treatment and disposal, nuclear security, health physics and radiation health care quality assurance, control of nuclear technology and the exchange of information, diagnosis and treatment with radioactive material research and development, revitalization of the global energy and nuclear energy, environmental rehabilitation, and other related topics for discussion. More than 60 cooperative projects are scheduled for the next coming year. At the end we arranged USA representatives to visit the Institute of Nuclear Energy Research, the Lungmen power plant, and the National Synchrotron Radiation Research Center.

Based on the signed "Agreenent Between The Coordination Council For North American Affairs And The American Institute In Taiwan Relaling to The Establishment of A Joint Standing Committee On Civil Nuclear Cooperation" which was signed in Taipei on October 3rd, 1984, Taiwan and the United States have been actively carrying out bilateral cooperation. Areas include cooperation of serious accidents react, health physics, isotope applications, seismic studies, spent fuel management, emergency response, non-destructive testing, and progress-reactor nuclear facilities decommissioning, environmental restoration, and such as a total of more than 30 topics. An average of 60 research projects each year was done with cooperation.

By the regular conference of this year and the already established nuclear information exchange relationship between Taiwan and the United States, cooperation of technology and information of nuclear energy will be extended to a new level. This will benefit and



↑Group photo of the 2007 TECRO-AIT JSC Meeting on Civil Nuclear Cooperation Conference

upgrade our nation's nuclear safety standards and promotion of peaceful applications of nuclear energy.

◆ The 2007 Sino-Japanese Seminar on Nuclear Safety

To further increase technical cooperation and information exchange of nuclear powers between Taiwan and Japan, the 22nd on Nuclear Safety took place at Tsuruga, Fukui in Japan from November 13th to 18th. Deputy Minister Tsing-Tung Huang led a total of 20 representatives including members from the AEC, Taiwan Power Company (TPC), and the Nuclear Science & Technology Association (NuSTA), during the conference the Monju demonstration nuclear plant and the Tsuruga Nuclear Power Plant were also visited.

The 22nd (Taiwan/Japan Convention) on Nuclear Safety included the 20 representatives from Taiwan and 70 representatives from Japan. With a further 10 nuclear engineering students posting their research from the University of Tokyo and Nagoya

University, there was to a total of approximately 100 people attending the conference. The meeting was held at the Wakasawan Research Energy Center. Unlike previous conforence, issues and concerns preplanned by both sides were thoroughly discussed. Six main topics: (1) Issues regarding earthquake resistance of nuclear power plants, (2) Operational information exchange of NPP, (3) Safety management and regulations, (4) Countermeasures regarding to aging NPP, (5) Experience sharing in NPP construction, and (6) Siting and Communication of radioactive waste disposal sites were discussed during the conference.

In 2007 Chūetsu Offshore Earthquake, which occurred in the northwest Niigata region of Japan released an amount energy that exceeded the design criteriea, the Kashiwazaki-Kariwa nuclear power plant of TEPCO was forced to shut down and still remains closed now. Taiwan's and Japan's shared geological similarities mean that issues associated with earthquake resistance were the major concerns for both sides, with discussions in a much more concrete and cogent manner than previous years. Every attendee benefited greatly from this years conference.



↑The 22nd Sino-Japanese SemInar



↑Group photo of the attendees from Taiwan and Japan

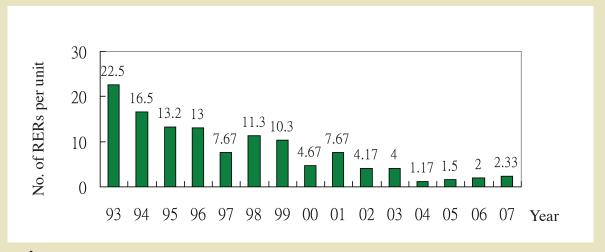
[Department of Nuclear Regulation]

The Department of Nuclear Regulation (NRD)has devoted a great deal of manpower every year to conducting different types of inspection, e.g. using resident inspection to keep abreast of daily operation status of nuclear power plants (NPPs), conducting several team inspections while adding one more resident inspector during the refueling outage in order to maintain the quality of major equipment and components. NRD also conducted unscheduled inspections systematically to identify possible deficiency in the plant to ensure safety. For the installation and testing of the major equipment and components of the Lungmen NPP in construction, AEC has also sent its staff to conduct quality assurance auditing on the spot so as to enhance the reliability of the equipment and components in their future use.

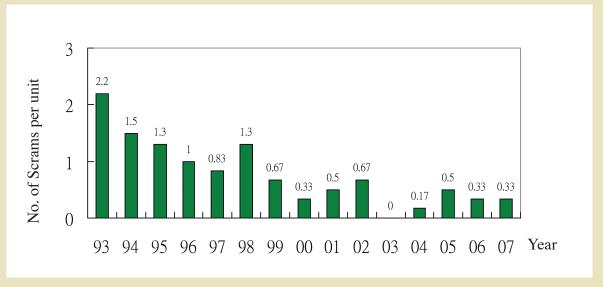
♦ Statistics of nuclear power plant inspection manpower and results

Plant	Chinshan	Kuoshen	Maanshan	Lungmen	Total
Inspection memorandum (cases)	19	8	14	12	53
Corrective action (cases)	15	19	14	12	60
Violation (cases)	2	3	0	5	10
Resident inspection (man- days)	280	293	286	301	1160
Refueling outage inspection (man-days)	62	90	47	0	199
Special inspection (times/ man-days)	13/160	14/151	10/163	8/339	45/813
Technical Specification revision (cases)	4	12	10	0	26
Design change (cases)	3	7	0	0	10
Operator license (persons)	31	26	25	0	82

There were 14 abnormal (reportable) events, including two automatic scrams, at the six operating nuclear units in Taiwan during 2007. This record is within reasonable variation for safe operation of NPPs, and all of the events were designated as "Level Zero", the lowest in severity, in the "International Nuclear Event Scale". Over the past 15 years, the annual average number of reportable event reports (RERs) per unit dropped from over 20 to around 2, and the average number of automatic scrams per unit decreased from over 2 to well below 1. To make operational safety of NPPs more transparent and understandable, Red/Green Color Designation of Safety Significance was devised to designate safety significance of various performance indicators and inspection findings using green, white, yellow and red lights. In 2007, among the 78 items designated, only one item showed white while the remaining items showed green, demonstrating a safe and stable condition continued in the operation of the nuclear power plants.



Average number of reportable event reports occurred in nuclear power plants in Taiwan



Average number of automatic scrams of nuclear power plants in Taiwan



↑Minister Su inspected Lungmen nuclear power plant



↑Minister Su inspected Lungmen nuclear power plant

During 2007, NRD also held 7 reactor operator license examinations. A total of 87 persons took the examinations, and 72 passed. NRD also conducted a Component Design Bases Inspection (CDBI) for the first time, completed 22 reactor safety cornerstones inspection procedures, built the intranet-based Nuclear Knowledge Management Website to strengthen the transfer of regulatory experiences to young inspectors, accomplished many important safety review tasks, such as Kuosheng NPP Measurement Uncertainty Recapture (MUR) power uprate, the installation of on-line Automatic Seismic Trip System (ASTS) at each plant. For the Lungmen NPP in construction, NRD inspected the installation of major components, performed special inspections on digital control system and reviewed the Final Safety Analysis Report (FSAR), among other regulatory duties. In 2007, besides for routinely posting the findings of nuclear safety cornerstones inspection on the internet, NRD also accomplished 83 inspection reports and posted them on the internet. The public could obtain all the information regarding AEC's regulatory activities of NPPs through its website www.aec.gov.tw.



↑Minister Su inspected Maanshan nuclear power plant



↑AEC inspectors inspected Kuosheng nuclear power plant



↑ Lungmen unit 1 control building in construction

↑Lungmen unit 1 reactor building in constructiont

↑Lungmen unit 2 reactor building in construction

In order to enhance regulatory consensus between AEC and Taipower, NRD held regular meetings for the operating NPPs as well as for the Lungmen NPP. Moreover, NRD held several special meetings to enforce rapid implementation of the corrective actions for operating power plants and enhance the quality for the construction of the Lungmen NPP. AEC also invited academics, experts from different disciplines and local county and township representatives to attend the meetings held by the Advisory Committee on Nuclear Facility Safety and the Supervising Committee on Nuclear Safety of the Lungmen Station every three months, so as to widely and regularly welcome opinions and advice from all fields with focus on quality and safety issues to ensure the safety of NPPs in Taiwan.



↑ Lungmen unit 1 turbing building in construction

[Department of Radiation Protection]

Strengthening control of radiation sources to provide a hazard-free environment

In order to protect the public's radiation safety, AEC has used a full set of rigid certificate/license and permit system to control the production, purchase, export (import), installation, use, disuse, transfer and abandonment of radioactive materials, and equipment capable of producing ionizing radiation related workers and radiation protection personnel. As of the end of 2007, the numbers of certificates and licenses issued by AEC are summarized in the following table. AEC also conducted and unscheduled periodical inspections of the radioactive materials and the equipment capable of producing ionizing radiation which are under regulatory control. For sealed radioactive materials, AEC has further requested the trade to perform monthly declaration on-line through the radiation protection control system, so as to ensure that all the radiation sources are under safety control.

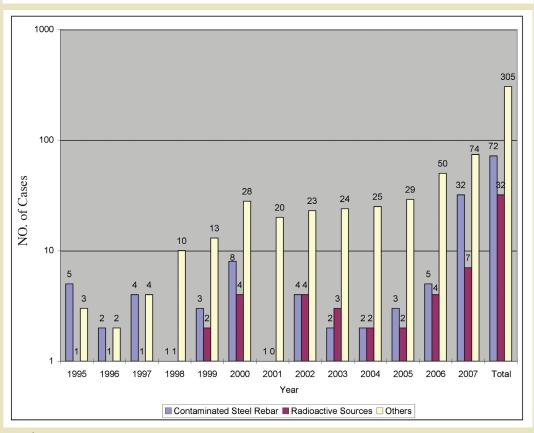


↑ Inspection of radiation sources



↑AEC staff conducted annual inspection in hospital

Number of Relevant Licenses and Certificates Issued (Compiled Date: 2008/01/07)						
Licenses and Certificates	Category	Quantity				
License of Radioactive Material	Permission	2,047				
Lineare of Faultane and Councille of	Registration Permission	1,429				
License of Equipment Capable of Producing Ionizing Radiation	Registration	17,926				
Radiation Safety Certificate for Radiation Worker	11,257					
Certificate of Operator (Including High-Level Radiation Facilities and Manufacturing Facilities)	80					
Certificate of Radiation Protection Personnel	Senior Radiation Protection Specialist	727				
	Radiation Protection Specialist	2,323				



Iron and steel radiation detection system fully implemented to prevent radioactivity contamination

In order to prevent domestic steel products from radioactivity contamination, AEC has assisted the domestic steel industry in establishing a radiation detection system, in which 18 steel mills with furnaces have installed portal type radiation detectors to conduct radiation detection on all the in-and out- materials and ex-factory products so as to ensure no abnormal radiation occurring to the entry and exit goods. AEC has also conducted annual inspection at every steel mill in order to make sure that all the steel mills have followed the regulations to perform detection operation. For every spotted abnormal radiative material, AEC has properly tracked, disposed of or isolated in order to ensure that the steel products are free from radioactivity contamination. It has well progressed since the implementation of the system in 1996.



↑Portal type radiation detector in a steel mill



↑Radiation detection before steel product leaves factory

AECs medical exposure quality assurance program expanded to enhance the quality of radio-diagnosis and radio-therapy

The purpose of promoting medical exposure quality assurance is to ensure that the patients receiving radiotherapy can receive proper dosage at accurate positions so as to enhance the treatment efficacy and reduce side effects. It is also hoped that optimal images can be obtained under reasonable exposures, which could help doctors make correct diagnoses. Based on the Ionizing Radiation Protection Act, AEC has begun implementing the medical exposure quality assurance program for the radiotherapy equipment, such as linear accelerators, Co-60 Tele-therapeutic machines, and Brachy-Therapeutic Machine since 2005. AEC was also ready to add gamma knives, cyberknives and computed tomography therapeutic machines to its medical exposure quality assurance program, effective January 1, 2008. About 1.2 million patients are expected to benefit from the QA program every year. Also, given the fact that breast cancer in Taiwan has topped the list of female cancer occurrences and in view of mammography being considered the optimal means for early diagnosis of breast cancer, the Bureau of Health Promotion of the Health Department has been actively promoting woman mammography screening in recent years. As a result, more than 110,000 women every year have received the mammography screening. Thus, one of the key tasks for RPD in 2007 was to be prepared for the mammography medical exposure quality assurance program which is scheduled for full-scale implementation in July 2008.



↑ AEC Assisted medical institutions in conducting medical exposure quality assurance operation



↑ AEC held mammography medical exposure quality assurance training course

[Department of Nuclear Technology]

Laid down and examined the related operations regulations to build a well-rounded emergency response mechanism

- To operate in coordination with the disaster prevention and relief and the national civil defense mobilization system, the Department has accomplished the radiation disaster prevention and relief plan, and the 2008 national defense mobilization program regarding technology mobilization and preparation the categorization plan to support the radiation disaster contingency mobilization and preparation to reinforce the national disaster prevention and rescue system.
- Formulated "the guidelines for the establishment, organization and operation of the nuclear emergency recovery committee", in order to refine the nuclear emergency response mechanism.

Conducted nuclear emergency exercises to enhance emergency response capability

■ The 2007 nuclear emergency exercise was held on August 21 and 22 in a professional and pragmatic manner, so as to effectively strengthen nuclear safety education and communication on the working crew and the public.



↑ Annual exercise at the forward command post of the national nuclear emergency response center



↑Decontamination drill conducted by the supporting center

- By cooperating with the National Security Council and supporting the Executive Yuan's national defense mobilization preparation taskforce, the Department sent its staffs to station in Yuanshan command post for Yushan 2007 drill and Hanguang 23 military tabletop drill, in an attempt to better the preparedness and supplement of various contingency resources.
- In line with Wanan 30 drill, the Department conducted a radioactive bomb explosion emergency rescue drill at Xinguang Township of Chiayi in order to accumulate its experience through the nuclear emergency operation and utilize it to build an allied emergency mechanism between central and local agencies. In this way, our "homeland security network" can therefore be constructed.
- The Department implemented the "2007 personnel training of nuclear emergency decision making". A total of 87 staffers from all response centers, participated in the training.
- The Department held the "2007 local government radiation disaster response workshop" in Taipei, Taichung, Tainan, Kaohsiung, Hsinchu and Hualien. Participants included the nuclear security related personnel from the varions office of the National Police Agency and the county/city governments. Totally, there were 270 participants.



Nuclear emergency exercise at the Kuosheng nuclear power plant



↑ Detection of personnel access in the control zone

Fulfilled the preparation of disaster prevention and rescue during the peace time

- During 2007, the Department inspected the preparedness and drills of the emergency response plan in the three nuclear power plants, and conducted unannounced mobilization testing to verify the mobilization capacity. Comments and recommendations were provided to Taipower for further improvement.
- The Department assisted local governments in establishing the initial response capacity for radiation detection, entrusted INER to produce INER-9200 radiation detectors for use by local governments. Training workshops were also conducted for users. A total of 11 county/city governments received the detectors from the Department.
- The Department held the 16th task coordination meeting for the national emergency response system to weigh in on the mutual connection and integration of the systems of nuclear emergency response, disaster prevention and rescue, emergency medical care, anti-terror actions and national defense mobilization preparation, in an attempt to reinforce the contingency and coordination mechanism among respective emergency response systems.
- The Department held the "AEC regulatory activities seminar" and implemented a series of "2007 nuclear emergency communication with locals family visit plan". The activities were mainly to familiarize the township leaders, representatives and village leaders in the emergency planning zone with the AEC's regulatory activities, government's emergency response to nuclear incidents, and the public's cooperation.



↑ Unannounced mobilization testing conducted during the non-office hours at the Chinshan nuclear power plant



↑ Inspection of emergency preparedness at the Maanshan nuclear power plant

Reinforced the operation functions of the nuclear safety duty center

- The Department has augmented the capacity of the un-interruptible power system, replaced VGA matrix switch and added the advance system of the optical fiber circuit with Taipower.
- The Department held 2 sessions of on-duty staff training. As a total, 120 people attended the training, which has effectively elevated the staff on-duty implementation capability.
- The Department completed 2 sets and revised 7 sets of operation procedures for the nuclear safety duty center in order to accurately carry out a variety of reporting and testing procedures.
- The Department received a total of 131 local and overseas visitors in 32 groups for their visit of the nuclear safety duty center.

Strengthened nuclear security and anti-terror actions to ensure the safety of nuclear facilities

- The Department has inspected the security system of the three nuclear power plants and pushed Taipower to improve nuclear security as requested so as to, ensure the safety of nuclear power plants.
- The Department revised the "contingency plan for countering radiation substance terror attacks", and provided to county/



↑Visit of the Chinshan nuclear power plant made by Yang Chao-Yie, AEC's deputy minister, to inspect the plant's security operation

city governments for their use as guidelines for their contingency plans.

Nuclear information security measures

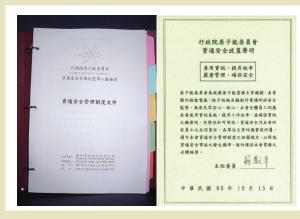
- The Department established an AEC information security and management system, drafted the information and communication security policy statement, prepared asset lists, conducted weakness detection, filtration testing, information asset risk appraisal, and devised and implemented a management mechanism so as to strengthen the protection of the information and communication security.
- In line with the policy of the Directorate-General of Budget, Accounting and Statistics of the Executive Yuan, the Department has conducted external auditing of the information and communication security, coordinated with Civil Service Ethics Office to conduct internal auditing of the information and communication security to inspect and reinforce AEC's overall information and communication security protection measures.
- The Department also conducted annual information and communication security reporting drills and helped its subsidiary organizations conduct information and communication security reporting and emergency response drills so as to strengthen their capacity of handling information and communication security incidents.
- The Department held an information and communication security education training to enhance the personnel's awareness of information and communication security. Two sessions of training were held respectively for general personnel and supervisors while additional five sessions were specifically held for information personnel.
- The Department inspected the cyber security operation at the maanshan NPP trying to have Taipower put more stress on the protection of cyber security and ensure the safe operation of the plant.
- The Department constructed a spam filter and detection system to watch out continuously for virus attacks, and set up a fire wall to rigidly block the attack of viruses transmitted through mails and false advertisement and hackers, in order to effectively maintain the normal operation of AEC's computers.



↑ Training to reinforce information security: Overview of information and communication security management system, and the safety of database and homepage program



↑ Establishment of information security and management system, including information and communication policy and the documentation of information and communication security management system



Network security defense equipment: fire wall and anti-virus wall

[Institute of Nuclear Energy Research (INER)]

Abstract of annual key performances and achievements

The Institute of Nuclear Energy Research (INER) has been actively integrating its R&D resources since 2004. There are three technology R&D centers and one R&D support center operating in matrices. Among them, the Nuclear Safety Technology Center is responsible for developing technologies for nuclear energy safety, nuclear facilities decommissioning and radioactive waste management. The Radiation Application Technology Center focuses on radiation biology and radiopharmaceutical R&D. The Environment and Energy Technology Center is responsible for developing new energy and environmental plasma technologies. In total, there are five main R&D fields and their central focus is on the development of practical solutions using system integrations.

The key performances and achievements of INER's research and development in 2007 are summarized below.

Nuclear safety technology

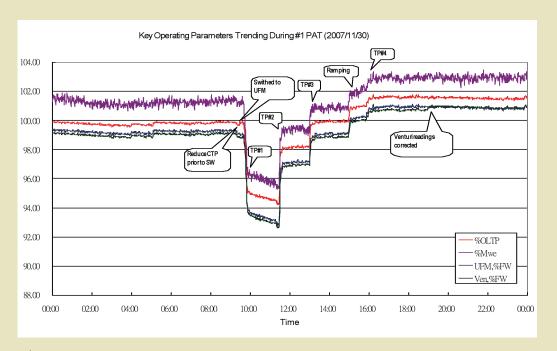
The Nuclear Safety Technology Center (NSTC) visions itself to be a capable and

unbiased technical center, a technical arbitrator at national laboratory level of excellency, and a reliable research institution that contributes to enhancing the public confidence on nuclear safety. In order to keep step with global renaissance of nuclear power, NSTC sets goals to continuously support

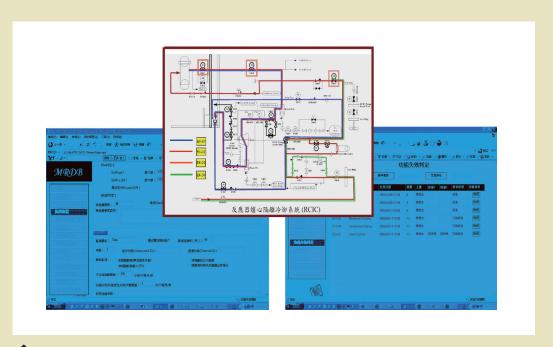


↑The UFM system (Caldon LEFM CheckPlus) installed at Kuosheng NPP

the safety for operating NPPs and the quality for Lungmen NPP construction, to develop techniques for processing radioactive wastes, and to assist AEC in reviewing and auditing related regulatory activities. In 2007, NSTC submitted 52 patent applications, published 58 international journal papers and 598 internal technical reports, and received business



↑The power ascension test and switchover at Kuosheng NPP Unit 1



↑The Maintenance Rule Database (MRDB) System

revenue for about NT\$ 582,866,000 and technical licensing fee at NT\$ 1,997,000. Comparing with previous years, each of these performance indicators reflected substantial progress and attained various technical achievements, with typical examples briefly described below.

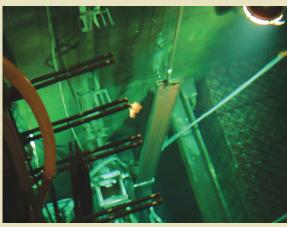
In the area of nuclear safety, INER has completed 81 license renewal application related documents for Chinshan NPP, including scoping, aging management, TLAA and fatigue evaluation. A peer review was conducted in the USA in June 2007. Safety Analysis Report (SAR) of the spent fuel dry storage project of Chinshan NPP is nearly approved by AEC. Assisted by NSTC, the subcontractor, CTCI Machinery Corporation, of the canister manufactory is qualified by ASME as an "N" Certificate Holder. The Measurement Uncertainty Recapture (MUR) work of Kuosheng Unit 2 has been finished. The UFM for Unit 1 has also been installed and is conducting required tests at the end of 2007. Both units can raise about NT\$ 100,000,000 electricity yearly. AEC has approved and issued SERs for the reports of RETRAN system thermal-hydraulic analysis model, ATWS safety analysis methodology and SBO safety analysis of Chinshan NPP. These reports will sufficiently support the MUR application. NSTC was contracted "Economic and Safety Evaluation for New Fuel Fabrication Services Bid for Nuclear Power Plant" . The fuel vendor awarded the contract will provide new fuel fabrication services for next 10 years. The 126 spent control rods of Chinshan Unit 2 have been cut and pressed to reduce storage space, and the work of Unit 1 is expected to be finished soon. The MOV verification test contract for Lungmen NPP has been awarded to NSTC. Comparing to the foreign quotation, it saves about 1 billion NT dollars. In 2006, the PRA team conducted a



The Loading of CRB Velocity Limiter into the Waste Barrel



The Loading of Compressed CRB Blade into the Container







↑ The Container Loaded with Compressed CRB Blades Hanged Inside the Spent Fuel Pool

quantitative risk assessment (QRA) on the phase 1 LNG tanks at the Yung-An site of the Taiwan Chinese Petroleum Corp. (TCPC). The results had been reviewed and accepted by the Labor Affairs Council (LAC). The LAC granted the TCPC with 2 additional years of extension in March 2007, depending on the final results of the QRA of the LNG tank systems performed by INER. The TCPC saved more than 2 billion NT dollars of direct costs with the exemption of periodic inspections of LNG tanks. The QRA technique has demonstrated its effectiveness in helping managers to make decision on the base of associated risk information and to optimize the resource taking full consideration between safety and operation requirements. The PRA team prepared the continued project for the QRA on the phase 2 LNG tanks at the Yung-An site in 2007, and it is expected to be granted the QRA associated projects on the Earth-Covered Tanks (ECTs) at the refinery and the OL3 plants of the Formosa Petrochemical Company in 2008.

In radiation safety, NSTC used the ICP-MS technique to develop the measurement and analysis method for transuranium radionuclides with long half-lives. This technique saved us complicated chemical purification processes of the traditional alpha spectrum counting method. Meanwhile, NSTC completed performance evaluation of the radioactivity monitors, which measure the solid wastes that are contained in barrels to be released or delivered. NSTC also continued to work actively on development of radiological dispersal devices (RDD)/dirty bomb emergency preparedness technology and improve mobile detection technology for environmental radiation to meet national needs in anti-terrorism operations. In 2007, NSTC supported the Won-An No. 2 drill with its self-developed web-based GIS information integration management system, emergency preparedness data warehouse system, contamination diffusion dosimetry evaluation

system, PC simulation on-line training platform as well as the mobile detection technology for environmental radiation. For the measurement standards establishment in the national standard laboratory, 19 comparison items of dosimetry and radioactivity were entered into the Appendix B of the BIPM (Bureau International des Poids et Measures) KCDB (key comparison database) and another 88 calibration services items were entered into the Appendix C of the BIPM KCDB. In international comparison activities, NSTC hosted the APMP.RI(I)-K4 comparison and played the chairman of the Technical Committee on Ionizing Radiation (TCRI) of the Asia-Pacific Metrology Programme (APMP); both showed that Taiwan's radiation protection technologies have achieved the world-class level.

Nuclear facilities decommissioning and radioactive waste handling play important rolls in environment safety. Major achievements in 2007 are described briefly as follows. One of the three research reactors in INER, the Water-Boiled-Reactor (WBR) in building 019, was decommissioned. In the on-going TRR spent fuel stabilization operations, seven ruptured spent fuels have been transported into the hot cell and five of them have accomplished the oxidation procedure. The transuranic contaminated Unit 20 glove box and five large-scale process tanks with its subsidiary piping facilities were dismantled in the 016 laboratory. The UO2 fabrication laboratory in building 021 and the solidification experiment facilities in the 039 laboratory have also been decommissioned and reused as non-radioactive controlled laboratory. For the radioactive waste recycling, 1,200 tons of concrete and 20 tons of metal from the WBR and 015K decommissioning procedure were qualified for clearance release, and 650 tons of concrete from the WBR biological shield were qualified to release as usual material. Furthermore, INER has obtained permission from the authority for the



↑ Unit 20 Glove Box in Building 016 Before Dismantling



↑Unit 20 Glove Box in Building 016 After Dismantling

operation of, one of the five in the world, radioactive waste plasma incinerator, which is under test before get into operation. The metallic waste decontamination facilities in the 012 building have fulfilled 600 barrels annual operation target. The major function of the decontamination facilities is to collaborate with the clearance procedure for metallic waste recycling.

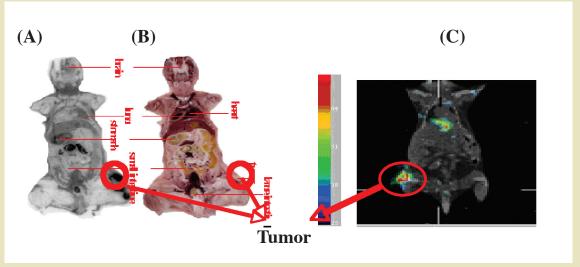
Radiation application technology

Both in the industrial development plan of "Challenge 2008 National Developing Key Plans" and "Two Trillion, Twin Star", bio-technology is listed one of the major intent industries the government focus on. In terms of this policy, the Radiation Application Technology Center (RATC) aims at the domestic clinical applications which provide the protection of the national health and early treatment among the related diseases. RATC developed medical radioisotope, new nuclear medicine, and irradiation therapeutic technology for both diagnosis and therapeutic demands, image fusion technology, technical service, created GMP and ISO-9001 (2,000) with its connected SOP, moreover, to promote the competitive ability of our country industry.

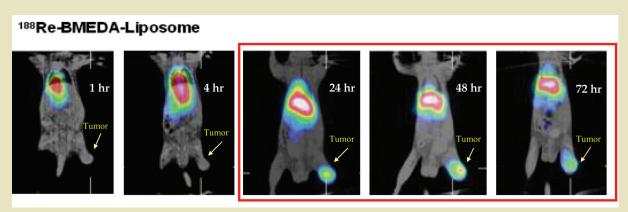
The RATC quantification accomplishments in 2007 contained: there were 187 research reports, 34 papers in international journal (31 papers in SCI), and external and internal conference dissertations. Of the 34 invention patents, 6 cases had been licensed and franchised income of NTD 5,825,000. Revenue in approving qualified sales of new medicines and radiation service amounted to NTD 167,750,000. Acquired one chartered license for INER MIBI KIT and hold two domestic large-scale seminars. Annual performance was listed as following:

- Promoting technologies of isotopes producing: Beam upgrade for the ion source performance we achieved 8 mA at 2.5 kW arc power, the tellurium-alumina target was set up technologies to produce radioiodine isotopes, we completed an automatic radiopharmaceutical dispenser and developed process of new irradiation therapeutic Cu-64.
- Radiopharmaceuticals: Establishment of proteomic analysis system and technical platform for protein biomarker discovery. It could support us to discover the protein

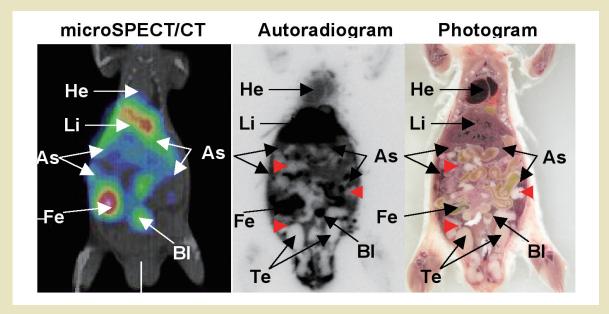
biomarkers of early liver cirrhosis and Alzheimer's disease and furthermore set up the diagnostic technologies and kits. We completed drug resistance of cells and its analysis combine with the Tc-99m-MIBI resistance applications thus it will be a good platform of sifting new anti-cancer drugs. The results of radioiodinated annexin V induced cell apoptosis were as our anticipation, we set up the biodistribution, pharmacokinetics and imaging of 188Re-BMEDA-Liposomes after intraperitoneal injection in a C26 Colon carcinoma ascites mouse model, the techniques of SOCTA-Herceptin and HYNIC-Herceptin to combine to HER-2/neu breast cancer receptors were successful set up, and



↑ Posterior whole body autoradiogram (A), photogram (B) and micro-SPECT/CT images (C) of a representative SCID mouse bearing subcutaneous HER-2/neupositive BT-474 human breast cancer xenografts at 24 h post-injection of 188Re-SOCTA-Trastuzumab. Tumor uptake is visualized as indicated by red circles and arrow. The autoradiogram and anatomic photogram of the section were performed immediately after micro-SPECT/CT imaging.



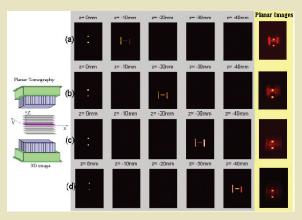
↑Micro-SPECT/CT images of 188Re-BMEDA-Liposomes targeting tumors in C26 tumor bearing BALB/c mice. The 188Re-BMEDA-Liposomes containing 0.5 mCi of 188Re was administered to each mouse by intravenous injection. The images were acquired at 1, 4, 24, 48 and 72 h after injection. Images clearly showed the accumulation of 188Re-BMEDA-Liposomes in tumors at 24, 48 and 72 h after injection.



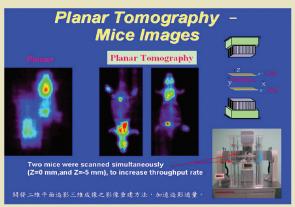
↑ Coronal microSPECT/CT image correlated with whole-body autoradiography in mice. MicroSPECT/CT imaging was performed at 72 h after i.p. injection of 12.95 MBq/200 μl RBLPL and scanned for 90 min. The mouse was i.p. inoculated C26 colon cancer cells after 13 days. The autoradiogram and anatomic photogram of the section were performed immediately after microSPECT/CT imaging. Tumor nodules are indicated by red arrow (Li: liver, As: ascites, He: heart; Fe: feces, Te: testis, Bl: bladder).

we also developed procedures of labeling Re-188 SOCTA-Herceptin, QC analysis and animal experiments, the animal model of liver cancer cell line N1S1 inoculated to SD rats and therapeutic assessment of Rh-188 ECD/ Lipiodol in animals were developed. There was one member made a visit mission to the Drug Studies Unit, Analytical Division, UCS and NIDA, NIH to introduce bio-assay and techniques of metabolite of drugs and this will help us to setup a unique laboratory to authenticate both pre-clinical and clinical metabolite of radiopharmaceuticals, and we cooperated with Prof. Huang of University of North Carolina to clad radioisotope Re-188 into liposomal vaccine to cure lung tumors, and we signed a contract with the Federal University of Sao Paulo-UNIFESP, SP-Brazil (UNIFESP) to extend Tc-99m TRODAT-1 kits as international cooperation.

■ Molecule image and medical equipments: We successful developed a bi-functional animal molecule image system, micro PET/CT, for R&D new drugs, and upgraded the SSD to improve the image contrast of INER micro-CT, and a new system interface between operator and INER micro-CT was created, for simplify procedures of the experiments the technique for image quantification was set up. We complete program development and reconstruction of 2D radiography and 3D images. Round photomultiplier tube (PMT) was successfully developed to adjust the front-end electircal



↑ Two phantoms placed at different z-direction locations. ":" phantom was always at the center and the "H" phantom was moved to various locations (z=-10, -20, -30, -40 mm). Left panel are the results of planar tomography, and right are planar.



↑ Results of two-layer couched tumor-bearing mice imaging, two mice placed at Z=20 mm, and Z=-50 mm were scanned simultaneously. The results of planar tomography reveal that scanned mice could be placed on the off focal plane without blurring the images.

signal processor module before amplifying. For improving the reconstruction efficiency and images quality, there was one member made practical training to the PET research laboratory in M.D. Anderson Cancer Center, University of Texas for a month, and the mission included the design idea of the units of PQS PET detectors, conducting scintillation crystal, input/output signal processing, and signal interface. The introduction of new technology from Prof. Gary Wong, University of Texas was a low cost and globular unique PMT Quadrant Sharing technology.

Environment and energy technology

The major R&D efforts of the Environment and Energy Technology Center are focused on the development of environmental plasma, renewable energy and associated technologies. To implement these technologies, a series of small-scale testing, prototype and pilot plants as well as demonstration facilities, are being set up. This Technology Center will then foster those matured technologies to industry communities.

In the year of 2007, accomplishments made in this center include: publishing 62 international journal papers (57 SCI papers), 70 conference papers (18 international conferences) and 351 technical research papers, application of 155 invention patents,

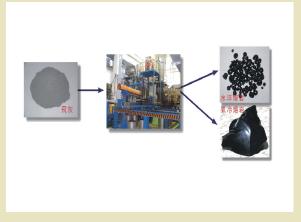
and endorsement of NDA agreements by 7 domestic companies for technology transfer, and income from commissioned projects and royalty of NT 110 million and 20 million respectively. The other achievements of 2007 are outlined below.

■ Environmental Plasma Technologies:

On February 16, 2007, permission for commercial operation of "The LLW Plasma Incineration and Melting Plant at INER" was granted by the FMCA, Atomic Energy Council of R.O.C. Taiwan then became the fourth country possessing plasma melting capacity to treat low-level radioactive wastes after Russia, Switzerland and Japan. The novel technique of high-temperature measurement for thermal plasma using Alexandrite spectropyrometer has been well established at INER. The actual temperature of flame jets can be correctly measured in real-time, irrelevant to the distribution of emission spectrum from flame of thermal plasma and whether the plasma is in LTE state. Obviously, it would be a great benefit to monitor and adjust the plasma torch. The fabrication of porous soundproofing plates from plasma molten slag was also completed. The plate has a dimension of 30 × 30 cm², porosity of 55%, and bulk density of approximately 0.85 g/cm3. In addition, the material has a soundproof level of E class, which would absorb a noise level of 42 dB. In order to study the lifetime of the electrode and gain the optimal condition of operation for plasma torch, the long-time testing platform has been installed as well. The modules of testing platform include gas-supply, cooling, power-supply, and safeguard subsystems. Furthermore, a series of techniques of plasma diagnostics have been established. The large-scale hollow cathode plasma source driven by 350 kHz DC discharge has been developed. Due to its lower ionic



↑ Large Screw-rod Plasma Surface Modification System



↑Recycled Products from Plasma Molten Slag

energy compared to the pure DC discharge and the higher plasma density up to 5× 1010 n/cm3, enhancing the activation rate on the polymer films, it is very suitable for the industrial application. The MOS device forming high-K dielectric layer by PIII (plasma immersion ion implantation) makes the EOT (equivalent oxidation thickness) reduction as well as leak current reduction. This process thus presents a great potential to further reduce the scale of integrated device. The roll-to-roll plasma activation system has also been developed successfully and applied in the flexible raw materials for domestic touch-panel industry.

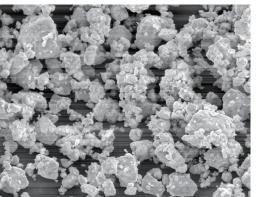
■ Renewable Energy: In this project, an "Energy Demonstration Park at INER", including a 100 kW HCPV power generation demonstration system, a pilot plant for 10-kg grade Cellulosic Ethanol Production, and a height of 49m lattice type wind tower for





↑ Direct Methanol Fuel Cell





↑Components of Solid-Oxide Fuel Cell

wind turbine field testing, was set up. Additionally, hydrogen storage capacity of MOF materials developed by INER is over 4.7 wt% under room temperature and 6.9 MPa. As the pressure increases to 10 MPa, it is possible to have a storage capacity over 5 wt%, a rather high value among most international research organizations.

■ R&D work on SOFC: the robust capability of stack design, component manufacture, sealing procedures, operation procedures, as well as cell/ stack performance test, has been well set up. The major accomplishments are briefly outlined. (1) The power density of INER-made MEAs either by traditional tape casting methods or Atmospheric Plasma Spraying techniques reaches 400~600 mW/cm2 (800 oC), which is at the same level as the famous international organizations. (2) Screening test of 42 formula of noble metal honeycomb type reforming catalyst with ethanol was performed. The system hydrogen generation efficiency is higher than 60%, and it would suffice the requirement of a 1 kW SOFC system. Furthermore, the 960-hour durability test was executed for a revised ethanol-hydrogen production system with a system size reduction of 50%. (3) The glass-



↑A Design of 25kW Wind Turbine System with Passive Control



↑The 150kW Wind Turbine Blade



↑The 200kW Dynamo Test Station



↑The Electronic Design for Power Conversion

ceramic sealant material gc9, with proper physical and chemical properties and long-term stability, has been employed for INER's stack. (4) A series of SOFC stack have been assembled and tested. The power output of a 25-cell stack, where InDEC's cells were used, reaches to 1008 W with λ equal to 1 and fuel utilization 48%.

- Wind Power Technology The following accomplishments were fulfilled: (1) setting up an integrated software package system for wind potential evaluation and wind field forecasting in our High Performance Computer Cluster System, (2) developing 25kW wind turbine systems with both active and passive control designs, (3) designing a FRP wind turbine tail vane for yawing control and for over speed protection, (4) setting up a 50m high lattice type wind tower for wind turbine field testing, (5) developing and completing the test of the first homemade hundred kilowatt class wind turbine blade, (6) setting up the first homemade hundred kilowatt class dynamo test station for wind turbine, and (7) developing a 25kW wind turbine inverter with maximum power tracking and low speed kickoff functions.
- Power Base Load: This project is to establish the integral assessment of sustainable IGCC system, including system design, optimization of advanced process research, life cycle assessment and domestic energy system model. The evaluation time period for the energy model is from 2000 to 2050, which is adequate to reflect possible technologies and scenarios in the future. The energy model is suitable for evaluating mid-term and long-term energy plan. This plan has accomplished the theory framework and preliminary establishment of CGE model for evaluation new energy industry development.



↑Ground Mounted 5 kW HCPV System



↑Roof-top 5 kW HCPV System

■ Photovoltaic System: The goal of this project is to establish domestic High Concentration Photovoltaic (HCPV) system technologies including manufacturing processes, assembling and testing of solar cells, encapsulating and qualification of HCPV module, developing of solar tracker, system integration and testing technologies, etc. The output power of one single module reaches over 100 W as the Direct Normal Irradiance (DNI) is 850 W/m2. Tracking accuracy of the homemade 5 kW tracker is below 0.5°. Compliance with the testing requirement and standard procedure of IEC 62108, 13 out of 17 items for the qualification technology of HCPV module have been successively established.

■ Cellulosic Ethanol Production:

The two-step pretreatment technologies including acid-catalyzed steam explosion and twin-screw extruder were established. The release efficiency of xylose from xylan in lignocellulosic fiber can reach up to 80%. These processes will be the design bases for the first instrument of acid-catalyzed pretreatment process with a feeding capacity of 1 tons/



↑ Hydrolysis / Fermentation System for Cellulosic Bioethanol

day in Taiwan. High solid reactor of enzymatic hydrolysis was also developed with a the solid content of hydrolysates over 20%. Investigation of simultaneous saccharification and fermentation process would result in a further reduction of capacity cost and reaction time. To enhance the fermentation efficiency of xylose, the adaptive yeast and its fermentation technology for xylose-to-ethanol were also developed. The ethanol yield of xylose fermentation was as high as 85%, which places this center at a leading position among international communities.

■ Conferences/Workshops hosted by INER

(1) The 2007 Taiwan Bioethanol Development Trend Workshop was held on Jan. 24, 2007. Outstanding domestic and international experts on micro-organism



↑2007 Taiwan Bioethanol Development Trend Workshop



↑2007 Taiwan Small Fuel Cells Symposium

development were invited to present 8 papers to around 150 people in the workshop.

- (2) The 2007 Taiwan Small Fuel Cells Workshop was held on June 21-22, 2007. In the workshop, internationally renowned companies, such as: Samsung, DuPont, Johnson Matthey, PolyFuel, ACTA, and CMR, participated and exhibited their latest development on the small fuel cell technologies.
- (3) A meeting for the "INER MARKAL-MACRO Modeling Capability Establishment-Taiwan's 2000-2025 BAU scenario energy analysis" was held for peer reviews and discussions by review committee outside the INER.

■ International Collaboration

- (1) A memorandum with Underwriters Laboratories (UL) was signed to develop a collaborative relationship on HCPV module validation, reliability analysis, safety issues, material degradation, and failure analysis.
- (2) A R&D project of the low-voltage input, high-efficiency power conversion system was commissioned to the Virginia Polytechnic Institute and State University (VT), which is known for its experience on power modulation and conversion design.
- (3) A Non-Disclosure Agreement was signed with the American Polyfuel Company on the DMFC technology.
- (4) A Non-Disclosure Agreement was signed with a NASA's strategically allied Working Group.
- (5) A collaborative work with the University of California at Los Angelus (UCLA) was performed for the "high-density, high-uniformity plasma reactor system".
- Honors and awards: "The development and application of photovoltaic technology using compound semiconductor" was granted a Grade A distinguished research award by Technology Committee of Executive Yuan in 2006.

INER was also the role organization granted the distinguished awards on both atomic and environmental fields among the domestic research institutes in Taiwan by the National Science Council. As a perspective outlook to the 21st century, this Institute has a vision to become one of the most outstanding research organizations among the international communities. We will devote to the following:

- (1) To a Accelerate and foster technology transfer to industries, as well as to establish outstanding system integration teams.
- (2) To take advantage of INER's capabilities on system integration and combine with the strength of domestic industries, to explore the oceanic natural resources of this country.
- (3) To comply with the revival of nuclear energy internationally, INER will speed up the cleanup work for the obsolete nuclear facilities, develop decommission and reduction technologies for radioactive wastes, develop disposal techniques with system optimization, as well as to improve the seismic analysis techniques for the nuclear facilities.
- (4) To promote the collaborative work between INER and international institutes on the basis of mutual benefits, so that the R&D work can be more specific with lower risks as well as to further improve the overall performance.

This year, we also have been evaluated by the National Science Council (NSC) as a research organization of grade "excellent" in two categories (i.e., atomic energy and environmental protection) based on the R&D performances, and INER is the sole research institute to receive such a high honor this year. Looking forward to the 21st Century, to become a leading world-class research institute is our perspective, the specific directions for our R&D efforts in the future are put forth as follows: (1) to accelerate the industrialization of our developed technologies as well as to actively transform into a leading R&D team of system technology in the world; (2) to participate in the national new energy R&D programs, to fully make use of our advantages on system integration, and to combine with the industrial strengths of our country so as to explore our natural resources as an island nation; (3) to take into account the international trends on nuclear renaissance, to accelerate the cleaning-up of our unused nuclear facilities, to develop technologies for reduction of decommissioned radioactive wastes, to develop optimization systems for deposition and storage of nuclear wastes, as well as to strengthen the studies on effects of earthquakes on the safety of nuclear facilities; (4) to integrate global useable resources, to focus on key issues of R&D, to expand international collaboration and cooperation, to lower the risks of R&D, as well as to promote the R&D performances and efficiencies.

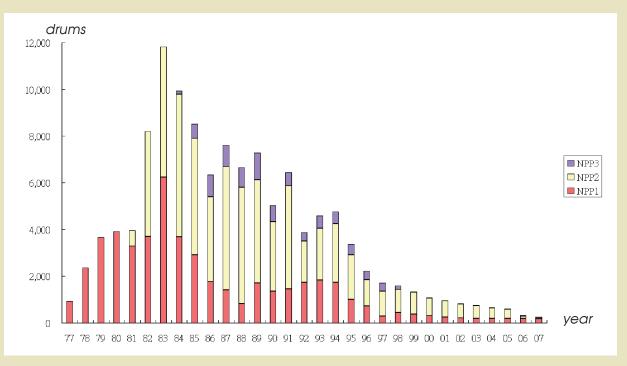
[Fuel Cycle and Materials Administration (FCMA)]

Promulgation of regulations related to radioactive materials management

As decreed, the "Regulations on the Management of Waste Containing Naturally Occurring Radioactive Materials (NORM)" have been enforced since January 5, 2007 and, following the review and modification, the "Regulations for Review and Approval of Applications for Construction License of Radioactive Waste Treatment, Storage, and Final Disposal Facilities" and the "Regulations for Review and Approval of Applications for Construction License of Nuclear Source Material and Nuclear Fuel Production and Storage Facilities" have been amended since February 16, 2007 whereas the "Fees on Regulatory Services under the Nuclear Material and Radioactive Waste Act" have been amended since October 26, 2007.

Oversight of low level radioactive waste (LLRW) management in nuclear facilities

- In 2007, inspectors had been dispatched periodically and non-periodically to inspect LLRW management in respective nuclear facilities and review the related monthly operation reports. The results show that neither waste liquid released nor industry accident occurred in the LLRW treatment and storage facilities at nuclear power plants (NPPs), Lanyu Storage Facility and the volume reduction center.
- FCMA continued to push NPPs to perform the minimization of radioactive waste. In 2007 production of solidified LLRW from the three NPPs totaled 259 drums, best record ever, and down 21% from 327 drams in 2006 and down as mach as 57% from 601 drums in 2005.



↑ Solidified LLRW Generated from Three NPPs in Taiwan

- FCMA promoted clearance operation for the accumulated scrap metal at NPPs and reviewed scrap metal clearance plans submitted by the NPPs.
- FCMA issued operating licenses to the second LLRW storage warehouse of the Chinshan NPP and the treatment center of Lanyu Storage Facility, and reviewed

and approved the renewal application of the incinerator of TPC's volume reduction center, the radioactive waste treatment operation procedures in the Lungmen NPP Final Safety Analysis Report (FSAR), the quality management plan for the inspection, repairment, and repacking period at Lanyu



↑ Inspection, Repairment and Repacking at Lanyu Storage Facility

Storage Facility, application for the use of re-packed containers at Lanyu Storage Facility (revised version) and the inspection, repairment, and repacking plan (revised version) for the rusty and damaged drums at Lanyu Storage Facility.

Regulatory activities for the final disposal of LLRW

- FCMA completed the review of TPC's "Final Disposal Plan for LLRW (revised version) " and two semi-annual implementation reports. The implementation reports and review report were posted on AEC's website for public viewing.
- The "Advisory Committee on Radioactive Materials Safety" met four times during the year to urge TPC to make progress on the radioactive waste final disposal program.
- FCMA reviewed and approved TPC's 2006 implementation report on the "Spent Nuclear Fuel Final Disposal Plan" and its 2008 working plan.

Spent nuclear fuel administration

- FCMA accepted TPC's application for the construction of a spent fuel dry storage facility at the Chinshan NPP in March, 2007 and organized a professional review team to review nuclear safety, civil engineering structure, operation system and site characterization according to planned schedule. Upon completion of four rounds of review on the submitted Safety Analysis Report (SAR), FCMA also drafted a Safety Evaluation Report (SER).
- According to the stipulations of the Nuclear Materials and Radioactive Waste Management Act, FCMA coordinated with four townships in the northern coast of Taiwan to announce the application and collect public comments. FCMA cooperated with academics and experts to give mock hearing and referred to other agencies' hearing experiences to plan hearing procedure and prepare countermeasures, resulting in the smooth process of pre-hearing and hearing on July 31 and August 10, 2007,respectively. The hearing minutes were completed and posted on AEC website on September 7, 2007.



↑Spent Fuel Dry Storage Facility in Chinshan NPP (simulated by computer)



↑ Hearing on the Construction Licensing of Spent Fuel Dry Storage Facility in Chinshan NPP (August 10, 2007)

■ FCMA participated in a industrial cooperation program sponsored by the Ministry of Economic Affairs (MOEA) to introduce the spent fuel dry storage facility structure and heat transfer analysis technology developed by Sandia National Laboratories (SNL), and cooperated with the National Center for Research on Earthquake Engineering to work on soil-structure seismic interaction analysis. FCMA also invited experts from Japan Nuclear Energy Safety Organization (JNES) to perform a seismic safety analysis and conduct a training seminar. Additionally, FCMA sponsored a workshop on the "manufacture and inspection of dry storage canisters" with Japan's Central Research Institute of Electric Power Industry and Hitachi Zosen Mechanical Corporation. FCMA also exchanged their licensing review opinions with the experts in the United States Nuclear Regulatory Commission (USNRC) through telephone conferences.

Regulatory control of nuclear source material, nuclear fuel, and LLRW of small producers

- FCMA implemented periodical and non-periodical inspections of nuclear fuel (or source material) operations, and decommissioning of nuclear waste facilities and research reactor facilities'.
- FCMA issued a license for the operation of the LLRW experimental type plasma incinerator and melting furnace to INER, reviewed INER's 10-year re-evaluation for five warehouses, a revied decommissioning plan for Taiwan Research Reactor (TRR) facilities, a plan for waste deliverance operation, and biological shielding of the a dismantling plan for the Water Boiler Reactor.

[Radiation Monitoring Center Work Report (TRMC)]

Nuclear fallout and environmental radiation monitoring

To establish a database on environmental background radiation level in Taiwan and understand the impact of global radioactive fallout caused by nuclear tests or nuclear facility accidents overseas, we have established radioactive fallout samples collection programme in regions of Taiwan, Kinmen, and Matzu. More than 520 soil and other environmental samples were analyzed during the whole year. Results show that all the data are within the variation of environmental background radiation.

Radiation monitoring on radioactivity in foodstuffs and drinking water

To understand and regulate amounts and changes of radioactivities in foodstuffs and drinking water, and to further evaluate radiation dosage by ingestion of the public, samples of homebred foods, imported foods, and drinking water were collected and analyzed. A total of 510 samples were collected and analyzed during the whole year. Results show that all committed effective dose due to consumption meet the radiation standards of commercial goods required by law.

Radiation Measurement in the vicinity of nuclear facilities

To ensure the safety of people living at nearby nuclear facilities, radiation monitoring programmes were setup around nuclear power plants, nuclear research facilities, and around the nuclear waste disposal facility in Lan-Yu. Detections were done with thermo luminescent dosimeters (TLD) to directly measure gamma dose rates. Environmental samples were periodically collected and analyzed for radiation. More than 2,300 analyses was conducted in 2007. Results show that all the data are within the variation



↑ Gamma radiation monitoring stations installed around nuclear facilities and major metropolitan areas.

of environmental background radiation. Based on the monitoring results, the maximal personal dose is assessed and found to be lower than the dose limit.

Radiation monitoring and automatic warning system

A total of 28 environmental gamma radiation-monitoring stations are installed around nuclear facilities and major metropolitan areas. With round-the-clock real time monitoring, data are transmitted through the network and real-time monitoring information is provided

via AEC's monitoring center and its website. The data are provided to the public with transparency. The monitoring results during the whole year show that all radiation is within the variation of environmental background radiation.

Safety inspection of ionization radiation in southern Taiwan

To maintain the convenience of safety inspection for the southern region in Taiwan, the safety inspection of ionization radiation in southern Taiwan continued its operation during 2007. Below is a summary of safety inspections performed in Southern Taiwan this year:

Safety inspections regarding medical, non-medical, and non-destructive testing radiation practices and facilities: 94 cases

Inspections for radioactively contaminated scrap metal and safety inspection for radiation of pier 69, Kaohsiung harbor: 76 cases

Special inspection and guidance on radiation protection practice of medical application in Chiayi and southern regions: 19 cases

Inspection and guidance of Categories 1 and 2 radiation sources operation, in the Kaohsiung area: 5 cases

For areas of Changhua and south of Changhua, inspection of owners/operators of units whose licenses/permits are no lorge valid: 88 cases

Regulatory activities regarding radiation protection, inspection, nuclear fuel transportation and transfer at Maanshan NPP: 25 cases

A total number of 307 cases of safety inspection for ionization radiation were performed this year in Southern Taiwan.

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