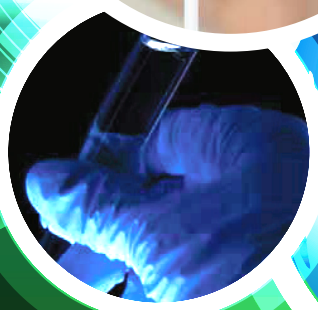
NUKLEAR MALAYSIA

Agensi Nuklear Malaysia

Malaysian Nuclear Agency



Laporan Tahunan

2015

Annual Report

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WAWASAN • MISI • OBJEKTIF
VISION MISSION OBJECTIVES

WAWASAN VISION

Sains dan teknologi nuklear untuk penjanaan ilmu, kemakmuran dan kesejahteraan masyarakat dan negara
Nuclear science and technology for knowledge generation, wealth creation, and societal and national well-being

MISI MISSION

Meneraju kecemerlangan dalam penyelidikan dan penggunaan teknologi nuklear untuk pembangunan lestari
Excellence in research and applications of nuclear technology for sustainable development

OBJEKTIF OBJECTIVES

- Menjana produk dan teknologi baru melalui penyelidikan dan inovasi berdasarkan agenda pembangunan negara
  To generate new products and technologies through research and innovation based on the national development agenda

- Mencapai sasaran minimum 30% dari bajet mengurus tahunan, menerusi pemindahan dan pengurusan pengkomersialan teknologi
  To achieve an income, at minimum 30% of the annual operating budget, through transfer and commercialisation of technology

- Meningkatkan kecemerlangan organisasi melalui perancangan dan pengurusan kualiti
  To enhance organisational excellence through planning and quality management

PERUTUSAN MENTERI KEMENTERIAN SAINS, TEKNOLOGI DAN INOVASI
MESSAGE FROM THE MINISTER MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION

Di bawah Rancangan Malaysia ke-11 , MOSTI akan memberi penekanan kepada penguasaan dan peningkatan kemahiran dalam teknologi strategik seperti nanoteknologi dan internet of things (IoT) untuk meningkatkan daya saing negara. Aktiviti penyelidikan, pembangunan, pengkomersialan dan inovasi akan berorientasikan pengguna dan permintaan pasaran, melibatkan kerjasama dan penyertaan dari semua institusi penyelidikan, universiti dan industri.

Under the 11th Malaysia Plan, MOSTI will emphasize on mastery and enhancement of skills in strategic technologies such as nanotechnology and internet of things (IoT) to improve the country's competitiveness. Research, development, commercialisation and innovation activities will be user or commercially oriented and market-driven, involving cooperation and participation of all research institutes, universities and industries.

Y.B DATUK SERI PANGLIMA DR EWON EBIN
Menteri Sains,
Teknologi dan Inovasi (MOSTI)
Minister of Science,
Technology and Innovation (MOSTI)

Dalam usaha ini, keterangkuman dan kemapanan perlu juga diberi perhatian sewajarnya untuk mengelak sebarang ketidakseimbangan sosioekonomi yang akan menjejaskan pembangunan.

MOSTI dan agensinya telah melaksanakan banyak projek inovasi sosial yang mengguna pakai konsep inovasi kemanusiaan di mana idea-idea inovasi disalurkan ke arah memenuhi keperluan masyarakat untuk mendapatkan barangan dan perkhidmatan yang mampu milik serta berkualiti. Program bagi meningkatkan taraf hidup isi rumah 40% yang terendah dan melindungi golongan yang mudah terjejas akan diberi penekanan.

Cabaran yang perlu dihadapi adalah untuk memastikan semua anggota masyarakat, terutama di peringkat akar umbi, memahami Sains, Teknologi dan Inovasi (STI) dan impaknya terhadap kualiti kehidupan seharian mereka. Dalam hal ini, komunikasi dalam bahasa yang mudah difahami adalah amat penting bagi merangsang minat dan penglibatan anggota masyarakat dalam pembangunan agenda STI nasional.

MOSTI akan terus menyokong Agensi Nuklear Malaysia (atau ringkasnya Nuklear Malaysia) dalam usahanya untuk mengeluarkan hasil penyelidikan yang memberi impak kepada pembangunan negara. Selari dengan hasrat ini, MOSTI komited dalam menyokong Nuklear Malaysia untuk meningkatkan kepakaran agensi dari segi infrastruktur penyelidikan dan modal insan, dengan kerjasama agensi antarabangsa seperti Agensi Tenaga Atom Antarabangsa (IAEA).

Melalui pelbagai usaha yang dilaksanakan, Nuklear Malaysia telah mewujudkan banyak teknologi baru yang berupaya menambah baik sosioekonomi masyarakat dengan meningkatkan pendapatan isi rumah. Nuklear Malaysia juga telah menghasilkan pelbagai produk, teknologi dan perkhidmatan

In this endeavour, inclusiveness and sustainability need also to be adequately addressed to avoid socio-economic imbalance which will undermine growth.

MOSTI and its agencies have undertaken many social innovation projects adopting the concept of humanizing innovation where ideas of innovation are channelled towards meeting the community's needs for affordable as well as quality goods and services. Programmes to elevate the livelihood of the bottom 40% households and safeguard the vulnerable will be re-emphasized.

The challenge is to ensure that all members of society, in particular at the grassroots level, understand Science, Technology and Innovation (STI) and its impact on the quality of their daily life. In this regard, communication in simple layman's language is essential to stimulate their interest and involvement in the development agenda of the national STI.

MOSTI will continue to support the Malaysian Nuclear Malaysia (or simply as Nuklear Malaysia) on its efforts of producing research outcomes that can impact the development of the country. In line with this, MOSTI is committed in supporting Nuklear Malaysia to increase the agency's expertise in terms of research infrastructure and human capital with the assistance of other international organisations such as the International Atomic Energy Agency (IAEA).

Through its efforts, Nuklear Malaysia has set forth many technologies capable of improving the socio-economic conditions of communities through elevating household incomes. It has produced products, technologies and services of high quality that benefit especially the Small and Medium Enterprises (SME) in Malaysia

yang berkualiti tinggi yang memberi manfaat terutama kepada Industri Kecil dan Sederhana (IKS) di Malaysia.

Saya yakin aktiviti pemindahan teknologi dan pengkomersialan dapat dipertingkatkan lagi melalui kerjasama antara Nuklear Malaysia dengan institusi penyelidikan lain, universiti dan pihak industri. Kerjasama ini amat penting bagi menghasilkan produk penyelidikan dan pembangunan (R&D) yang mempunyai nilai komersial serta memenuhi kehendak pasaran.

Syabas dan tahniah kepada Nuklear Malaysia di atas kejayaan pada tahun 2015!

I am confident that technology transfer and commercialisation activities can be further enhanced through cooperation between Nuklear Malaysia and other research institutes, universities and industries. Collaborations are important to produce the research and development (R&D) products with commercial value that meet market needs.

Congratulations to Nuklear Malaysia for another well-done job in 2015!

Y.B DATUK SERI PANGLIMA DR EWON EBIN
Menteri Sains, Teknologi dan Inovasi (MOSTI)
Minister of Science, Technology and Innovation (MOSTI)

PERUTUSAN KETUA SETIAUSAHA KEMENTERIAN SAINS, TEKNOLOGI DAN INOVASI
MESSAGE FROM THE SECRETARY GENERAL, MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION

Pada tahun 2015, Agensi Nuklear Malaysia (Nuklear Malaysia) telah mencapai beberapa kejayaan penting melalui pelbagai program dan projek penyelidikan, pembangunan dan pengkomersialan (R,D& C) yang dilaksanakan melalui kerjasama dengan pihak industri, institusi pengajian tinggi dan agensi penyelidikan lain.

In 2015, the Malaysian Nuclear Agency (Nuklear Malaysia) has achieved several notable milestones through implementation of various research, development and commercialization (R,D&C) programmes and projects in collaboration and synergy between industries, academia and agencies.

Y.BHG TAN SRI DR. NOORUL AINUL BT. MUHD NOR
Ketua Setiausaha,
Kementerian Sains, Teknologi dan Inovasi (MOSTI)
Secretary General,
Ministry of Science, Technology & Innovation (MOSTI)

Ini dibuktikan dengan kerjasama antara Nuklear Malaysia dengan PROTON Holdings Berhad dalam pembangunan teknologi automotif. Dalam kerjasama ini, sebuah Pusat Kecemerlangan Automotif telah ditubuhkan, yang mana Nuklear Malaysia telah menjalankan penyelidikan dan pembangunan (P&P) untuk produk seperti wayar dan kabel serta komposit dan bahan polimer yang akan diuji pakai oleh PROTON Holdings Berhad.

Di peringkat antarabangsa, MOSTI turut merasa bangga kerana Nuklear Malaysia diiktiraf sebagai Pusat Kerjasama Agensi Tenaga Atom Antarabangsa (IAEA) untuk Ujian Tanpa Musnah (NDT) bagi tahun 2015 hingga 2019. Pelantikan sebagai rakan kolaborasi IAEA membuktikan kepakaran dan kecemerlangan Nuklear Malaysia dalam teknologi NDT di peringkat antarabangsa.

Selain itu, Nuklear Malaysia juga terlibat secara aktif dalam melaksanakan inisiatif MOSTI yang dikenali sebagai program MOSTI Social Innovation (MSI) iaitu membawa produk R&D dan inovasi yang dihasilkan oleh penyelidik dan saintis ke peringkat akar umbi. Program ini dilaksanakan selaras dengan Strategi Lautan Biru Kebangsaan (NBOS), dengan memberi keutamaan kepada projek-projek kos rendah dan berimpak tinggi yang dapat dijalankan dengan cepat.

Pada tahun 2015 juga, sebanyak tiga projek MSI telah dilaksanakan oleh Nuklear Malaysia, yang berjaya mewujudkan peluang pekerjaan dan membantu meningkatkan pendapatan isi rumah komuniti terbabit.

Saya mengucapkan tahniah dan syabas kepada Nuklear Malaysia di atas sumbangan besar dan kecemerlangan yang dicapai pada tahun 2015. Sebagai perintis kepada pembangunan sains dan teknologi nuklear negara, Nuklear Malaysia telah menunjukkan tahap dedikasi, profesionalisme dan integriti yang tinggi.

This is evidenced by the cooperation between Nuklear Malaysia and PROTON Holdings Berhad in the development of automotive technology. In this cooperation, a Centre of Excellence On Automotive was established, where Nuklear Malaysia has conducted research and development (R & D) for products such as wires and cables as well as composites and polymeric materials which will be used in trial runs by PROTON Holdings Berhad.

At the international level, MOSTI is proud with the recognition received by Nuklear Malaysia as an International Atomic Energy Agency (IAEA) Collaborating Centre for Non-Destructive Testing (NDT) for the year 2015 until 2019. The appointment as an IAEA collaboration partner is a recognition of the expertise and excellence in Nuklear Malaysia in NDT.

Besides, Nuklear Malaysia is also actively involved in the implementation of the MOSTI's initiative known as MOSTI Social Innovation (MSI) programme by bringing R&D and innovation products generated by researchers and scientists to the grassroots. This programme which is being implemented under the National Blue Ocean Strategy (NBOS), where the priority is given to the low cost and high impact projects which can be implemented quickly.

In 2015 too, a total of three MSI projects have been implemented by Nuklear Malaysia which successfully created employment opportunities and helped in increasing household incomes of the communities involved.

I would like to congratulate Nuklear Malaysia for the immense contribution and excellence achieved in 2015. As the pioneer of the national nuclear science and technology development, Nuklear Malaysia has demonstrated a high degree of dedication, professionalism and integrity.

Saya yakin dengan kepakaran modal insan dan kemudahan yang ada, Nuklear Malaysia akan terus menyumbang kepada pembangunan sosioekonomi negara. Sekali lagi, syabas Nuklear Malaysia!

I am confident that with the available pool of expertise and advanced facilities, Nuklear Malaysia will continue to contribute further to the national socio-economic development. Last but not least, congratulations to Nuklear Malaysia!

Y.BHG TAN SRI DR. NOORUL AINUL BT. MUHD NOR
Ketua Setiausaha, Kementerian Sains,
Teknologi dan Inovasi (MOSTI)
Secretary General, Ministry of Science,
Technology & Innovation (MOSTI)

LAPORAN KETUA PENGARAH AGENSI NUKLEAR MALAYSIA
REPORT BY THE DIRECTOR GENERAL MALAYSIAN NUCLEAR AGENCY

Agensi Nuklear Malaysia (Nuklear Malaysia), seiring dengan Kementerian Sains, Teknologi dan Inovasi (MOSTI) sentiasa peka dengan aspirasi kerajaan dalam memacu Malaysia untuk terus maju melalui pelbagai program. Visi, Misi, Objektif dan Pelan Tindakan Nuklear Malaysia diselaraskan dengan Visi, Misi dan Agenda pembangunan MOSTI dan negara.

Malaysian Nuclear Agency (Nuklear Malaysia) along with the Ministry of Science, Technology and Innovation (MOSTI) is always sensitive to the aspirations of the government in promoting Malaysia to move forward through various programmes. The Vision, Mission and Objectives and Action Plan for Nuklear Malaysia have been streamlined with the Vision, Mission and development agenda of MOSTI and the nation.

Y. BHG. DATO' DR. MUHAMAD B. LEBAI JURI
Ketua Pengarah,
Agensi Nuklear Malaysia
Director General,
Malaysian Nuclear Agency

Demi kemajuan pembangunan dan ekonomi negara, Nuklear Malaysia komited memberi tumpuan pada projek penyelidikan yang berpotensi untuk dikomersialkan dan memberi impak. Sebanyak 36 projek penyelidikan dan pembangunan (P&P) di bawah biayaan *ScienceFund* dilaksanakan dalam tahun 2015, di mana 28 projek ialah projek lanjutan 2014 manakala lapan adalah projek baharu. Nuklear Malaysia berjaya menghasilkan 48 output penyelidikan, meliputi 23 produk, sembilan proses baharu, 12 prosedur baharu dan empat pangkalan data. Sejumlah 625 bahan penerbitan dalam bentuk buku ilmiah dan umum, jurnal kebangsaan dan antarabangsa, kertas kerja konferen, penerbitan am dan kertas kerja teknikal, prosiding dan tesis telah dihasilkan oleh Nuklear Malaysia.

Kelangsungan program P&P turut disokong oleh aktiviti jalinan hubungan kerjasama di peringkat serantau dan antarabangsa. Nuklear Malaysia bergiat aktif di dalam rangka kerjasama serantau dan antarabangsa dengan pelbagai agensi seperti Agensi Tenaga Atom Antarabangsa (IAEA), Perjanjian Kerjasama Serantau di Asia dan Pasific (RCA), Forum Kerjasama Nuklear di Asia (FNCA), dan Suruhanjaya Persediaan Triti Pengharaman Menyeluruh Ujian Senjata Nuklear (CTBTO). Dua memorandum persefahaman (MoU) telah ditandatangani, iaitu antara Nuklear Malaysia dengan PROTON Holding Sdn. Bhd. dan bersama Dewan Bahasa dan Pustaka (DBP).

Aktiviti komersialisasi Nuklear Malaysia giat dilaksanakan melalui dua perjanjian kerjasama (MOA) dan 13 perjanjian kerahsiaan (NDA). Bersempena dengan penganjuran Technology Showcase & Preview Nuklear Malaysia 2015 (TPS2015), yang menggabungkan Hari Pelanggan, Hari Inovasi dan IP Showcase, Nuklear Malaysia telah melancarkan lima produk baharu iaitu Rust Inhibitor, Active Packaging Grafted Film, Aquacage, Survery Meter dan Iridium-192. Majlis pelancaran produk tersebut telah disempurnakan oleh YB. Datuk Seri Panglima Madius Tangau, Menteri MOSTI.

For the progress and economic development of the nation, Nuklear Malaysia is committed to giving on research projects with commercial potential and impact. A total of 36 R&D projects were funded via ScienceFund in 2015, with 28 projects as continuation from 2014 and eight new projects. Nuklear Malaysia has produced 48 research outputs, comprising 23 products, nine processes, 13 new procedures and four databases. A total of 625 scientific publications in the forms of knowledge-based and general books, national and international journals, conference papers, general publications, technical papers, proceedings and thesis have been produced by Nuklear Malaysia.

Sustainability of the R&D programme was supported by collaborative activities at regional and international levels. Nuklear Malaysia was very active in the framework of regional and international cooperation with various agencies such as the International Atomic Energy Agency (IAEA), the Regional Cooperative Agreement in Asia and the Pacific (RCA), Forum for Nuclear Cooperation in Asia (FNCA), and the Preparatory Commission of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO). Two memorandums of understanding (MoU) were signed, viz/ between Nuklear Malaysia and PROTON Holding Sdn. Bhd. and with Dewan Bahasa dan Pustaka (DBP).

Nuklear Malaysia's commercialisation activities have being undertaken, with two memorandums of agreement (MOA) and 13 non-disclosure agreements (NDA). In conjunction with the Technology Showcase & Preview Nuclear Malaysia 2015 (TPS2015) that combined Customer Day, Showcase Innovation and IP Day, Nuclear Malaysia has launched five new products, namely Rust Inhibitor, Active Packaging Grafted Film, Aquacage, Survey Meter and Iridium-192. The product launch was officiated by YB. Datuk Seri Panglima Madius Tangau, Minister of MOSTI.

Kesedaran awam mengenai teknologi nuklear amat penting bagi penerimaan awam terhadap teknologi ini. Nuklear Malaysia mengambil pelbagai inisiatif promosi dan aktiviti kesedaran awam. Pada tahun 2015, Nuklear Malaysia menerima kujungan seramai 3927 orang pelawat ke agensi ini. Usaha ini diperkukuhkan dengan pengelolaan 25 pameran kesedaran awam di seluruh Malaysia di samping pelaksanaan tiga Program Penggalakan Sains MOSTI, iaitu Program Perkhemahan Nuklear 3V (Veni, Vidi, Vici), Jelajah Ikon Saintis (JIS) dan *Nuclear Science & Technology for Secondary Schools (NST4SS)*. Program ini disasarkan bagi memberi pendedahan kepada generasi baharu membentuk hala tuju dan masa hadapan negara.

Nuklear Malaysia terus komited untuk meningkatkan program penyelidikan, perkhidmatan teknikal dan pengkomersialan teknologi untuk kekal relevan dengan aspirasi MOSTI dan kerajaan untuk memacu Malaysia menjadi sebuah negara maju.

Public awareness on nuclear technology is important for public acceptance to this technology. Nuckear Malaysia undertook several initiatives to promote and provide public awareness. Throughout 2015, Nuklear Malaysia has attracted 3927 visitors to this agency. These efforts were enhanced through 25 public awareness exhibitions in selected schools across the country in addition to the implementation of the three programmes under MOSTI Science Promotion, namely 3V Nuclear Camp (Veni, Vidi, Vici), *Jelajah Ikon Saintis* and Nuclear Science & Technology for Secondary Schools (NST4SS). These programmes were targeted to expose the new generations in shaping the future direction of the nation.

Nuklear Malaysia is steadfast in its commitment to enhance its research programmes, technical services and technology commercialisation to remain relevant to the aspirations of MOSTI and the government to spur Malaysia as a developed nation.

Y. BHG. DATO' DR. MUHAMAD B. LEBAI JURI
Ketua Pengarah, Agensi Nuklear Malaysia
Director General, Malaysian Nuclear Agency

CARTA ORGANISASI
ORGANISATIONAL CHART

KETUA PENGARAH
DIRECTOR GENERAL
Y. Bhg. Dato' Dr Muhamad b. Lebai Juri

UNIT KOMUNIKASI KORPORAT
CORPORATE COMMUNICATION UNIT
En. Balakrishnan a/l Ramanathan

TIMBALAN KETUA PENGARAH
DEPUTY DIRECTOR GENERAL
Dr. Muhd Noor b. Muhd Yunus

Program Penyelidikan & Pembangunan Teknologi
Research & Technology Development Programme

PENGARAH
Bhg. Teknologi Perubatan (BTP)
Director of Medical Technology Div.
Dr Shafiee b. Khamis

PENGARAH
Bhg. Teknologi Pemprosesan Sinaran (BTS)
Director of Radiation Processing Technology Div.
Dr. Zulkafli b. Ghazali

PENGARAH
Bhg. Teknologi Industri (BTI)
Director of Industrial Technology Div.
Dr. Muhamad b. Daud

PENGARAH
Bhg. Teknologi Sisa dan Alam Sekitar (BAS)
Director of Waste Technology & Environment Div.
Dr. Mohd Abd Wahab b. Yusof

PENGARAH
Bhg. Agroteknologi & Biosains (BAB)
Director of Agrotechnology & Biosciences Div.
Dr. Khairuddin b. Abd Rahim

TIMBALAN KETUA PENGARAH
DEPUTY DIRECTOR GENERAL
Dr. Mohd Ashhar b. Hj Khalid

Program Perkhidmatan Teknikal
Technical Service Programme

PENGARAH
Bhg. Sokongan Teknikal (BST)
Director of Technical Support Div.
Tn Hj. Aziz b. Mhd. Ramli

PENGARAH
Bhg. Keselamatan & Kesihatan Sinaran (BKS)
Director of Radiation Health & Safety Div.
Dr. Wan Shafie b. Wan Abdullah

PENGARAH
Bhg. Kejuruteraan (BKJ)
Director of Engineering Div.
Ir. Alwi b. Othman

PENGARAH KANAN
SENIOR DIRECTOR
Dr. Dahlan b. Hj Mohd

Program Pengurusan
Management Programme

PENGARAH
Bhg. Khidmat Pengurusan (BKP)
Director of Management Services Div.
En. Masri b. Misran

PENGARAH
Bhg. Pembangunan Modal Insan (BMI)
Director of Human Resources Development Div.
En. Zakaria b. Taib

PENGARAH
Bhg. Pengurusan Maklumat (BPM)
Director of Information Management Div.
Cik Habibah bt. Adnan

PENGARAH KANAN
SENIOR DIRECTOR

Program Pengkomersilan dan Perancangan Teknologi
Commercialisation & Technology Planning Programme

PENGARAH
Bhg. Pengkomersilan Teknologi (BKT)
Director of Technology Commercialisation Div.
Tn. Hj. Ahamad Sahali b. Mardi

PENGARAH
Bhg. Perancangan & Hubungan Antarabangsa (BPA)
Director of Planning & International Relation Div.
Dr. Noriah bt Jamal

PENGARAH
Bhg. Kemudahan Iradiasi (BKI)
Director of Irradiation Div.
En. Mohd Sidek b. Othman

PENGURUS-PENGURUS / MANAGERS
Unit Khidmat Latihan
Training Services Unit
Pn. Hadzalina Sukarseh
SSDL / SSDL
Tn. Hj. Taiman b. Kadni

BARISAN PENGURUSAN
MANAGEMENT TEAM

KETUA PENGARAH
DIRECTOR GENERAL
Y. Bhg. Dato' Dr Muhamad b. Lebai Juri

TIMBALAN KETUA PENGARAH
DEPUTY DIRECTOR GENERAL
Program Penyelidikan & Pembangunan Teknologi
Research & Technology Development Programme
Dr. Muhd Noor b. Muhd Yunus

TIMBALAN KETUA PENGARAH
DEPUTY DIRECTOR GENERAL
Program Perkhidmatan Teknikal
Technical Service Programme
Dr. Mohd Ashhar b. Hj Khalid

PENGARAH KANAN
SENIOR DIRECTOR
Program Pengurusan
Management Programme
Dr. Dahlan b. Hj Mohd

PENGARAH KANAN
SENIOR DIRECTOR
Program Pengkomersilan dan Perancangan Teknologi
Commercialisation & Technology Planning Programme
Dr. Zulkifli b. Mohamed Hashim
(Dipinjamkan ke MOSTI)

Program Penyelidikan Dan Pembangunan Teknologi

RESEARCH AND TECHNOLOGY DEVELOPMENT PROGRAMME

TIMBALAN KETUA PENGARAH
DEPUTY DIRECTOR GENERAL
Program Penyelidikan & Pembangunan Teknologi
Research & Technology Development Programme
Dr. Muhd Noor b. Muhd Yunus

PENGARAH
Bhg. Teknologi Perubatan (BTP)
Director of Medical Technology Div.
Dr Shafiee b. Khamis

PENGARAH
Bhg. Teknologi Industri (BTI)
Director of Industrial Technology Div.
Dr. Muhamad b. Daud

PENGARAH
Bhg. Agroteknologi & Biosains (BAB)
Director of Agrotechnology & Biosciences Div.
Dr. Khairuddin b. Abd Rahim

PENGARAH
Bhg. Teknologi Pemprosesan Sinaran (BTS)
Director of Radiation Processing Technology Div.
Dr. Zulkaflli b. Ghazali

PENGARAH
Bhg. Teknologi Sisa dan Alam Sekitar (BAS)
Director of Waste Technology & Environment Div.
Dr. Mohd Abd Wahab b. Yusof

Program Perkhidmatan Teknikal
TECHNICAL SERVICE PROGRAMME

TIMBALAN KETUA PENGARAH
DEPUTY DIRECTOR GENERAL
Program Perkhidmatan Teknikal
Technical Service Programme
Dr. Mohd Ashhar b. Hj Khalid

PENGARAH
Bhg. Sokongan Teknikal (BST)
Director of Technical Support Div.
Tn. Hj. Abd Aziz b. Mhd. Ramli

PENGARAH
Bhg. Kejuruteraan (BKJ)
Director of Engineering Div.
Ir. Alwi b. Othman

PENGARAH
Bhg. Keselamatan & Kesihatan Sinaran (BKS)
Director of Radiation Health & Safety Div.
Dr. Wan Saffiey b. Hj. Wan Abdullah

Program Pengurusan
MANAGEMENT PROGRAMME

PENGARAH KANAN
SENIOR DIRECTOR
Program Pengurusan
Management Programme
Dr. Dahlan b. Hj Mohd

PENGARAH
Bhg. Khidmat Pengurusan (BKP)
Director of Management Services Div.
En. Masri b. Misran

PENGARAH
Bhg. Pengurusan Maklumat (BPM)
Director of Information Management Div.
Cik Habibah bt. Adnan

PENGARAH
Bhg. Pembangunan Modal Insan (BMI)
Director of Human Resources Development Div.
En. Zakaria b. Taib

Program Pengkomersilan dan Perancangan Teknologi

COMMERCIALISATION & TECHNOLOGY PLANNING PROGRAMME

PENGARAH KANAN
SENIOR DIRECTOR
Program Pengkomersilan dan Perancangan Teknologi
Commercialisation & Technology Planning Programme
Dr. Zulkifli b. Mohamed Hashim
(Dipinjamkan ke MOSTI)

PENGARAH
Bhg. Pengkomersilan Teknologi (BKT)
Director of Technology Commercialisation Div.
Tn. Hj. Ahamad Sahali b. Mardi

PENGARAH
Bhg. Kemudahan Iradiasi (BKI)
Director of Irradiation Div.
En. Mohd Sidek b. Othman

PENGARAH
Bhg. Perancangan & Hubungan Antarabangsa (BPA)
Director of Planning & International Relation Div.
Dr. Noriah bt. Jamal

DIARI KORPORAT
CORPORATE DIARY

JANUARI JANUARY

7) Seminar on Ultra High Performance Concrete - **Bangi**

8-9) Bengkel Petunjuk Prestasi Utama (KPI) 2014 dan Penetapan Sasaran Kerja Tahunan (SKT) 2015 - **Bangi**

13) Kempen Derma Darah Nuklear Malaysia - **Bangi**

14-15) Bengkel Penyediaan Sebut Harga bagi Tahun 2015 - **Bangi**
Workshop on Quotation Preparation for 2015 - **Bangi**

16) Course on Integrated Management System (IMS) Awareness at RTP - **Bangi**

18-29) 3rd Follow-up Training Course (FTC) on Reactor Engineering - **UTM Skudai, Johor**

19) Taklimat Lembaga Pembiayaan Perumahan Sektor Awam (LPPSA) - **Bangi**

20) Courtesy Visit by HE Yukiya Amano, Director General of the IAEA - **Bangi**

21-23) RAS6077/05/01 : Develop Guidelines for Accreditation of Academic and Clinical Institutions for Medical Physics Education and Training (Project code IAEA RAS6077/05/01) - **Bangi**

22) Majlis Perhimpunan Pagi dan Amanat Ketua Pengarah Bil 1/2015 Agensi Nuklear Malaysia - **Bangi**

27) The 6th Annual Nuclear Power Asia Conference and Exhibition - **Kuala Lumpur**

29) Courtesy Visit by Atmea Mitsubishi Corporation Delegation - **Bangi**

29-30) Bengkel Penambahbaikan Sistem Pengurusan Bersepadu (IMS) di RTP - **Bangi**
Workshop on Improvement of Integrated Management System (IMS) at RTP - **Bangi**

FEBRUARI FEBRUARY

9) Taklimat Pemutihan Penempatan Secara Pentadbiran 2015 - **Bangi**

24) Seminar Teknik Pengaktifan Neutron **- Bangi**
Seminar on Neutron Activation Technique **- Bangi**

9-13) IAEA/RCA Regional Training Course on Advanced Characterisation Methods of Grafted Polymeric - **Putrajaya**

10-13) Workshop on Cyclotron Value Management Laboratory - **Bangi**

13) Bengkel Pengenalan kepada Pengurusan Pengetahuan (KM) - **Bangi**

24) Bengkel E-Client - **Bangi**
Workshop on E-Client - **Bangi**

24-26) Kursus Asas Keselamatan Sinaran Tidak Mengion - **Penang**
Course on Basic Safety of Non-ionising Radiation - **Penang**

25-27) Kursus Keselamatan Sinaran dan Kesihatan - **Penang**
Course on Radiation Safety and Health **- Penang**

26) Program Bertemu Saintis - **Bangi**

MAC MARCH

5-6) Workshop on Knowledge Management System (SP-KMS) for site owner - **Bangi**

6) Majlis Makan Malam Kelab Sukan dan Kebajikan Nuklear Malaysia 2015 - **Bangi**

6) Kursus Kawalan Proses Pengeluaran Raymintex - **Bangi**
Course on Raymintex Production Process Control - Bangi

6-8) Carnival Creativity and Science4U for Southern Zone - **Seremban**

10) Bengkel Penstrukturan Semula Nuklear Malaysia Peringkat Satu - **Bangi**
Workshop on Nuklear Malaysia Restructuring Phase One - **Bangi**

14) Seminar Pengimejan Perubatan - **Kota Bharu**
Workshop on Medical Imaging - **Kota Bharu**

17-25) Latihan 'Nuclear Energy System Modelling and Assessment'- **Bangi**
Training on Nuclear Energy System Modelling and Assessment - **Bangi**

18-20) Bengkel Penggubalan Soalan bagi Peperiksaan Khas Pengendali Loji, Pekerja Sinaran Mengion, Pengesahan Jawatan Skim C dan Kenaikan Pangkat Secara Lantikan (KPSL) - **Port Dickson**
Workshop on Preparation for Special Examination for Plant Operator, Ionising Radiation Worker and C Scheme and KPSL Post Confirmation Examination - **Port Dickson**

24) Misi Pakar IAEA – 'Design for Borehole Construction'- **Bangi**
IAEA Expert Mission- Design for Borehole Construction - **Bangi**

24) Lawatan oleh Delegasi Institut Pertanian Nuklear Bangladesh
Visit by Delegation from Bangladesh Institute of Nuclear Agriculture

24-26) Mesyuarat Majlis Bersama Jabatan - **Johor Bahru**

26) Seminar on Intensive Basic Statistical Package for the Social Sciences (SPSS) Exposure - **Bangi**

31) Taklimat Penambahbaikan Tatacara Pengurusan Aset & Stor Kerajaan Selaras dengan Pelaksanaan 1 Pekeliling Perbendaharaan - **Bangi**

APRIL APRIL

1) Taklimat E-Client untuk Pusat Khidmat NDT - **Bangi**
Briefing on E-Client for NDT Service Centre - **Bangi**

2-4) Carnival Creativity and Science4U for Northern Zone - **Penang**

6-10) Eksperimen Sekolah Nuklear berkenaan Fizik Reaktor dan Sains Neutron bagi Rantau Asia Pasifik (NSEAP2015) - **Bangi**
Nuclear School Experiment on Reactor Physics and Neutron Science for Asia Pacific Region (NSEAP2015) - **Bangi**

7) Seminar' ITC SharePoint Roadshow (KMS Technology Update & Sharing)' Hari Bersama ICT - **Bangi**
Seminar on ITC SharePoint Roadshow (KMS Technology Update & Sharing) A Day with ICT - **Bangi**

8-9 Kursus Pembantu Makmal - **Bangi**
Course for Lab Assisstant - **Bangi**

9) Taklimat Perlaksanaan GST (Cukai barang dan perkhidmatan) dalam Perolehan Kerajaan - **Penang**

10) Course on Phased Array Application for NDT/NDE - **Bangi**

10) Closing Ceremony and Presentations of IAEA Sponsorship Certificate to Malaysian Representatives to Nuclear School Experiments on Reactor Physics and Neutron Applications for Asia-Pacific Region (NSEAP2015) Programme - **Putrajaya**

13-17) Workshop on Design Of Electrical & IMC System for Nuclear Power Plant - **Bangi**

15) Kursus Pengguna Akhir SP-KMS - **Bangi**
Course on SP-KMS Final User - **Bangi**

16-18) Carnival Creativity and Science4U for Central Zone - **Putrajaya**

17) Bengkel Kajian Kepuasan Pelanggan Makmal RAS 2014 - **Bangi**
Workshop on Customer Satisfaction Study of RAS 2014 Laboratory - **Bangi**

20) Radiation Workshop for Science Teachers - **Bangi**

20-24) Course on Train The Trainer - **Bangi**

22-23) Bengkel Semakan Kompetensi - **Bangi**

23) Penyertaan dalam Program Membaca 10 Minit anjuran Perpustakaan Negara Malaysia - **Bangi**

22-24) Bengkel Mencapai Prestasi Puncak Melalui Sinergi Manusia - **Port Dickson**
Workshop on Achieving Peak Performance through People Synergy - **Port Dickson**

30 April - 1 Mei) Carnival Creativity and Science4U for Sabah Zone - **Sabah**

MAY MEI

5-6) Bengkel Pemurnian Laporan Tahunan Nuklear Malaysia 2014 - **Bangi**

11) Radiation Workshop for Science Teachers - **Kota Kinabalu**

26-28 Mei) Workshop on Advanced Characterisation Techniques for Thorium Flagship Project - **Bangi-Putrajaya Hotel**

6-7) Kursus Kesedaran Keselamatan Sinaran & Prosedur Kecemasan Nuklear Malaysia - **Bangi**
Course on Nuclear Malaysia Radiation Safety and Emergency Procedures Awareness - **Bangi**

12) Kursus Penghasilan Benih Cecair Cendawan untuk Kakitangan Jabatan Pertanian - **Bangi**

12-14) Seminar on Overview and Key Topics in the World Nuclear Industry Today - Putrajaya

13-24) Penyertaan dalam Pameran Mini Bersempena Pesta Keamatan - **Sabah**

18-20) Kursus Mesra Pelanggan & Perkhidmatan Cemerlang, Agensi Nuklear Malaysia - **Cameron Highland**

19-21) Workshop on Advanced use of Image Xpress Micro XL - **Bangi**

23) Seminar Pengimejan Perubatan - **Penang**
Seminar on Medical Imaging - **Penang**

25 Mei-6 Jun) IAEA/RCA Regional Training Course on DIR and IndustriaL CT for Trainers - **Bangi**

26-28) Kursus Pemantapan Jati Diri - **Pahang**

27-28) Seminar Penulisan dan Penerbitan Saintifik - **Melaka**

JUN

JUNE

1) IAEA Expert Mission on Review and Advice on Neutron Optics Design for the Upgrade of Neutron Beam Facilities - **Bangi**

1) Clinical Guideline for Diagnostic Imaging - **Bangi**

1-27 Nov) 12th Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources (PGEC-12) - **Bangi**

2) Bengkel Semakan Kompetensi Siri 2 - **Bangi**

6) Lawatan oleh CTO Proton - **Bangi**

7-9) Program Perkhemahan Nuklear Veni, Vidi, Vici Siri 1 - **Bangi**
3V Nuclear Camp (Veni, Vidi, Vici) Programme Series 1 - **Bangi**

9-11) Workshop on Strengthening of Radiation Protection Practice in Field Work and Laboratory Safety - **Penang**

9-11) Conference and Workshop on Radiation Protection - **Sabah**

10) Program Mari Membaca 2015 - **Bangi**

11) Fiesta Ekspresi Seni 2015 - **Bangi**

12) An Afternoon with Women in Nuclear (WIN) - **Bangi**

15) Majlis Pertukaran Nota Kerjasama antara Agensi Nuklear Malaysia dan Politeknik Banting **- Banting**

15) Mesyuarat Agung Koperasi Kakitangan Puspati Berhad Ke-32 - **Bangi**

15-16) Seminar Keselamatan Makanan 2015 - **Kuala Lumpur**

16 - 17) Bengkel Penulisan dan Penerbitan Nuklear Malaysia Siri 1 - **Bangi**

16-18) Talk on Plant Operator Examination for OSH and RP Talk No. 1/2015 - **Bangi**

17-18) Kolokium Pengenalan kepada Pegawai Baru - **Bangi**

25) Workshop on Thorium - **Bangi**

29) Taklimat untuk Pelajar Latihan Industri - **Bangi**

JULAI JULY

3) Majlis Berbuka Puasa - **Bangi**

14) Penyampaian Sumbangan Ramadhan Kepada Unit Keselamatan Fizikal - **Bangi**

27-30) Program Jelajah Ikon Saintis Zon Utara - **Perlis, Kedah, P.Pinang, Perak**

27-31) Workshop on Hemathology Analyser Application - **Bangi**

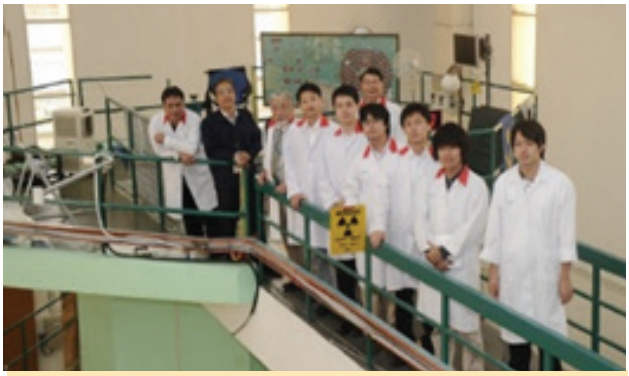
30) Semakan SKT-KPI Pertengahan Tahun 2015 - **Bangi**

OGOS AUGUST

10-12) Workshop on Advanced Use of Fluorescence Molecular Tomography (FMT) **- Bangi**

11-13) Workshop on Preparation and Enhancement of Lecture Notes for TRIGA PUSPATI Reactor Operators Training - **Port Dickson**

13) Perhimpunan Pagi Nuklear Malaysia Bil 2/2015 dan Sambutan Aidilfitri - **Bangi**



20) Lawatan Delegasi Tokyo Tech - **Bangi**
Visit by Tokyo Tech Delegation - **Bangi**

26-29) Workshop on Document Preparation of IAEA Country Programme Framework 2017-2021 - **Port Dickson**

19) Participation in iNusTec-USIM Conference - **USIM**

24) Majlis Penyerahan Kereta untuk Projek Penyelidikan Kerjasama PROTON Holding Sdn Bhd-Nuklear Malaysia - **Bangi**

26-29) Bengkel Penulisan dan Buku Ilmiah Nuklear Malaysia - **Melaka**

SEPTEMBER

2-3) Bengkel Semakan Semula Kompetensi Nuklear Malaysia - **Bangi**

8) Bengkel Semakan Semula Kompetensi Nuklear Malaysia - **Bangi**

19) Seminar Pengimejan Perubatan - **Kota Kinabalu**
Seminar on Medical Imaging - **Kota Kinabalu**

20-22) Carnival Creativity and Science4U for Sarawak Zone - **Sarawak**

SEPTEMBER

3) Workshop on Advanced Use of Fluorescence Molecular Tomography (FMT) - **Bangi**

2-4) Bengkel Penambahbaikan Berterusan Sistem Pengukuran Kualiti Makmal Tentukuran Fizik Perubatan - **Bangi**
Workshop on Continuous Improvement of Quality Measurement System for Medical Physic Calibration Laboratory - **Bangi**

4-6) Bengkel Pemantapan Penyelidikan dan Hasil Projek 3S RMK10 - **Port Dickson**
Workshop on Research and 3S RMK10 Project Output - **Port Dickson**

5-6) Kursus Kesedaran Keselamatan Sinaran - **Bangi**
Awareness Course on Radiation Safety - **Bangi**

15) Lawatan Ilmu ke Arkib Negara Malaysia - **Kuala Lumpur**

20-22) 3V Nuclear Camp (Veni, Vidi, Vici) Programme Series 2 - **Bangi**

29) Lawatan oleh Wakil Rosatom Asia - **Bangi**
Visit by Rosatom Asia Representatives - **Bangi**

30-1 Okt) Bengkel Penulisan dan Penerbitan Nuklear Malaysia Siri 2 - **Bangi**

OKTOBER OCTOBER

9-11) Kursus Penulisan Laporan Teknikal Kontrak Penyelenggaraan Peralatan dan Sistem - **Kuantan**

12-16) Kursus Pengenalan Teknik Ujian Ultrasonik dalam NDT - Bangi
Introduction Course on Ultrasonic Testing Technic in NDT - **Bangi**

13) Penyertaan dalam Kongres Belia Nuklear 2015 - **Johor Bahru**
Participation in Nuclear Youth Congress 2015 - **Johor Bahru**

14-15) Hands-on Open Source for Integration of Data & Image Acquisition - **Bangi**

19-21) Nuclear Malaysia-JAEA Steering Committee Meeting **- Bangi**

19-23) KEK-NM EGS5 & PHITS Monte Carlo Simulation School on Detector Response and Accelerator Beam Transport - **Bangi**

20) Kursus Kesedaran Perlindungan Sinaran
Course on Radiation Protection Awareness
- Bangi

21-22) Workshop on Development of Innovative Nuclear Reactor Technology (with the Spin-off) Based on Thorium - **Bangi**

22-23) Kursus Latihan Dalaman MS ISO 17043 - **Bangi**
In-House Training Course on MS ISO 17043 - **Bangi**

23) Bengkel Penggunaan Alat Pemadam Kebakaran - **Bangi**

26-29) Technology Preview & Showcase Nuklear Malaysia 2015 - **Bangi**

28-30) IAEA Country Programme Framework (CPF) for 2017-2021 Cycle - **Melaka**

20-22) Persidangan Sinaran Tidak Mengion - **Kuala Lumpur**
Conference on Non-Ionizing Radiation - **Kuala Lumpur**

NOVEMBER

NOVEMBER

2-3) Workshop on Plasma Focus - **Bangi**

3-5) Nuklear Malaysia Technical Convention 2015 (NTC 2015) - **Bangi**

3) Seminar Hari Bersama ICT 2/2015 - **Bangi**

3-5) Latihan Kembara Lasak bagi Kakitangan Unit Keselamatan Fizikal Nuklear Malaysia - **Perlis**

6) Lawatan oleh Timbalan Pesuruhjaya Tinggi India - **Bangi**
Visit by Deputy High Commissioner of India - **Bangi**

14-15) Carnival Creativity and Science4U for Eastern Zone-Terengganu - **Terengganu**

21) Mesyuarat Saintifik Pengimejan Perubatan - **Kuala Lumpur**
Scientific Meeting on Medical Imaging - **Kuala Lumpur**

9-16) Workshop on Corrosion and Form of Corrosion - **Bangi**

9-20) Workshop on Control and Operating of Electron Beam Irradiator ELV-4 - **Bangi**

12) Workshop on Chemical and Radioactive Spill Handling - **Bangi**

12) Workshop on Updating of Integrated Manual System Procedure at RTP - **Bangi**

16-20) Workshop on Advanced Non-Destructive Testing: Electromagnetic Acoustic Transducer (EMAT) - **Bangi**

17) Seminar Keselamatan Kimia - **Bangi**
Seminar on Chemical Safety - **Bangi**

17-19) Kursus Konfigurasi Asas Sistem CITECT SCADA - **Bangi**
CITECT SCADA Basic System Configuration Course - **Bangi**

19-21) Bengkel Konsolidasi Profil Kompetensi Agensi Nuklear Malaysia 2015 **- Pahang**
Workshop on Consolidation of Nuclear Malaysia Competency Profile **- Pahang**

23-26) Bengkel Kalibrasi Pusat Instrumentasi & Automasi bagi Akreditasi MS ISO/IEC 17025 - **Bangi**
Workshop on Calibration for Instrumentation Centre and Automation for MS ISO/IEC 17025 Accreditation - **Bangi**

24-27) Bengkel Keselamatan Sinaran dan Penilaian Dos Kemudahan Utama Agensi Nuklear Malaysia - **Ipoh**
Workshop on Radiation Safety and Main Facilities Dose Evaluation, Malaysian Nuclear Agency - **Ipoh**

25-26) Seminar Keutuhan Bahan - **Kuala Lumpur**
Seminar on Materials Integrity - **Kuala Lumpur**

25-26) Course on Microcontroller Skill for Reactor Control System using Arduino - **Bangi**

25-27 Kursus Pengurusan Kewangan (Terimaan) - **Melaka**

30 Nov-11Dis Advanced Course on Benzene Synthesis and Radiocarbon Dating - **Bangi**

DISEMBER DECEMBER

2-3) In-House Training on Ground Penetrating Radar (GPR) for Detection and Assessment Subsurface Target - **Bangi**

2-4) Kursus Pembantu Tadbir 2015 Agensi Nuklear Malaysia - **Langkawi**

3) Program Galakan Membaca - **Bangi**

8) Program Jasamu Dikenang - **Bangi**

9) Seminar on Biotechnology - **Bangi**

16) Jamuan Persaraan Dr Muhd Noor Muhd Yunus, TKP Teknikal - **Bangi**

9-11) In-House Training on Ground Penetrating Radar (GPR) for Detection and Assessment Subsurface Target - **Penang & Bangi**

8 PENYELIDIKAN DAN PEMBANGUNAN TEKNOLOGI

Sebagai peneraju penyelidikan dan pembangunan (P&P) dalam bidang teknologi nuklear dan berkaitan, Agensi Nuklear Malaysia (Nuklear Malaysia) terus menunjukkan kecemerlangannya pada tahun 2015 dalam enam bidang utama iaitu teknologi perubatan; sumber air, sisa dan alam sekitar; teknologi industri; teknologi sinaran; teknologi reaktor nuklear dan agroteknologi dan biosains.

RESEARCH AND TECHNOLOGY DEVELOPMENT

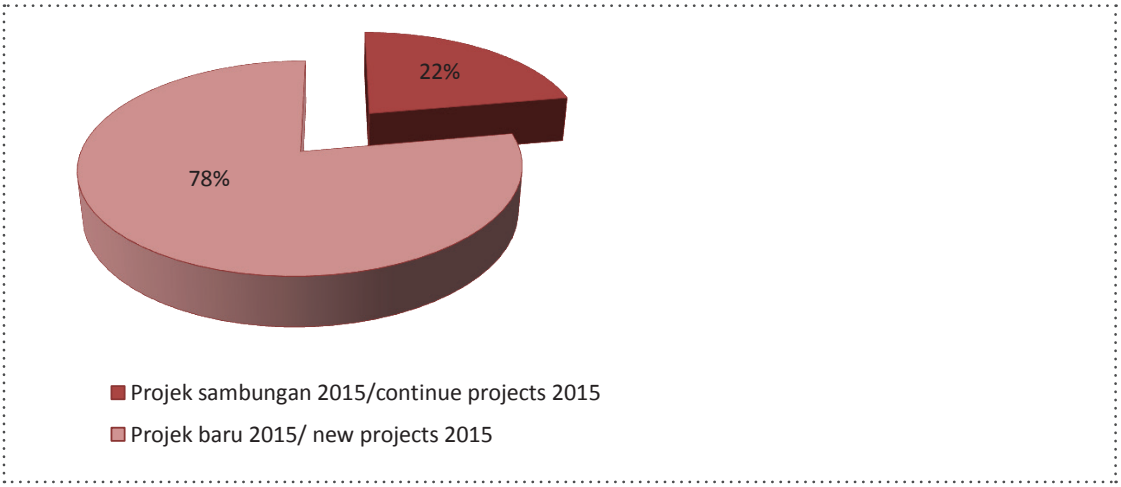
As a leader in research and development (R&D) in the field of nuclear and related technologies, Malaysian Nuclear Agency (Nuklear Malaysia) has continued its excellence in 2015 in six key areas viz. medical technology; water resources, waste and environment; industrial technology; radiation technology; Malaysian Nuclear Agency (Nuklear Malaysia) technology and agrotechnology and biosciences.

8.1) Dana Penyelidikan dan Pelaksanaan P&P

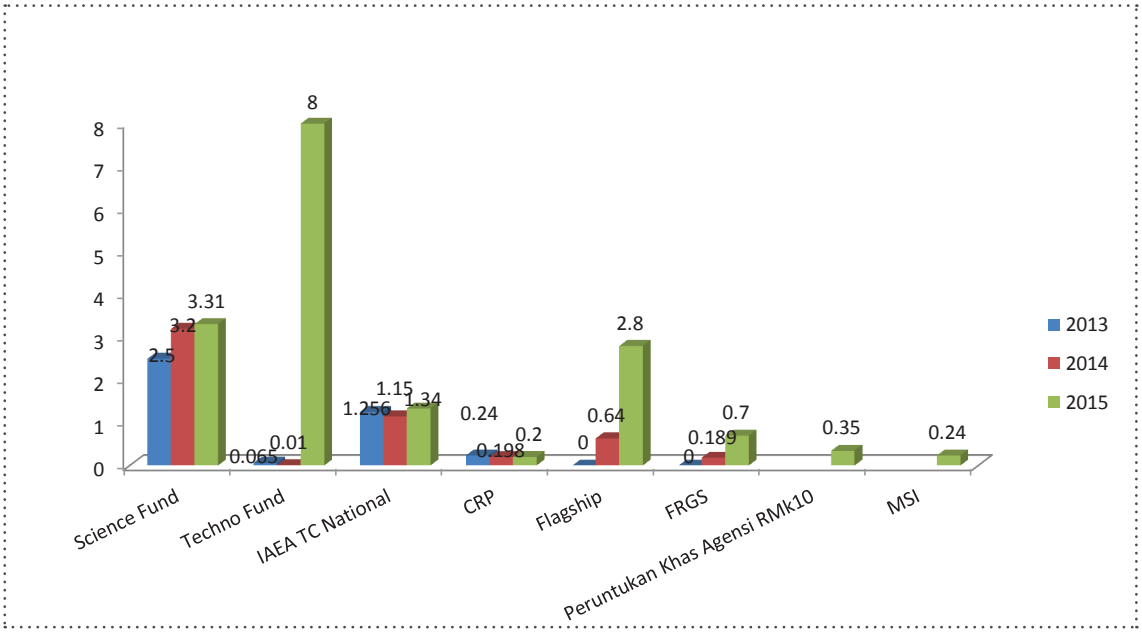
Jumlah dana penyelidikan yang telah diterima oleh Nuklear Malaysia adalah sebanyak RM 16.32 juta (Rajah 8.1) berbanding RM 5.4 juta yang diterima pada 2014 (Rajah 8.2).

8.1) Research Grant and R&D Implementation

The total research grant received by Nukear Malaysia was RM 16.32 million (Figure 8.1) compared with RM5.4 million received in 2014 (Figure 8.2)



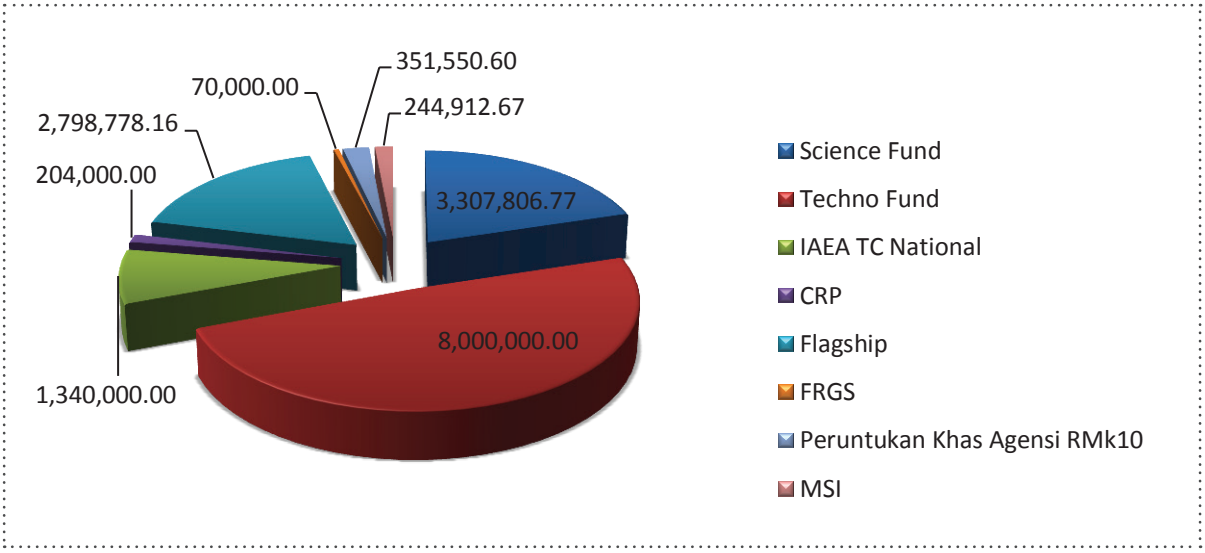
Rajah 8.1: Jumlah dana penyelidikan diterima pada tahun 2015 (RM)
Figure 8.1: Total research grant received in year 2015 (RM)



Rajah 8.2: Dana penyelidikan yang diterima pada 2013-2015 (RM juta)
Figure 8.2: Research grant received for 2013-2015 (RM million)

Sejumlah 36 projek P&P di bawah ScienceFund telah dilaksanakan dalam tahun 2015 meliputi 28 projek sambungan dari tahun-tahun sebelumnya (RM 6.4 juta) dan lapan projek baru (RM 1.8 juta) dengan nilai keseluruhan sebanyak RM 8.2 juta (Rajah 8.3). Selain itu, pada tahun 2015 sejumlah tiga (3) projek telah diluluskan di bawah peruntukan MOSTI Social Innovation (MSI) dengan jumlah sebanyak RM 0.4 juta.

A total of 36 R&D projects under ScienceFund was implemented in 2015, includes 28 projects continued from previous years (RM 6.4 million) and an additional eight new projects (RM 1.8 million) totalling RM 8.2 million (Figure 8.3). Apart from it, in 2015 a total of three (3) projects have been approved under the provisions of the MOSTI Social Innovation (MSI) with the sum of RM 0.4 million.



Rajah 8.3: Bilangan projek ScienceFund yang dilaksanakan pada tahun 2015
Figure 8.3: Number of SciencFund project implemented in year 2015

8.2) Peralatan Saintifik Utama

Bagi menyokong aktiviti P&P, Nuklear Malaysia telah memperoleh beberapa peralatan saintifik pada tahun 2015. Perolehan peralatan adalah untuk memenuhi fungsi Nuklear Malaysia dalam melaksanakan penyelidikan dan menawarkan khidmat teknikal meliputi bidang pengukuran keradioaktifan, pemantauan sinaran, pencirian jirim, pengujian kestabilan bahan dan lain-lain.

8.2) Main Scientific Equipments

To support R&D activities, Nuklear Malaysia purchased some scientific equipment in 2015. Procurement of equipment is to meet the functions of Nuklear Malaysia in carrying out research and offer technical services, covering the field of measurement of radioactivity, radiation monitoring, matter characterisation, material's stability testing and others.

8.2.1) Penganalisa Terma Serentak (STA)

Penganalisa Terma Serentak (STA) seperti Foto 8.1 merujuk kepada penggunaan serentak bagi aplikasi termogravimetri (TGA) dan kalorimeter pengimbasan pembezaan (DSC) untuk sampel yang sama. Oleh itu, penganalisa ini menghasilkan maklumat yang lebih banyak dan pantas. STA mengukur perubahan jisim dan kesan terma di antara -150°C dan 2400°C. Maklumat bahan seperti transformasi fasa, penguraian, kondensasi, pirolisis, pengoksidaan dan pembakaran dapat diperoleh menggunakan penganalisa ini. Ia dilengkapi dengan alat penimbang mikro, relau elektrik, sistem asas, sistem penyejukan, perkakasan dan perisian untuk menganalisis terma.

8.2.1) Simultaneous Thermal Analyzer (STA)

The Simultaneous Thermal Analyzer (STA) (Photo 8.1) refers to the simultaneous use of thermogravimetric (TGA) and Differential Scanning Calorimetry (DSC) applications for the same samples. Therefore, it produces more information rapidly. STA measures mass changes and thermal effects between -150°C and 2400°C. Information such as phase transformation, decomposition, condensation, pyrolysis, oxidation and combustion of a sample can be obtained using this analyser. It is equipped with a micro scales, electric furnace, founder systems, cooling systems, hardware and software for thermal analysis.

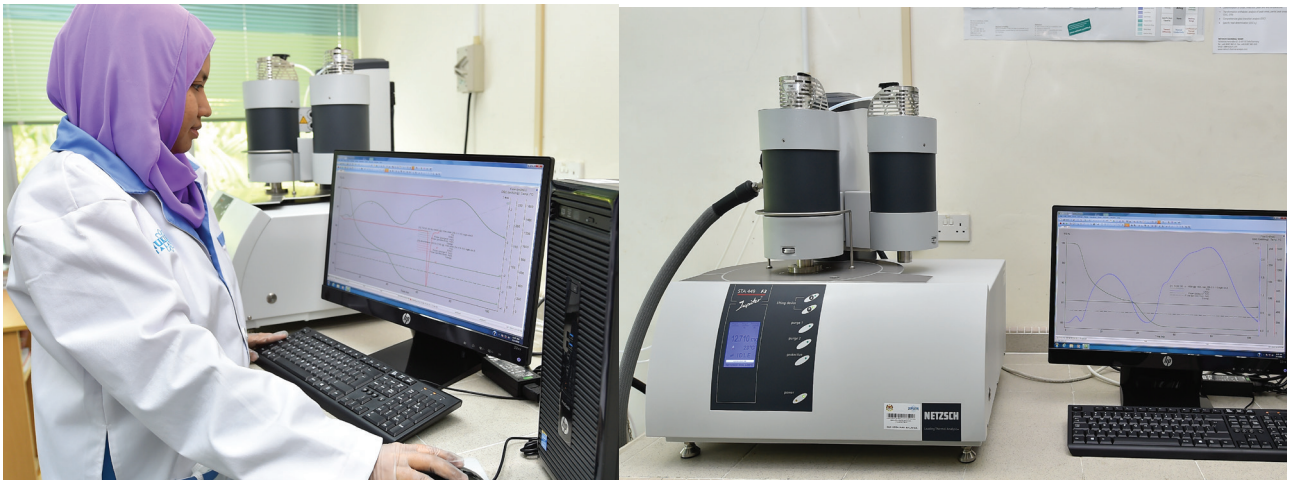


Foto 8.1: Penganalisa Terma Serentak (STA)
Photo 8.1: Simultaneous Thermal Analyzer (STA)

8.2.2) Ball Milling System

Pengisar Bebola (Foto 8.2) terdiri daripada jar pengisar dan media pengisar. Ia digunakan untuk mengisar bahan seperti bijih, bahan kimia, bahan mentah seramik dan cat. Jar pengisar berputar sepanjang paksi mengufuk dan sebahagiannya diisi dengan bahan yang ingin dikisar beserta media pengisar. Terdapat pelbagai jenis media pengisar seperti bebola seramik, batu dan keluli nir-karat (Foto 8.3)

8.2.2) Ball Milling System

A Ball Mill (Photo 8.2) consists of grinding jar and media. It is used in grinding materials like ores, chemicals, ceramic raw materials and paints. Grinding jar rotates around a horizontal axis, partially filled with the material to be ground plus the grinding media. There are various types of grinding media such as ceramic balls, flint pebbles and stainless steel (Photo 8.3).

Foto 8.2: Sistem Pengisar Bebola
Photo 8.2: Ball Milling System

Foto 8.3: (a) Jar pengisar dan
(b) Pelbagai saiz media pengisar
Photo 8.3: (a) Grinding jar and (b)
Multi size grinding media

8.2.3) Reaktor Berjaket

Reaktor Berjaket (Foto 8.4) direkabentuk untuk mensintesis bahan dalam skala besar (contohnya titanium dioksida dan torium). Penyejukan atau pemanasan jaket di sekitar vesel yang mana bendalir penyejuk atau pemanas dikitarkan maka parameter sintesis dipertingkatkan. Keadaan ini meningkatkan pertukaran bahan reaktan kepada produk, di samping itu ketulenan produk turut dipertingkatkan.

8.2.3) Jacketed Reactor

The Jacketed Reactor (Photo 8.4) is designed to synthesize material in large scale (eg. titanium dioxide and thorium). The cooling or heating jacket around the vessel through which a cooling or heating fluid is circulated therefore enhanced synthesizing parameters. This resulted in an increased conversion of reactant feed to product, besides that the purity of product also enhanced.

Foto 8.4: Sistem Reaktor Berjaket
Photo 8.4: Jacketed Reactor System

8.2.4) Sistem Multi-Pengesan Pembilang Alfa/Beta Berlatar Belakang Rendah

Sistem Multi-Pengesan Pembilang Alfa/Beta Berlatarbelakang Rendah (Foto 8.5) ini dilengkapi dengan empat laci pembilangan, sesuai untuk aplikasi yang memerlukan beberapa sampel diukur pada masa yang sama dan memerlukan masa pembilangan yang panjang. Ia turut dilengkapi dengan sistem pemantauan gas P-10 (argon 90%, metana 10%). Alat ini menjimatkan penggunaan P10 sebanyak 50% berbanding dengan model lama. Kegunaan utama alat ini adalah untuk pengukuran keradioaktifan gros alfa/gros beta dalam pelbagai sampel alam sekitar termasuk air sungai, tanah, sedimen, sampel ujian calitan, ais, debu udara, dan juga untuk analisis kecekapan sistem penapisan air.

8.2.4) Low Background Alpha/Beta Counting Multi-Detector System

Low Background Alpha/Beta Counting System (Photo 8.5) is equipped with four counting drawers, suitable for applications that require multiple samples measured at the same time and require a long counting time. It is also equipped with P-10 (90% argon, 10% methane). This equipment can reduce the use of P10 by 50% compared with the old model. The main application of this equipment is for measurement of gross alpha/gross beta radioactivity in various environmental samples, including water, soil, sediment, smear test sample, ice, dust, air, and also to analyse the efficiency of water filtration systems.

Foto 8.5: Penganalisis sedang meletakkan sampel ke dalam Sistem Multi-Pengesan Pembilang Alfa/Beta Berlatar belakang Rendah

Photo 8.5: Analyst is placing a sample into the Low Background Alpha/Beta Counting Multy-Detector System

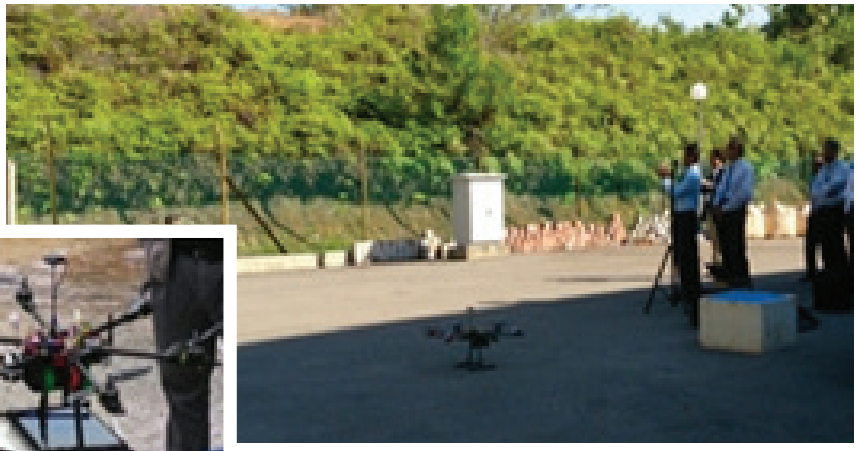
8.2.5) Pengesan Sinaran Sky Shine

Pengesan Sinaran Sky Shine digunakan untuk mengukur aras sinaran yang terserak ke udara dari kemudahan penyinaran menggunakan punca gama. Pengesan sinaran ini dilekatkan pada dron seperti Foto 8.6 dan Foto 8.7 dan diterbangkan di ruang udara zon kemudahan penyinaran. Isyarat dari pengesan direkod dalam bentuk taburan dos sinaran di kawasan penyinaran.

8.2.5) Sky Shine Radiation Detector

The Sky Shine Radiation Detector is used to measure sky shine radiation level from irradiation facilities using gamma sources. The radiation detector is attached to a drone as Photo 8.6 and Photo 8.7, and is flown over the irradiation facility zone. Signal from detector is recorded in the form of radiation dose distribution over the irradiation facility.

Foto 8.6: Pengesan sinaran mudah alih
Photo 8.6: Portable radiation detector



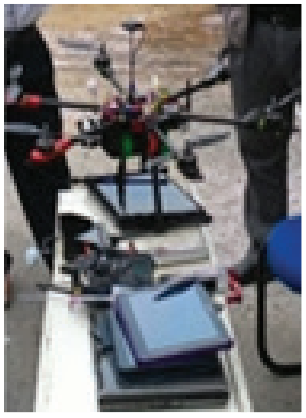


Foto 8.7: Dron yang dilekatkan dengan pengesan sinaran mudah alih
Photo 8.7: Drone attached with portable radiation detector

8.2.6) Sistem Amaran Pintar Pengesanan Sinaran (SARD)

Sistem Amaran Pintar Pengesanan Sinaran (SARD) digunakan untuk memantau dan memberi amaran kepada pekerja sinaran apabila aras sinaran melebihi tahap yang ditetapkan. SARD beroperasi 24 jam secara automatik melalui bekalan kuasa solar yang dilengkapkan dengan aplikasi pembilang Geiger Muller (GM). Bagi pengukuran aras dos, isyarat denyutan dari GM akan digunakan untuk memberikan nilai dos radiasi dalam μSv/jam. Sistem ini mampu mengesan dan merakam kadar dos setiap 3 saat dan bacaan direkod di pangkalan data 'Cloud' melalui platfom wifi untuk memberi isyarat kepada petugas. Foto 8.8 menunjukkan SARD yang diletakkan di kawasan simpanan sisa radioaktif untuk ujian ketahanan dan kestabilan data sebelum digunakan di loji perintis torium.

8.2.6) Smart Alert Radiation Detection (SARD)

Smart Alert Radiation Detection (SARD) system monitors the area monitoring and alerts the user when radiation level is more than a permissible level. SARD is 24 hours operating system that powered by solar energy and equipped with a Geiger Muller Counter application. For dose level measurement, the pulse from GM will be converting to count per minute (cpm). The cpm reading is used to obtain radiation dose in uSv/h. The system can record and tracking the dose rate every 3 seconds and will send them to a Cloud database though wifi platform to give signals to the worker. A special platform by using android is also being developed. Photo 8.8 shows SARD installed at radioactive waste storage area for toughness and data stability testing before being applied at thorium pilot plant.

Foto 8.8: SARD diletakkan di lapangan untuk menguji ketahanannya dan kestabilan data sebelum digunakan
Photo 8.8: SARD located at field site to test its toughness and data stability before being applied

8.2.7) Mikrostereolitografi

Teknologi mikrostereolitografi (Foto 8.9) digunakan dalam bidang pembuatan dan bioperubatan untuk memfabrikasi rekabentuk struktur. Proses fabrikasi ini dikenali sebagai proses penambahan lapisan, iaitu proses yang diulang lapisan demi lapisan sehingga struktur tiga dimensi (3D) terbentuk melalui ikatan taut silang daripada proses pempolimeran cahaya seperti dari cahaya ultraungu, laser dan infra merah-dekat. Teknik ini menawarkan kos pembuatan yang lebih murah, cekap dan jitu serta sistem pemprosesan yang dapat meningkatkan ketahanan produk.

8.2.7) Microstereolithography

Microstereolithography technology (Photo 8.9) is utilised in the manufacturing and biomedical field for fabricating imprinted structures. The fabrication process is an additive layer process, in which the process is repeated layer by layer to construct a full three dimension (3D) structure. These structures are formed through cross linking bonds formed from photo polymerization process such as ultraviolet (UV), laser or near-infrared laser. The technique offers low cost of production, is efficient and precise, and also the processing system is able to increase product durability.

Foto 8.9: Mikrostereolitografi digunakan untuk fabrikasi rekabentuk struktur dan mampu mengenalpasti analit yang disasarkan
Photo 8.9: Microstereolithography is utilized for imprinted structures fabricating and capable of recognizing a targeted analyte

8.2.8) Magnetometer Sampel Bergetar (VSM)

Magnetometer Sampel Bergetar (VSM) (Foto 8.10) digunakan untuk mencirikan sifat magnet bahan. Sifat bahan seperti pemagnetan tepu (M_s), pemagnetan baki (M_r) dan daya koersif (H_c) bahan dalam medan magnet (H_s) pada suhu bilik boleh diperolehi dari VSM.

8.2.8) Vibrating Sample Magnetometer (VSM)

The vibrating sample magnetometer (VSM) (Photo 8.10) is utilised to characterize the magnetic properties of the materials. Properties of materials such as the magnetic saturation (Ms), magnetic retentivity (Mr) and coercivity forces (Hc) of a material in the magnetic field (Hs) at room temperature can be obtained from the VSM.

Foto 8.10: Magnetometer Sampel Bergetar (VSM)
Photo 8.10: Vibrating Sample Magnetometer (VSM)

8.2.9) Sistem Pemendapan Wap Kimia (CVD)

Sistem Pemendapan Wap Kimia (Foto 8.11) digunakan secara meluas dalam teknologi pemprosesan bahan. Aplikasi utamanya adalah dalam penyalutan permukaan; dalam industri fabrikasi wafer silikon dan juga modifikasi filem nipis. Ekoran kepelbagaian aplikasinya, penggunaan sistem CVD boleh dikembangkan untuk memendapkan lapisan monomer dan glisidil metakrilat (GMA) ke atas gentian kenaf menggunakan teknik pencangkukan aruhan sinaran.

8.2.9) Chemical Vapour Deposition (CVD) System

Chemical Vapor Deposition (CVD) System (Photo 8.11) is a widely used for materials-processing technology. The main application is in a surface coating; in silicon wafer fabrication industries and thin film modification. Due to its wide application, the use of CVD system can be expanded to deposit the monomer, glycidyl methacrylate (GMA) layer onto kenaf fiber using radiation-induced grafting technique.

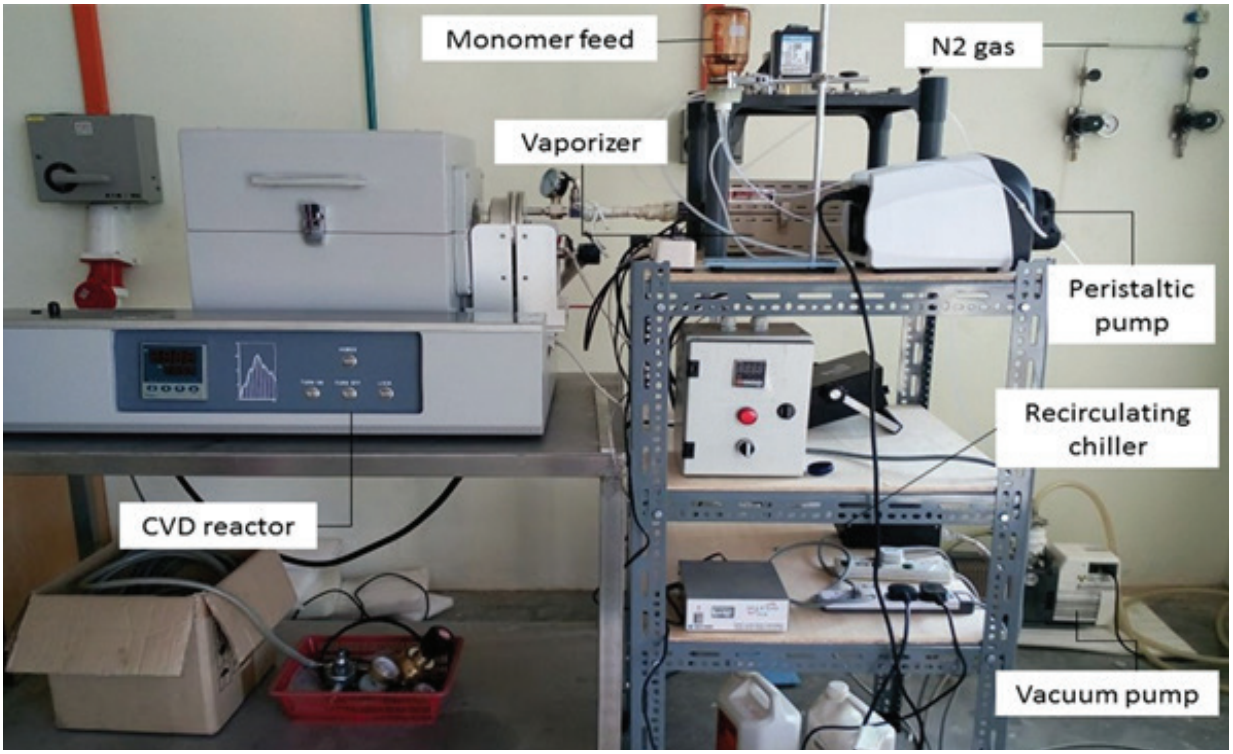


Foto 8.11: Sistem Pemendapan Wap Kimia (CVD)
Photo 8.11: Chemical Vapour Deposition (CVD) System

8.3) Kemudahan yang Dibangunkan

8.3.1) Pembangunan Loji Rintis Perawatan dan Penyesuaian Sisa Radioaktif Menggunakan Teknologi Plasma

Loji rintis teknologi terma dibangunkan untuk perawatan dan penyesuaian sisa radioaktif menggunakan teknologi plasma (Foto 8.12). Teknologi ini berupaya menukar bentuk sisa bahan radioaktif menjadi bahan lengai dan berpotensi digunakan sebagai bahan lain. Teknologi terma juga dapat mengurangkan jumlah longgokan sisa dan selamat kepada alam sekitar. Penggunaan teknologi ini seterusnya dapat menyelesaikan masalah ruang penyimpanan sisa radioaktif yang terhad.

8.3) Developed Facilities

8.3.1) Development of the Pilot Plant for the Treatment and Adjustment of Radioactive Waste Using Plasma Technology

Thermal technology pilot plant is developed for the treatment and adjustment of radioactive waste using plasma technology (Photo 8.12). This technology capable to transform radioactive material into inert form and potentially used as other materials. The thermal technology also able to reduce the amount of waste pile and safe to the environment. The application of the technology will solve the problem of limited radioactive waste storage.

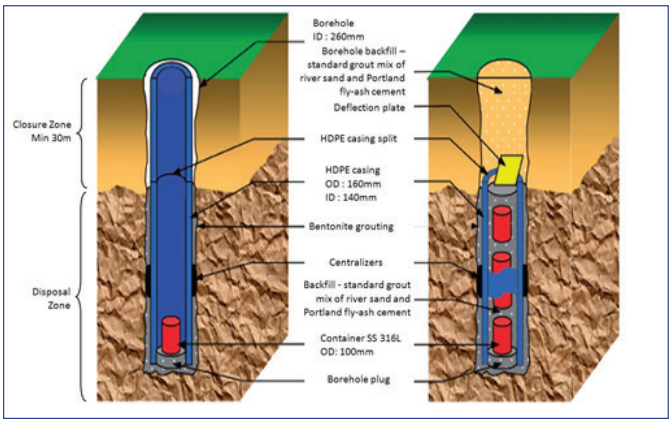
Foto 8.12: Loji perintis untuk perawatan dan penyesuaian sisa radioaktif menggunakan teknologi plasma
Photo 8.12: Pilot plant for the treatment and adjustment of radioactive waste using plasma technology

8.3.2) Pembangunan Kemudahan Pelupusan Lubang Gerek Ujian untuk Sumber Radioaktif Terkedap Terpakai (DSRS)

Pelupusan lubang gerek merupakan satu konsep yang diketengahkan oleh Badan Tenaga Atom Antarabangsa (IAEA) untuk pelupusan sisa punca terkedap terpakai atau lebih dikenali sebagai *Disused Sealed Radioactive Sources* (DSRS). Kaedah pelupusan ini terdiri daripada beberapa struktur lapisan yang berfungsi sebagai ciri-ciri keselamatan yang bertujuan untuk mengasing, membendung, dan mengekalkan sisa radioaktif di dalam lubang gerek. Rajah 8.4 menunjukkan konsep rekabentuk kemudahan pelupusan lubang gerek. Kemudahan ini masih dalam peringkat pengujian.

8.3.2) Development of Testing Borehole Disposal Facility for Disused Sealed Radioactive Source (DSRS)

Borehole disposal is a concept featured by the International Atomic Energy Agency (IAEA) for the disposal of unused or waste sealed source known as Disused Sealed Radioactive Sources (DSRS). Disposal method consists of several structure layers functioning as security features that aim to isolate, contain, and retain radioactive waste in the borehole. Figure 8.4 shows the design concept of Bore Hole Disposal Facilities. This facility is still in testing phase.



Rajah 8.4: Keratan rentas rekabentuk kemudahan pelupusan lubang gerek
Figure 8.4: Cross-sectional design of borehole disposal facilities

Foto 8.13: Pembinaan kemudahan pelupusan lubang gerek ujian di bawah projek Sistem Pelupusan Sisa Bahan Radioaktif Mengikut Piawaian IAEA
Photo 8.13: Construction of disposal facilities testing borehole under project of Disposal System of Radioactive Waste According to IAEA Standards

8.3.3) Sistem Pemantauan Sinaran Berpusat

Pemantau kawasan digital adalah alat yang digunakan untuk memantau sinaran kawasan berpusat. Ia adalah alat utama untuk projek Sistem Pemantauan Sinaran Berpusat di Nuklear Malaysia melalui kemudahan internet/sesawang dalaman. Pengesan ini ditempatkan di lokasi dan bangunan terpilih di Nuklear Malaysia seperti kemudahan reaktor, bilik pembilang NAA, makmal radiografi, bilik sinar-X, dan lain-lain (Foto 8.14). Data yang diperoleh dari alat pengesan ini juga disimpan dan diagihkan kepada pengguna melalui talian internet dalaman (Foto 8.15).

8.3.3) Centralised Radiation Monitoring System

Digital area monitors are used for the centralize area radiation monitoring. It is main equipment for the Centralised Radiation Monitoring System project via local internet/web facility. The detectors were located at selected locations and buildings in Nuklear Malaysia such as reactor facility, NAA counting room, radiography laboratory, X-Ray room and etcetera (Foto 8.14). The data from the detectors were saved and distributed to the user by using internet facility in Nuklear Malaysia (Photo 8.15).

Foto 8.14: (a) Pemantau Kawasan Digital di bilik pembilang and (b) Pemantauan Kawasan Digital ditempatkan di bangunan yang dikenalpasti/terpilih
Photo 8.14: (a) Digital area monitor at counting room and (b) Digital Area Monitor located at identified/selected building

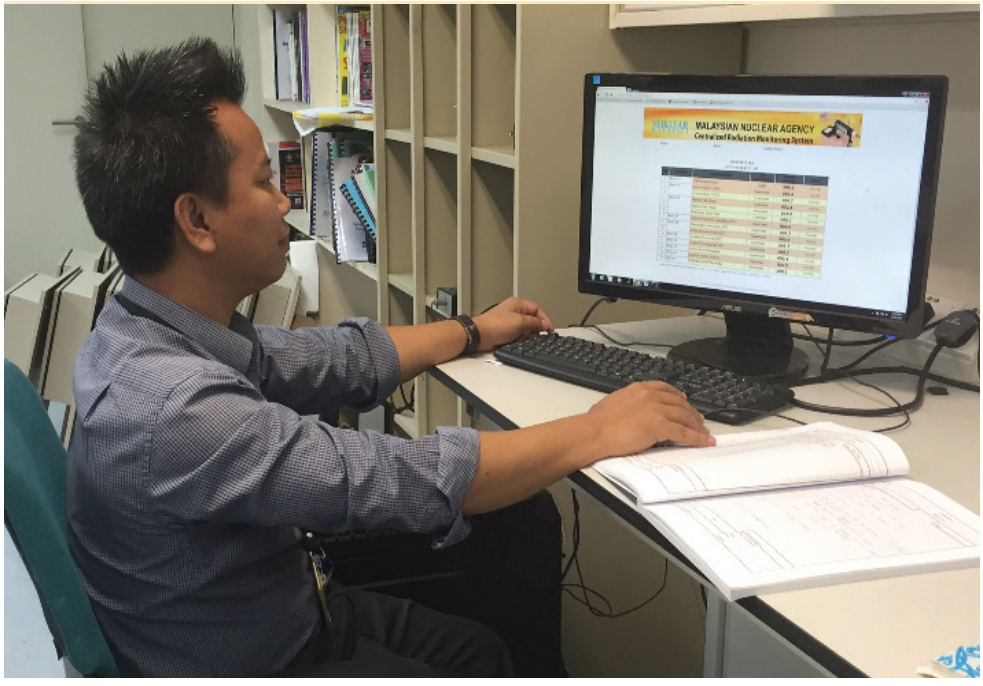


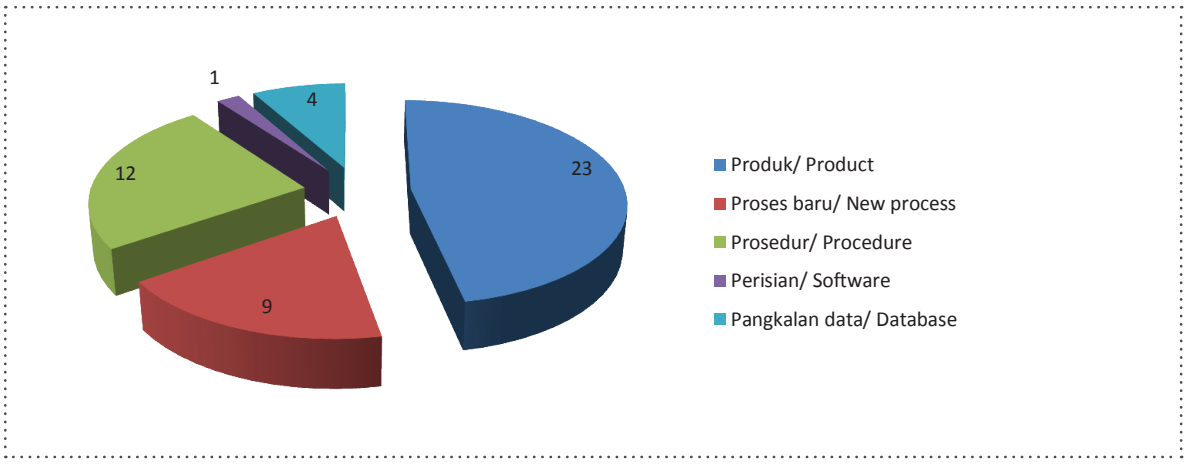
Foto 8.15: Laman web pemantauan sinaran berpusat - pemantauan masa sebenar
Photo 8.15: Centralised radiation monitoring website – real time monitoring

8.4) Output Penyelidikan

Sejumlah 48 output penyelidikan yang merangkumi penghasilan produk, proses, prosedur, perisian dan pangkalan data telah dihasilkan sepanjang tahun 2015 berbanding 39 output yang dihasilkan pada tahun 2014. Jumlah keseluruhan output ditunjukkan di dalam Rajah 8.5, manakala butiran terperinci output disenaraikan di dalam Jadual 8.1 hingga 8.5.

8.4) Research Output

A total of 48 research outputs, comprising new products, processes, procedures, software and database were generated in 2015 as compared to 39 outputs in 2014. The total output is shown in Figure 8.5, while the details are listed in Tables 8.1 to 8.5.



Rajah 8.5: Output P&P yang dijana pada 2015
Figure 8.5: R&D output generated in 2015

8.4.1) Produk

8.4.1) Product

Jadual 8.1: Senarai produk yang dihasilkan pada 2015
Table 8.1: List of products produced in 2015

Bilangan / Number	Produk / Product
1	Penghasilan anak benih kultur tisu dan anak pokok stevia
2	Cendawan mutan bagi strain shiitake
3	Pleurotus berkualiti melalui mutagenesis dan *single spore cross mating*
4	Inovasi kit *low-cost bioreactor system*
5	*Radiation compatible thermoplastic elastomers (TPEs) for healthcare industry*
6	*Palm oil based eco-friendly printing ink materials*
7	*Hematite concrete interlock blocks (292 blocks)*
8	*Rust converter (800 litters)*
9	*Aluminium alloy sacrificial anode (13 pcs (6kg))*
10	*Eddy current thermography system*
11	*Pulsed eddy current system*
12	*Portable film digitizer for DIR*
13	*Mobile digital laser shearography system*
14	*Magnetic flux leakage (MFL) system*
15	*Phased array ultrasonic testing (PAUT)*
16	*Ultrasonic probe*
17	*Nano titania (3 kg)*
18	*Bonigent as drug delivery system in bone tissue [4 kg (50 pellet, 50 porous block)]*
19	Pengeluaran Ir-192 untuk radiografi
20	*Mas cotek tablet 50 mg*
21	*Deltozide capsule 100 mg*
22	*Deltozide tablet 200 mg*
23	*Plasma pilot plant for treatment and vitrification of low level radioactive waste*

8.4.2) Proses Baru

8.4.2) New Process

Jadual 8.2: Senarai proses baru
Table 8.2: List of new process

Bilangan / Number	Proses Baru / New Process
1	Sistem ekstraksi minyak gaharu di Sg. Asap, Belaga, Sarawak
2	Pembangunan nurseri dan makmal kultur tisu stevia
3	Pengurusan rawatan sisa cecair Th-232 berisipadu besar yang terhasil daripada eksperimen bioakumulasi oleh *Anabas testudineus*
4	Proses formulasi MasCotek tablet 50 mg
5	Proses formulasi Deltozide capsule 100 mg
6	Proses formulasi Deltozide tablet 100 mg
7	*Conductivity based test method for industrial radiography film developer solution*
8	Proses propagasi anak benih pisang tanduk

8.4.3) Prosedur

8.4.3) Procedure

Jadual 8.3: Senarai prosedur yang dibangunkan pada 2015
Table 8.3: List of procedures developed in 2015

Bilangan / Number	Prosedur / Procedure
1	Penanaman benih kultur tisu stevia
2	Kultur tisu dan sistem bioreaktor untuk pisang tanduk
3	SOP pengesanan makanan diiradiasi dengan teknik *photostimulated luminescence*
4	Site master file (SMF) persijilan GMP loji fitofarmaseutikal
5	Prosedur pengkelasan sisa radioaktif cecair organik bercampur
6	Prosedur pelupusan lampu krypton
7	*A manual procedure of radiotracer techniques for leak detection in heat exchanger*
8	*A manual procedure of radiotracer techniques for movement of suspended sediment in estuary*
9	*Pipeline welding inspection using laser shearography technique*
10	Pengujian PAUT ke atas *Single V Butt Weld*
11	*Standard of procedure (SOP) for synthesis plant*
12	*Technical document/ procedure: IAEA-TECDOC-1764*

8.4.4) Perisian

8.4.4) Software

Jadual 8.4: Senarai perisian yang dibangunkan pada 2015
Table 8.4: List of software developed in 2015

Bilangan / Number	Perisian / Software
1	Aplikasi automasi proses dan pejabat

8.4.5) Pangkalan Data/Database

8.4.5) Pangkalan Data/Database

Jadual 8.5 Senarai pangkalan data yang dibangunkan pada 2015
Table 8.5: List of database developed in 2015

Bilangan / Number	Pangkalan data / Database
1	*Air particulate mass and elemental concentration of air particle in Kuala Lumpur from 2000 to 2012*
2	Pembangunan pangkalan data inventori sisa radioaktif
3	Pembangunan dan simulasi data inventori DSRS menggunakan perisian SIMBOD
4	Pengkalan data ketidakpatuhan (NC) dan tindakan pembetulan hasil audit dalaman dari tahun 2005 hingga 2014

8.5) Penerbitan

Sejumlah 625 penerbitan telah berjaya diterbitkan sepanjang tahun 2015, meliputi buku (ilmiah dan umum), jurnal kebangsaan dan antarabangsa, kertas kerja konferens, penerbitan am dan teknikal. Butiran terperinci setiap kategori adalah seperti ditunjukkan dalam Jadual 8.6 dan penerbitan terpilih seperti disenaraikan dalam lampiran.

8.5) Publication

A total of 625 publications were successfully published throughout 2015, include books (general and scientific), articles in international and national journals, and conference papers, general and technical publications. A detailed list of each category is shown in Table 8.6 and selected publications as listed in the appendix.

Jadual 8.6: Jumlah penerbitan pada 2015
Table 8.6 Total of publications in 2015

Penerbitan / Publication	**Bilangan / Number**
Buku / Book	4
Bab dalam buku / Chapter in book	3
Tesis (Sarjana dan PhD) / Thesis – Hasilan staf Nuklear Malaysia	8
Tesis (Sarjana dan PhD) / Thesis – Staf Nuklear Malaysia sebagai penyelia	7
Jurnal antarabangsa / International journal	84
Jurnal kebangsaan / National journal	9
Pembentangan antarabangsa / International conference	83
Prosiding antarabangsa / International proceeding	56
Pembentangan kebangsaan / National conference	108
Prosiding kebangsaan / National proceeding	88
Penerbitan umum antarabangsa / International general publication	3
Penerbitan am kebangsaan / Laporan teknikal National general publication / Technical report	120
Lain-lain penerbitan	52
Jumlah penerbitan / Total publication	**625**

8.6) Produk Berpotensi dikomersialkan

8.6.1) Fitofarmaseutikal Ficus Deltoidea: Tablet Deltozide Tablet 200 mg dan Kapsul Deltozide

Mas cotek atau nama saintifiiknya Ficus deltoidea merupakan salah satu tumbuhan ubatan yang lazim di Malaysia. Ianya juga telah digunakan dalam perubatan tradisi tempatan untuk merawat sakit kepala, sakit gigi, demam, kencing manis, tekanan darah tinggi, masalah jantung, gout, cirit-birit, radang paru-paru dan penyakit kulit. Tumbuhan ini

8.6) Potential Products for Commercialisation

8.6.1) Ficus Deltoidea Phytopharmaceuticals: Deltozide Tablet 200 mg and Deltozide Capsule

Mas cotek or its scientific name Ficus deltoidea is one of the commonly used medicinal plant in Malaysia. It has been used in local folk medicine as remedy for treatment of headache, fever, toothache, diabetes, high blood pressure, heart problems, gout, diarrhea, pneumonia and skin diseases. The plant was also used as herbal drink

juga digunakan oleh wanita selepas bersalin untuk menguatkan rahim dan meningkatkan peredaran darah. Kini, terdapat banyak produk berasaskan Ficus deltoidea yang terdapat di pasaran.

Produk fitofarmaseutikal Ficus deltoidea adalah formulasi dos oral mengikut piawaian dalam bentuk kapsul dan tablet iaitu Deltozide tablet 200 mg dan Deltozide kapsul 100 mg. Bahan aktif yang digunakan dalam formulasi ini adalah ekstrak akuas semburan kering daun Ficus deltoidea (Foto 8.16).

by women after birth to strengthen the uterus and to improve blood circulation. Currently, there are many Ficus deltoidea-based products available on the market.

Ficus deltoidea phytopharmaceuticals are standardized oral dosage formulation in the form of tablet and capsule which are Deltozide tablet 200 mg and Deltozide capsule 100 mg. The active ingredient of this formulation is spray dried aqueous extract of Ficus deltoidea (Photo 8.16).

Foto 8.16: Penghasilan tablet dan kapsul mas cotek (Deltozide tablet 200 mg dan Deltozide capsule 100 mg)
Photo 8.16: Production of mas cotek tablet dan capsule (Deltozide tablet 200 mg and Deltozide capsule 100 mg)

8.6.2) Perencat Karat

Projek penghasilan perencat karat telah dibangunkan untuk memenuhi keperluan industri dalam aspek perlindungan daripada kakisan untuk meningkatkan ketahanan sesuatu struktur. Salutan Perencat Karat telah dicipta untuk memenuhi keperluan ini sebelum penggunaan salutan dan cat akhir. Perencat karat (Foto 8. 17) ini diperbuat daripada bahan berasaskan air yang membolehkan salutan dilakukan ke atas besi berasaskan ferous yang karat dan kemudiannya disalut sekali lagi (*topcoat*) dengan cat yang diingini tanpa perlu menggosok besi tersebut. Produk unik ini bertindak secara kimia dengan karat dan seterusnya menghalang proses kakisan. Di samping itu, oksida yang lebih stabil ditinggalkan pada permukaan untuk membolehkan salutan atas dilakukan menggunakan kesemua jenis cat.

8.6.2) Rust Inhibitor

This project was developed to serve important technical needs of the industry involving corrosion protection, in order to extent reliability of the existing structures. Rust Inhibitor coating is used to fill those specific needs before applying coating and painting for the ultimate aim of the coating technologists. Rust Inhibitor (Photo 8.17) is made from water-based compound that allows coating to be done over rusty ferrous-based metal and then topcoat with any kind of paint without the need to sand or grind to bare metal. This unique product reacts chemically with rust and prevents corrosion process. In addition, a more stable oxide is left on the surface, allowing for top coating with any type of paint.

(a)

(b)

(c)

Foto 8.17: (a) Cecair perencat karat, (b) Keadaan meriam sebelum rawatan dan (c) Keadaan meriam setelah rawatan menggunakan perencat karat

Photo 8.17: (a) Rust inhibitor liquid, (b) Condition of artillery before treatment (c) Condition of artillery after treatment using rust inhibitor inhibitor

8.6.3) Filem Pembungkusan Aktif Anti-mikrob

Teknologi filem pembungkusan aktif anti-mikrob yang dibangunkan mampu meningkatkan jangka hayat dan keselamatan produk makanan. Kajian penggunaan filem ini juga melambatkan proses pembiakan mikroorganisma perosak seperti yis dan kulat (Foto 8.18). Secara tidak langsung, teknologi ini dapat mengurangkan pembaziran makanan.

8.6.3) Anti-microbial Active Packaging Film

Anti-microbial active packaging film technology is being developed to extend the shelf life and improve safety of food products. The use of this film was shown to successfully protect the food against spoilage microorganism like yeast and mould (Photo 8.18). Indirectly, this technology can reduce food wastage.

Foto 8.18: Perbandingan roti yang menggunakan filem pembungkusan aktif anti-mikrob dengan pembungkus biasa

Photo 8.18: Comparison of bread package in anti-microbial active packaging film with normal packaging

8.6.4) Komposit Polimer-Bermagnet

Komposit polimer (Foto 8.19) bermagnet digunakan dalam pelbagai aplikasi disebabkan oleh sifat elektrik dan magnetnya yang unik. Kajian keatas komposit polimer bermagnet dijalankan khususnya untuk aplikasi sebagai bahan pemantul inteferens elektromagnet (EMI). Sifat magnet bahan komposit yang dihasilkan bergantung kepada tahap keserasian bahan magnetik seperti ferit splinel yang dicampurkan dalam matriks polimer. Spinel ferit seperti ferit nikel ($NiFe_2O_4$), ferit nikel zink ($NiZnFe_2O_4$) dan ferit nikel kobalt ($NiCoFe_2O_4$) diadunkan dalam bahan getah dan polimer dalam pelbagai nisbah jisim.

8.6.4) Magnetic-Polymer Composite

Magnetic-polymer composites (Photo 8.19) are used in diverse applications due to its unique electrical and magnetic properties. Research on magnetic-polymer composites is done primarily for its potential application as an electromagnetic interference (EMI) shielding material. The magnetic properties of these composites largely depend on the degree of dispersion of the magnetic fillers such as spinel ferrites in the polymer matrix. Spinel ferrites such as nickel ferrite (NiFe2O4), nickel zinc ferrite (NiZnFe2O4) and nickel cobalt ferrite (NiCoFe2O4) are melting blended in rubber and polymer matrixes at various weight ratios.

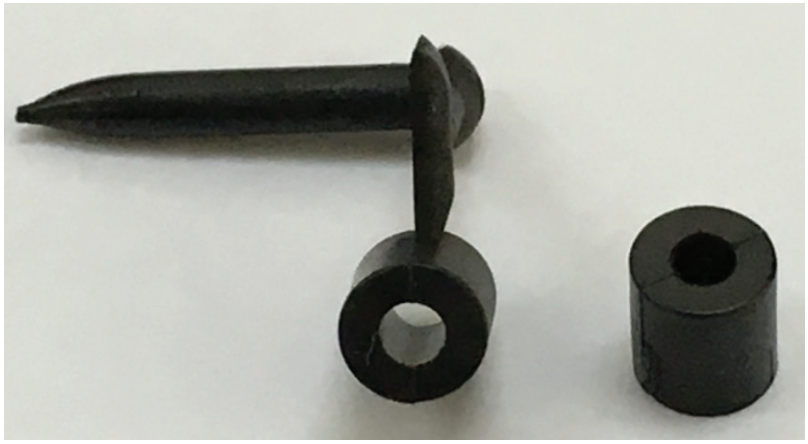


Foto 8.19: Komposit polimer-bermagnet
Photo 8.19: Magnetic-polymer composite

8.6.5) Pengeluaran Ir-192 untuk Radiografi

Satu projek usaha sama antara Nuklear Malaysia dan sebuah syarikat NDT di Malaysia telah diadakan untuk menghasilkan punca terkedap Ir-192 (Foto 8.20). Projek ini terdiri daripada pemindahan teknologi dari Institut Penyelidikan Agensi Tenaga Atom Korea (KAERI)/Ho Jin Industri Ltd. kepada Nuklear Malaysia. Peralatan pengeluaran akan dipasang di dalam sel aktif (hot cell) yang mempunyai ketebalan plumbum sebanyak 10 cm. Sel aktif ini mampu untuk menampung aktiviti sehingga 50 Ci.

Dwi-kapsul cakera Ir-192 tersinar yang diimport dari KAERI akan menjalani pemasangan akhir. *Decay sources* daripada gamma projektor dikeluarkan, dipotong dan disimpan di dalam bekas sisa.

Peralatan 'in-cell' tersebut sesuai untuk penyediaan Ir-192 pigtails untuk kegunaan jenis Gamma Projector Tech-Ops, INC dan Gamma-Mat dari MDS bagi memenuhi permintaan tempatan. Foto 8.20: (a) Penyediaan Ir-192 'pigtails' untuk kegunaan ujian tanpa musnah (NDT) (b) Punca terkedap Ir-192

8.6.5) Ir 192 Production for Radiography

A joint venture project between Nuklear Malaysia and a local NDT company has been initiated to produce the Ir-192 sealed source (Photo 8.20). The project consists of technology transfer from Korean Atomic Energy Agency Research Institute (KAERI)/ Ho Jin Industry Ltd. to Nuclear Malaysia. Production equipment will be installed in our 10 cm thickness lead (Pb) shielded hot-cell. The hot cell is capable of with standing up to 50 Ci of activity.

The irradiated double encapsulated Ir-192 disc imported from KAERI will undergo final assembly at Nuklear Malaysia. Decay sources from gamma projector is removed, cut and stored in a waste container.

The in-cell equipment is suitable to prepare Ir-192 pigtails for Gamma Projectors from Tech-Ops, INC and Gamma-Mat from MDS Nordion to meet local demands.

(a)

(b)

Foto 8.20: (a) Penyediaan Ir-192 'pigtails' untuk kegunaan ujian tanpa musnah (NDT), (b) Punca terkedap Ir-192
Photo 8.20: Assembly of Ir-192 pigtails for use in non-destructive testing (NDT), (b) Ir-192 sealed source

8.7) Pengurusan Harta Intelek

Pada tahun 2015, Nuklear Malaysia telah berjaya memfailkan sembilan harta intelek serta membaharui 13 paten dan dua cap dagangan. Senarai harta intelek yang difailkan adalah seperti yang ditunjukkan dalam Jadual 8.7.

8.7) Intelect Properties Management

In 2015, Nuklear Malaysia has filed nine intellectual properties and renewed 13 patents and two trademarks. List of intellectual properties filed is shown in Table 8.7.

Jadual 8.7: Senarai harta intelek yang difailkan pada 2015
Table 8.7: List of intellectual properties filed in 2015

Bilangan / Number	Harta Intelek / Intellectual Properties	No. Fail / Filing No.
1	*Nanogels and method of preparing the same*	PI2015701036
2	*Modular for aquaculture farming and method thereof*	PI2015702190
3	*Sterilising radiation stable composition for medical devices*	PI2015702539
4	*Smart alert radiation dosimeter device*	UI2015702805
5	*Radiation modified adsorbent via grafting technique using chemical vapour deposition*	UI2015703161
6	*Method of processing xenotime for the recovery of thorium, uranium and phosphate*	PI2015704208
7	*Antimicrobial polymeric film*	PI2015704656
8	*Padi NMR151*	PVBT 026/15
9	*Padi NMR 152*	PVBT 027/15

8.8) Pencapaian Inovasi

Sepanjang tahun 2015, Nuklear Malaysia telah menyertai dan memenangi beberapa pertandingan inovasi di peringkat kebangsaan mahupun antarabangsa. Antara pertandingan yang telah disertai di peringkat antarabangsa ialah *43rd International of Inventions of Geneva, Seoul International Invention Fair* (SIIF), Soul, Korea dan *59th General Conference IAEA 2015* di Vienna, manakala di peringkat kebangsaan ialah *Malaysia Technology Expo 2015* (MTE 2015), Ekspo Inovasi Islam (i-Inova2015), Pharma and Bio Asia dan Hari Inovasi Nuklear Malaysia. Pencapaian Nuklear Malaysia adalah seperti yang ditunjukkan dalam Jadual 8.8.

8.8) Innovation Achievement

Throughout 2015, Nuklear Malaysia has participated and won various innovation events held nationally and internationally. Among the competitions participated internationally were 43rd International of Inventions of Geneva, Seoul International Invention Fair (SIIF), Soul, Korea dan 59th General Conference IAEA 2015 at Vienna, while nationally were Malaysia Technology Expo 2015 (MTE 2015), Ekspo Inovasi Islam (i-Inova2015), Pharma and Bio Asia and Nuklear Malaysia Innovation Day. Details of Nuklear Malaysia's achievements are shown in Table 8.8.

Jadual 8.8: Pencapaian inovasi Nuklear Malaysia
Table 8.8: Innovation Achievements of Nuclear Malaysia

(a) Malaysian Technology Expo (MTE) 2015 (12 – 14 February 2015)

Bilangan / Number	**Anugerah / Award**	**Tajuk Projek / Project Title**
1.	Pingat Emas / Gold Medal	*MYstone*
2.	Pingat Gangsa / Bronze Medal	*Heat Insulation Coating using Schedule Waste*
3.	Pingat Perak / Silver Medal	*Active Packaging Grafted Film with Antimicrobial Properties for Enhancing Food Safety*
4.	Pingat Perak / Silver Medal	*Functional Mutant Rice for Diabetic and Obesity*
5.	Sijil Penyertaan / Participation Certificate	*Magnetic Polymer Nanocomposite*
6.	Sijil Penyertaan / Participation Certificate	*Development of Ultrasonic Goniometry (GoNIO) for Characterization of High Density Concrete*
7.	Sijil Penyertaan / Participation Certificate	*Gawa - Gaharu Particle Boards from Gaharu By-Products for House Decoratives and Indoor Accessories*

(b) 43rd International of Inventions of Geneva, Switzerland (15 – 19 April 2015)

Bilangan / Number	**Anugerah / Award**	**Tajuk Projek / Project Title**
1.	Pingat Gangsa / Bronze Medal	*Gold Nano Tracer*

(c) Pharma-Bio Asia, KLCC Kuala Lumpur (2 – 4 September 2015)

Bilangan / Number	**Anugerah / Award**	**Tajuk Projek / Project Title**
1.	Pingat Perak / Silver Medal	*Innovative Stevia Tissue Culture Seedlings through Tubular Light Emitting Diode (TLED) Technology*
2.	Pingat Perak / Silver Medal	*Characterization of Radiolabeled Epidermal Growth Factor Receptor (EGFR) Monoclonal Antibody Against Head and Neck Cancer*
3.	Pingat Perak / Silver Medal	*MasCotek Tablet 50MG: Improved Formulation for Enhanced Therapeutic Effect*
4.	Pingat Gangsa / Bronze Medal	*Beta-Glucan From Submerged Culture Fermentation of Pleurotus Flabellatus for Immunomodulation Application*

(d) 59th General Conference IAEA 2015 at Viena (14 – 18 September 2015)

Bilangan / Number	**Anugerah / Award**	**Tajuk Projek / Project Title**
1.	Sijil Penyertaan / Participation Certificate	*Aluminium Anode for Corrosion Protection*

(e) 4th Exposition on Islamic Innovation 2015 (i-Inova2015) (24 – 25 Oktober 2015)

Bilangan / Number	**Anugerah / Award**	**Tajuk Projek / Project Title**
1.	Anugerah Al-Khawrizmi, Pingat Emas dan RM1500 / Al-Khawrizmi Award, Gold Medal and RM1500	*Nanotitania Antibacterial Coating*
2.	Pingat Emas dan RM500 / Gold Medal and RM500	*Heat Insulation Coating Using Scheduled Waste*
3.	Pingat Perak / Silver Medal	*Nanocurcumin from Radiation Processing Technology for Cancer Treatment Applications*
4.	Pingat Perak / Silver Medal	*Palm Oil Based Eco-Friendly Printing Ink Materials*
5.	Pingat Perak / Silver Medal	*Characterization of Radiolabeled Epidermal Growth Factor Receptor (EGFR) Monoclonal Antibody Against Head and Neck Cancer*
6.	Pingat Gangsa / Bronze Medal	*Deltozide Phythopharmaceuticals : Innovative Repartion for Better Therapeutic Effect*
7.	Pingat Gangsa / Bronze Medal	*GammaKite : A Novel Gamma-Ray Scanning System for Online Diagnostic Inspection of Industrial Process Columns*

(f) Hari Inovasi Nuklear Malaysia 2015 (26 – 29 Oktober 2015)

Bilangan / Number	**Anugerah / Award**	**Tajuk Projek / Project Title**
1.	Pingat Emas / Gold Medal	*Dielectric Barrier Discharge Based Device for Air and Water Pollution Control*
2.	Pingat Emas / Gold Medal	*Smart Alert Radiation Survey Meter*
3.	Pingat Emas / Gold Medal	*GammaSpider: A Novel Gamma-Ray Computed Tomography System with Portable-Clamp-On-Features for Engineering Inspection*
4.	Pingat Emas / Gold Medal	*Nuklear Malaysia Agronomy Package for High Yield Rice Production*
5.	Pingat Perak / Silver Medal	*Haze Facemask: Nano Titania Coated Face Mask to Solve Haze Problem*
6.	Pingat Perak / Silver Medal	*Active Packaging Grafted Film with Antimicrobial Properties for Enhancing Food Safety*
7.	Pingat Perak / Silver Medal	*TEcGEn 1 – The Solid-State Thermoelectric Nanogenerator*
8.	Pingat Perak / Silver Medal	*Nuklear Malaysia Design Formulation Matrix Tablet for Colon Targeted Delivery*
9.	Pingat Perak / Silver Medal	*Enviromental Friendly Tablet Film Coating Material from Modified Metroxylum Sago Starch*
10.	Pingat Perak / Silver Medal	*An Improved Method of Producing an Adsorbent for Heavy Metals Removal using Radiation-Induced Graft Polymerization*
11.	Pingat Perak / Silver Medal	*Deltozide Phytopharmaceuticals: Innovation Preparation for Better Therapeutic Effect*
12.	Pingat Perak / Silver Medal	*Automated Welding Machine (AWM)*
13.	Pingat Perak / Silver Medal	*ROSScan Software Development R- Theta Scanning Arm for Corrosion Mapping using NDT Ultrasonic Technique*
14.	Pingat Perak / Silver Medal	*The Prototype Development of Radio Frequency (RF) Database Level in Malaysia*
15.	Pingat Gangsa / Bronze Medal	*New Boron Selective Adsorbent with Fast Kinetics by Radiation Grafting of Nylon Fibers*
16.	Pingat Gangsa / Bronze Medal	*Hybrid Impeller Mixer: Industrial Application*
17.	Pingat Gangsa / Bronze Medal	*LoCo-HV : Development of Low Cost Cockcrort-Walton High DC Voltage Power Supply*
18.	Pingat Gangsa / Bronze Medal	*Free and Open Source Scilab Based Software to Control Sample Positioning Stages and Camera for Computed Tomography Imaging System*
19.	Pingat Gangsa / Bronze Medal	*Radiation Dose Mapping and Monitoring Using Unmanned Aerial Vehicle (UAV)*
20.	Sijil Penyertaan / Participation Certificate	*Reactor Console Simulator*
21.	Sijil Penyertaan / Participation Certificate	*Development of Ultrasonic Goniometry System (GoNIO) for Characterization of Materials*

(g) Seoul International Invention Fair (SIIF), Seoul, Korea (26 – 29 November 2015)

Bilangan / Number	Anugerah / Award	Tajuk Projek / Project Title
1.	Pingat Perak / Silver Medal	*Size Matter- Cellulose Microfibril/Nanofibril (CMNF) from Bio-Based*

8.9) Pengiktirafan dan Kecemerlangan Penyelidikan

Nuklear Malaysia telah berjaya meneruskan momentum kecemerlangan P&P bagi tahun 2015. Pelbagai kejayaan, penemuan dan pengiktirafan di peringkat kebangsaan dan antarabangsa telah dicapai dalam usaha untuk mengekalkan status Nuklear Malaysia sebagai institusi penyelidikan bertaraf dunia. Nuklear Malaysia telah menerima pengiktirafan IAEA sebagai pusat kolaborasi untuk beberapa kemudahan seperti di bawah.

8.9.1) Pusat Kolaborasi

8.9.1.1 Ujian Tanpa Musnah (NDT)

Nuklear Malaysia telah dipilih sebagai Pusat Kerjasama IAEA bagi Ujian Tanpa Musnah (NDT) untuk empat tahun (2015 - 2019). Perjanjian antara IAEA dan Nuklear Malaysia telah ditandatangani semasa Persidangan IAEA pada September 2015. Penyerahan plak bagi pusat kolaborasi ini telah disempurnakan pada *Technology Preview and Showcase 2015*. Plak telah diserahkan oleh wakil IAEA, Dr. Gashaw Wolde kepada Ketua Pengarah Nuklear Malaysia, Dato' Dr. Muhamad Lebai Juri, disaksikan oleh Yang Amat Berhormat Datuk Seri Panglima Madius Tangau , Menteri MOSTI.

8.9) Recognition and Research Excellence

Nuklear Malaysia has continued its R&D excellence in 2015. Various accomplishments, discoveries and recognitions at national and international levels, reinforced Nuklear Malaysia's reputation as a world class research institution. Nuklear Malaysia has received IAEA recognition as collaborating centre for several facilities as below.

8.9.1) Collaborating Centre

8.9.1.1 Non-Destructive Testing (NDT)

Nuklear Malaysia has been designated as the IAEA Collaborating Centre for Non-Destructive Testing (NDT) for four years (2015 – 2019). The agreement between the IAEA and Nuklear Malaysia was signed during the IAEA General Conference in September 2015. The inauguration of the collaborating centre plaque took place during the Technology Preview and Showcase 2015. The plaque was handed over by the IAEA representative, Dr. Gashaw Wolde to the Director General of Nuklear Malaysia, Dato' Dr. Muhamad Lebai Juri, witnessed by the Honourable Datuk Seri Panglima Madius Tangau, Minister of MOSTI.

Objektif Pusat Kolaborasi IAEA bagi NDT ini adalah untuk menyokong program IAEA berkaitan aplikasi NDT dalam bidang industri. Nuklear Malaysia akan menjalankan penyelidikan, pembangunan dan aktiviti latihan untuk mengoptimumkan kepakaran bagi perlaksanaan NDT dalam aplikasi industri. Pengiktirafan Nuklear Malaysia sebagai institusi rakan kolaborasi IAEA telah membantu dalam pelaksanaan program IAEA (Foto 8.21).

The objective of the IAEA Collaborating Centre for NDT is to support IAEA programme in industrial applications of NDT. Nuklear Malaysia will conduct research, development and training activities, which will strengthen capabilities and optimize expertise in NDT for industrial applications. The recognition of Nuklear Malaysia as the IAEA collaborative partner has helped in the implementation of IAEA's programme (Photo 8.21).

Foto 8.21: Lawatan oleh United Nations Resident Coordinator (UNRC) ke Pusat Kolaborasi IAEA bagi Ujian Tanpa Musnah (NDT)

Photo 8.21: A visit by the United Nations Resident Coordinator (UNRC) to the IAEA Collaborating Centre for NDT

8.9.1.2 Kerjasama antara PROTON Holding Berhad dan Nuklear Malaysia

Pusat Kecemerlangan Nuklear Malaysia-PROTON Holdings Berhad telah dilancarkan semasa Technology Preview and Showcase 2015 oleh Yang Berhormat Datuk Seri Panglima Madius Tangau, Menteri MOSTI dengan disaksikan oleh Ketua Pengarah Nuklear Malaysia, Dato' Dr. Muhamad Lebai Juri dan Ketua Pegawai Teknikal PROTON, Encik Abdul Rashid Musa. Nuklear Malaysia telah menerima sebuah Proton Iriz sebagai bahan kajian untuk projek tersebut (Foto 8.24). Objektif kerjasama ini adalah untuk membangunkan komponen wayar dan kabel berasaskan taut silang polimer. Satu standard kabel automatif akan dibangunkan dan bakal dijadikan sebagai standard kabel automatif di Malaysia kelak. Pusat kecemerlangan ini juga melibatkan kerjasama dengan syarikat Wonderful Ebeam Cable (WEC) Sdn. Bhd dalam penambahbaikan formulasi taut silang wayar dan kabel.

8.9.1.2 Collaboration between PROTON Holding Berhad and Nuklear Malaysia

Nuklear Malaysia-PROTON Holdings Berhad Center of Excellence was launched during Technology Preview and Showcase 2015 by the Honourable Datuk Seri Panglima Madius Tangau, Minister of MOSTI and witnessed by Director General Nuklear Malaysia, Dato' Dr. Muhamad Lebai Juri and PROTON's Chief Technical Officer, Mr. Abdul Rashid Musa. Nuklear Malaysia has received a Proton Iriz as test material for the project (Photo 8.24). The objective of collaboration is to develop wire and cable components based on cross linked polymers. A standard for automotive cables will be developed and used for automotive cable in Malaysia in the future. This centre of excellence is also involved in collaboration with Wonderful Ebeam Cable (WEC) Sdn. Bhd company to formulate enhancement in cross linked wire and cable.

Foto 8.22: Majlis penyerahan Proton Iriz untuk projek kerjasama
Photo 8.22: Proton Iriz hand over ceremony for project collaboration

.....9 JARINGAN KERJASAMA

9.1) Perjanjian Kerjasama

Dua perjanjian kerjasama telah ditandatangani oleh Agensi Nuklear Malaysia (Nuklear Malaysia) pada tahun 2015 seperti Jadual 9.1

COLLABORATION NETWORK

9.1) Memorandum of Agreement

Two memorandum of agreement was signed by Malaysian Nuclear Agency (Nuklear Malaysia) in 2015 as Table 9.1.

Jadual 9.1: Senarai perjanjian kerjasama
Table 9.1: List of memorandum of agreement

Bil. No.	Organisasi Organisation	Tajuk Projek Project Title
1.	Usains Holding Sdn Bhd	Postgraduate Educational Course in 'Radiation Protection and Safety of Radiation Sources' Course – PGEC-12
2.	Madani NDT Training Centre Malaysia (M) Sdn Bhd	Kerjasama Penganjuran Latihan dalam Bidang Ujian Tanpa Musnah (NDT) Tahap 2 dan 3

Foto 9.1: Pertukaran perjanjian kerjasama dengan Usains Holding Sdn. Bhd.
Photo 9.1: Exchange of collaboration agreement with Usains Holding Sdn. Bhd.

Foto 9.2: Pertukaran perjanjian kerjasama dengan Madani NDT Training Centre Malaysia (M) Sdn. Bhd.
Photo 9.2: Exchange of collaboration agreement with Madani NDT Training Centre Malaysia (M) Sdn. Bhd.

9.2) Perjanjian Kerahsiaan

Nuklear Malaysia telah menandatangani 13 perjanjian kerahsiaan dengan pihak syarikat yang berhasrat untuk mengkomersilkan hasil P&P di pasaran tempatan dan antarabangsa.

9.2) Non-Disclosure Agreement (NDA)

Nuklear Malaysia has signed 13 Non-Disclosure Agreements (NDA) with companies to commercialise R&D findings for local and international markets.

Jadual 9.2 :Senarai Perjanjian Kerahsiaan
Table 9.2: List of Non-Disclosure Agreements (NDA)

Bil. No.	Organisasi Organisation	Tajuk Kerjasama Title of Collaboration
1.	Kencana Fibercomposite (KL) Sdn Bhd	*Radiation Curing of Composite Coating Industry*
2.	Goldextra Property Management Sdn Bhd	Pengendalian Kursus-Kursus Persijilan Radiografi Industri Tahap 2 dan Kursus-Kursus di bawah Program Pendidikan Perubatan Berterusan (CME)
3.	Midas Radiant Sdn Bhd	Pengkomersilan Khidmat Penyinaran Alur Elektron
4.	Wonderful Ebeam Cable Sdn Bhd	*Development and Commercialization of Radiation Cross-linked Cable and Radiation Compatible Flame Retardant Compound for Automotive Industry*
5.	Politeknik Banting	*Development of Expertise and Advanced Non-Destructive Testing (NDT) for Inspection in Aviation Industry*
6.	Madani NDT Training Centre Malaysia (M) Sdn Bhd	Kerjasama Penganjuran Latihan dalam Bidang Ujian Tanpa Musnah (NDT) Tahap 2 dan 3
7.	Edaran Prestasi Sdn Bhd	*Production of Ir-192 Sealed Source*
8.	Kenaf Bio Solution Sdn. Bhd.	Kerjasama Pembangunan Produk Kenaf *Non-Woven Fiberboards*
9.	Enviro Clean Energy Sdn Bhd	*Production of Chitosan from Shrimp Shells and Radiation Degradation in Production of Oligochitosan*
10.	Asia Lab (M) Sdn Bhd	Program Bersekutu / Kerjasama Latihan
11.	Johor Skills Development Centre	Kerjasama Dalam Pengendalian Kursus Latihan Ujian Radiografi (RT)
12.	Dewan Perniagaan Melayu Malaysia Negeri Perak	1. Bahan Nano untuk Kemudahan Industri Biokomposit 2. Aplikasi Teknologi Nuklear untuk Industri Organik 3. Pembangunan Zon Ekonomi Selatan Perak
13.	Satu Chi Sdn Bhd	*Development of Radiation Modified Aerogel Compound as Insulation Material for Industrial Application*

Foto 9.3: Pertukaran nota kerjasama dengan Politeknik Banting Selangor
Photo 9.3: Exchange of collaboration note with Politeknik Banting, Selangor

Foto 9.4: Pertukaran perjanjian kerahsiaan dengan Dewan Perniagaan Melayu Malaysia Negeri Perak
Photo 9.4: Exchange of non-disclosure agreement with Dewan Perniagaan Melayu Malaysia Negeri Perak

Foto 9.5: Pertukaran perjanjian kerahsiaan dengan Kenaf Bio Solution Sdn Bhd
Photo 9.5: Exchange of non-disclosure agreement with Kenaf Bio Solution Sdn Bhd

Foto 9.6: Pertukaran perjanjian kerahsiaan dengan Edaran Prestasi Sdn Bhd
Photo 9.6: Exchange of non-disclosure agreement with Edaran Prestasi Sdn Bhd

Foto 9.7: Pertukaran perjanjian kerahsiaan dengan Wonderful Ebeam Cable Sdn Bhd
Photo 9.7: Exchange of non-disclosure agreement with Wonderful Ebeam Cable Sdn Bhd

9.3) Khidmat Profesional dan Pengurusan Akaun Amanah

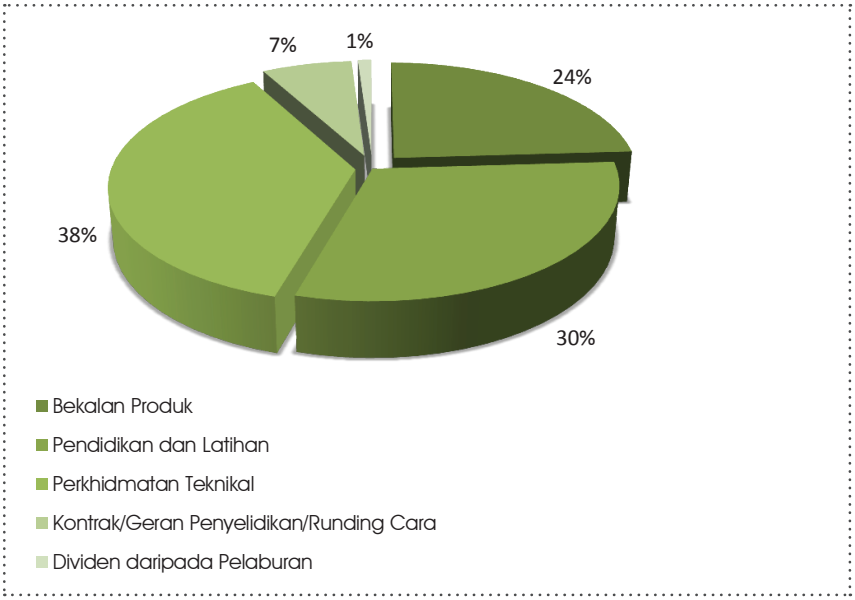
9.3.1) Prestasi Khidmat Profesional

Nuklear Malaysia menyediakan perkhidmatan kepakaran profesional dalam lima aktiviti utama seperti dalam Rajah 9.1. Pada 2015, Nuklear Malaysia telah memberikan khidmat kepada lebih 6,000 pelanggan dengan jumlah pendapatan yang dijana sebanyak RM11.41 juta.

9.3) Professional Services and Trust Fund Management

9.3.1) Professional Service Performance

Nuklear Malaysia has provided professional services in five major activities as shown in Figure 9.1. In 2015, Nuklear Malaysia has served over 6,000 customers generating RM11.41 million in income.



Rajah 9.1: Pendapatan khidmat profesional
Figure 9.1: Revenue for professional services

9.3.2) Prestasi Kewangan Akaun Amanah

Pada 2015, Nuklear Malaysia menerima peruntukan sebanyak RM23 Juta bagi pusat khidmat, projek IAEA dan projek kerjasama. Jadual 9.3 menunjukkan peratus prestasi yang telah tercapai.

9.3.2) Financial Performance of Trust Account

In 2015, Nuklear Malaysia received an allocation of RM23 million for the service center, the IAEA projects and collaboration projects. Table 9.3 shows the percentage of performance that has been achieved.

Jadual 9.3: Prestasi Kewangan Akaun Amanah
Table 9.3: Financial performance of Trust Account

Projek Projects	Peruntukan (RM Juta) Allocation (RM million)	Perbelanjaan (RM Juta) Expenses (RM million)	Prestasi (%) Performance (%)
Pusat Khidmat Service Centre	12.5	10.49	87.8
IAEAIAEA	0.74	0.39	44.3
Projek Kerjasama Collaboration Project	10.2	0.9	9.4
Jumlah Total	**23.44**	**11.78**	**50.26**

9.4) Projek Dana

Lima projek kerjasama antara Nuklear Malaysia dengan syarikat tempatan (Jadual 9.4) telah berjaya mendapat dana pra-pengkomersilan MOSTI. Projek tersebut ialah projek menaiktaraf hasil P&P Nuklear Malaysia dari skala makmal ke skala pra-pengkomersialan.

9.4) TechnoFund Project

Five collaboration projects between Nuklear Malaysia and local company (Table 9.4) successful funded by MOSTI TechnoFund. These projects involve up scaling R&D output from lab to pre-commercialisation scale

Jadual 9.4: Senarai projek pembiayaan dana pra-pengkomersialan
Table 9.4: List of project funded by TechnoFund

Bil. No.	Syarikat Company	Tajuk Projek Title of Project	Jumlah Dana (RM) Total Grant (RM)
1.	Polycomposite Sdn Bhd	*Up-scaling of the production capability of Eco-Riverbank Protection Composite From Agrofiber Plastic Materials: RiverProtec*	2.25Juta
2.	Hyklaz Corporation Sdn Bhd	*Development of Floating Aquaculture Cage from Nanohybrid Biocomposite Material*	0.65Juta
3.	Sinaran Utama Teknologi Sdn Bhd	Pembangunan dan Pra-Pengkomersilan Meter Tinjau Pintar Untuk Industri Nuklear	1.79Juta
4.	Duta Nusajaya Sdn Bhd	*Pre-commercialisation of LED Lighting Technology for Plant Tissue Culture Production In Sabah*	1.32Juta
5.	Labzinc Industries (M) Sdn. Bhd.	*Pre-commercialisation Production of High Purity Zinc Oxide from Electric Arc Furnace Dust (EAFD) via Solvent Extraction Technology*	2Juta

Foto 9.8: Fabrikasi dan pemasangan papan litar tercetak bagi pembangunan Meter Tinjau Pintar
Photo 9.8: Printed Circuit Board (PCB) fabrication and assembly for development of Smart Survey Meter

Foto 9.9: Makmal tisu kultur stevia yang dibangunkan di Sabah
Photo 9.9: Tissue cuture stevia laboratory developed at Sabah

Foto 9.10: Pemasangan RiverProtec bagi tujuan ujian lapangan di Sungai Lui, Hulu Langat
Photo 9.10: Installation of RiverProtec for field test at Sungai Lui, Hulu Langat

9.5) Technology Preview & Showcase Nuklear Malaysia 2015

Nuklear Malaysia telah menganjurkan *Technology Preview & Showcase Nuklear Malaysia 2015* (TPS2015) buat pertama kali dengan menggabungkan tiga program utama iaitu Hari Pelanggan, Hari Inovasi dan IP Showcase. Objektif TPS2015 ialah untuk menemukan para penyelidik Nuklear Malaysia dengan pihak industri bagi mengenal pasti penyelidikan yang bersesuaian sekaligus memperkasakan hala tuju bidang penyelidikan teknologi nuklear ke arah pengkomersilan.

Di samping itu, program ini juga dapat mengetengahkan produk baru hasil P&P yang berpotensi dan mempunyai nilai tinggi kepada pihak industri untuk dikomersilkan. Program ini juga mewujudkan hubungan lebih rapat antara Nuklear Malaysia dan pelanggan. Aktiviti program meliputi pelancaran produk, seminar, padanan perniagaan, pameran dan lawatan teknikal.

9.5.1) Pelancaran Produk

Nuklear Malaysia telah melancarkan lima produk hasil R&D sempena program TPS2015. Senarai produk yang dilancarkan adalah seperti di Jadual 9.5.

9.5) Technology Preview & Showcase Nuklear Malaysia 2015

Nuklear Malaysia for the first time has organised the Technology Preview & Showcase Nuklear Malaysia 2015 (TPS2015) which combines three main programmes, Hari Pelanggan, Hari Inovasi and IP Showcase. The objective of TPS2015 is to connect Nuklear Malaysia researchers with industry players in identifying suitable areas of research as well as strengthening future direction in nuclear technology-based research toward commercialisation.

This TPS2015 programme also highlights new product from R&D activities which has potential and high value to industry for commercialisation. This programme has established good relationship between Nuklear Malaysia and customers. The programme activities including product launching, seminar, business matching, exhibition and technical visits

9.5.1) Product Launching

Nuklear Malaysia has launched five products R&D during TPS2015 programme. The list of products launched was showns in Table 9.5.

Jadual 9.5: Senarai produk yang dilancarkan sempena TPS2015
Table 9.5: List of products launched during TPS2015

Bil. No.	Produk Product	Keterangan Produk Product Description
1.	Rust Inhibitor	Salutan perencat karat berasaskan air untuk pelindungan daripada kakisan dan meningkatkan ketahanan sesuatu struktur. Water based Rust Inhibitor coating for corrosion protection and to extent reliability of the existing structures.
2.	Anti-microbial Active Packaging Film	Filem pembungkusan aktif anti-mikrob digunakan untuk meningkatkan jangka hayat makanan dan melambatkan proses pembiakan mikroorganisma. Anti-microbial active packaging film to extend the shelf life and improve safety of food products.
3.	Aquacage	Sangkar akuakultur berasaskan teknologi nano-hibrid biokomposit dibangunkan dengan sistem modul yang mudah alih bagi memudahkan pemasangan dan bersesuaian dengan kehendak pengguna. Aquaculture cage is based nano-hybrid biocomposites technology developed with portable module system for ease of installation and appropriate to requirements of users.
4.	Smart Survey Meter	Meter Tinjau Pintar merupakan alat yang dibangunkan dengan sensitiviti yang mencukupi yang boleh mengesan sebarang perubahan kecil terhadap tahap radiasi bagi semua radionuklid. Smart Survey Meter has developed with adequate sensitivity that can detect any small changes in radiation levels for many common radionuclides.
5.	Iridium-192 Sealed Source	Punca Terkedap Iridium-192 merupakan radioisotop yang digunakan dalam bidang ujian tanpa musnah. Iridium-192 Sealed Source is a radioisotope used in the field of non-destructive testing.

Foto 9.11: Majlis Pelancaran Produk oleh YB. Datuk Seri Panglima Madius Tangau, Menteri MOSTI
Photo 9.11: Product Lauching Ceremony by The Hon. Datuk Seri Panglima Madius Tangau, Minister of MOSTI

Foto 9.12: Produk yang dilancarkan
Photo 9.12: Products launched

Foto 9.13: Penerangan mengenai produk yang dilancarkan
Photo 9.13: Briefing on product launched

9.5.2) Pelancaran Pusat Kecemerlangan Nuklear Malaysia - PROTON Holdings Berhad

Nuklear Malaysia menjalinkan kerjasama dengan PROTON Holdings Berhad dalam pembangunan teknologi industri automotif. Kedua-dua pihak bersetuju untuk mewujudkan Pusat Kecemerlangan dalam bidang automotif dengan peranan utama masing-masing di mana Nuklear Malaysia menyumbang dalam P&P produk seperti wayar dan kabel, komposit, bahan polimer untuk diujipakai oleh PROTON Holdings Berhad.

9.5.2) Launching on Centre of Excellent Nuklear Malaysia - PROTON Holdings Berhad

Nuklear Malaysia has collaborated with PROTON Holdings Berhad in technology development for automotive industry. Both parties agreed to develop Centre of Excellent on automotive in which Nuklear Malaysia is to provide R&D on wires and cables, composite, polymeric material for trial by PROTON Holdings Berhad.

Foto 9.14: YB. Datuk Seri Panglima Madius Tangau merasmikan Pusat Kecemerlangan Nuklear Malaysia-PROTON Holdings Berhad
Photo 9.14: The Hon. Datuk Seri Panglima Madius Tangau officiate the Centre of Excellent Nuklear Malaysia-PROTON Holdings Berhad

Gambar 9.15: Penerangan mengenai sistem wayar dan kabel dalam kereta Proton IRIZ oleh Encik Abdul Rashid Musa, Ketua Pegawai Teknikal, PROTON Holdings Berhad
Photo 9.15: Briefing on wire and cable used in Proton IRIZ by Mr. Abdul Rashid Musa, Chief Technical Officer, PROTON Holdings Berhad

Foto 9.16: Demostrasi ujian wayar dan kabel yang telah ditaut silang menggunakan alur elektron
Photo 9.16: Testing demonstration on wire and cable cross-linked by electron beam

9.5.3) Seminar Pengkomersialan dan Pemindahan Teknologi

Seminar Pengkomersilan dan Pemindahan Teknologi telah diadakan sempena program TPS2015. Seminar telah melibatkan pembentang yang mempunyai pengalaman luas dalam bidang pengkomersilan dan pemindahan teknologi dari industri automotif, pertanian, organisasi pembiayaan dana dan universiti. Jadual 9.6 menunjukkan senarai pembentang dan tajuk pembentangan.

9.5.3) Seminar on Commercialisation and Technology Transfer

Seminar on Commercialisation and Technology Transfer was held in conjunction with TPS2015 programme. The seminar has involved presenters who have extensive experience in commercialisation and technology transfer from the automotive industry, agriculture, funding organisations and universities. Table 9.6 shows the list of presenters and title of presentation.

Jadual 9.6: Senarai pembentang dan tajuk pembentangan
Table 9.6: List of presenters and title of presentation

Bil. No.	Tajuk Title	Pembentang Presenter
1.	IRIZ – *Safety Made Affordable*	Ketua Pegawai Teknikal Kumpulan Kejuruteraan PROTON Holdings Berhad
2.	Pengalaman Jalinan Kerjasama Membangunkan Mutan Orkid dalam Industri Pertanian	Pengarah Hexagon Green Sdn. Bhd.
3.	Teknologi Bioreaktor	Pegawai Penyelidik Bahagian Agroteknologi & Biosains Nuklear Malaysia
4.	Pembangunan Radiofarmaseutikal di Nuklear Malaysia	Pengarah Bahagian Teknologi Perubatan, Nuklear Malaysia
5.	Cabaran Produk Penyelidikan dari Makmal ke Pasaran	Pengarah R&D Diversatech Fertilizer Sdn Bhd
6.	Pengkomersialan Produk R&D di UPM	Ketua Pegawai Eksekutif UPM Holdings Sdn. Bhd.
7.	Potensi Produk R&D Herba	Pegawai Penyelidik Bahagian Teknologi Perubatan Nuklear Malaysia
8.	Teknologi dan Perniagaan	Pengarah Urusan Suhan Biotech Sdn. Bhd.
9.	Kemudahan Dana MOSTI	Setiausaha Bahagian Dana MOSTI

Foto 9.17: Pembentangan bertajuk "Pembangunan Radiofarmaseutikal di Nuklear Malaysia" oleh Pengarah Bahagian Teknologi Perubatan
Photo 9.17: Presentation entitled "Development of Radiopharmaceutical at Nuklear Malaysia" by Director of Medical Technology Division

Foto 9.18: Pembentangan bertajuk "Teknologi dan Perniagaan" oleh Pengarah Urusan Suhan Biotech Sdn. Bhd.
Photo 9.18: Presentation entitled "Technology and Business" by Managing Director of Suhan Biotech Sdn. Bhd.

Foto 9.19: Pembentangan bertajuk "Pengalaman Jalinan Kerjasama Membangunkan Mutan Orkid dalam Industri Pertanian" oleh Pengarah Hexagon Green Sdn. Bhd.
Photo 9.19: Presentation entitled "Collaboration Experience on Development of Mutant Orchid in Agriculture Industry" by Director of Hexagon Green Sdn Bhd

Foto 9.20: Pembentangan bertajuk "IRIZ – Safety Made Affordable" oleh Ketua Pegawai Teknikal, Perusahaan Otomobil Nasional Sdn. Bhd.
Photo 9.20: Presentation entitled "IRIZ – Safety Made Affordable" by Chief Technical Officer, PROTON Holdings Berhad

9.5.4) Pameran Produk

Pameran produk diadakan sepanjang program TPS2015 berlangsung. Terdapat tiga kategori pameran yang diadakan iaitu:

(a) Pameran Produk dan Khidmat Nuklear Malaysia

(b) IP Showcase dan Penerima Dana MOSTI

(c) Pertandingan Inovasi

9.5.4) Product Exhibition

Product exhibition was held during TPS2015 program. There are three categories of the exhibition:

(a) Exhibition on Nuklear Malaysia's Product and Services

(b) IP Showcase and MOSTI Fund Recipients

(c) Innovation Competition

Foto 9.21: Penerangan produk pertanian kepada YB. Datuk Seri Panglima Madius Tangau, Menteri MOSTI semasa lawatan ke pameran.
Photo 9.21: Product briefing to The Hon. Datuk Seri Panglima Madius Tangau, Minister of MOSTI during visit the exhibition.

Foto 9.22: Kunjungan pelawat di tapak pameran teknologi bioreaktor
Photo 9.22: Visitors at exhibition booth of bioreactor technology

Foto 9.23: Penerangan filem pembungkusan aktif anti-mikrob kepada pelawat.
Photo 9.23: Briefing on anti-microbial active packaging film to visitors.

Foto 9.24: Tapak pameran SME Corporation Sdn. Bhd.
Photo 9.24: SME Corporation Sdn. Bhd. exhibition booth

Foto 9.25: Penerangan produk kenaf kepada wakil industri
Photo 9.25: Briefing on kenaf to industry representative

Foto 9.26: Demonstrasi pengimpal PomiSpot kepada pelawat
Photo 9.26: Demonstration on PomiSpot welder to visitors

9.5.5) Seminar Harta Intelek (IP)

Seminar Harta Intelek (IP) bertujuan untuk memberi pendedahan kepada penyelidik Nuklear Malaysia berkenaan harta intelek seperti paten, tanda niaga dan rekabentuk industri. Seminar ini juga bertujuan untuk menanam budaya harta intelek dalam kalangan penyelidik. Klinik IP turut diadakan bagi membantu peserta seminar untuk memahami dengan lebih jelas tentang pengurusan IP.

ProIP Sdn. Bhd. telah menyampaikan dua ceramah bertajuk *'Overview of Intellectual Property (IP) and Introduction to Patent'* dan *'Introduction to Trademark and Industrial Design Teknologi Bioreaktor'*.

9.5.5) Seminar on Intellectual Property (IP)

Seminar on Intellectual Property (IP) aims to provide exposure to Nuklear Malaysia's researchers on intellectual property matter such as patent, trademark and industrial design. It also aims to establish intellectual property culture among researchers. IP Clinics are also held to assist participants to clearly understand IP management.

ProIP Sdn. Bhd. gave two talks entitled 'Overview of Intellectual Property (IP) and Introduction to Patent' and 'Introduction to Trademark and Industrial Design Bioreaktor Technology'.

Foto 9.27: Perbincangan antara peserta seminar dengan ProIP Sdn. Bhd.
Photo 9.27: Discussion between participants with ProIP Sdn. Bhd.

Foto 9.28: Penerangan pembentang daripada ProIP Sdn. Bhd. kepada peserta semasa Klinik IP.
Photo 9.28: Briefing from presenter from ProIP Sdn. Bhd. to participants during IP Clinic.

9.5.6) Ceramah dan padanan perniagaan

Sesi padanan dan perbincangan perniagaan diadakan di tapak pameran sepanjang program TPS2015 berlangsung. Sesi ini merupakan platform untuk syarikat mengenal dan mengetahui khidmat dan produk yang terdapat di Nuklear Malaysia. Syarikat yang berminat boleh berinteraksi secara terus dengan penyelidik untuk mendapatkan khidmat dan produk yang ditawarkan. Jadual 9.7 menunjukkan senarai syarikat dan penceramah yang terlibat dalam sesi ini.

9.5.6) Business Pitching and Talks

Business pitching and talks were held at the exhibition booth in conjunction with TPS2015 programme. The sessions were a platform for companies to learn about the services and products available in Nuklear Malaysia. Interested companies can interact directly with researchers to obtain the services and products offered. Table 9.7 shows the list of company and speakers who were involved during these sessions.

Jadual 9.7: Senarai organisasi yang terlibat dalam Ceramah dan padanan perniagaan
Table 9.7: List of organisation involved during business pitching and talks

Bil. No.	Tajuk Title	Organisasi Organisation
1.	Keselamatan Pekerja Sinaran	Bahagian Keselamatan Sinaran, Nuklear Malaysia
2.	Pengenalan Dana SME Corp	SME Corporation Malaysia
3.	Kemudahan Dana Pengkomersialan	Malaysian Technology Development Corporation Sdn. Bhd (MTDC)
4.	Promosi Produk Rust Inhibitor	Alpha Prima Engineering Sdn. Bhd.
5.	Promosi Program Latihan di Pusat Latihan Nuklear Malaysia	Pusat Latihan, Nuklear Malaysia
6.	Pengenalan Dosimeter Peribadi Jenis OSL	Bahagian Keselamatan Sinaran, Nuklear Malaysia
7.	Perkhidmatan Radiokimia Alam Sekitar	Bahagian Teknologi Sisa & Alam Sekitar, Nuklear Malaysia

Foto 9.29: Ceramah perniagaan bertajuk "Pengenalan Dana SME Corp" dari SME Corporation Malaysia
Photo 9.29: Business talk entitled "Pengenalan Dana SME Corp" from SME Corporation Malaysia

Foto 9.30: Ceramah "Keselamatan Pekerja Sinaran" oleh penyelidik Nuklear Malaysia
Photo 9.30: Talk on "Keselamatan Pekerja Sinaran" by Nuklear Malaysia's researcher

9.5.7) Lawatan ke Kemudahan Utama Nuklear Malaysia

Para pelawat yang hadir ke program TPS2015 telah diberi peluang untuk mengunjungi kemudahan utama di Nuklear Malaysia. Lawatan ini bertujuan untuk memberi pendedahan kepada pelawat berkenaan aktiviti yang dilaksanakan di loji dan makmal. Senarai kemudahan yang dilawati adalah seperti berikut:

9.5.7) Visit to Main Facilities in Nuklear Malaysia

Visitors of TPS2015 programme were given the opportunity to visit main facilities at Nuklear Malaysia. The visit aimed to expose visitors about activities at pilot plants and laboratories. List of facilities visited are as follows:

(a) Makmal Fizik Perubatan

(b) Loji Alurtron

(c) Rumah Hijau Gama

(d) Loji Singama

(e) Loji Raymintex

(f) Makmal Standard Dosimetri Sekunder (SSDL)

(a) Medical Physics Laboratory

(b) Alurtron Plant

(c) Gamma Green House

(d) Sinagama Plant

(e) Raymintex Plant

(f) Secondary Standard Dosimetry Laboratory (SSDL)

9.6) Program Promosi dan Pemasaran

9.6.1) Lawatan Industri

Nuklear Malaysia telah mengadakan 25 lawatan kerja ke syarikat industri kecil dan sederhana (IKS) dan institusi. Lawatan ini bertujuan mempromosi produk P&P dan perkhidmatan Nuklear Malaysia kepada industri dan institusi berkenaan.

9.6) Promotion and Marketing Programme

9.6.1) Industrial Visit

Nuklear Malaysia has visited 25 small and medium enterprise (SME) companies and institutions. The purpose of the visits was to promote R&D products and services offered by Nuklear Malaysia to relevant industries and institutions.

Foto 9.31: Lawatan teknikal bersama Alphaprima Engineering Sdn. Bhd. ke Pelabuhan Tanjung Pelepas, Johor bagi projek kerjasama mengkomersilkan perencat karat

Photo 9.31: Technical visit with Alphaprima Engineering Sdn. Bhd. to Tanjung Pelepas Port, Johor for collaboration project on commercialisation of rust inhibitor

Foto 9.32: Lawatan teknikal ke Venture Diecasting Sdn Bhd bagi projek pengkomersialan *aluminium sacrificial anode*
Photo 9.32: Technical visit to Venture Diecasting Sdn. Bhd. for project commercialisation of aluminium sacrificial anode

Foto 9.33: Lawatan teknikal ke Netcess Berhad bagi projek kerjasama penghasilan produk 'O' Ring untuk kegunaan automotif
Photo 9.33: Technical visit to Netcess Berhad for collaboration project on production of 'O' Ring for automotive application

Foto 9.34: Lawatan teknikal daripada PROTON Holdings Berhad ke Bahagian Pemprosesan Teknologi Sinaran, Nuklear Malaysia

Photo 9.34: Technical visit from PROTON Holdings Berhad to Radiation Processing Technology Division, Nuklear Malaysia

Foto 9.35: Lawatan teknikal ke Politeknik Banting, Selangor

Photo 9.35: Technical visit to Politeknik Banting, Selangor

9.6.2) Pameran

Nuklear Malaysia turut bergiat aktif dalam pameran di peringkat kebangsaan dan antarabangsa yang dikelola oleh SME Corporation Malaysia, MOSTI dan institusi lain. Senarai pameran yang disertai adalah seperti di Jadual 9.8.

9.6.2) Exhibition

Nuklear Malaysia was actively involved in exhibitions at national and international levels conducted by SME Corporation Malaysia, MOSTI and other institutions. The list of exhibitions participated by Nuklear Malaysia as in Table 9.8.

Jadual 9.8: Senarai pameran yang disertai oleh Nuklear Malaysia
Table 9.8: List of exhibitions participated by Nuklear Malaysia

Bil. No.	Pameran Exhibitions
1.	Pameran Sempena 6th Annual Nuclear Power Asia 2015, 26 – 28 Januari 2015 di Hotel Hilton Kuala Lumpur anjuran PICO International (M) Sdn. Bhd.
2.	Bio Borneo 2015, 20 – 21 April 2015 di Magellan Sutera, Sutera Harbour Resort Kota Kinabalu, Sabah anjuran MOSTI, Sabah Economic Development & Investment (SEDIA), BiotechCorp & Sabah Biodiversity Centre (SaBC)
3.	Pameran Sempena *WNU Short Course*, 11 – 14 Mei 2015 di Hotel Everly, Putrajaya anjuran MARPA
4.	NICE 2015, 20 – 23 Mei 2015 di Kuala Lumpur Convention Centre (KLCC) anjuran MOSTI
5.	IMU *Science Discovery Challenge Biotechnology 2015*, 25 Julai 2015 di IMU Bukit Jalil anjuran International Medical University Malaysia (IMU)
6.	Pameran Sempena Persidangan Agong IAEA kali ke 59, 4 – 8 September 2015 di Vienna, Austria anjuran IAEA
7.	*Technology Preview & Showcase* Nuklear Malaysia, 26 – 29 Oktober 2015 di Agensi Nuklear Malaysia, Bangi anjuran Nuklear Malaysia
8.	Pameran sempena Konferensi Antrabangsa Warisan Islam (1st ISHEC 2015), 11 – 12 November 2015 di Hotel Mahkota, Bandar Hilir Melaka anjuran UiTM Melaka
9.	MCCE 2015, 18 – 19 November 2015 di PWTC anjuran MOSTI
10.	Program Tangga Batu A, 28 November 2015 di Pantai Puteri Melaka anjuran MOSTI & Parlimen Tangga Batu

Foto 9.36: Lawatan YBhg. Dato' Dr. Mohd Azhar Bin Hj Yahaya, Timbalan Ketua Setiausaha (Dasar) MOSTI di tapak pameran sempena NICE2015 di Kuala Lumpur Convention Centre (KLCC)
Photo 9.36: Visit by YBhg. Dato' Dr. Mohd Azhar Bin Hj Yahaya, Deputy Secretary General (Policy) MOSTI at exhibition booth during NICE2015 at Kuala Lumpur Convention Centre (KLCC)

Foto 9.37: Lawatan YB Datuk Dr. Abu Bakar bin Mohamad Diah, Timbalan Menteri MOSTI di tapak pameran sempena Program Tangga Batu A, Pantai Puteri Melaka
Photo 9.37: Visit by The Hon. Datuk Dr. Abu Bakar bin Mohamad Diah, Deputy Minister MOSTI at exhibition booth during Program Tangga Batu A, Pantai Puteri Melaka

Foto 9.38: Pameran sempena Persidangan Agong IAEA di Vienna, Austria
Photo 9.38: Exhibition during IAEA General Conference at Vienna, Austria

9.6.3) Pengiklanan

Satu iklan telah diterbitkan untuk tujuan mempromosi aktiviti pengkomersilan Nuklear Malaysia dalam Buku Program Konferensi Antarabangsa Warisan Islam (1st ISHEC 2015) anjuran Universiti Teknologi Mara, Alor Gajah, Melaka.

9.6.3) Advertisement

An advertisement has been published to promote Nuklear Malaysia's commercialisation activities in Programme Book of International Islamic Heritage Conference (1st ISHEC 2015) organised by Universiti Teknologi Mara, Alor Gajah, Melaka.

9.7) Projek Komuniti

Nuklear Malaysia telah berjaya melaksanakan projek pembangunan loji ekstrasi minyak gaharu di Kampung Uma Baloi Liko, Sungai Asap bagi komuniti Belaga, Sarawak. Projek ini adalah kerjasama dengan *Asap Koyan Development Community (AKDC)* dan menerima pembiayaan dana *Community InnoFund MOSTI (CIF)* sebanyak RM500,000.00.

9.7) Community Project

Nuklear Malaysia has successfully completed the pilot plant project on extraction of gaharu oil at Kampung Uma Baloi Liko, Sungai Asap for Belaga community in Sarawak. The project is a collaboration with Asap Koyan Development Community (AKDC) through Community InnoFund MOSTI (CIF) funding for the sum of RM500,000.00.

Foto 9.39: Loji ekstraksi minyak gaharu yang dibangunkan di Uma Baloi Liko, Sungai Asap, Belaga, Sarawak
Photo 9.39: Gaharu oil extraction plant developed at Uma Baloi Liko, Sungai Asap, Belaga, Sarawak

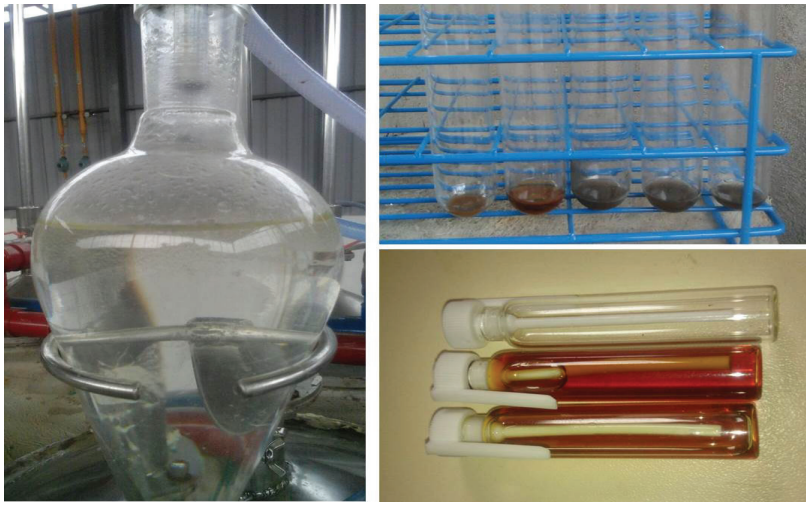


Foto 9.40: Minyak gaharu yang dihasilkan melalui sistem ekstraksi
Photo 9.40: Gaharu oil produced through extraction system

Foto 9.41: Lawatan panel pasukan pengurusan projek ke loji ekstraksi minyak gaharu
Photo 9.41: Visit by project management team to gaharu oil extraction plant

9.8) Pusat Latihan

Pusat Latihan Nuklear Malaysia diamanahkan dengan tugas melaksanakan program-program latihan dalam sektor-sektor berikut untuk meningkatkan kemahiran yang diperlukan, menggalakkan kesedaran keselamatan yang lebih besar dan mewujudkan tenaga kerja yang cekap dalam memainkan peranan yang lebih besar dalam agenda pembangunan negara.

- Sektor keselamatan dan kesihatan
- Sektor sinar-X perubatan
- Sektor keselamatan persekitaran dan kesihatan
- Sektor penilaian tanpa musnah
- Sektor instrumentasi dan kejuruteraan
- Sektor pengurusan teknologi
- Sektor latihan antarabangsa

9.8 Training Center

Nuklear Malaysia Training Center was entrusted with the task of implementing training programmes in the following sectors to enhance necessary skills, promote greater safety awareness and establish a competent workforce to play a greater role in national development agenda.

- Radiation safety and health sector
- Medical X-ray sector
- Environmental safety and health sector
- Non-destructive evaluation sector
- Instrumentation and engineering sector
- Technology management sector
- International training sector

Foto 9.42: Pusat Latihan Nuklear Malaysia
Photo 9.42: Nuklear Malaysia Training Center

Semua program latihan yang dianjurkan seperti latihan awam, program serantau dan program asas agensi direka khas untuk memenuhi kehendak dan keperluan organisasi. Program-program ini adalah kos efektif dan mampu menangani isu-isu kepentingan tertentu. Program latihan Nuklear Malaysia dijalankan oleh kumpulan fasilitator yang

All the training programmes, such as public training, regional based programmes or agency based programmes are designed to respond to the demands and meet the needs of the organisation. These programmes are cost-effective and able to address issues of particular interest. Nuklear Malaysia training programmes are conducted by

berpengalaman dan disokong oleh kemudahan yang lengkap dan pengalaman penyelidikan yang mendalam. Kursus yang dianjurkan sentiasa dikemaskini berdasarkan perubahan keperluan peraturan yang berkenaan serta mendapat nasihat pakar tanpa mengabaikan kepentingan pelanggan. Pusat latihan ini mendapat diiktiraf oleh :

- Pembangunan Sumber Manusia Berhad (PSMB) sebagai Penyedia Latihan Kelas A (0219) dan Pusat Kecemerlangan Peningkatan Kemahiran PKS
- Kementerian Kewangan untuk insentif potongan dua kali
- Lembaga Perlesenan Tenaga Atom (AELB) sebagai pusat kecemerlangan dalam aktiviti perlindungan sinaran
- Jabatan Pembangunan Kemahiran (JPK) di bawah Kementerian Sumber Manusia sebagai pusat latihan dan peperiksaan Sijil Kemahiran Malaysia (SKM)
- Kementerian Kesihatan Malaysia (KKM) sebagai penyedia latihan dalam sinar-X perubatan untuk program CME
- IAEA Regional Training Center untuk program Post Graduate Educational Course dan kursus-kursus lain
- Jabatan Keselamatan dan Kesihatan Pekerjaan (DOSH) sebagai penyedia latihan yang mengendalikan kursus yang mendapat mata pemberat CEP (CEP Point)
- Lembaga Pembangunan Industri Pembinaan Malaysia (CIDB) sebagai penyedia latihan yang menyediakan latihan peningkatan kompentensi kontraktor bagi mengumpul mata CCD (Continuous Contractor Development).

a pool of qualified and experienced facilitators and supported by well-equipped facilities and extensive research experiences. Our courses are regularly updated based on changing needs of regulatory requirements, expert advice without neglecting customer interest. Our training center were recognised by :

- PSMB's Class A Approved Training Provider and an Approved Center of SME Skill Advancement
- An Approved Training Institution by Ministry of Finance for Double Deduction Incentive
- Center of excellence in Radiation Protection Activities by Atomic Energy Licensing Board (AELB)
- JPK's Recognised Center for SKM Training & Examination
- Training provider in medical X-ray for CME programme under Ministry of Health (MOH)
- A Regional Training Center recognised by International Atomic Energy Agency (IAEA) for program Post Graduate Educational Course (PGEC) and other courses
- CEP training for selected courses approved by Department of Occupational Safety and Health (DOSH)
- Construction Industry Development Board (CIDB) approved center for Continuous Contractor Development (CCD) points in enhancement of contractor competency

Prasarana latihan kami disokong oleh rangkaian lengkap makmal P&Pdan lain-lain kemudahan radiasi utama yang menawarkan satu peluang yang baik untuk mempunyai pendedahan langsung dalam pelbagai jenis aplikasi dalam sinaran mengion. Nuklear Malaysia adalah satu-satunya organisasi yang boleh memberikan kemudahan ini di Malaysia. Dengan lebih 40 tahun pengalaman, ditambah pula dengan pengiktirafan kebangsaan dan antarabangsa, Pusat Latihan Nuklear Malaysia akan memberikan jaminan perkhidmatan yang terbaik untuk pelanggan.

Nuklear Malaysia telah berjaya menjadi hub dalam memberi khidmat kepakaran dan latihan dalam teknologi nuklear kepada pelatih dalam dan luar negara. Sepanjang (2007 – 2014), Pusat Latihan telah memberi latihan dan kepakaran kepada peserta tempatan dan luar negara yang rata-ratanya datang dari peserta IAEA, negara asia tengah dan juga dikalangan anggota asia yang lain. Sehubungan itu, Nuklear Malaysia telah diberi kepercayaan untuk menjalankan Kursus Postgraduate Educational Course in Radiation Protection and The Safety in Radiation Sources (PGEC) sejak tahun 2000 pada penganjuran pertamanya lagi. PGEC yang diadakan dengan kerjasama Agensi Tenaga Atom Antarabangsa (IAEA), adalah anjuran bersama Nuklear Malaysia dengan Universiti Sains Malaysia (USM), LPTA (Lembaga Perlesenan Tenaga Atom) dan Kementerian Kesihatan Malaysia (KKM). Kursus ini direka bagi meningkatkan Infrastruktur Perlindungan Sinaran di rantau ini. Malaysia bersetuju untuk berkongsi sumber, pengalaman dan infrastruktur latihan dengan negara-negara membangun bagi mencapai matlamat ini. Objektif utama kursus ini adalah untuk memberi pengetahuan asas kepada profesional antarabangsa dan tempatan yang terlibat dalam kerjaya sinaran. Untuk maklumat lanjut, sila layari laman web sesawang **https://www.iaea.org/**

Our training infrastructure is supported by a complete range of R&D laboratories and other main radiation facilities that offer an excellent opportunity to have first hand exposure in different types of application in ionising radiation. Nuklear Malaysia is the only organisation that can provide this sort of facilities in Malaysia. With over 40 years behind us, coupled with both national and international recognitions will assure you the best services from us.

Nuklear Malaysia has become a hub in providing expertise and training in nuclear technology locally and abroad. Throughout, (2007 - 2014), Training Center has provided training and expertise to both local and foreign participants mostly from IAEA participants, Central Asian countries and among other members in Asia. With that success, Nuklear Malaysia has been entrusted to carry out The Post Graduate Educational Course (PGEC) in collaboration with the International Atomic Energy Agency (IAEA) since 2000. The programme has been conducted in cooperation with Universiti Sains Malaysia (USM) and other local partners including AELB (Atomic Energy Licensing Board) and Ministry of Health (MOH). This course was established to improve Radiation Protection Infrastructure in the region. Malaysia has agreed to share its resources, experience and training infrastructures with other region of developing countries to achieve this objective. The general aim of the course is to provide initial basic knowledge for professional from international and local who involved in radiation professionals. For any information, please visit website **https://www.iaea.org/**

Jadual 9.9 Kursus PGEC di Malaysia
Table 9.9: Radiation Safety & Safety of Radioactive Sources

PGEC	Tarikh/ Date	Masa/ Duration	Peserta/Participants		
			Antarabangsa/International	Tempatan/Local	Jumlah/Total
PGEC-1	1 November 2000 – 30 Oktober/ October 2001	1 tahun/year	13	-	13
PGEC-2	18 Februari/February 2002 – 25 Januari/ January 2003	1 tahun/year	20	-	20
PGEC-3	8 Disember/December 2003 – 2 Disember/ December 2004	1 tahun/year	18	2	20
PGEC-4	1 Jun/June 2005 – 20 Mei/May 2006	1 tahun/year	18	4	22
PGEC-5	27 November 2006 – 7 Julai/July 2007	32 minggu/ weeks	22	3	25
PGEC-6	15 Oktober/October 2008 – 31 Mei/May 2009	32 minggu/ weeks	20	3	23
PGEC-7	14 Oktober/October 2009 – 30 Mei/May 2010	32 minggu/ weeks	21	4	25
PGEC-8	11 Oktober/October 2010 – 24 Mei/May 2011	32 minggu/ weeks	26	2	28
PGEC-9	17 September 2012 – 9 Mac/March 2013	25 minggu/ weeks	24	4	24
PGEC-10	10 Jun/June 2013 – 6 Disember/December 2013	25 minggu/ weeks	24	4	24
PGEC-11	9 Jun/June -5 Disember/December 2014	25 minggu/ weeks	25	5	30
PGEC-12	1 Jun/June -27 November 2015	26 minggu/ weeks	30	4	34
PGEC-13	1 6 May – 11 November 2016	26 minggu/ weeks	30	5	35

Foto 9.43: *Post Graduate Educational Course* (PGEC)
Photo 9.43: The Post Graduate Educational Course (PGEC)

Pelaksanaan program-program latihan ini adalah untuk meningkatkan kemahiran dan kesedaran keselamatan dalam setiap sektor. Ianya juga selaras dengan usaha untuk menggalakkan penggunaan teknologi nuklear dalam bidang industri minyak dan gas, perubatan, kejuruteraan, pertanian, alam sekitar, geologi, penyelidikan dan pembangunan serta bidang lain-lain yang berkaitan.

All the training programmes are to improve skills and safety awareness in every sector. It is also in line with efforts to promote the use of nuclear technology in oil and gas industry, medicine, engineering, agriculture, environment, geology, research and development and other related fields.

9.9) Pencapaian Kursus

9.9.1) Statistik

Sepanjang tahun 2015, sebanyak 60.2% daripada agenda latihan yang dirancang berjaya dilaksanakan dimana Pusat Latihan Nuklear Malaysia telah melatih 3400 peserta dengan 33 produk dan 138 frekuensi kursus/seminar dijalankan di dalam pelbagai sektor latihan termasuk latihan asas agensi dan luar pesisir.

Pusat Latihan turut menyumbang kepada pembangunan Perusahaan Kecil dan Sederhana (PKS) yang merupakan penyumbang lebih daripada 60% kepada perkembangan ekonomi negara dengan melatih 147 peserta dalam

9.9) Achievement

9.9.1 Statistic

In 2015, we have successfully organized 60.2% of the planned training agenda and has trained 3400 participants with 138 frequency of courses / seminars conducted training in various sectors including public and offshore training

We also contributed to the development of Small and Medium Enterprises (SMEs) which added more than 60% to the country's economic development by training 147 participants in the field of radiation and entrepreneurship. For the international participants, we have trained 30 participants from various countries who joined PGEC course. We will

bidang sinaran dan juga perusahaan. Bagi peserta antarabangsa pula, 30 peserta dari pelbagai negara telah berjaya mengikut kursus PGEC yang kami anjurkan. Latihan yang ditawarkan sentiasa dikemaskini setiap tahun dan cadangan penghasilan produk-produk latihan yang baharu akan dinilai oleh pakar-pakar serta mengikut amalan-amalan standard yang berkaitan dengan mengambil kira keperluan pelanggan.

9.9.2) Acara Tahunan

Sebanyak lapan program acara tahunan telah dijalankan iaitu empat seminar pengimejan perubatan, satu seminar Penulisan & Penerbitan Saintifik dan Bengkel, satu Seminar Keselamatan Makanan, dua persidangan iaitu Persidangan Perlindungan Sinaran dan Bengkel dan Persidangan Sinaran Tidak Mengion serta satu kursus jangka pendek World Nuclear University (WNU). Kesemua acara ini dijalankan di luar pesisir agensi nuklear dengan jumlah penyertaan peserta seramai 661 orang.

regularly update our training products and proposed new training products which will be evaluated by experts in accordance with standard practices by considering the needs of our customers.

9.9.2) Annual Event

A total of eight program has been organised such as four seminars on Scientific Meeting on Medical Imaging, one seminar on Scientific Writing & Publication, one Seminar on Food Safety, two conferences, which are, Radiation Protection Conference and workshops and Conference on Non-Ionising Radiation with one World Nuclear University short course (WNU). All these events have been conducted in various states with 661 number of participants.

Foto 9.44: *World Nuclear University* (WNU)
Photo 9.44: World Nuclear University (WNU)

9.9.3) Laporan Audit

Satu renewal audit oleh pihak syarikat SGS Malaysia telah dijalankan pada 20 Januari 2015 dan tiada Major dan Minor Non-Conformity dan ini yang membolehkan UKL mengekalkan prestasi dan persijilan ISO 9001:2008 terhadap sistem pengurusan kualiti UKL masih diteruskan.

9.9.3) Audit Report

Audit Renewal SGS Malaysia was conducted on 20 January 2015 with no major and minor non-conformity and this shows that we have maintain the standards as in ISO 9001: 2008 for Quality Management System.

9.10) Lakaran Kejayaan

9.10.1) Kursus baharu

Tahun 2015 menunjukkan penambahan sebanyak lapan kursus baharu yang menjadikan sejumlah 89 kursus berbanding hanya 81 pada tahun sebelumnya. Pelaksanaan kursus baru merupakan salah satu usaha penambahbaikan latihan UKL yang berterusan bagi menjamin penganjuran kursus-kursus yang menarik dan relevan dengan perubahan akta dan peraturan perundangan semasa. Kursus-kursus ini dijalankan hasil daripada kajian terhadap maklum balas peserta, perubahan terkini akta dan peraturan dan bagi memenuhi keperluan latihan pelanggan.

9.10.2) Projek Kerjasama Latihan

Sesuai dengan prinsip kerjasama awam swasta yang mencerminkan hasrat kerajaan untuk mempergiatkan penglibatan swasta, Pusat Latihan telah menjalinkan kerjasama dengan syarikat – syarikat seperti Lady Faza Solution Sdn. Bhd., Madani Training Sdn Bhd dan beberapa syarikat lain bagi merancakkan lagi penawaran program – program latihan yang berasaskan teknologi nuklear dan yang berkaitan. Pada tahun 2015, sebanyak enam program latihan telah berjaya dikendalikan oleh Lady Faza Solution Sdn. Bhd dan dua pogram latihan oleh Syarikat Madani Training Sdn Bhd.

9.10) Success Sketch

9.10.1) New Courses

In 2015, there an increase of eight new courses that makes a total of 89 courses offered in 2015 compared to only 81 in the previous year. By implementing new courses, it shows that our efforts to improve our training offered in accordance to the changing legal acts and regulations. This new courses offered also as a result in studying our customers feedback to meet the training needs of the customer.

9.10.2) Training Partnership Project

In accordance with the principle of public-private partnership which reflects the government's desire to encourage private sector involvement, we has been working with companies like Lady Faza Solution Sdn. Bhd., Madani Training Sdn Bhd and several other companies to boost the training program which are related with nuclear technologies. In 2015, Lady Faza Solution Sdn. Bhd has conducted six training program followed by two program by Madani Training Sdn Bhd.

9.10.3) Sistem Atas Talian

Seiring dengan perkembangan teknologi dan memudahkan capaian maklumat kursus, UKL turut telah mempunyai laman sesawang/portal Pusat Latihan sendiri. Di laman web tersebut, terdapat juga kemudahan sistem pembelajaran atas talian, e-Tuition yang telah dinaiktaraf untuk kegunaan para peserta program yang berdaftar mendapatkan nota kursus dan berkomunikasi dengan tenaga pengajar secara percuma dan boleh mula digunakan pada tahun 2015.

9.10.3) Online Training System

In line with the current technology development abridging the user to access information available, we has created our own training portal/website. In the website, the participants can access our online learning system, e-Tuition to get notes and communicate with instructors for free. E Tuition is a system that enable our customers to reach our training programmes anywhere, anytime. User can learn at their own space and get certificate on site.

9.10.4) Kemudahan Penginapan Suite57@Rumah Tamu Nuklear Malaysia

Penginapan ini telah digunakan sejak tahun 2013 untuk kemudahan kursus dan dijadikan sebahagian pakej kursus. Dengan sejumlah hanya 15 buah bilik, telah menjana kutipan sebanyak RM57,000 dengan 570 malam jumlah malam yang dihuni dan ini telah menjana kutipan ke dalam akaun hasil kerajaan.

9.10.4) Accomodation at Suite57@ Rumah Tamu Nuklear Malaysia

We have offered this accomodation since 2013 to facilitate our participants and it has been include in our course package. With a total of 15 rooms, we have generated RM57, 000 with 570 number of nights occupied that has made revenue into government account.

Foto 9.45: Kemudahan Penginapan *Suite*57@Rumah Tamu Nuklear Malaysia
Photo 9.45: Accomodation at Suite57@Rumah Tamu Nuklear Malaysia

9.11) Dimensi Baharu

Pusat Latihan juga telah memperkenalkan dua program khas baharu iaitu Sarjana Sains (Sains Sinaran) dengan kerjasama Universiti Sains Malaysia. .Ini adalah satu usaha bagi meningkatkan persijilan program latihan sedia ada ke peringkat yang lebih tinggi. Kelebihan ini didokong dengan tenaga pengajar dari penyelidik nuklear dan infrastruktur P&P yang dapat membantu meningkatkan usaha penyelidikan yang lebih banyak, kreatif. Sebagai peneraju menyediakan latihan teknologi nuklear dan berkaitan, Pusat Latihan turut berperanan untuk menonjolkan pegawai penyelidik yang kompeten dan berdaya saing dalam bidang dan kepakaran/ kemahiran masing-masing. Tanggungjawab ini bagi memastikan setiap agenda pembangunan negara yang disasarkan dapat dipenuhi menerusi pakej latihan dan pembelajaran yang disediakan selaras dengan ministrial function Nuklear Malaysia. Seramai 14 orang pegawai penyelidik Nuklear Malaysia telah dipilih untuk menjadi tenaga pengajar bagi program ini dan akan dijalankan sepenuhnya di Nuklear Malaysia.

Program khas seterusnya turut dikenalkan adalah Program Scientific Attachment. Ia merupakan peluang pembelajaran yang dinamik untuk para penyelidik dan saintis untuk meningkatkan pengetahuan dan pengalaman di dalam bidang yang berkaitan dengan radiasi dan teknologi nuklear. Program ini akan membolehkan pelatih dibimbing oleh Pegawai Penyelidik Nuklear Malaysia yang sangat berpengalaman dan berkepakaran dalam penyelidikan. Pelatih yang telah diterima untuk menyertai program sangkutan saintifik akan ditempatkan di bahagian yang bersesuaian mengikut keperluan projek masing-masing. Seterusnya, pelatih akan menjalankan kajian di fasiliti-fasiliti yang terdapat di Nuklear Malaysia dengan bimbingan penyelia. Program ini terbuka kepada pegawai penyelidik/saintis tempatan dan juga antarabangsa dan tempoh komitmen mungkin berbeza-beza bergantung kepada permintaan dan juga keperluan projek.

9.11) New Dimension

Training Center also has introduced two new special programme such as Master of Science (Radiation Sciences) in collaboration with Universiti Sains Malaysia (USM) and Scientific Attachment Programme. Master of Science (Radiation Sciences) in collaboration with USM is an effort to improve the existing certification training programme to a higher level. The advantage of this is supported by the teaching staff of researchers and infrastructure nuclear R&D that can help boost research efforts more creative. As a leader in providing nuclear technology and related training, training center also serves to highlight the research officers who are competent and competitive in the field and expertise / skills of each. The responsibility to ensure that every country's development agenda can be met through targeted training and learning package prepared in accordance with the ministrial function Nuklear Malaysia. A total of 14 officers Nuklear Malaysia researchers have been selected to become trainers for this programme and will be conducted entirely in Nuklear Malaysia.

The Scientific Attachment Programme provides a good learning platform for researcher or scientist to enhance their knowledge and hand-on experience in the field related to radiation and nuclear technology. This programme will allow participants to guide and supervise by our highly experienced researcher. Participant who has been accepted to join this scientific attachment programme will be able to take on varied assignments or projects in one of our divisions. Participants will be allowed to conduct their research in Nuklear Malaysia facilities. This programme is opened to participant from national and international establishments and period of commitment may vary depending on request and project needs.

9.12) Aktiviti Pusat Latihan

Pusat latihan telah menjalankan beberapa siri bengkel bagi pemantapan program latihan seperti :

- Bengkel WIM – untuk bahan pengajaran dan pembelajaran terhadap kursus Radiografi Industri (Tahap 1) mengikut keperluan NOSS baharu di bawah Jabatan Pembangunan Kemahiran.

- Bengkel buku kajian kes – bagi siri penerbitan tehadap kompilasi bahan-bahan kajian kes yang dikumpulkan yang boleh digunapakai untuk kepelbagaian kaedah pengajaran dan dijangka penghasilan buku ini yang ditulis oleh para penyelidik Nuklear Malaysia akan diterbitkan pada tahun 2016.

- Sebagai pusat khidmat yang mendapat ISO 9001:2008, pusat latihan telah mengambil langkah untuk peralihan kepada ISO 9001:2015 melalui siri bengkel pertama terhadap pemahaman dan kesedaran terhadap ISO dan pengimplementasian yang dijalankan selama 2 hari.

- Bengkel EnT -.Bengkel *Establishing National Strategy on Education and Training in Radiation,Transport and Waste Safety* yang melibatkan wakil Nuklear Malaysia, Lembaga Perlesenan Tenaga Atom, Kementerian Kesihatan Malaysia dan Universiti untuk merangka polisi dan strategi kebangsaan terhadap pendidikan dan latihan dalam keselamatan sinaran.

- Mengadakan Bengkel Melatih Tenaga Pengajar sebagai persediaan bagi Program *Master Science (Radiation Science)* yang akan bermula pada September 2016.

9.12) Training Center Activities

Training Center has conducted a series of workshops to strengthen the training programme such as:-

- WIM Workshop – To upgrade the teaching and learning materials for Industrial Radiography (Level 1) course in accordance with the requirements of the new NOSS under the Skills Development Department.

- Case Studies Book Workshop - This book is a series of publications of materials collected case studies that can be used for variety of teaching methods. Written by researchers in Nuklear Malaysia and expected to be published in 2016.

- Accredited to ISO 9001: 2008, Nuklear Malaysia training center has taken steps for the transition to ISO 9001: 2015 through the first series of two days workshop in understanding the requirement needed of the new version.

- EnT Workshop – Workshop in Establishing National Strategy on Education and Training in Radiation, Transport and Waste Safety, which involved representatives of the Nuklear Malaysia, Atomic Energy Licensing Board, Ministry of Health and University are to formulate policy and national strategy on education and training in radiation safety.

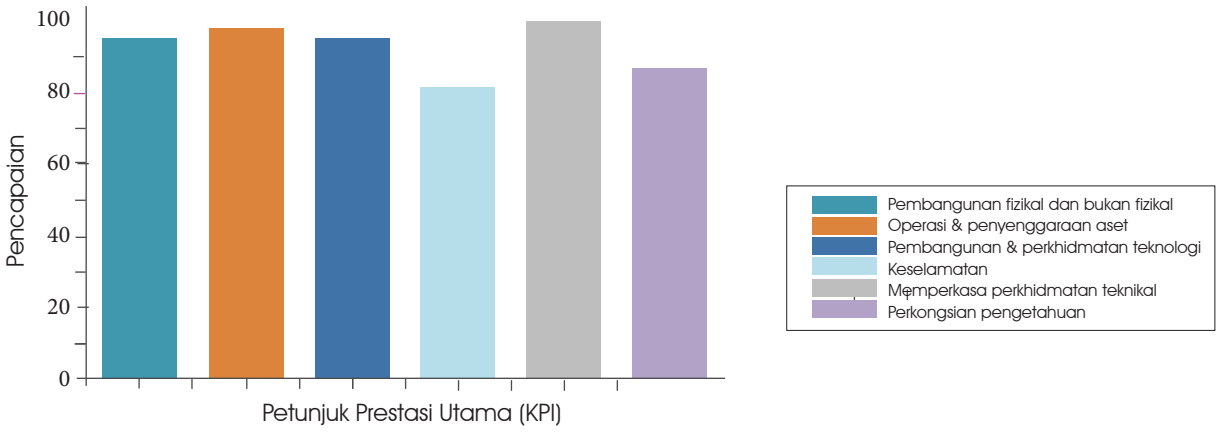
- Workshop in Training the Trainers for the Master of Science (Radiation Science) Programme which will begin in September 2016.

.....10 KHIDMAT KEJURUTERAAN & TEKNIKAL

Matlamat organisasi yang berorientasikan penyelidikan adalah untuk mengeluarkan hasil penyelidikan yang berimpak tinggi. Peralatan penyelidikan dan sistem sokongan serta instrumen bertujuan menjaga keselamatan fizikal adalah antara komponen penting bagi mencapai matlamat tersebut. Peralatan penyelidikan yang digunakan mestilah boleh dipercayai dan terkini. Kemudahan makmal, utiliti, komunikasi dan infrastruktur ICT adalah sebagai pemangkin turut membantu organisasi mencapai matlamat tersebut. Peralatan khusus untuk tujuan keselamatan fizikal adalah perlu bagi memastikan keselamatan fizikal sentiasa terjamin. Perkhidmatan Teknikal telah dirancang dan dilaksanakan bagi mempastikan prestasi, ketersediaan dan kebolehharapan bagi peralatan penyelidikan, peralatan keselamatan dan sistem sokongan berada pada tahap yang optima. Program ini memperoleh pencapaian purata melebihi 90% sepertimana ditunjukkan oleh rajah 10.1.

ENGINEERING & TECHNICAL SERVICES

The main goal of organisation based on research oriented is to produce high-impact research results. Research equipment, support systems with instruments for the purpose of physical security are crucial components in achieving the goal. Research equipment used must be reliable and up to date. Laboratory facilities, utilities, communications and ICT infrastructure are the catalyst to help the organisation achieve its goals. Special equipment for the physical security is needed to ensure the physical protection. Technical services has been designed and implemented to ensure the performance, availability and reliability for all research instruments at optimal levels. This program has achieved its goal with averaged above 90% as shown in the figure 10.1.



Rajah 10.1: Petunjuk prestasi utama (KPI) bagi Program SKT 3 bagi Perkhidmatan Teknikal tahun 2015
Figure 10.1: Key performance indicators (KPI) under Program SKT3 for Technical Services in 2015.

10.1) Aktiviti Pembangunan Fizikal dan Bukan Fizikal

Pembangunan fizikal adalah pembinaan prasarana penyelidikan yang baru dan menaiktaraf kemudahan sedia ada melibatkan kerja awam, elektrikal dan mekanikal. Pembangunan bukan fizikal pula termasuk perolehan aset dan perkhidmatan. Aktiviti pembangunan fizikal dan bukan fizikal di bawah peruntukan Rancangan Malaysia Kesepuluh (RMK10), One-Off dan Harta Modal. Pembangunan fizikal telah membelanjakan sebanyak RM1.96 juta. Sementara pembangunan bukan fizikal membelanjakan sejumlah RM2.36 juta.

(a) Pembangunan fizikal

- Pagar perimeter bersekuriti tinggi
- Kolam penyimpanan bahan api nuklear terpakai dan menaiktaraf sistem penyejukan sekunder RTP
- Pendawaian elektrik Blok 20
- Menaiktaraf sistem keselamatan reaktor

10.1) Physical and Non-Physical Development Activities

Physical development is the construction of new research facilities and upgrading existing infrastructure including civil, electrical and mechanical works. Non-physical development is involved providing services and aset procurement. Physical and non-physical developments were implemented under allocation in 10MP, One-Off and Capital Asset. Physical development required RM1.96 million. While non-physical development spent a total of RM2.36 million.

(a) Physical development

- High security fencing
- Construction of spent fuel pool and Upgrading secondary cooling system RTP
- Electrical rewiring Block 20
- Upgrading reactor safety system
- Upgrading active ventilation system RTP
- Outdoor water pipe reticulation in Complex Jalan Dengkil

- Menaiktaraf sistem pengedaran udara aktif RTP
- Retikulasi paip air luaran di Kompleks Jalan Dengkil
- Pendawaian semula elektrik Blok 42
- Pembaikan bumbung bangunan

(b) Pembangunan bukan fizikal - perolehan aset baru dan khidmat juruperunding

- *Fission Chamber* bagi RTP
- Pengesan Neutron Terbekal-diri
- Sistem keselamatan reaktor-*Radiation Portal*
- Sistem Talian Gas *Liquified Petroleum Gas (LPG)*
- Sistem Rangkaian IPv6 dan Pusat Rangkaian Kompleks Jalan Dengkil
- Kebuk wasap di Makmal Radiokimia dan Alam Sekitar (RAS)

Sistem keselamatan perimeter bersekuriti tinggi, pembinaan kolam bahan api terpakai dan perolehan aset fission chamber adalah di bawah peruntukan RMK10, namun pelaksanaan sepenuhnya sehingga RMK11.

- Electrical rewiring Block 42
- Repairing building roof

(b) Non-physical development - acquisition of new movable assets and Consultancy services

- Fission Chamber for RTP
- Self Powered Neutron Detector
- Reactor safety system -Radiation Portal
- Liquified Petroleum Gas (LPG) system
- Network System IPv6 and Server Centre Kompleks Jalan Dengkil
- FumeHood for Environment and Radiochemistry Laboratory (RAS)

High security fencing system, construction of spent fuel pool and comissioning of fission chamber are under budget allocated in 10MP, however the full implementation is extended until 11MP.

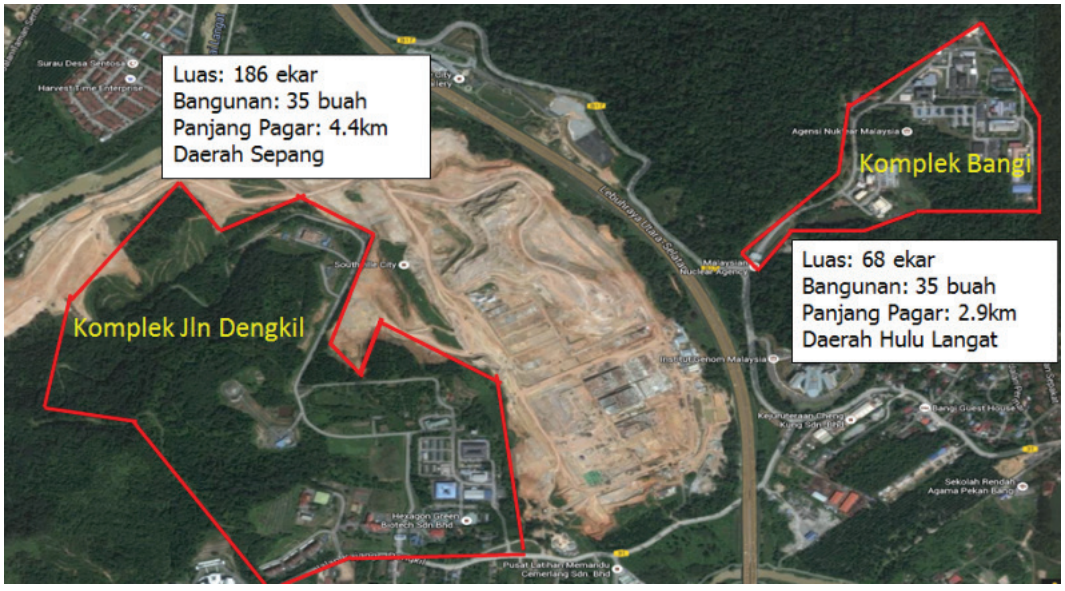
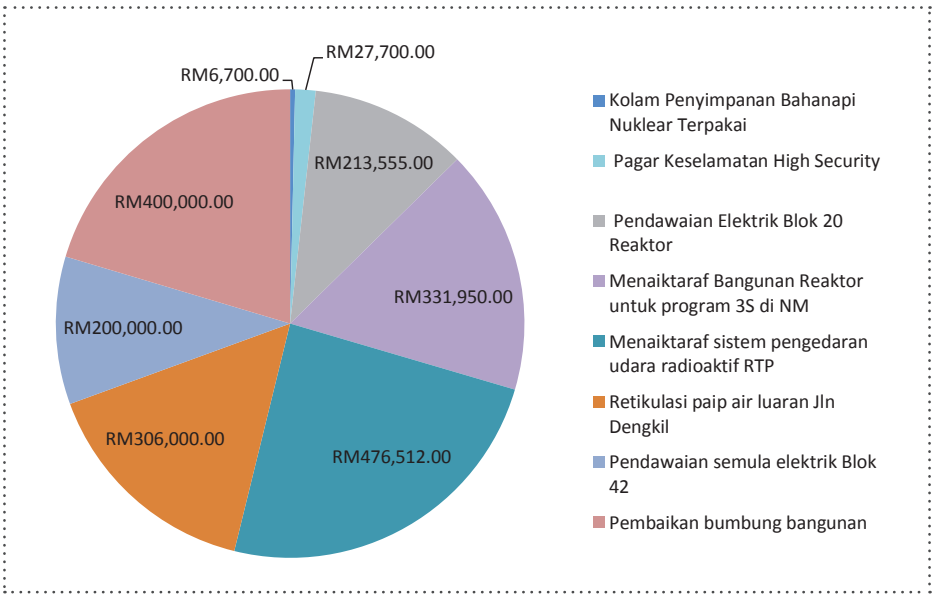


Foto 10.1: Pembinaan pagar bersekuriti tinggi di Kompleks Utama Bangi dan Komplek Jalan Dengkil menggunakan peruntukan pembangunan yang diluluskan dalam dan dilaksanakan sehingga RMK-11

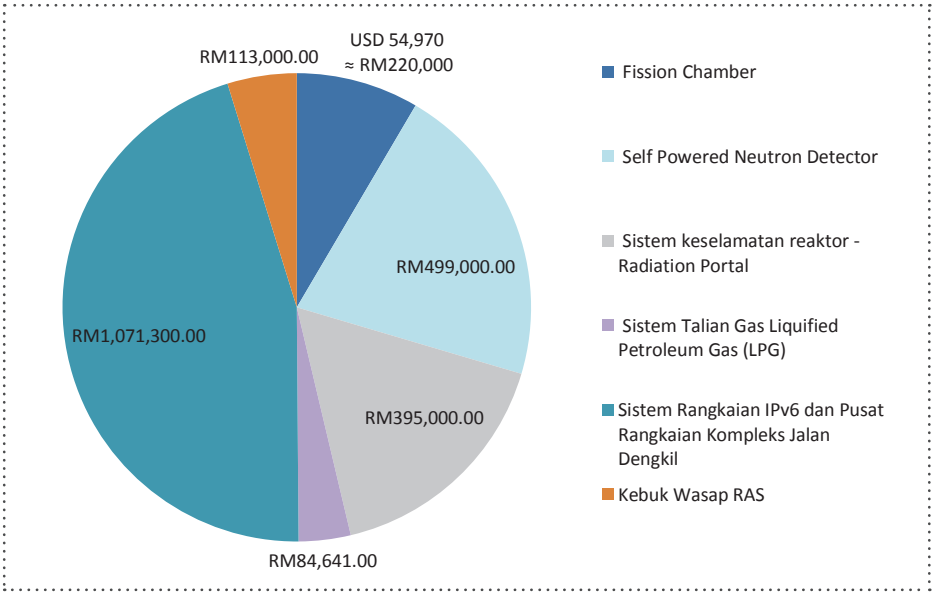
Photo 10.1: Construction of high security fencing for Main Complex Bangi and Jalan Dengkil Complex using allocation approved in 10MP and implemented until 11MP.

Foto 10.2: Tapak pembinaan kemudahan kolam penyimpanan bahanapi terpakai yang dicadangkan semasa RMK10.
Photo 10.2: Proposed site for construction of spent fuel pool in 10MP project.

Foto 10.3: Menaiktaraf sistem penyejukan sekunder Reaktor TRIGA PUSPATI (RTP) dilaksanakan dari RMK10 dan dijangka tamat dalam RMK11
Photo 10.3: Upgrading Secondary Cooling System *Reactor TRIGA PUSPATI (RTP)* has been implemented in 10MP and expected to be completed in 11MP.



a. Pembangunan Fizikal
a. Physical Development



b. Pembangunan Bukan Fizikal
b. Non-Physical Development

Rajah 10.2: Perbelanjaan aktiviti pembangunan fizikal dan tidak fizikal
Figure 10.2: Budget allocations for physical and non-physical development activities

10.1.1) Aktiviti Pembangunan Fizikal

10.1.1) Physical Development Activities

a. Pembangunan Fizikal

a. Physical Development

Foto10.4: Kerja retikulasi paip air luaran di Kompleks Jalan Dengkil
Photo 10.4: Reticulation work of outdoor piping within Complex Jalan Dengkil

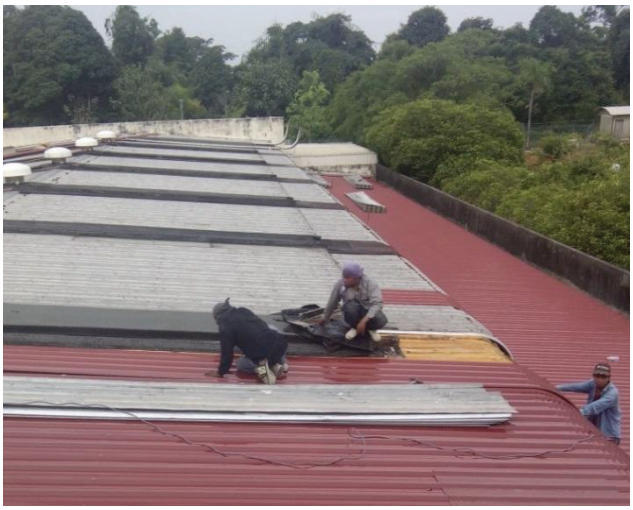
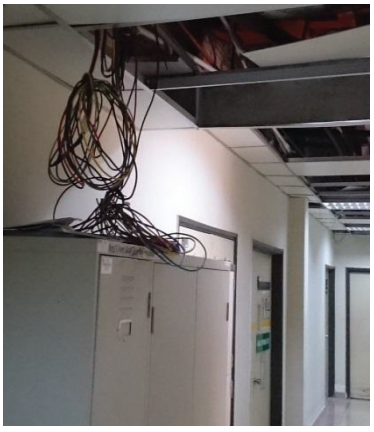


Foto 10.5: Kerja-kerja pembaikan bumbung bangunan di blok 43
Photo 10.5: Repairing building roof in block 43

b. Pembangunan Bukan Fizikal

b. Non-Physical Development



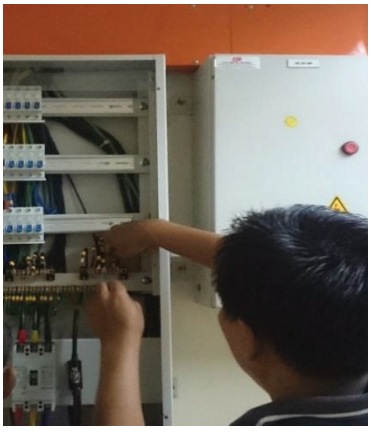


Foto 10.6: Kerja pendawaian semula elektrik dan papan agihan di blok 42
Photo 10.6: Electrical rewiring and distribution board (DB) in block 42

10.2) Pembangunan dan Penambahbaikan Sistem Peralatan Keselamatan, Komunikasi dan Ict

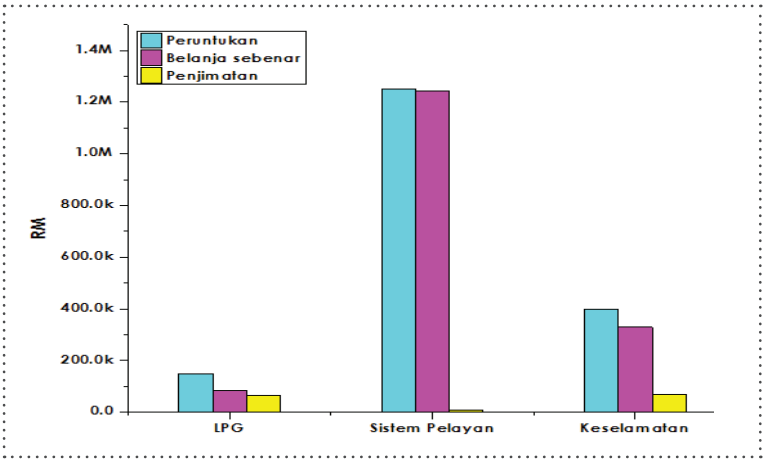
Satu program khusus fokus kepada menambahbaik sistem keselamatan fizikal, komunikasi dan ICT telah dilaksanakan di Agensi Nuklear Malaysia (Nuklear Malaysia). Satu pelayan baru telah dibangunkan bagi meningkatkan keupayaan rangkaian internet di kompleks Jalan Dengkil. Pembangunan tersebut telah dibiayai di bawah peruntukan mengurus one-off melibatkan RM1.071 juta. Sistem perpaipan bagi menyalurkan gas petroleum cecair (LPG) kepada enam makmal penyelidikan di kompleks Jalan Dengkil dilaksanakan dengan kos sebanyak RM 84,641.00, yang mana 43% lebih rendah berbanding bajet yang diluluskan lalu menepati dasar penjimatan yang disarankan. Kecekapan penyaluran gas petroleum cecair dalam keadaan yang lebih selamat diperoleh dari projek ini.

Peralatan sistem CCTV di komplek MINTEC park telah dibaikpulih sepenuhnya dengan memasang pendawaian bumi yang dilengkapkan dengan perlindung kilat. Masalah yang sama dijangka tidak berulang di masa akan datang. Sistem pengesan pencerobohan perimeter juga telah dibangunkan di rumah hijau gama (GGH). Sistem amaran awal ini bagi mengesan penceroboh di kawasan tersebut. Kos bagi pembangunan sistem keselamatan berkenaan adalah RM330,000.00, dengan 17.5% penjimatan.

10.2) Development and Upgrading Equipment Security System, Communication and Ict

A specific program mainly focuses on upgrading physical security, communication and ICT have been implemented in Malaysian Nuclear Agency (Nuklear Malaysia). A network server has been installed to increase internet capability in Complex Jalan Dengkil. The cost for new server and networks system was RM1.076 million, it has been funded under one-off provisions. The new LPG piping system had been installed to supply LPG for six laboratories in Complex Jalan Dengkil with a total cost of RM 84,641.00, where it was 43% lower than the budget so that as required in saving policy. This success can increase the efficiency in the distribution of liquefied petroleum gas in a more secure.

The Closed Curcuit Television (CCTV) equipment in Complex MINTEC park have been repaired and installed of earthing with a lightning strikes protection system. Similar problem is expected is not recurring in the future. Perimeter Intrusion Detection System (PIDS) has been comssioned at Greenhouse Gama (GGH) facility. This serves as an early warning system to detect unauthorized access in this facility. The cost for this work is RM 330,000.00 which is 17.5% saving.



Rajah 10.3: Graf Bar menunjukan peruntukkan, penbelanjaan sebenar serta penjimatan bagi melaksanakan Program pembangunan fasiliti & penambahbaikan sistem peralatan keselamatan, komunikasi dan ICT

Figure 10.3: Bar Chart shows the allocation, actual expenses and saving for facility development & upgrading security equipment, communication and ICT Program

Foto 10.6: Kerja penambahbaikan sistem Sistem kamera litar tertutup (CCTV)
Photo 10.6: Improvement closed-circuit camera system (CCTV)

Foto 10.7: Kerja penambahbaikan sistem pengesan pencerobohan perimeter (PIDS).
Photo 10.7: Improvement of perimeter intrusion detection system (PIDS).

10.3) Operasi, Penyenggaraan dan Pengurusan Aset

Operasi, penyenggaraan dan pengurusan aset bagi pusat khidmat mempunyai objektif untuk mengekalkan kebolehfungsian dan kebolehharapan aset di Nuklear Malaysia. Seterusnya dapat meningkatkan tahap keselamatan fizikal, menjimatkan kos operasi serta menyediakan persekitaran kerja yang selesa. Aktiviti yang telah dilaksanakan adalah seperti berikut:

10.3) Operation, Maintenance and Asset Management

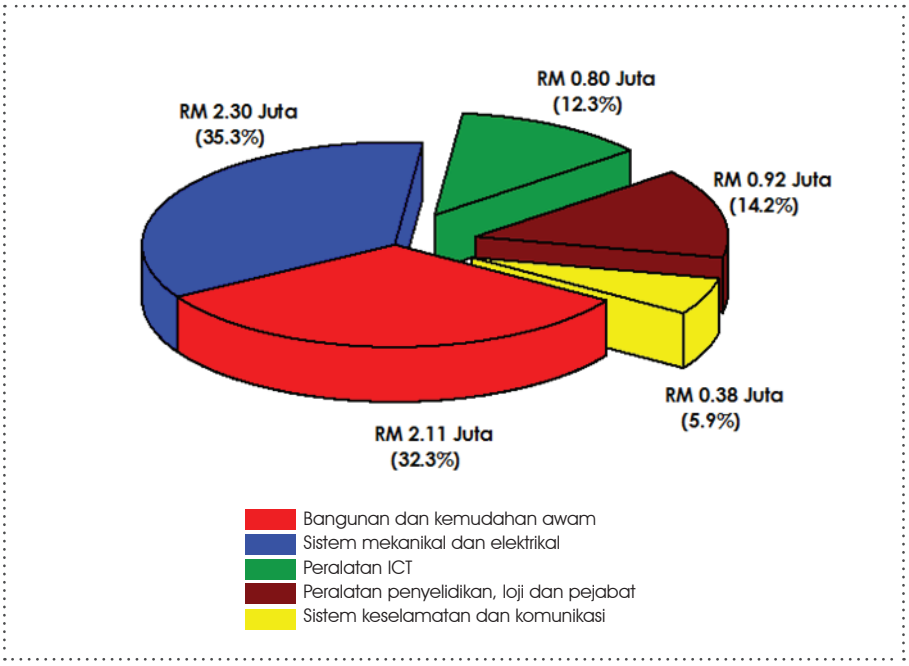
Operation, maintenance and asset management provided by the service centre is to achive the objectives for retaining the functionality and reliability of assets in Nuklear Malaysia. Furthermore, enhances safety of physical asset, reducing operational cost and provides a comfortable working environment. Activities that have been implemented are as follows:-

- Penyenggaraan bangunan dan kemudahan awam
- Penyenggaraan sistem elektrikal dan mekanikal
- Penyenggaraan sistem dan peralatan ICT
- Penyenggaraan peralatan penyelidikan, loji dan pejabat
- Penyenggaraan sistem keselamatan dan komunikasi

Aktiviti tersebut dilaksanakan secara berkala melalui perolehan khidmat secara kontrak, menggunakan khidmat kepakaran dalaman ataupun perolehan khidmat kontraktor luar. Rajah 10.4 menunjukkan pecahan perbelanjaan dalam melaksanakan aktiviti operasi, penyenggaraan dan pengurusan aset tahun 2015.

- Maintenance of building and civil infrastructures
- Maintenance of electrical and mechanical systems
- Maintenance of ICT instruments and system
- Maintenance of research, office and pilot plant equipment
- Maintenance of security and communication systems

These activities were carried out periodically through a contract basis, using an internal expertise or procurement of external services. Figure 10.4shows the breakdown of organizational expenditure for implementing the operation, maintenance, and asset management in 2015.



Rajah 10.4: Pecahan perbelanjaan organisasi bagi melaksanakan pelbagai aktiviti di bawah program operasi, penyenggaraan dan pengurusan aset.
Figure 10.4: Organisational breakdown expenditure for implementing various activities under the operational, maintenance and asset management program.

10.3.1) Aktiviti Operasi dan Penyenggaraan Aset

10.3.1) Asset Management and Operation Activities

Foto 10.8: Operasi penyenggaraan aset tak alih (awam): pencucian bangunan
Photo 10.8: Maintenance operation of fixed asset (public): cleaning of buildings

Foto 10.9: Operasi penyenggaraan aset tak alih (awam): penyenggaraan berkala komprehensif bangunan
Photo 10.9: Maintenance operation of fixed asset (public): cleaning of buildings

Foto 10.10: Operasi penyenggaraan aset tak alih (awam): prasarana
Photo 10.10: Maintenance operation of fixed asset (public): infrastructure

Foto 10.11: Operasi penyenggaraan aset tak alih (awam): perkarangan
Photo 10.11: Maintenance operation of fixed asset (public): periodic maintenance of compound

Foto 10.12: Perkhidmatan kawalan anti serangga
Photo 10.12: Pest-control service

Pembaikan Kuarters Sri Mint
Repairing of Sri Mint Quarters

Pembaikan paip air yang bocor di Kompleks Bangi
Repairing of leaking water pipe at Bangi Complex

Pembaikan saluran air hujan di bumbung
Repairing gutter on the roof

Menurap permukaan jalan berhampiran Blok 43T
Paving road surface near to Block 43T

Membaik pulih laluan pejalan kaki di Kompleks Dengkil
Refurbish walkway at Complex Dengkil

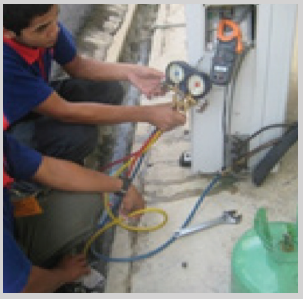
Pemeriksaan cerun berhampiran Pondok Pengawal Kompleks Bangi
Slope inspection near to Guard House Complex Bangi

Foto 10.13: Operasi penyenggaraan aset tak alih (awam): Pembaikan bangunan dan kemudahan
Photo 10.13: Maintenance operation of fixed asset (public): Repairs buildings and facilities

Pembaikan mesin pengokol mini di Blok 64
Repairs mini chiller at Building 64

Penggantian Injap untuk menara penyejuk di Blok 27
Replacement cooling tower valve at Block 27

Penyenggaraan mesin pengokol di loji penghawa dingin berpusat
Maintenance works of chiller in centralized air conditioning plant



Penyenggaraan penghawa dingin jenis berasingan
Maintenance of air conditioner split unit

- Penyenggaraan sistem pemampat udara di Blok 45
  Maintenance work of air compressed system in Block 45
- Penyenggaraan pam air di loji penghawa dingin berpusat
  Maintenance of water pump in Centralized AirConditioning Plant

Foto 10.14: Operasi dan penyenggaraan sistem mekanikal
Photo 10.14: Operation and maintenance of the mechanical system

Kerja-kerja penggantian High Voltage (HV) kabel di Kompleks Dengkil
Replacement of High Voltage (HV) cable at Complex Dengkil

Kerja-kerja pendawaian semula di dalam bangunan-bangunan Nuklear Malaysia
Rewiring works inside Nuklear Malaysia buildings

Penyelenggaraan dan pembaikan Transformer di Pencawang-Pencawang Elektrik
Maintenance and repair works on transformer in electrical substation

Foto 10.15: Penyenggaraan prasarana kemudahan sistem elektrikal
Photo 10.15: Operation and maintenance of the infrastructure of electrical sistem

Foto 10.16: Penyenggaraan sistem kawalan kad akses (CACS)
Photo 10.16: Maintenance of card access control system (CACS).

Foto 10.17: Penyenggaraan sistem pemantauan akses bahan nuklear dan radioaktif di pintu masuk utama Nuklear Malaysia

Photo 10.17: Maintenance of nuclear and radioactive material access monitoring system at main entrance of Nuklear Malaysia.

10.4) Pembangunan dan Perkhidmatan Teknologi (PPT)

Projek penyelidikan yang dilaksanakan di program teknikal adalah bersifat pembangunan dan perkhidmatan teknologi. Misalnya, pembangunan prototaip, loji rintis, pembangunan aplikasi komputer serta instrumentasi. 40 penyelidikan dan pembangunan telah dilaksanakan oleh pusat khidmat dalam program teknikal. Pusat Pembangunan Prototaip (PDC) telah membangunkan lima unit loji rintis serta menghasilkan 150 reka bentuk kejuruteraan, fabrikasi pemasangan, pengujian dan pentauliahan pelbagai peralatan, rig dan aksesori R&D. Dana sebanyak RM4.587 juta bagi tempoh dua tahun mulai 2015 telah digunakan bagi pembangunan sel aktif mudah-alih, perolehan sistem dan peralatan kejuruteraan, naiktaraf bangunan serta pembinaan bunker bagi mesin akselerator bertenaga 300 keV. Foto 10.18 menunjukkan struktur sel aktif mudahalih bungkah pelumbum. Foto 10.19 pula sistem dan peralatan bagi kegunaan pengurusan punca radioaktif beraktiviti tinggi.

10.4) Development and Technology Services (PPT)

Research projects carried out in Technical Programme were the development and technical services such as prototype development, pilot plant, software development and instrumentation. 40 research and development projects have been carried out by service centres under Technical Programme. There are five pilot plants, 150 engineering designs, fabrication, testing and commissioning of equipment, rig and R&D accessories have been produced by Prototype Development Centre (PDC). Funds of RM4.587 million for period of two years starting 2015 was allocated for development of mobile hotcell, procurement of system and engineering equipment, building upgrading and bunker construction for 300 keV accelerator machine. Photo 10.18 shows the structure of mobile hotcell consists of lead block. Photo 10.19 shows the system and equipment that were acquired for handling high activity radioactive sources.

Foto 10.18: Projek pembangunan sel aktif mudahalih, gambar di sebelah atas menunjukkan struktur utama bagi sel aktif mudah-alih manakala gambar-gambar di bahagian bawah adalah komponen-komponen asas bagi binaan struktur tersebut.

Photo 10.18: Mobile hotcell project, the pictures at the top are the main structure while the pictures at the bottom are the basic components.

Foto 10.19: Sistem dan peralatan kejuruteraan yang diperolehi oleh pusat PDC melalui pembiayaan RMK10.

Photo 10.19: System and engineering equipment acquired by PDC by using 10MP allocation.

Bangunan dan bunker bagi menempatkan babyEBM telah dibangunkan oleh Pusat Pembangunan Akselerator (ADC) hasil kerjasama dengan Pusat Pembangunan Prototaip (PDC) dan Bahagian Kejuruteraan (BKJ). Sistem pengimbas alur elektron, sistem penyejuk dan gas penebat serta bekalan kuasa tinggi telah dinaiktaraf bagi membolehkan kapasiti tenaga output mesin tersebut ditingkatkan daripada 140 keV kepada 250 keV. Foto 10.20 menunjukkan fasiliti, komponen kejuruteraan serta peralatan yang telah dibangunkan oleh pusat ADC.

he building and bunker for placement of babyEBM has been developed by Accelerator Development Centre (ADC) collaboration with Prototype Development Centre (PDC) and Engineering Division (BKJ). Electron beam scanning system, cooling system, insulation gas and a high power supply have been upgraded to enable higher power machine output capacity so that can increase from 140 keV to 250 keV. Photo 10.20 shows the facility, components and engineering equipment developed by ADC centre.

Foto 10.20: Kemudahan dan peralatan yang dibangunkan oleh ADC. Bangunan baru dan bunker untuk mesin babyEBM (tengah), gambar lain bermula dari atas-kiri, mengikut arah jam (sangkar Faraday, sistem gas penebat, panel kawalan elektrik, sistem penyejukan dan penyedut udara, transformer, sistem fokus plasma dan pintu diperbuat daripada plumbum sebagai perisai di pintu masuk bunker).

Photo 10.20: Facility and instruments developed by ADC. New building and bunker for babyEBM machine (centre), photographs started from top-left, clockwise (Faraday cage, gas insulating system, electrical control panel, cooling and air-blower system, transformers, plasma focus system and lead door as shielding at bunker entrance).

yang dibangunkan oleh Pusat Pembangunan Accelerator (ADC). Bangunan baru dan bunker untuk mesin babyEBM (tengah), gambar lain bermula dari atas-kiri, mengikut arah jam (sangkar Faraday, sistem gas penebat, panel kawalan elektrik, sistem penyejukan dan penyedut udara, transformer, sistem fokus plasma dan pintu diperbuat daripada plumbum sebagai perisai di pintu masuk *bunker*).

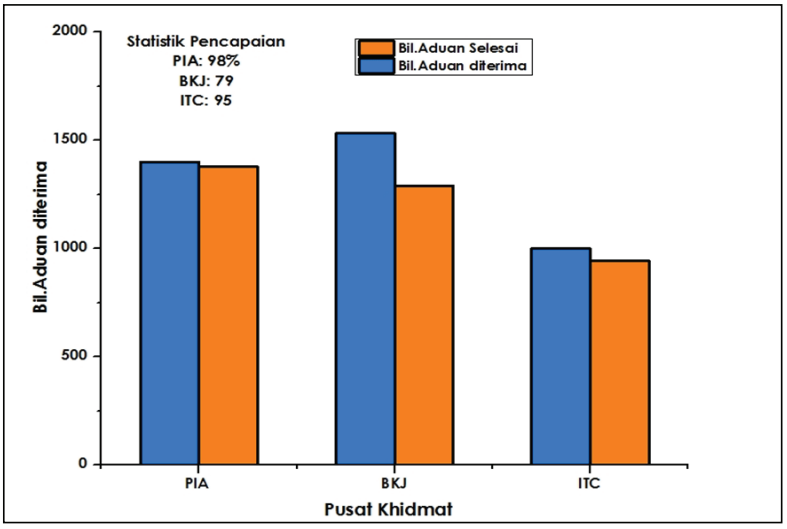
developed by Accelerator Development Centre (ADC). New building and bunker for babyEBM machine (center), photographs started from top-left, clockwise (Faraday cage, gas insulating system, electrical control panel, cooling and air-blower system, transformers, plasma focus system and lead door as shielding at bunker entrance).

10.5) Sistem Aduan Teknikal (Helpdesk)

Khidmat pelanggan menerusi sistem aduan teknikal Helpdesk sudah bermula sejak dari tahun 2010 dan hingga sekarang penggunaannya telah melebihi satu ribu aduan setahun. *Trend* ini dijangka bertambah dengan masa kerana aset semakin buruk. Aduan yang diterima melibatkan kemudahan prasarana, sistem teknologi maklumat (IT) dan peralatan saintifik. Rajah 10.5 menunjukkan pencapaian pelaksaan perkhidmatan kepada pelanggan melalui sistem aduan teknikal (*Helpdesk*) bagi pusat khidmat iaitu PIA, BKJ dan ITC.

10.5) Technical Complaint System (Helpdesk)

Customer service through Technical Helpdesk system has started in 2010, since then the usage has exceeded one thousand requests per year. This trend is expected to increase due to aging of assets. Complaints received including infrastructure facilities, Information Technology (IT) system and scientific equipment. Figure 10.5 shows the achievement in implementing the survices to the customers using technical (HelpDesk) such as for PIA, BKJ and ITC.



Rajah 10.5: Statistik pencapaian sistem aduan Helpdesk bagi pusat-pusat khidmat di program perkhidmatan teknikal di Nuklear Malaysia
Figure 10.5: Statistical achievement of the Helpdesk system of various service centres under technical service programme at Nuklear Malaysia

.....11 TEKNOLOGI REAKTOR

11.1) Reaktor TRIGA PUSPATI

Reaktor TRIGA PUSPATI (RTP) adalah satu reaktor nuklear di Malaysia yang telah beroperasi dengan selamat sejak mencapai kritikal yang pertama dalam tahun 1982. RTP digunakan bagi aktiviti penyelidikan dan pembangunan serta latihan dalam bidang sains dan kejuruteraan reaktor nuklear. Program pengurusan penuaan RTP iaitu menaiktaraf sistem keselamatan telah dijalankan bagi memastikan reaktor terus beroperasi dengan selamat dan cekap. Kerja utama yang telah berjaya adalah menaik taraf sistem pengudaraan serta pendawaian elektrik bagi bangunan RTP termasuk penggantian papan agihan, soket kuasa dan pencahayaan.

REACTOR TECHNOLOGY

11.1 PUSPATI TRIGA Reactor

PUSPATI TRIGA Reactor (RTP) is the only nuclear reactor in Malaysia which has been operating safely since its first criticality in 1982. RTP has been used for research and development activities as well as training in the field of science and engineering of nuclear reactor. RTP ageing management program including upgrading the safety system of the reactor has been implemented to ensure efficient operation and safety. The major work that is being done is the upgrading of ventilation system and wiring of electrical supply for RTP building including replacement of distribution board, power sockets and lighting.

Foto 11.1: Papan agihan lama di bangunan RTP
Photo 11.1: Old distribution board at RTP building

Foto 11.2: Papan agihan baru di bangunan RTP
Photo 11.2: New distribution board at RTP building

11.1. 1) Pentauliahan Pengesan Neutron Berkuasa Sendiri (SPND)

Sistem Pengesan Neutron Berkuasa Sendiri (SPND) adalah sistem pengesanan dan perolehan data nilai fluks neutron termal dalam teras bahan api RTP. Peralatan ini menjadi satu kemudahan penyelidikan baru bagi RTP. SPND digunakan untuk pemetaan taburan fluks neutron di dalam teras bahan api nuklear RTP bagi tujuan pelesenan. Nilai fluks neutron terma di kawasan penyinaran sampel dapat diukur dengan tepat dengan menggunakan SPND. Di samping itu, keseimbangan taburan

11.1.1) Commissioning of Self-Powered Neutron Detectors (SPND)

Self-Powered Neutron Detectors System (SPND) is a detection system for measuring thermal neutron flux in the RTP fuel core. This equipment has become a new facility for research at the RTP. SPND is used for mapping the distribution of neutron flux in the nuclear fuel core of RTP for the licensing purposes. The value of thermal neutron flux at the sample irradiation area being identified appropriately using SPND. On the other hand, the balance of the thermal neutron flux distribution in the reactor core

fluks neutron termal di teras reaktor juga dapat ditentukan. Maklumat ini penting bagi pengurusan teras bahan api nuklear RTP untuk keselamatan reaktor. Data pengukuran adalah penting dan diperlukan dalam perancangan aktiviti penyinaran sampel, serta taburan fluks yang ditentukan melalui simulasi dapat ditentusahkan. Pentauliahan sistem SPND telah berjaya dilakukan bersama pakar dari *Thermocoax* di Perancis dan SCK di Belgium yang disertai oleh penyelidik dan penolong jurutera Pusat Teknologi Reaktor (PTR).

is also determined. This information is important in fuel core management to ensure the reactor safety. Measured data is indispensable and required in planning activities related with sample irradiation, as well as a validation of flux distribution determined from simulation. The commissioning of SPND system has been successfully held together with the experts from the Thermocoax in France and SCK in Belgium accompanied by the researchers and assistant engineers from Reactor Technology Centre (PTR).

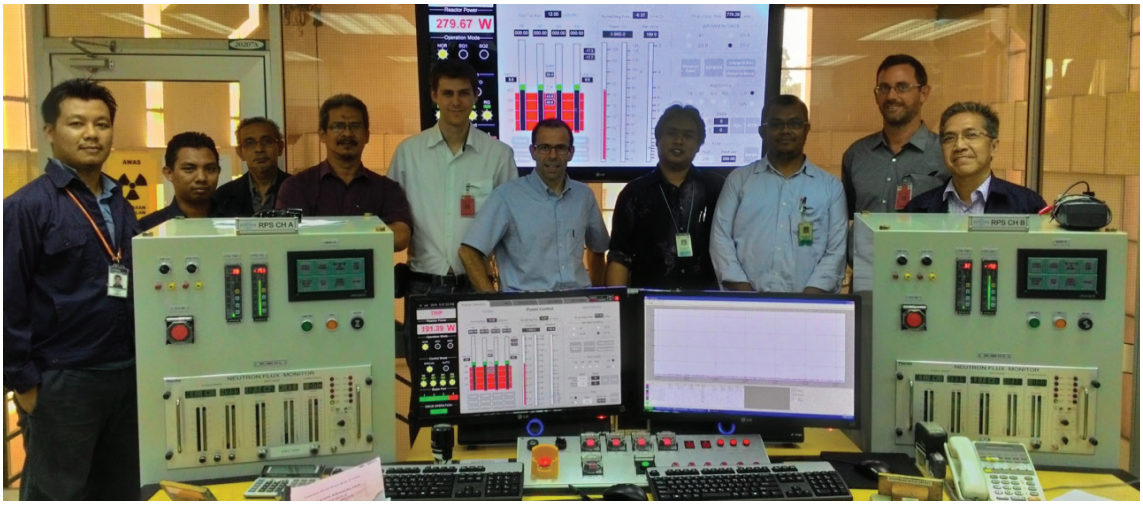


Foto 11.3: Pasukan pentauliahan SPND di RTP
Photo 11.3: SPND's commissioning team members at RTP

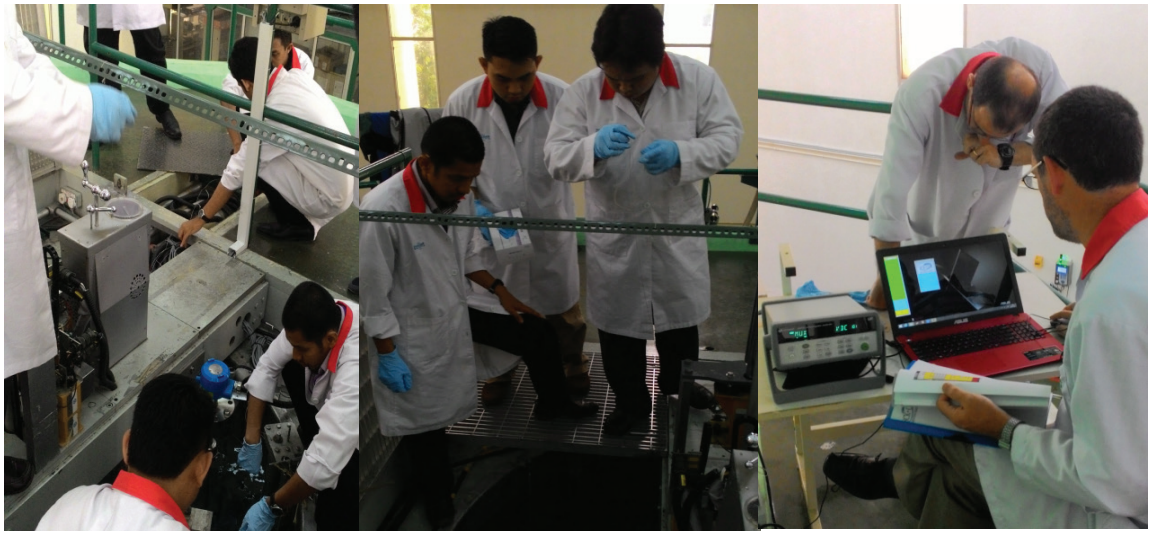


Foto 11.4: Kerja-kerja pemasangan dan pengujian SPND
Photo 11.4: The installation and testing of SPND

11.1.2) Amali Reaktor di RTP

a) *Nuclear School Experiment on Reactor Physics and Neutron Science for Asia Pacific (NSEAP 2015)*

Nuclear School Experiment on Reactor Physics and Neutron Science for Asia Pacific (NSEAP 2015) telah diadakan pada 6-10 April 2015 di RTP. Latihan ini adalah anjuran bersama Nuklear Malaysia dan Badan Tenaga Nuklir Nasional (BATAN), Indonesia dengan kerjasama IAEA. Peserta dari Malaysia, Bangladesh, Cambodia, Indonesia, Iraq, Thailand dan Vietnam telah ditaja sepenuhnya oleh Agensi Tenaga Atom Antarabangsa (IAEA) bagi mengikuti latihan ini. Objektif utama adalah bagi mengoptimumkan penggunaan reaktor penyelidikan nuklear sebagai alatan pengajaran bidang kejuruteraan nuklear dan yang berkaitan di rantau Asia Pasifik. Majlis penutup telah disempurnakan oleh Timbalan Menteri Sains, Teknologi dan Inovasi, YB Datuk Dr. Abu Bakar Mohamad Diah, yang telah diadakan di Kementerian Sains, Teknologi dan Inovasi (MOSTI), Putrajaya.

11.1.2) Reactor Experiment at RTP

a) Nuclear School Experiment on Reactor Physics and Neutron Science for Asia Pacific (NSEAP 2015)

The Nuclear School Experiment on Reactor Physics and Neutron Science for Asia Pacific (NSEAP 2015) was held on 6-10 April 2015 at RTP. This training is jointly organized by Nuklear Malaysia and National Nuclear Energy Agency (BATAN), Indonesia with the cooperation from International Atomic Energy Agency (IAEA). Participants from Malaysia, Bangladesh, Cambodia, Indonesia, Iraq, Thailand and Vietnam obtained fully support from the IAEA to attend this training. The main objective is to optimize use of research reactor as the teaching tool for nuclear engineering and related fields in Asia Pacific region. The closing ceremony was officiated by the Deputy Minister of Science, Technology and Innovation, YB Datuk Dr. Abu Bakar Mohamad Diah which was held at the Ministry of Science, Technology and Innovation (MOSTI), Putrajaya.

Foto 11.5; Tenaga pengajar PTR dan peserta NSEAP15 menggunakan kemudahan RTP dalam pembelajaran dan latihan kejuruteraan nuklear dan reaktor serta kegunaan alur neutron.
Photo 11.5: Instructors and course participants of NSEAP15 utilized RTP facilities in education and training of nuclear and reactor engineering and neutron beam applications

Foto 11.6: Majlis Penutup "Nuclear School Experiment on Reactor Physics and NSEAP 2015"
Photo 11.6: The closing ceremony "Nuclear School Experiment on Reactor Physics and NSEAP 2015"

b) Amali pelajar Sarjana Muda Sains Kejuruteraan Nuklear UTM di Reaktor TRIGA PUSPATI bagi

Amali pelajar Sarjana Muda Sains Kejuruteraan Nuklear UTM di Reaktor TRIGA PUSPATI telah diadakan pada 13 hingga 24 April, 2015. Seramai 30 pelajar telah hadir dan setiap seorang telah menjalankan tujuh eksperimen. Eksperimen yang dilakukan di RTP adalah syarat bagi pengijazahan sarjana muda sains kejuruteraan nuklear UTM.

b) Experiment by Bachelor of Science in Nuclear Engineering students, UTM at the PUSPATI TRIGA Reactor

Practical for Bachelor of Science in Nuclear Engineering students UTM was held on April 13 to 24, 2015 at the PUSPATI TRIGA Reactor. 30 students have attended with each of them has completed seven experiments. Experiment performed at RTP is required for graduation of bachelor science degree in nuclear engineering UTM.

Foto 11.7: Pelajar menjalankan amali eksperimen bersama pegawai penyelidik RTP
Photo 11.7: Student carried out practical experiment with the assistance from research officer of RTP

Foto 11.8: Pelajar diberi penerangan berkaitan *Small Angle Neutron Scattering (SANS)*
Photo 11.8: Student were explained about Small Angle Neutron Scattering (SANS)

Foto 11.9: Pelajar diajar berkenaan pengoperasian RTP menggunakan konsol kawalan digital (ReDICS)
Photo 11.9: Participants learn about the operation of the RTP using digital control console (ReDICS)

11.1.3) IAEA-ANSN Regional Workshop on Regulatory Inspection for Research Reactor.

IAEA-ANSN Regional Workshop on Regulatory Inspection for Research Reactor telah diadakan pada 18 hingga 22 Mei 2015 bertempat di Reaktor TRIGA PUSPATI, Agensi Nuklear Malaysia.

11.1.3) IAEA-ANSN Regional Workshop on Regulatory Inspection for Research Reactor.

IAEA-ANSN Regional Workshop on Regulatory Inspection for Research Reactor was held on 18 until 22 May 2015 at PUSPATI TRIGA Reactor, Malaysian Nuclear Agency.

Foto 11.10: Peserta bengkel diberi taklimat dan penerangan berkenaan RTP
Photo 11.10: Participants of workshop were given a briefing regarding RTP

Foto 11.11: Bengkel dijalankan di dalam dewan reaktor, bilik kawalan dan galeri RTP.
Photo 11.11: The workshop was conducted in the reactor hall, control room and RTP gallery.

Foto 11.12: Pegawai PTR memberi penerangan kepada peserta bengkel berkenaan sistem penukar haba di RTP.
Photo 11.12: PTR officer is explaining the workshop participants on the heat exchanger system in RTP

11.1.4) Bengkel Serantau IAEA bagi Kajian Latihan untuk Analisis Transient dan Kemalangan

Bengkel Serantau IAEA bagi Kajian Latihan untuk Analisis Transient dan Kemalangan telah diadakan pada 1hingga 5 Jun 2015 di Nuklear Malaysia.

11.1.4) IAEA Regional Workshop on Review Exercise for Transient and Accident Analysis

IAEA Regional Workshop on Review Exercise for Transient and Accident Analysis was held on 1 to 5 June 2015 at Nuklear Malaysia.

Foto 11.13: Peserta Bengkel Serantau IAEA bagi Kajian Latihan untuk Analisis Transient dan Kemalangan bersama Timbalan Ketua Pengarah (Penyelidikan dan Pembangunan) Agensi Nuklear Malaysia
Photo 11.13: Participants of IAEA Regional Workshop on Review Exercise for Transient and Accident Analysis with Deputy Director (Research & Development) of Malaysian Nuclear Agency

Foto 11.14: Peserta bengkel melawat RTP
Photo 11.14: Participants of the workshop visit RTP

11.1.5) Bengkel Penyediaan dan Pemantapan Nota Kuliah bagi Latihan Pengendali Reaktor TRIGA PUSPATI

Bengkel Penyediaan dan Pemantapan Nota Kuliah bagi Latihan Pengendali Reaktor TRIGA PUSPATI telah diadakan pada 11 hingga 13 Ogos 2015 di PNB Ilham Resort, Port Dickson. Bengkel ini telah dihadiri oleh pegawai penyelidik dan kakitangan sokongan dari Pusat Teknologi Reaktor (PTR), Bahagian Keselamatan Sinaran (BKS), Nuklear Malaysia serta pegawai sains dari Lembaga Perlesenan Tenaga Atom (LPTA).

11.1.3) Workshop on Preparation and Enhancement of Lecture Notes for the PUSPATI TRIGA Reactor Operator Training

Workshop on Preparation and Enhancement of Lecture Notes for the PUSPATI TRIGA Reactor Operator Training was held on 11 to 13 August 2015 at the PNB Ilham Resort, Port Dickson. The workshop was attended by research officers and support staff of Reactor Technology Center (PTR), Radiation Safety Division (BKS), Nuklear Malaysia as well as science officers of Atomic Energy Licensing Board (AELB).

Foto 11.5: Peserta Bengkel Penyediaan dan Pemantapan Nota Kuliah Bagi Latihan Pengendali Reaktor TRIGA PUSPATI

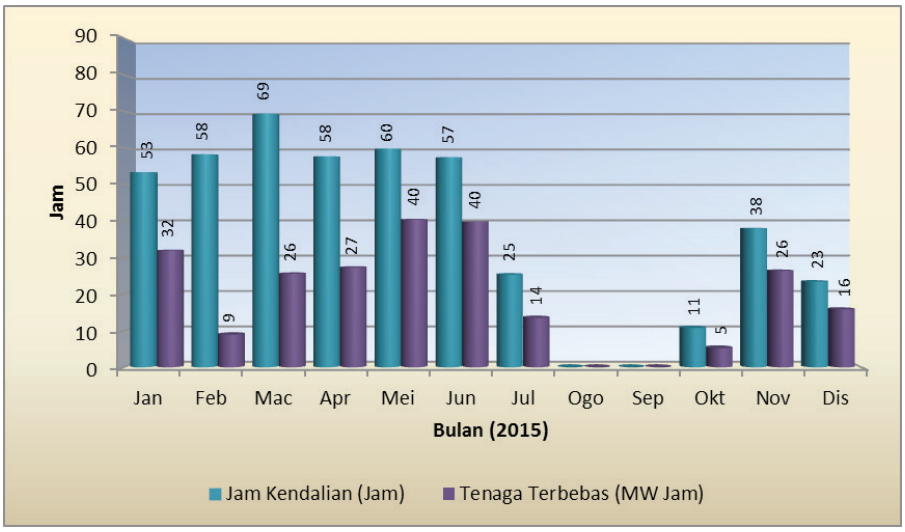
Photo 11.5: Participants of Workshop on Preparation and Enhancement of Lecture Notes for the PUSPATI TRIGA Reactor Operator Training

11.1.6) Data Kendalian RTP bagi 2015

Pada tahun 2015, RTP telah dikendalikan selama 453 jam dengan tenaga terbebas sebanyak 235 MWjam. Rajah di bawah menunjukkan data kendalian RTP bagi tahun 2015. Pada Ogos dan September 2015, reaktor tidak beroperasi untuk memberi ruang kepada kerja pendawaian semula bangunan reaktor. Reaktor kembali beroperasi pada Oktober 2015 selepas kerja pendawaian selesai.

11.1.6) Data of RTP Operation for 2015

In 2015, RTP has operated for 453 hours with total energy released about 235 MWh. The figure below shows the RTP operating hour for 2015. In August and September 2015, the reactor had been shutdown to allow electrical rewiring work at the reactor building. The reactor resumed operation in October 2015 after wiring work is completed.



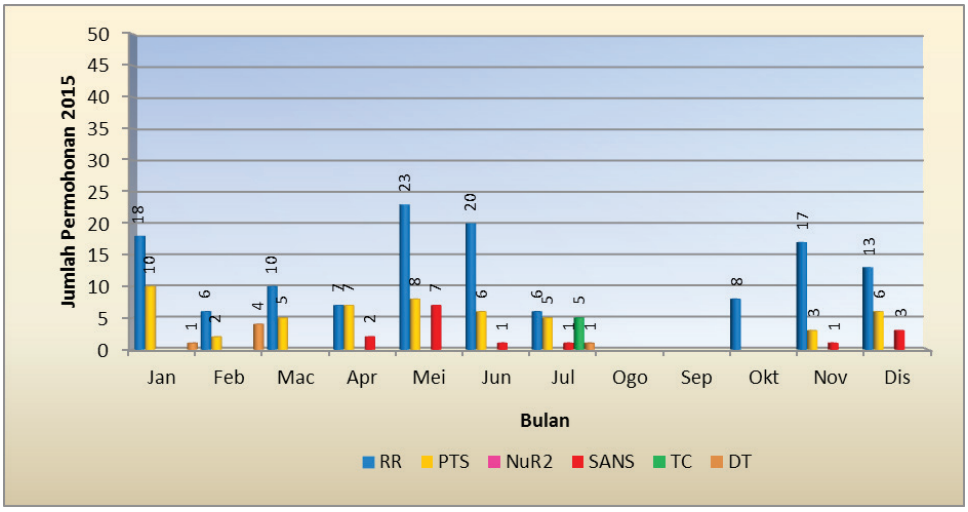
Rajah 11.1: Data kendalian RTP tahun 2015
Figure 11.1: RTP operation data in 2015

11.1.7) Permohonan Penyinaran dan Sampel Tersinar di RTP bagi 2015

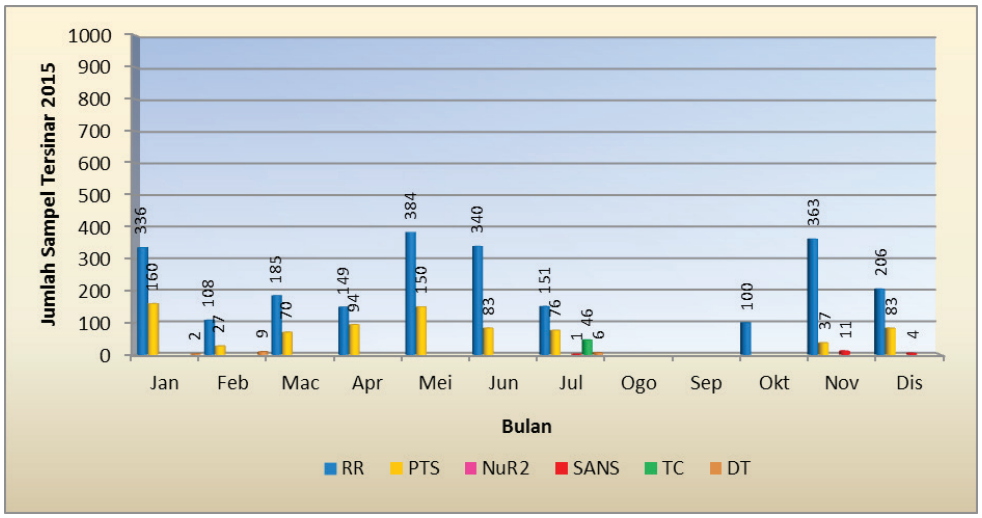
Pada 2015, RTP telah menerima sebanyak 206 permohonan penyinaran dengan 3181 sampel telah disinarkan. Rajah di bawah adalah bilangan permohonan yang dikemukakan dan juga bilangan sampel yang disinar bagi tahun 2015 pada setiap bulan. Penyinaran sampel tidak dapat dilakukan pada Ogos dan September kerana RTP tidak beroperasi.

11.1.7) Irradiation Application and Radiated Samples at RTP for 2015

In 2015, RTP received a total of 206 applications with 3181 samples were irradiated . Figures below are the number of applications submitted and samples irradiated for 2015 in every month . Sample irradiation has not been performed in August and September during the shutdown of RTP.



Rajah 11.2: Jumlah permohonan penyinaran sampel di RTP dari Januari hingga Disember 2015
Figure 11.2: The total of applications on samples irradiation at RTP from January to December 2015



Rajah 11.3: Jumlah sampel disinar di RTP dari Januari hingga Disember 2015
Figure 11.3: The total of Irradiated samples at RTP from January to December 2015

11.1.8) Pemeriksaan dan Penyenggaraan RTP

Aktiviti pemeriksaan dan penyenggaraan di RTP dijalankan dua kali setahun bagi memastikan reaktor beroperasi dengan selamat dan cekap. Penyenggaraan dan pemeriksaan dilakukan oleh operator berlesen bersama kakitangan profesional yang lain.

11.1.8) Inspection and Maintenance of RTP

Inspection and maintenance at RTP were carried out twice a year to ensure the reactor is operating safely and efficiently. Maintenance and Inspections have been conducted by licensed operator together with other professionals.

Foto 11.6: Pemeriksaan ke atas Instrumented *Fuel Element (IFE)* di pelantar reaktor
Photo 11.6: Inspection on Instrumented Fuel Element (IFE) at reactor top

Foto 11.7: Pemeriksaan dan penyenggaraan rod kawalan Transient
Photo 11.7: Inspection and maintenance of Transient control rod

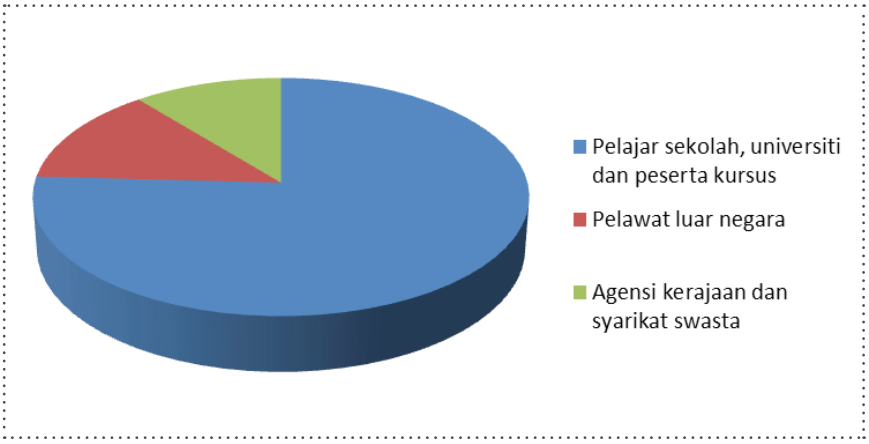
Foto 11.8: Pemeriksaan ke atas *Fuel Element Inspection Tool*
Photo 11.8: Inspection on Fuel Element Inspection Tool

11.1.9) Pelawat RTP

RTP telah menerima sekitar 1560 pelawat daripada kakitangan agensi kerajaan, syarikat swasta, pelajar universiti, peserta kursus, orang awam dan pelawat luar negara.

11.1.9) RTP visitors

RTP received around 1560 visitors from government agencies, private companies, university students, course participants, member of public and foreign visitors.



Rajah 11.4: Bilangan pelawat RTP mengikut kategori sepanjang 2015
Figure 11.4: The number of visitors by categories throughout 2015

Foto 11.8: Pelajar diberi penerangan ketika berada di pelantar atas RTP
Photo 11.8; Students received an explaination at the top platfrom of RTP

Foto 11.9: Pelawat luar negara bersama Pengurus RTP di dalam bilik kawalan reaktor
Photo 11.9: The foreign visitors with RTP Manager in the reactor control room

11.1.10) Pembangunan Teknologi Reaktor Nuklear

Sebagai sebuah pusat penyelidikan dan pembangunan teknologi nuklear di Malaysia, Nuklear Malaysia secara aktif melibatkan diri dalam pelbagai program termasuk mesyuarat teknikal dan kursus mengenai kajian terkini dalam teknologi nuklear bagi reaktor penyelidikan dan penjanaan kuasa.

a) *Training Workshop on Assessment of the National Nuclear Infrastructure to Support a New Research Reactor Project* telah diadakan pada 4 hingga 8 Mei 2015 di Ibu Pejabat IAEA, Vienna, Austria.

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11.1.10) Development of Nuclear Reactor Technology

As a nuclear research and development centre in Malaysia, Nukear Malaysia actively participated in various programs, including technical meetings and courses involving study on nuclear technology for research and power generation reactor.

a) Training Workshop on Assessment of the National Nuclear Infrastructure to Support a New Research Reactor Project was held on 4 to 8 May 2015 at IAEA Headquarters, Vienna, Austria.

Foto 11.10: Peserta-peserta *Training Workshop on Assessment of the National Nuclear Infrastructure to Support a New Research Reactor Project*
Photo 11.10: Participants of Training Workshop on Assessment of the National Nuclear Infrastructure to Support a New Research Reactor Project

b) *IAEA Workshop on the Advanced Practical Applications on Generating and Interpreting Results Using the Relap-5 Computer Code* telah diadakan pada 22 sehingga 26 Jun 2015 di Hanoi, Vietnam.

b) IAEA Workshop on the Advanced Practical Applications on Generating and Interpreting Results Using the Relap-5 Computer Code, 22 to 26 June 2015 at Hanoi, Vietnam.

Foto 11.11: *IAEA Workshop on the Advanced Practical Applications on Generating and Interpreting Results Using the Relap-5 Computer Code* disertai oleh Nuklear Malaysia, AELB, dan TNB.
Photo 11.11: IAEA Workshop on the Advanced Practical Applications on Generating and Interpreting Results Using the Relap-5 Computer Code was participated by Nuklear Malaysia, AELB, and TNB.

c) *Training Course on High Temperature Gas Cooled Reactor Technology* telah diadakan pada 19 hingga 23 Oktober 2015 di Serpong, Indonesia.

c) Training Course on High Temperature Gas Cooled Reactor Technology was held on 19 to 23 October 2015 at Serpong, Indonesia.

Foto 11.12: Peserta-peserta kursus bersama pakar-pakar dari IAEA
Photo 11.12: The participants with the IAEA experts

d) *MEXT Nuclear Research Exchange Program 2015 telah dijalankan di Institut Penyelidikan Kejuruteraan Nuklear (RINE) pada 16 September hingga 4 Disember 2015 di Universiti Fukui, Kampus Tsuruga.*

d) MEXT Nuclear Research Exchange Program 2015 was carried out at Research Institute of Nuclear Engineering (RINE) on 16 September to 4 December 2015 at University of Fukui, Tsuruga Campus.

Foto 11.13: Peserta-peserta MEXT Nuclear Research Exchange Program 2015 dari pelbagai negara.
Photo 11.13: Participants of MEXT Nuclear Research Exchange Program 2015 from various countries.

.....12 KESELAMATAN DAN KESIHATAN PEKERJAAN

Jawatankuasa Keselamatan, Kesihatan dan Alam Sekitar (JKSHE) Nuklear Malaysia ditubuhkan untuk menjamin keselamatan dan kesihatan di tempat kerja. Manakala Bahagian Keselamatan dan Kesihatan Sinaran (BKS) bertindak sebagai sekretariat. JKSHE juga berperanan untuk memantau keselamatan, sekuriti, kawal selia dan perlindungan sinaran. Pemantauan dilakukan supaya aktiviti yang dijalankan memenuhi garis panduan Sistem Pengurusan SHE dan IAEA, termasuk peraturan Lembaga Perlesenan Tenaga Atom (LPTA), Jabatan Keselamatan dan Kesihatan Pekerjaan (JKKP) dan Jabatan Alam Sekitar (JAS)

OCCUPATIONAL HEALTHS AND SAFETY

Safety, Health and Environmental Committee (JKSHE) Nuklear Malaysian has established to ensure the safety and health at workplace. Meanwhile, Health and Radiation Safety Division (BKS) as the secretariat. In addition, JKSHE also monitors safety, security, safeguard and radiation protection. Monitoring is implemented in order to comply with the standard required by SHE Management System and IAEA, includes regulations enforced by Atomic Energy Licensing Board (AELB), Department of Occupational Safety and Health (DOSH) and Department of Environment (DOE).

12.1) Pematuhan Amalan Standard Keselamatan dan Kesihatan

Sebanyak 11 permohonan baru pengubahsuaian kemudahan telah dinilai dan disyorkan oleh Jawatankuasa Kecil Kemudahan Utama (JKKU). Ini sebagai syarat pematuhan amalan standard Sistem Pengurusan SHE dan peraturan yang dikuatkuasa oleh LPTA, JKKP dan JAS (Akta 304 dan 504). Sebanyak lima permohonan pengubahsuaian dan pembangunan makmal untuk kelulusan Jawatankuasa Kecil Makmal dan Kerja Lapangan (JKMKL) telah dinilai dan disyorkan. Sementara itu, Jawatankuasa Kecil Keselamatan Fizikal (JKKF) menerima dua permohonan melibatkan sekuriti dan kawal selia di premis Nuklear Malaysia dan lapangan. Jawatankuasa Kecil Audit (JKA) telah mengaudit dua kemudahan utama dan satu lokasi kerja lapangan. Jawatankuasa Kecil Kecemasan (JKK) telah melakukan 40 kali latih amal pengosongan bangunan di blok yang berlainan. Latih amal kecemasan di bangunan Reaktor TRIGA PUSPATI (RTP) pula melibatkan Skuad Kimia, Biologi, Radiologi dan Nuklear (CBRN), Keselamatan Fizikal, Memadam Kebakaran, Kejuruteraan dan Bantu Mula. Kakitangan LPTA juga telah hadir sebagai pemerhati dalam latih amal ini.

12.1) Compliance with the Standard Practice of Safety and Health

A total of 11 new applications of facilities modification has been evaluated and recommended by Subcommittee of Main Facilities (JKKU). This is compliance with the standard practices required by SHE Management System and regulations enforced by the AELB, DOSH and DOE (Act 304 and 504). A total of five applications of laboratory modification and development have been evaluated and recommended by Subcommittee of Laboratory and Field Work (JKMKL).Furthermore, subcommittee of Physical Security (JKKF) has received two applications on securities and safeguard for premises in Nuklear Malaysia and at field work. Subcommittee of Audit (JKA) has audited two main facilities and one at field work. Subcommittee of Emergencies (JKK) has conducted 40 evacuation drills at different building. Emergency drill for Reactor TRIGA PUSPATI (RTP) building involved the Chemical, Biological, Radiological and Nuclear (CBRN) Squad, Physical Security, Fire Fighting, Engineering and First Aider. The personnel from AELB also presented as an observer during the drill.

Foto 12.1: Mesyuarat JKK di Pusat Kawalan Kecemasan (ECC) semasa latih amal kecemasan reaktor

Photo 12.1: JKK meeting at Emergency Control Center (ECC) during an emergency drill for reactor

Foto 12.2: Latih amal pengosongan bangunan di blok berlainan Nuklear Malaysia
Photo 12.2: Evacuation drill at various buildings in Nuklear Malaysia

Jawatankuasa Kecil Penyelia Kawasan (JKPK) bertanggungjawab mengawal selia persekitaran bangunan dan kawasan kerja supaya kemas, selesa dan selamat. Bagi memantapkan fungsi dan tugas Penyelia Kawasan, JKPK telah menganjurkan Bengkel Penggunaan Alat Pemadam Api Mudah Alih pada 23 Oktober 2015 dan Bengkel Menangani Tumpahan Bahan Kimia dan Bahan Radioaktif pada 12 November 2015.

Sub-committee of Area Supervisor (JKPK) is responsible to monitor the building and working area for tidiness, comfortable and safe. To strengthen the functions and duties of Area Supervisor, JKPK has organized a Workshop on the Use of Mobile Fire Extinguishers on 23 October 2015 and Workshop on Handling of Spillage of Chemical and Radioactive Materials on 12 November 2015.

Foto 12.3: Demonstrasi menangani tumpahan bahan kimia dan radioaktif
Photo 12.3 :Demonstration of how to handle the chemical and radioactive spillage

Dua jawatankuasa kecil baharu telah dibentuk iaitu Jawatankuasa Kecil Keinstitusian Biokeselamatan (JKKB) dan Jawatankuasa Kecil Kemudahan Reaktor (JKKR). JKKB mengeluarkan panduan kepada penyelidik mengenai dasar dan isu keselamatan biologi dalam penyelidikan melibatkan penggunaan *'Living Modified Organism / Recombinant Deoxyribonucleic Asid (LMO/rDNA)'*. Manakala JKKR pula berperanan memastikan penggunaan kemudahan reaktor mematuhi standard peraturan keselamatan nuklear dan radiasi yang telah ditetapkan.

Kursus Keselamatan Sinaran dan Prosedur Kecemasan telah dianjurkan pada 6 hingga 7 Mei 2015 manakala Kursus Kesedaran Perlindungan Sinaran pada 20 Oktober 2015. Dua kursus ini bertujuan untuk memberi dan memupuk kesedaran keselamatan dan perlindungan sinaran kepada pekerja sinaran di Nuklear Malaysia.

Two new sub-committees were established such as Subcommittee of Biosafety Institutional (JKKB) and Subcommittee of Reactor Facility (JKKR). JKKB provide guidance to the researcher on policies and issues of biological safety for the use of 'Living Modified Organism / Recombinant Deoxyribonucleic Acid (LMO/rDNA)'. While the JKKR is to ensure the utilization of reactor facilities is compliance with radiation and nuclear safety standards and regulations.

Radiation Safety and Emergency Procedures Course was organized on 6 to 7 May 2015, while Radiation Protection Awareness Course on 20 October 2015. These two courses aimed to create awareness regarding safety and radiation protection for radiation workers in Nuklear Malaysia.

Foto 12.4: Ceramah yang disampaikan semasa Kursus Keselamatan Sinaran dan Prosedur Kecemasan
Photo 12.4: Lectures delivered during Radiation Safety and Emergency Procedures Course

JKMKL telah menganjurkan Seminar Keselamatan Kimia pada 17 November 2015. Seminar ini bertujuan untuk meningkatkan kesedaran serta pengetahuan mengenai pengurusan hazard kimia, pencegahan kemalangan, kebakaran dan letupan di tempat kerja kepada pembantu makmal.

JKMKL has organized Chemical Safety Seminar on 17 November 2015. This seminar aimed to enhance awareness and knowledge on chemical hazard management, prevention of accident, fire and explosion at the workplace for laboratory assistant.

Foto 12.5: Ceramah disampaikan semasa Seminar Keselamatan Kimia anjuran JKMKL
Photo 12.5: Lectures delivered at Seminar on Chemical Safety organized by JKMKL

Bengkel Keselamatan Sinaran dan Penilaian Dos Kemudahan Utama 2015 telah diadakan pada 24 hingga 27 November 2015 bagi membentangkan data dos sinaran di kemudahan utama Nuklear Malaysia. Tujuan bengkel adalah untuk mengkaji dan menilai semula status pengkelasan kawasan kerja mengikut syarat Perlesenan Tenaga Atom (Perlindungan Sinaran Keselamatan Asas 2010). Seramai 50 peserta yang terdiri daripada wakil kemudahan utama telah menghadiri bengkel ini.

Workshop of Radiation Safety and Dose Assessment for Main Facilities 2015 was held on 24 to 27 November 2015 to present data on radiation dose in the Nuklear Malaysia main facilities. This workshop aimed to study and re-evaluate the status of classification of area in accordance with the Atomic Energy Licensing (Basic Safety Radiation Protection Regulations 2010). A total of 50 participants comprising representatives of major facilities attended the workshop.

Foto 12.6: Pembentangan laporan pelaksanaan Program Perlindungan Sinaran dan Penilaian Dos semasa Bengkel Keselamatan Sinaran dan Penilaian Dos Kemudahan Utama
Photo 12.6: Presentation of reports on implementation of Radiation Protection Program and Dose Assessment during the of Radiation Safety and Dose Assessment for Main Facilities

12.2) Memperkasa Keselamatan, Sekuriti dan Kawal Selia (3S)

Seramai 37 penyelia sinaran telah diiktiraf di bawah lesen LPTA/A/724 bagi membantu pegawai perlindungan sinaran (RPO) menguruskan aspek pematuhan ke atas Program Perlindungan Sinaran dan syarat lesen LPTA/A/724. Sementara 17 juruperunding perlindungan sinaran (JPS) telah diiktiraf di bawah lesen LPTA/A/724 bagi memberikan khidmat perundingan perlindungan sinaran kepada industri dan agensi. Sebanyak 120 khidmat perundingan perlindungan sinaran telah diberikan oleh Nuklear Malaysia kepada pihak industri.

12.2) Strengthening Safety, Security and Safeguard (3S)

A total of 37 Radiation Supervisor has been recognized by LPTA under license LPTA/A/724 to assist the radiation protection officer (RPO) in implementing the Radiation Protection Program to compliance with this license. While 17 radiation protection consultants (JPS) have been recognized under the same license to provide consultancy services to the industries and agencies. A total of 120 consultancy services on radiation protection have been provided by the Nuklear Malaysia to the industries.

12.3) Perkhidmatan Teknikal berkaitan Keselamatan dan Kesihatan

Berikut adalah perkhidmatan yang ditawarkan oleh Nuklear Malaysia kepada industri:

i. Perkhidmatan tentukuran peralatan meter tinjau

Makmal Standard Dosimetri Sekunder (SSDL) mempunyai kepakaran dalam memberi perkhidmatan tentukuran meter tinjau bagi sinar-X, gama, beta dan neutron. Tentukuran adalah perlu bagi mendapatkan lesen mengendali bahan radioaktif dan nuklear serta radas penyinaran di Malaysia. Lebih 1,000 perkhidmatan tentukuran telah diberikan melibatkan sebanyak 4,454 unit meter tinjau.

12.3) Technical Services Related to Radiation Safety and Health

The following are services offered by Nuklear Malaysia to the industries.

i.Calibration service of radiation survey meter

Secondary Standard Dosimetry Laboratory (SSDL) has expertise in providing calibration of survey meter for X-ray, gamma, beta and neutron. Calibration is necessary for the user to obtain license for handling radioactive materials, nuclear and irradiation apparatus in Malaysia. More than 1,000 calibration services have been provided covering 4,454 units of survey meter.

Foto 12.7: Penyinar gama yang digunakan dalam tentukuran meter tinjau
Photo 12.7: Gamma Irradiator used for survey meter calibration

Foto 12.8: Mesin sinar-X bagi tentukuran meter tinjau
Photo 12.8: X-ray machine for survey meter calibration

ii. Perkhidmatan pemantauan dos peribadi dan kawasan

SSDL telah menyediakan perkhidmatan pemantauan dos peribadi dan persekitaran di Malaysia. Perkhidmatan ini untuk mengawasi keselamatan pekerja sinaran supaya tidak melebihi had dos yang dibenarkan iaitu 20 mSv setahun. Lebih 20,000 pekerja sinaran daripada

ii. Personal and area dose monitoring services

SSDL has provided personal and area dose monitoring services in Malaysia. The monitoring services are done to ensure that the radiation workers do not receive more than 20 mSv per year. More than 20,000 radiation workers from 1,600 services every month for personal dose using film

1600 perkhidmatan yang diberikan setiap bulan bagi dos peribadi menggunakan lencana filem, dosimeter *thermoluminescence* (TLD) dan *dosimeter optically stimulated luminescence* (OSLD). Sejumlah 113,323 unit TLD dikeluarkan dalam tempoh Januari hingga Jun, sementara mulai Julai hingga Disember, sebanyak 103,951 unit OSLD dikeluarkan menggantikan TLD telah dibekalkan kepada pekerja sinaran di Malaysia.

badges, thermoluminescence dosimeter (TLD) and optically stimulated luminescence dosimeter (OSLD). A total of 113,323 units TLD has been produced from January to June, while, 103,951 units OSLD has been produced to replace TLD from July to December have been supplied to radiation workers through out Malaysia.

Foto 12.9: Alat pembaca automatik kad TLD yang digunakan bagi mengukur jumlah luminesen dari TLD

Photo 12.9: Automatic TLD card reader used to measure the amount of luminescent from TLD

Foto 12.10: OSLD dan alat pembaca automatik OSLD yang digunakan bagi mengukur jumlah luminesen dari OSLD

Photo 12.10: OSLD and automatic OSLD reader used to measure the amount of luminescent from OSLD

iii. Perkhidmatan ujian kawalan mutu radas penyinaran sinar-X

Nuklear Malaysia telah diktiraf oleh Kementerian Kesihatan Malaysia (KKM) sebagai pemegang lesen kelas H bagi perkhidmatan ujian kawalan mutu radas penyinaran sinar-X di hospital dan klinik. Sejumlah 123 radas sinar-X di hospital dan klinik seluruh Malaysia dan Brunei telah menjalani ujian kawalan mutu oleh pakar teknikal Nuklear Malaysia. Perkhidmatan yang diberi adalah bagi memastikan radas sinar-X berada dalam keadaan kualiti optimum serta menjana dos yang minimum.

iii. Quality control test for X-ray irradiating apparatus services

Nuklear Malaysia has recognized by Ministry of Health (MOH) as a licence class H holder to deliver the quality control test for X-ray irradiating apparatus at hospital and A total of 123 x-ray irradiation apparatus in hospitals and clinics have been checked for quality control in 2015. This is to ensure that X-ray irradiating apparatus produces an optimum quality of diagnostic radiology image and provide a minimum dose to the patient.

Foto 12.11: Kakitangan teknikal KFP sedang menjalankan ujian kawalan mutu ke atas mesin sinar-X am di hospital
Photo 12.11; KFP's technical staff conducting a quality control test on the general X-ray machine in hospital

iv. Perkhidmatan tentukuran peralatan ujian kawalan mutu radiologi diagnostik

Peralatan yang digunakan bagi melakukan ujian kawalan mutu perlu ditentukur dalam selang masa setahun bagi memastikan ketepatan dan kejituan bacaan alat tersebut. Paramater yang ditentukur adalah merangkumi dos dan kV diagnostik, dos dan kV mamo, pemasa dedahan, sensitometer dan densitometer. Pelanggan bagi ujian kawalan mutu tersebut adalah pemegang lesen kelas H

iv. Calibration services of test equipment used in the quality control test in diagnostic radiology

The equipment used to perform quality control testing should be calibrated annually to ensure the accuracy and precision of the equipment. Those parameters that offer for calibration include a dose and kV diagnostic, dose and kV mammo, exposure timer, sensitometer and densitometer. Customers who send equipment for quality control testing for calibration is a Class H license holder MOH and

KKM serta hospital dan klinik yang menggunakan peralatan ujian berkenaan. Makmal Tentukuran Fizik Perubatan telah menjalankan tentukuran ke atas 269 alat terhadap semua parameter yang dinyatakan.

hospitals and clinics using the test equipment. A total of 269 test equipment were sent by the client to be calibrated at the Medical Physics Calibration Laboratory includes all the parameters specified.

Foto 12.12: Tentukuran peralatan ujian kawalan mutu radiologi diagnostik di Makmal Tentukuran Fizik Perubatan sedang dijalankan

Photo 12.12: A calibration of test equipment used in the quality control in diagnostic radiology at Medical Physics Calibration Laboratory is being performed

v. Perkhidmatan tentukuran kebuk terapi

SSDL memberikan perkhidmatan teknikal bagi tentukuran kebuk terapi hospital dan pusat perubatan di seluruh negara. Semua kebuk terapi daripada pusat radioterapi perlu ditentukur bagi memastikan ketepatan dan kejituan bacaan semasa peralatan ini digunakan bagi tujuan merawat pesakit. Tentukuran kebuk terapi menggunakan punca gama Co-60 di Bunker SSDL. Tentukuran telah dilakukan ke atas 107 unit kebuk terapi di SSDL sepanjang 2015.

v. Calibration services of therapy chamber

SSDL offer technical services for the calibration of therapy chamber for hospitals and medical centers across the country. All chamber therapy of radiotherapy centers should be calibrated to ensure the precision and accuracy of the chamber reading while the chamber is used for treating the patients. Calibration of therapy chamber using the gamma sources of Co-60 at Bunker SSDL. A total of 107 units have been delivering to calibrate in SSDL throughout 2015.

Foto 12.13: Mesin terapi yang digunakan untuk tentukuran kebuk terapi
Photo 12.13: Therapy machine that used for calibration of theraphy chamber

vi. Perkhidmatan tentukuran penentukur dos

Penentukur dos yang digunakan dalam Perubatan Nuklear di hospital dan di pusat perubatan ditentukur supaya bacaannya tepat dan jitu setiap masa bagi menjamin dos diberikan kepada pesakit dalam yang dibenarkan. Prestasi penentukur dos dinilai dari ujian dalam aspek pencemaran, kestabilan sistem, ketepatan,kemalaran, kelinearan, kejituan dan geometri. Sejumlah 39 penentukur dos telah ditentukur oleh pakar teknikal Nuklear Malaysia tahun 2015.

vi. Calibration services of dose calibrator

Dose calibrator used in Nuclear Medicine at hospitals and medical centers is calibrated to ensure accurate and precise readings in order to obtain an exact dose given to the patient within an allowable limit. The performance of dose calibrator is evaluated from various aspects such as contamination test, stability testing system, accuracy test, constancy test, linearity test, precision test and geometry test. A total of 39 dose calibrators have been calibrated by Nuklear Malaysia in 2015

Foto 12.14: Tentukuran penentukur dos sedang dijalankan di dalam Makmal Nuklear Malaysia
Photo 12.14: Calibration of dose calibrator is carrying out in Nuklear Malaysia laboratory

vii. Perkhidmatan ujian ketebalan setara plumbum bilik penyinaran

Integriti bilik penyinaran dari aspek ketebalan setara plumbum dinilai bagi mempastikan perlindungan dan pemerisaian dari sinaran mengion mencukupi. Bilik penyinaran dipastikan mempunyai taburan dos lebih rendah daripada 20 mSv setahun bagi pekerja sinaran dan 1 mSv setahun bagi orang awam. Ketebalan setara plumbum telah diuji ke atas 107 bilik penyinaran di pusat perubatan swasta serta klinik dan hospital awam.

vii. Lead equivalent thickness testing services for irradiation room

Integrity of irradiation room in terms of lead equivalent thickness is evaluated to ensure sufficient protection and shielding from ionizing radiation. Dose distribution in irradiation room has to be lowered than 20 mSv per year for radiation workers and 1 mSv per year for the public. Lead equivalent thickness of 107 irradiation rooms have been tested for a private medical center as well as clinics and hospitals.

Foto 12.15: Ujian ketebalan setara plumbum bagi cermin plumbum di bilik penyinaran sedang dilakukan

Photo 12.15: Testing for lead equivalent thickness of lead glass in irradiation room is being conducted

viii. Perkhidmatan ujian kebocoran punca terkedap

Ujian kebocoran dilakukan ke atas punca sinaran terkedap bagi mengetahui status punca tersebut. Sebanyak 226 punca terkedap telah diuji oleh pakar teknikal Nuklear Malaysia.

viii. Leak testing services for sealed source

Leak test is conducted on the sealed source in order to obtain information of presence condition. A total of 226 sealed sources have been tested by technical expert of Nuklear Malaysia.

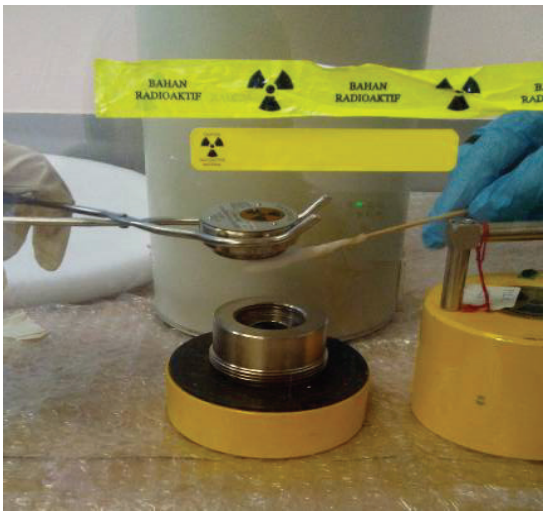


Foto 12.16: Ujian kebocoran punca terkedap sedang dilakukan bagi punca Sr-90
Photo 12.16: Sealed source of Sr-90 have been tested for leak testing

ix. Perkhidmatan dosimetri aras tinggi untuk aplikasi industri

Kebolehpercayaan dan ketepatan sistem dosimeter aras tinggi mempunyai peranan penting dalam kawalan dan jaminan kualiti industri pemprosesan sinaran. Dosimeter *'ceric-cerous'* mampu mengukur dos penyinaran di dalam julat 5 kGy sehingga 50 kGy. Sebanyak 15,300 unit dosimeter 'ceric-cerous' telah dihasilkan dan dibekalkan kepada pelanggan untuk tahun 2015.

ix. High dose dosimetry services for industrial application

The reliability and accuracy of the dosimeter system plays an important role in control and quality assurance in industrial radiation processing. The ceric-cerous dosimeters can measure radiation doses in the range of 5 kGy to 50 kGy. Around 15,300 units of ceric-cerous dosimeters were produced and supplied to the customer in the year 2015.

Foto 12.17: Dosimeter aras tinggi yang dibekalkan oleh SSDL
Foto 12.17: High dose dosimeter supplied by the SSDL

.....13 HUBUNGAN DAN KERJASAMA ANTARABANGSA

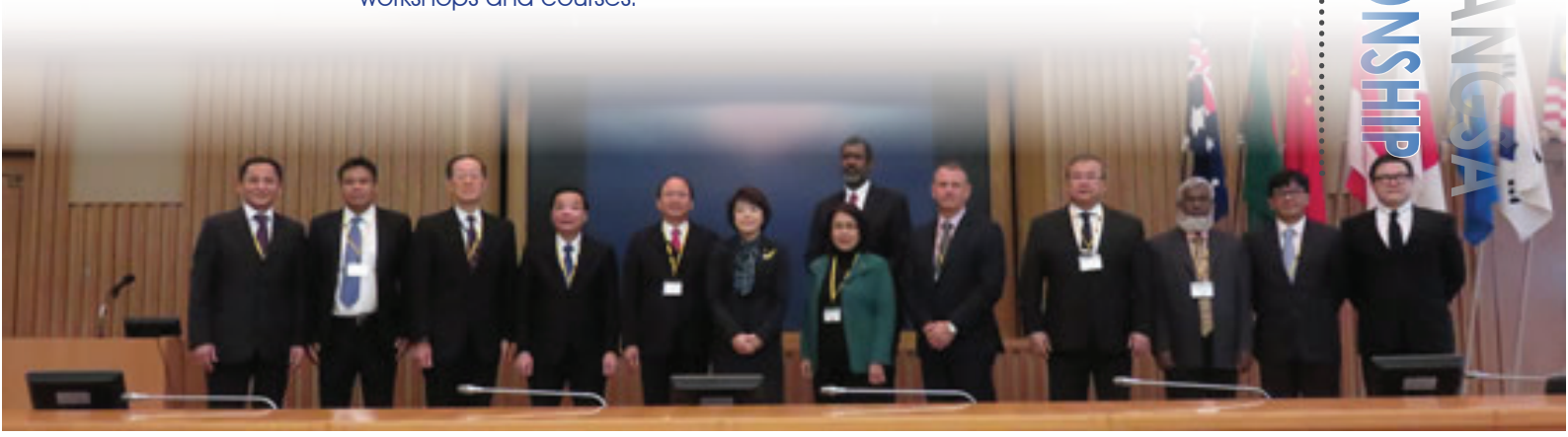
Agensi Nuklear Malaysia mempunyai kerangka kerjasama serantau dan antarabangsa dalam pelbagai bidang penyelidikan serta bergiat aktif di dalam rangka kerjasama serantau dan antarabangsa seperti dengan Agensi Tenaga Atom Antarabangsa (IAEA), Projek Kerjasama Serantau (RCA), Forum Kerjasama Nuklear di Asia (FNCA), dan Suruhanjaya Persediaan Triti Pengharaman Menyeluruh Ujian Senjata Nuklear (CTBT). Kerjasama ini bertujuan bagi membangunkan sains dan teknologi nuklear secara aman di Malaysia.

Skop kerjasama adalah merangkumi bantuan kepakaran, penempatan dan latihan pegawai penyelidik di bawah program fellowship dan lawatan saintifik, penyertaan dan penganjuran persidangan, mesyuarat teknikal, seminar, bengkel dan kursus.

INTERNATIONAL RELATIONS AND COOPERATIONS

Malaysian Nuclear Agency (Nuklear Malaysia) has the framework of regional and international cooperation in various fields of research and has actively involved in regional and international cooperation such as the International Atomic Energy Agency (IAEA), Regional Cooperative Agreement (RCA), Forum for Nuclear Cooperation in Asia (FNCA), and the Preparatory Commission for Comprehensive Nuclear Test Ban Treaty (CTBT). This collaboration is aimed at developing a peaceful use of nuclear science and technology in Malaysia.

The scope of cooperation includes expert missions, placements and trainings of researchers under the fellowship programs and scientific visits, participation and organizing of conferences, technical meetings, seminars, workshops and courses.



13.1) Aktiviti

13.1.1) Aktiviti 1 : Persidangan Agong IAEA ke-59

Delegasi Malaysia telah menghadiri Persidangan Agong IAEA ke-59 yang berlangsung pada 14 hingga 18 September 2015. Delegasi Malaysia yang diketuai oleh Duta Malaysia di Austria, Ketua Pengarah Nuklear Malaysia, Ketua Pengarah LPTA dan Pengarah Bahagian Perancangan dan Hubungan Antarabangsa telah hadir ke persidangan ini untuk mewakili, menyuarakan dan mempertahankan pendirian Malaysia dalam pelbagai isu berbangkit.

Pada persidangan tersebut Malaysia telah menyuarakan dan mempertahankan pendirian negara berkaitan penggunaan tenaga nuklear secara aman di Malaysia. Penglibatan aktif Malaysia dalam IAEA memberikan hasil positif yang membolehkan perlaksanaan kerjasama strategik dikalangan negara ahli dalam bidang sains dan teknologi nuklear.

13.1) Activity

13.1.1) Activity 1: IAEA 59th General Conference

Malaysian delegations had attended the 59th IAEA General Conference which took place on 14 to 18 September 2015. The Malaysian delegation headed by the Malaysian Ambassador in Vienna together with the Director General of Nuklear Malaysia, Director General of AELB and Director of Planning and International Relations Division had attend the General Conference to represent, express and defend Malaysia stance in various issues raised

At the conference, Malaysia have expressed and defended the country's stance regarding the peaceful use of nuclear energy in Malaysia. Active participation of Malaysia's in the IAEA gives a positive outcome that enables the implementation of the strategic cooperation among member countries in the field of nuclear science and technology.

Foto 13.1: Delegasi Malaysia pada Persidangan Agong IAEA ke-59 di Vienna Austria
Photo 13.1: Malaysian delegations at the 59th IAEA General Conference, Vienna Austria

13.1.2) Aktiviti 2 : Bengkel penyediaan "Country Programme Framework, (CPF) 2017-2021"

Bengkel penyediaan CPF telah diadakan pada 28 hingga 30 Oktober 2015 di Hotel Mahkota, Melaka. Hasil daripada bengkel tersebut, satu draf dokumen CPF telah telah di sediakan dan dokumen ini telah dihantar kepada IAEA. Dokumen ini akan menjadi sumber rujukan utama sebagai panduan untuk merangka dan membentuk kerjasama teknikal diantara Malaysia dan IAEA pada masa hadapan.

13.1.3) Aktiviti 3 : Mesyuarat FNCA Peringkat Menteri ke-16

Delegasi Malaysia telah diketuai oleh YB Datuk Seri Panglima Madius Tangau, Menteri di MOSTI dan disertai oleh Ketua Pengarah Nuklear Malaysia, penyelaras FNCA di Malaysia dan pegawai berkaitan. Mesyuarat FNCA ini telah berlangsung pada 7 hingga 9 Disember 2015. Mesyuarat di peringkat menteri ini bertujuan untuk membincangkan mengenai langkah-langkah kerjasama dan polisi tenaga nuklear di bawah rangka kerja FNCA.

13.1.2) Activity 2: Workshop on preparation of "Country Programme Framework, (CPF) 2017-2021"

Workshop on preparation of CPF was held on 28 to 30 October 2015 at the Mahkota Hotel, Melaka. As a result of the workshop, a CPF draft document has been prepared and this document was sent to the IAEA. This document will serve as the main source of reference to be used as a guide for formulating and designing future technical cooperation between Malaysia and IAEA.

13.1.3) Activity 3: FNCA 16th Ministerial Level Meeting

Malaysian delegation is led by the Hon. Datuk Seri Panglima Madius Tangau, Minister of MOSTI, together with the Director General of Nuklear Malaysia, FNCA Coordinator of Malaysia and relevant officers had attended this FNCA meeting. The FNCA meeting was took place on 7 to 9 December 2015. This ministerial level meeting aims to discuss on cooperation measures and nuclear energy policies under the FNCA framework.

Foto 13.2: YB Menteri MOSTI bersama menteri-menteri negara ahli FNCA di Jepun
Photo 13.2: Honorary Minister of MOSTI with representing minister from FNCA member country at Japan

13.2) Dokumen

13.2.1) Pelan Strategik Agensi Nuklear Malaysia 2012 – 2020

Pelan strategik Agensi Nuklear Malaysia menggariskan tujuh teras strategik bagi memastikan kejayaan Nuklear Malaysia dalam meningkatkan keupayaan pengetahuan sains dan teknologi nuklear kearah mereliasasikan misi Nuklear Malaysia. Setiap strategi dan pelan tindakan digariskan dalam dokumen ini adalah untuk memastikan visi dan misi Nuklear Malaysia tercapai.

13.2) Document

13.2.1) Malaysian Nuclear Agency Strategic Plan 2012 – 2020

The Malaysian Nuclear Agency Strategic Plan 2012 – 2020 outlines seven strategic thrust that will ensure the success of Nuklear Malaysia for advancement of knowledge in nuclear science and technology towards the realization of Nuclear Malaysia mission. Each strategy and action plan in this document will ensure that Nuklear Malaysia's vision and mission are achieved.

Rajah 13.1: Rangka Kerja Program Negara, (CPF) 2017-2021
Figure 13.1: Country Programme Framework, (CPF) 2017-2021

Dokumen Rangka Kerja Program Negara (CPF) merupakan rangka kerja bagi penyediaan kerjasama teknikal antara Malaysia dan IAEA. Objektif dokumen CPF ini adalah untuk mewujudkan persefahaman di antara Malaysia dan IAEA dengan tumpuan projek-projek kerjasama teknikal kepada bidang keutamaan negara. Ini adalah supaya projek-projek kerjasama teknikal yang di laksanakan akan memberikan impak yang signifikan dan menyokong program nasional untuk pembangunan sosio-ekonomi.

The Country Programme Framework (CPF) document constitutes the framework for the provision of technical cooperation between Malaysia and the IAEA. The objective of CPF is to establish mutual understanding between Malaysia and IAEA focusing on Technical Cooperation (TC) project aligned with national priority areas. As a result this TC project will deliver significant impact and support the national programme for socio-economic development.

13.3) Projek

Pada masa yang sama, Nuklear Malaysia bertanggungjawab mengurus hubungan dan kerjasama antarabangsa dalam pelbagai projek dan program. Projek–projek tersebut adalah disenaraikan seperti dibawah.

13.3) Projects

At the same time, Nuklear Malaysia is responsible for managing international relations and operation in various projects and programs. The projects are listed below.

Jadual 13.1: Senarai Projek yang Aktif
Table 13.1: List of Active Project

Bil.	Kod Projek	Tajuk projek	Koordinator projek
A	**IAEA COORDINATED RESEARCH PROJECTS**		
1.	16565	**CRP Title :** *Radiation Treatment of Wastewater for Reuse with Particular Focus on Wastewaters Containing Organic Pollutants* **Project Title :** *Radiation Treatment for Recycling of Industrial Wastewater for Industrial Usage*	Agensi Nuklear Malaysia - BTS
2.	16860	**CRP Title :** *Approaches to Improvement of Crop Genotypes with High Water and Nutrient use Efficiency for Water Scarce Environments* **Project Title :** *Mutation Breeding for the Evaluation of Advanced Mutants Lines of Aerobic Rice for Yield Potential and Stability under Water Stress Condition*	Agensi Nuklear Malaysia - BAB
3.	16861	**CRP Title :** *Approaches to Improvement of Crop Genotypes with High Water and Nutrient use Efficiency for Water Scarce Environments* **Project Title :** *Enhancing Nutrient and Water Use Efficiency of New Varieties of Malaysian Aerobic Rice, MR219-4 and MR219-9*	Agensi Nuklear Malaysia - BAB
4.	17122	**CRP Title :** *Strengthening of "Biological dosimetry" in IAEA Member States: Improvement of current techniques and intensification of collaboration and networking among the different institutes* **Project Title :** *Development of a Calibration Curve using Premature Chromosome Condensation (PCC) and Micronuclei (MN) Assays for Malaysia Biological Dosimetry*	Agensi Nuklear Malaysia - BTP

5.	17228	**CRP Title :** *Application of Two and Three Dimensional Neutron Imaging with Focus on Cultural Heritage Research* **Project Title :** *Enhancement and Utilization of Neutron Radiography and Neutron Tomography System at TRIGA MARK II PUSPATI Nuclear Reactor for Cultural Artifact Characterization*	Agensi Nuklear Malaysia - BST
6.	17374	**CRP Title :** *Radiometric Methods for Measuring and Modelling Multiphase Systems Towards Process Management* **Project Title :** *Advanced Radiometric Techniques to Study Liquid and Gas Hydrodynamics in Bubble Columns/Slurry Bubble Columns*	Agensi Nuklear Malaysia - BTI
7.	17399	**CRP Title :** *Development of an Integrated Approach to Routine Automation of Neutron Activation Analysis* **Project Title :** *Development of Process Automation in the Neutron Activation Analysis Facility in Malaysian Nuclear Agency*	Agensi Nuklear Malaysia - BST
8.	17457	**CRP Title :** *Application of Radiation Technology in the Development of Advanced Packaging Materials for Food Products* **Project Title :** *Radiation Modified Polymeric Material for Active Packaging Applications*	Agensi Nuklear Malaysia - BTS
9.	18306	**CRP Title :** *Instructive Surfaces and Scaffolds for Tissue Engineering Using Radiation Technology* **Project Title :** *The Development of 3 Dimensional Tissue Scaffolds for Tissue Engineering Application via Microstereolithography Technique*	Agensi Nuklear Malaysia - BTS
10.	18450	**CRP Title :** *Nanosized Delivery Systems for Radiopharmaceuticals* **Project Title :** *Nanosized Delivery Systems for Radiopharmaceuticals*	Agensi Nuklear Malaysia - BTP
11.	18865	**CRP Title:** *Options and Technologies for Managing the Back End of the Research Reactor Nuclear Fuel Cycle* **Project Title:** *Comparative Analysis of Two Strategic Spent Fuel Management Options in Malaysia*	Agensi Nuklear Malaysia - BAS

12.	18988	**CRP Title:** *Multi-Element Analysis in Tin Processing Plants Using Neutron-Induced Prompt Gamma-Ray Techniques (Capture Reactions and Inelastic Scattering Reactions)* **Project Title:** *Development of Radiometric Methods for Exploration and Process Optimization in Mining and Mineral Industries*	Agensi Nuklear Malaysia - BTI
13.	19306	**CRP Title:** *Rapid Screening Techniques for Disease Resistance in Banana against Fusarium Wilt through Mutation Induction using Chronic Gamma Irradiation* **Project Title:** *Efficient Screening Techniques to Identify Mutants with Disease Resistance for Coffee and Banana*	Agensi Nuklear Malaysia - BAB
14.	16697	**Project Title:** *Radiation Curing of Composites for Enhancing their Features and Utility in Helath Care and Industry*	Agensi Nuklear Malaysia - BTS
15.	17526	**CRP Title:** *Integrated Utilization of Cereal Mutant Varieties in Crop/Livestock Production Systems for Climate Smart Agriculture* **Project Title:** *Evaluation and Selection of Rice Mutants/Varieties for Utilization to Increase Yield and Production and for Quality Fodder*	Universiti Putra Malaysia
16.	18272	**CRP Title:** *Advanced Moderators for Intense Cold Neutron Beams in Materials Research* **Project Title:** *Neutron Moderation Effectiveness by Alumina (LTCC Based) and Polymeric Materials such as Teflon under TRIGA Neutron Environment with and without Be filter Cooled with liquid Nitrogen*	Universiti Tenaga Nasional
17.	18337	**CRP Title:** *Evidence-Based Assessment of Radiotherapy Demand and Quality of Radiotherapy Services* **Project Title:** *Radiotherapy Utilization Rate in Developing Countries - a Survey*	Institut Kanser Negara
18.	18454	**CRP Title:** *Application and Development of Isotope Techniques to Evaluate Human Impacts on Water Balance and Nutrient Dynamics of Large River Basins* **Project Title:** *The Water Balance of Perak River Basin: Stable Isotope Constrains*	Universiti Sains Malaysia

19.	18668	**CRP Title:** *Assessing the National and Regional Economic and Social Effects of Nuclear Programmes* **Project Title:** *Assessing Economic, Social and Environmental Impacts of Nuclear Power Plant for Electricity Production in Malaysia*	Universiti Putra Malaysia

B	**IAEA TECHNICAL COOPERATION (TC) NATIONAL PROJECTS**		
1	MAL/1/012	*Building Capacity in Basic Neutron Science and Engineering for Education, Training and Research Using a TRIGA Mark II Research Reactor*	Agensi Nuklear Malaysia
2	MAL/1/013	*Enhancing the National Non-Destructive Testing Capabilities for the Nuclear Power Programme*	Agensi Nuklear Malaysia
3	MAL/7/005	*Studying the Impact of Climate Change on Water Resources by Using Integrated Isotope, Hydro-chemical and Conventional Methods*	Agensi Nuklear Malaysia
4	MAL/9/015	*Supporting Site Characterization for the Development of a Low Level Waste Repository and Borehole Disposal Facility*	Agensi Nuklear Malaysia
5	MAL/9/016	*Strengthening the Regulatory Authority's Capabilities to Support the Development of the Nuclear Power Programme*	Lembaga Perlesenan Tenaga Atom
6	MAL/2/006	*Supporting Development National Nuclear Power Infrastructure*	*Malaysian Nuclear Power Corporation*
7	MAL/6/021	*Improving Human Resource Skills in Hybrid Imaging*	Universiti Putra Malaysia

C	IAEA REGIONAL COOPERATIVE AGREEMENT (RCA) PROJECTS		
1.	RAS0068	*Enhancing the Management of the Regional Agreement and Programme*	Agensi Nuklear Malaysia
2.	RAS1014	*Supporting Radiation Processing for the Development of Advanced Grafted Materials for Industrial Applications and Environmental Preservation*	Agensi Nuklear Malaysia
3.	RAS1020	*Building Capacity for Applications of Advanced Non-Destructive Evaluation Technologies for Enhancing Industrial Productivity*	Agensi Nuklear Malaysia
4.	RAS5056	*Supporting Mutation Breeding Approaches to Develop New Crop Varieties Adaptable to Climate Change*	Agensi Nuklear Malaysia
5.	RAS5070	*Developing Bioenergy Crops to Optimize Marginal Land Productivity through Mutation Breeding and Related Techniques*	Agensi Nuklear Malaysia
6.	RAS5071	*Strengthening Adaptive Climate Change Strategies for Food Security through the use of Food Irradiation*	Agensi Nuklear Malaysia
7.	RAS7021	*Marine benchmark study on the possible impact of the Fukushima radioactive releases in the Asia-Pacific Region*	Agensi Nuklear Malaysia
8.	RAS7022	*Applying Isotope Techniques to Investigate Groundwater Dynamics and Recharge Rate for Sustainable Groundwater Resource Management*	Agensi Nuklear Malaysia
9.	RAS7023	*Supporting Sustainable Air Pollution Monitoring Using Nuclear Analytical Technology*	Agensi Nuklear Malaysia
10.	RAS7024	*Supporting Nuclear and Isotopic Techniques to Assess Climate Change for Sustainable Marine Ecosystem Management*	Agensi Nuklear Malaysia
11.	RAS6065	*Strengthening the Application of Stereotactic Body Radiation Therapy to Improve Cancer Treatment*	Hospital Kuala Lumpur
12.	RAS6071	*Strengthening Radionuclide Therapy for High Impact Cancer Treatment Strategy in Member States of the Regional Cooperative Agreement*	Hospital Pulau Pinang
13.	RAS6072	*Strengthening Intensity Modulated Radiation Therapy Capability in the Region*	Institut Kanser Negara
14.	RAS6076	*Improving Cancer Management Through Strengthening the Computed Tomography Cancer Staging Process*	Universiti Putra Malaysia
15.	RAS6077	*Strengthening the Effectiveness and Extent of Medical Physics Education and Training*	Hospital Universiti Sains Malaysia
16.	RAS5055	*Improving Soil Fertility, Land Productivity and Land Degradation Mitigation*	Universiti Pendidikan Sultan Idris
17.	RAS6053	*Improving Image Based Radiation Therapy for Common Cancers in the RCA Region*	Universiti Kebangsaan Malaysia
18.	RAS6062	*Supporting 3D Image-Guided Brachytherapy Services*	Universiti Kebangsaan Malaysia

D	FORUM FOR NUCLEAR COOPERATION IN ASIA (FNCA) PROJECTS		
1.		Mutation Breeding	Agensi Nuklear Malaysia
2.		Biofertilizer	Agensi Nuklear Malaysia
3.		Electron Accelerator Application	Agensi Nuklear Malaysia
4.		Radiation Oncology	Institut Kanser Negara
5.		Research Reactor Network	Agensi Nuklear Malaysia
6.		Neutron Activation Analysis	Agensi Nuklear Malaysia
7.		Safety Management Systems for Nuclear Facilities	Agensi Nuklear Malaysia
8.		Radiation Safety and Radioactive Waste Management	Agensi Nuklear Malaysia
9.		Human Resources Development	Agensi Nuklear Malaysia
10.		Nuclear Security and Safeguards	Lembaga Perlesenan Tenaga Atom

13.4) Kerjasama Dua Hala Antarabangsa

Dalam usaha menyokong dan memantapkan program penyelidikan dan pembangunan teknologi nuklear di Malaysia, Nuklear Malaysia sentiasa berusaha untuk meneroka peluang kerjasama dua hala dengan pelbagai institusi dan agensi di peringkat serantau dan antarabangsa. Jaringan kerjasama dua hala ini dilakukan melalui pelaksanaan Memorandum Persefahaman (MoU) atau Memorandum Perjanjian (MoA) dan Perjanjian Kerahsiaan (NDA).

Sehingga 2015, Nuklear Malaysia telah mengadakan rundingan awal untuk mengadakan kerjasama dua hala dengan *Korea Atomic Energy Research Institute* (KAERI) di mana *Implementing Arrangement* antara Nuklear Malaysia dan KAERI telah ditandatangani. Nuklear Malaysia juga telah bekerjasama dengan *Malaysian Industry-Government Group for High Technology* (MIGHT), untuk mewujudkan hubungan kerjasama dua hala dalam bidang teknologi nuklear dengan *Japan Atomic Energy Agency* (JAEA), yang telah di mulakan pada tahun 2015. Di samping itu Nuklear Malaysia juga mengfokuskan untuk mengadakan jalinan kerjasama dengan Badan Tenaga Nuklir Nasional (BATAN), Indonesia

13.4) International Bilateral Cooperation

In the process of supporting and enhancing Research and Development of nuclear sciences and technology in Malaysia, Nuklear Malaysia has seek an opportunity to establish bilateral cooperation with various institutions and agencies in the region and internationally. This bilateral cooperation was being implemented through memorandum of understanding (MoU) or Memorandum of Agreement (MoA) and Non-Disclosure Agreement (NDA).

Until 2015, Nuklear Malaysia has works on early negotiations to process the bilateral cooperation with Korea Atomic Energy Research Institute, (KAERI), where Implementing Arrangement between Nuklear Malaysia and KAERI has been signed. Nuklear Malaysia also has initiated in 2015 cooperation with Malaysian Industry-Government Group for High Technology, (MIGHT) to establish bilateral arrangements in the field of nuclear technology with Japan Atomic Energy Agency, (JAEA). In addition, Nuklear Malaysia also focuses on joint ventures with the *Badan Tenaga Nuklir Nasional* (BATAN), Indonesia.

Jalinan kerjasama di antara Nuklear Malaysia dan pusat penyelidikan seperti ini akan mewujudkan satu platform untuk membolehkan pusat penyelidikan berkongsi pengetahuan, pengalaman dan kepakaran dalam bidang sains dan teknologi nuklear.

Secara keseluruhan, kerjasama dua hala di antara Nuklear Malaysia dan pelbagai institusi dan agensi di peringkat serantau dan antarabangsa ini amatlah penting dalam usaha menjadikan Nuklear Malaysia sebagai pusat penyelidikan dan pembangunan sains dan teknologi nuklear yang bertaraf dunia dan terus melangkah maju bagi menyumbang kepada peningkatan daya saing negara melalui output penyelidikan yang berkualiti dan berimpak tinggi.

Throughout the bilateral cooperation between Nuklear Malaysia and these research institute, will provide a platform for sharing of knowledge, experience and expertise in the field of nuclear science and technology.

In conclusion, these bilateral cooperation between Nuklear Malaysia and various institutions and agencies in the region and internationally are important for Nuklear Malaysia to be as an internationally recognized Centre of Excellence for research and development in the field of nuclear science and technology and towards the contribution to the country competitiveness through high quality and high impact research output.

.....14 PENGURUSAN

14.1 Pengurusan Perolehan

14.1.1 ePerolehan

Pada tahun 2015, Agensi Nuklear Malaysia telah melaksanakan sebanyak 75.9% perolehan bekalan dan perkhidmatan kerajaan melalui sistem ePerolehan. Pencapaian ini telah melebihi sasaran 75% yang ditetapkan oleh Kementerian Kewangan.

MANAGEMENT

14.1 Procurement Management

14.1.1 eProcurement

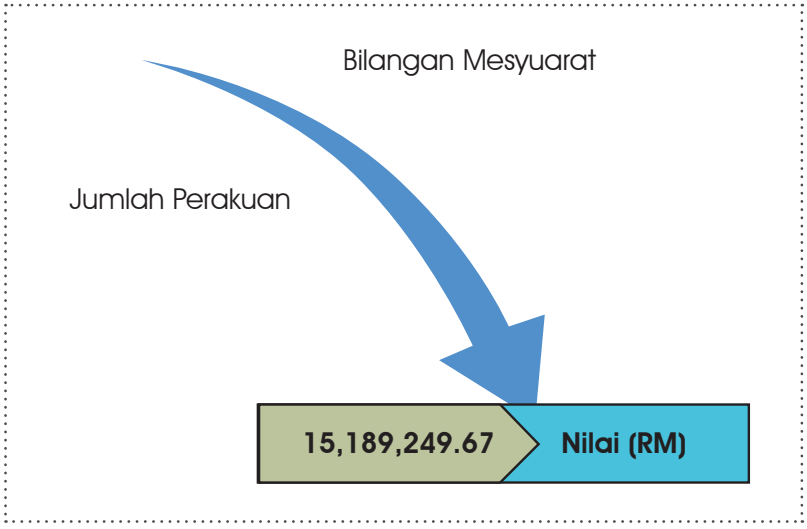
In 2015, Malaysian Nuclear Agency (Nuklear Malaysia) has implemented a total of 75.9% of government procurement for supplies and services eProcurement system. This performance has exceeded the target of 75% set by the Ministry of Finance.

14.1.2) Jawatankuasa Sebut Harga

Jawatankuasa Sebut Harga Nuklear Malaysia telah bersidang sebanyak 18 kali. Sehingga Disember 2015, 121 dokumen dengan nilai perolehan sebanyak RM15.1 juta telah dipertimbang dan diluluskan oleh jawatankuasa tersebut (Rajah 14.1).

14.1.2) Quotation Committee

Nuklear Malaysia Quotation Committee meeting was conducted 18 times. As of December 2015, 121 documents with procurement value of RM15.1 million has been considered and approved by the committee (Figure 14.1).



Rajah 14.1: Jumlah dokumen dan nilai perolehan yang diluluskan oleh Jawatankuasa Sebutharga
Figure 14.1: Number of documents and procurement value approved by Quotation Committee

14.1.3) Pelaksanaan Dasar GST ke atas Perolehan Kerajaan

Unit Perolehan telah menganjurkan kursus/taklimat Pelaksanaan Dasar GST pada 9 April 2015 bagi memberi penerangan kepada kakitangan Nuklear Malaysia berkaitan kenaan GST dalam perolehan Kerajaan selaras dengan penguatkuasaan Seksyen 56 Akta Cukai Barang dan Perkhidmatan 2014 [Akta 762].

14.1.3) GST Policy Implementation Towards Government Procurement

The Procurement Unit has organised GST Policy Implementation course / briefing on 9th April 2015 in order to provide information to the staff of Nuklear Malaysia regarding GST imposed in government procurement, in line with the enforcement of Section 56 Goods and Services Tax Act 2014 [Act 762].


Foto 14.1: Taklimat Perlaksanaan Dasar GST
Photo 14.1: Briefing on GST Policy Implementation

14.1.4) Pengurusan Aset dan Stor

a) Pendaftaran Harta Modal/ Inventori

Sebanyak 558 kad telah didaftarkan di dalam Sistem Pengurusan Aset (SPA). Ini meliputi Daftar Harta Modal, Kew.Pa-2 dan Daftar Aset Alih Bernilai Rendah, Kew.Pa-3 yang masing-masing sebanyak 336 dan 222 kad. Manakala, nilai perolehan aset pada tahun 2015 adalah RM9,061,623.97.

b) Pelupusan Aset

Sehingga Disember 2015, sebanyak 131 unit aset telah dilupuskan di Nuklear Malaysia dengan nilai perolehan asal sebanyak RM38, 875.00.

c) Kursus Pengurusan Aset

Selaras dengan penambahbaikan terhadap Pekeliling Perbendaharaan, Unit Pengurusan Aset (UPA) telah menganjurkan kursus pada 31 Mac 2015 untuk mendedahkan semua pegawai dan staf Nuklear Malaysia kepada penambahbaikan ini.

14.1.4) Asset and Store Management

a) Capital Asset/Inventory Registration

A total of 558 cards have been registered in the Assets Management System (SPA). This includes Capital Assets Register, Kew.Pa - 2 and Low Value Asset Register Kew.Pa - 3 of 336 and 222 cards, respectively. Meanwhile, the value for procurement of assets in 2015 was RM9, 061,623.97.

b) Asset Disposal

As of December 2015, a total of 131 units of asset have been disposed by Nuklear Malaysia with the original procurement value of RM38, 875.00

c) Asset Management Course

In accordance with the improvement of the Treasury Circular, Asset Management Unit (UPA) has organised a course on 31st March 2015 in order to expose all officers and staff of Nuklear Malaysia to this improvement.

Foto 14.2: Kursus pengurusan asset
Photo 14.2: Asset management course

d) Penubuhan Pasukan Pemantauan Aset dan Stor

Dalam memastikan pengurusan aset dan stor di Nuklear Malaysia mematuhi sepenuhnya tatacara pengurusan sebagaimana yang ditetapkan oleh Kementerian Kewangan, Unit Pengurusan Aset Nuklear Malaysia telah menubuhkan Pasukan Pemantauan Aset dan Stor. Sebanyak 21 siri lawatan yang meliputi 13 siri bagi pemantauan aset dan 8 siri bagi pemantauan stor telah dilaksanakan.

d) The Establishment of Asset and Store Monitoring Team

In order to ensure the management of assets and stores in Nuklear Malaysia implemented in accordance with management procedures as specified by Ministry of Finance; Asset Management Unit (UPA) of Nuklear Malaysia has established the Asset and Store Monitoring Team. A total of 21 series of visits that include 13 series of assets monitoring and 8 series of store monitoring has been executed.

14.1.5) Pengurusan Keselamatan Fizikal

Berikut adalah aktiviti-aktiviti yang telah dilaksanakan:

a) Menguruskan kemasukan sebanyak 62,178 pelawat ke Nuklear Malaysia.

b) Menguruskan pengeluaran dan pengagihan sebanyak 645 keping pas keselamatan di Nuklear Malaysia.

c) Menguatkuasakan Akta Kawasan Larangan Dan Tempat Larangan 1959, Akta Rahsia Rasmi 1972, Akta Polis 1967 serta peraturan -peraturan keselamatan lain yang berkaitan.

14.1.5) Physical Security Management

Activities that have been implemented as follow:

a) Managing the entry of 62,178 visitors to Nuklear Malaysia.

b) Managing the production and disbursement of 645 security passes at Nuklear Malaysia.

c) Enforce Protected Area And Protected Places Act 1959, Official Secret Act 1972, Police Act 1967 as well as other security related regulations.

d) Perform checks on security passes as well as car stickers at Bangi and Dengkil Complexes

d) Melaksanakan pemeriksaan pada pas keselamatan serta pelekat kenderaan di Kompleks Bangi dan Dengkil.

e) Melakukan pemeriksaan pili bomba di Kompleks Bangi dan Dengkil.

f) Melaksanakan Latihan Kecemasan di Kompleks Bangi dan Dengkil.

g) Mengadakan rondaan keselamatan sepanjang tahun di Kompleks Bangi dan Dengkil.

e) Conducting inspections of fire hydrant at Bangi and Dengkil Complexes.

f) Perform Emergency Training at Bangi and Dengkil Complexes.

g) Security Patrol at Bangi and Dengkil Complexs throughout the year.

14.2) Pembangunan Modal Insan

Modal insan yang berpengetahuan, berpengalaman dan mahir amat diperlukan untuk melaksanakan fungsi dan tanggungjawab yang digalas oleh Nuklear Malaysia. Dalam usaha melahirkan modal insan yang mempunyai kompetensi yang diperlukan, pelaburan yang signifikan perlu disediakan dalam membangun ilmu, kepakaran dan etika kerja warga Nuklear Malaysia. Hasrat ini boleh dicapai melalui program-program latihan yang terancang, berterusan dan terkini selaras dengan keperluan semasa, jangka sederhana dan jangka panjang jabatan serta negara.

Pada tahun 2015, Nuklear Malaysia telah membelanjakan sebanyak RM940,015.98 untuk program pembangunan modal insan. Peruntukan meliputi bajet pembangunan HCD-STI, Belanja Mengurus dan Akaun Amanah jabatan. Agihan perbelanjaan mengikut peruntukan ditunjukkan di dalam Jadual 14.1

14.2) Human Capital Development

Knowledgeable, experienced and skilled human capital is needed to carry out the functions and responsibilities undertaken by Nuklear Malaysia. In order to produce human capital that has the required competencies, a significant investment need to be made available in developing the knowledge, expertise and the work ethic of Malaysia's employees. This goal can be achieved through the provision of training programs that are well planned, persistent and timely in accordance with current, medium-term and long-term needs of the department and as well as the country.

In 2015, Nuklear Malaysia has spent a total of RM940,015.98 for its human capital development program. The allocation includes the HCD-STI development budget, operating budget and Nuklear Malaysia's Trust Accounts. Distribution of expenditure by the allocation is shown in Table 14.1.

Jadual 14.1: Perbelanjaan bagi Aktiviti Latihan Mengikut Peruntukan bagi Tahun 2015
Table 14.1: Expenses for Training Activities by Allocations for the Year 2015

Peruntukan Allocation	Perbelanjaan Expenditure (RM)	Peratusan Percentage (%)	Bil. Aktiviti Latihan No. of Training Activities
HCD-STI	837,946.80	89.14	48
Budget Mengurus (Generik) Operating Budget(Generik)	51,146.50	5.44	7
Akaun Amanah (Trust Accounts)	50,922.68	5.42	8
Jumlah	940,015.98	100.00	63

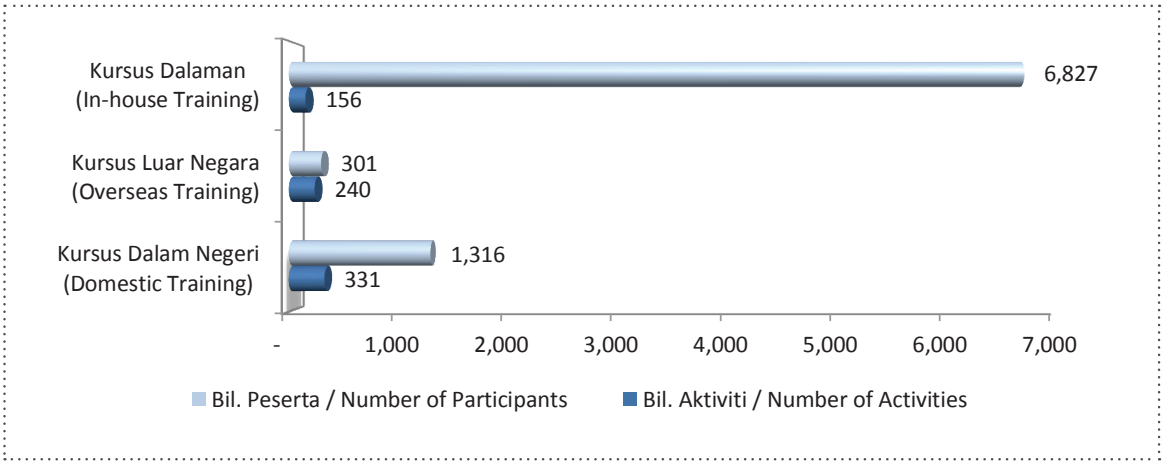
Nuklear Malaysia komited dalam usaha melengkapkan warganya dengan pengetahuan, kemahiran dan kepakaran agar mereka berupaya mencapai potensi masing-masing. Sehingga Disember 2015, Nuklear Malaysia menyediakan lebih 727 aktiviti untuk latihan dalam perkhidmatan yang merentasi semua peringkat kumpulan pegawai. Latihan yang dilaksana ini merangkumi aktiviti kursus dalam negeri, kursus luar negara dan kursus dalaman.

Nuklear Malaysia is committed in equipping every emplyee with the knowledge, skills and expertise so that they are able to achieve their potential. As of December 2015, Nuklear Malaysia provided over 727 activities for the in-service training across levels of employees. These implemented trainings activities including domestic trainings, overseas trainings and in-house trainings.

Foto 14.3: Peserta Kursus dan Lawatan Tapak bagi *"4th Follow-Up Training Course (FTC) Malaysia on Environmental Radiaoctivity Monitoring"*
Photo 14.3: Course Participants and Field Trip for "4th Follow-up Training Course (FTC) on Environmental Radioactivity Monitoring"

Bagi kategori kursus dalam negeri, seramai 553 orang pegawai telah dilatih dalam 331 aktiviti sementara bagi kursus luar negeri pula, seramai 162 orang pegawai telah dilatih dalam 240 aktiviti. Manakala, seramai 951 orang pegawai telah mendapat latihan dalam sejumlah 156 aktiviti kursus dalaman. Rajah 14.2 menunjukkan bilangan peserta dan bilangan aktiviti yang dilaksanakan sepanjang tahun 2015. bagi ketiga-tiga kategori kursus iaitu dalam negeri, kursus luar negara dan kursus dalaman.

For the category of domestic training, a total of 553 employees have been trained in 331 activities while for overseas training, a total of 162 employees have been trained in 240 activities. Meanwhile, a total of 951 employees have been trained in a total of 156 in-house training activities. Figure 14.2 shows the number of participants and the number of activities conducted throughout the year 2015 for all three categories of training, namely domestic training, overseas training and in-house training.



Rajah 14.2: Bilangan Penyertaan dalam Aktiviti Kursus Dalam Negeri, Kursus Luar Negara dan Kursus Dalaman
Figure 14.2: Number of Participations in Domestic Training, Overseas Training and In-house Training

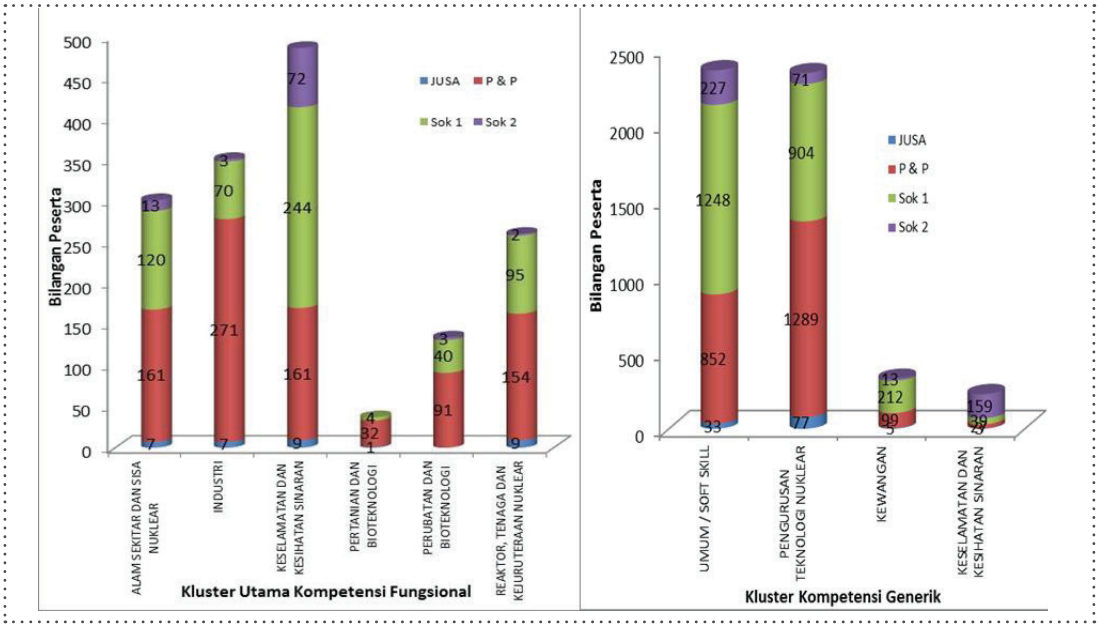
Foto 14.4: Kursus Pembantu Tadbir 2015
Photo 14.4: Administrative Assistant Course 2015

Dalam usaha mencapai Dasar Latihan Sektor Awam yang mensasarkan agar setiap kakitangan mengikuti sekurang-kurangnya tujuh hari berkursus dalam setahun, Nuklear Malaysia mencuba sebaik mungkin untuk menggunakan peruntukan latihan yang diperolehi dengan cara yang paling optimum.

Justeru, bagi membolehkan setiap kakitangan Nuklear Malaysia meningkatkan ilmu, kemahiran dan juga sahsiah diri, program latihan atau kursus dalaman dirangka di pelbagai peringkat sama ada di peringkat kumpulan, unit, bahagian, jabatan dan juga peringkat kementerian. Kursus dalaman yang dilaksana ini merangkumi aspek teknikal, pengurusan dan pengukuhan sikap kakitangan. Penyertaan kakitangan Nuklear Malaysia dalam aktiviti kursus dalaman sehingga Disember 2015 ditunjukkan di dalam Rajah 14.3 mengikut sepuluh kluster yang dibahagikan kepada dua kategori kompetensi iaitu kompetensi generik dan kompetensi fungsional.

In order to achieve the Public Sector Training Policy which aims to ensure every employee attends a minimum of seven days of training of the year, Nuklear Malaysia trying her best to use the obtained training allocation in the most optimal way.

Thus, to enable every employee of Nukear Malaysia to enhance their knowledge, skills and personal development, training programs or courses are designed internally at various levels either in a group, unit, division, department or ministery level. The implemented in-house training courses include aspects of technical, management and strengthening of employees' attitudes. Nuklear Malaysia employee participation in in-house training activities until December 2015 is shown in Figure 14.3 according to ten clusters which are divided into two competency categories, namely generic and functional competency.



Rajah 14.3: Penyertaan Kakitangan dalam Aktiviti Kursus Dalaman mengikut Kluster bagi Kategori Kompetensi Generik dan Fungsional

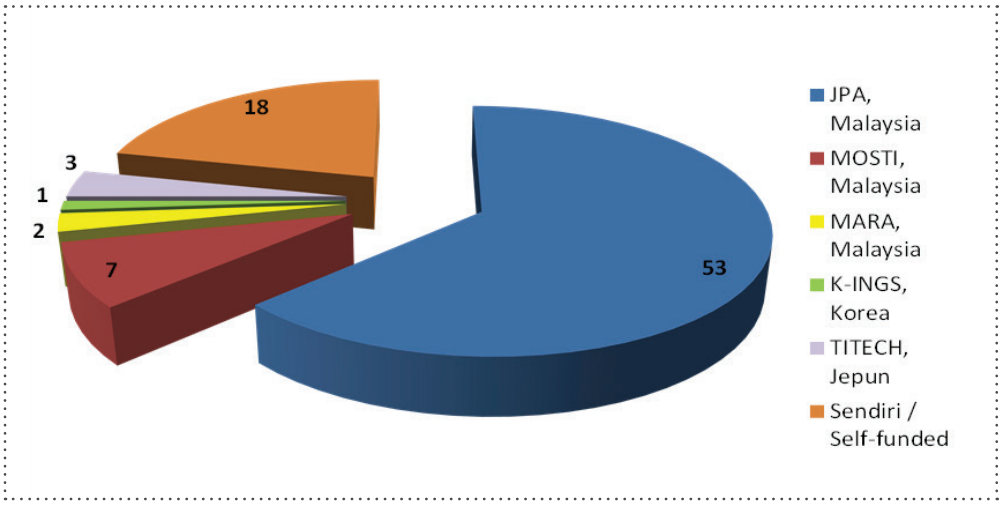
Figure 14.3: Staff Participation in In-house Training Activities by Cluster within Generic and Functional Competencies


Foto 14.5: Bengkel Semakan dan Penilaian Kompetensi Bahagian 2015 Siri I: Program Penyelidikan dan Pembangunan Teknologi

Photo 14.5: Workshop on Competency Review and Assessment by Division 2015 Series I: Research and Technology Development Program

Dalam usaha untuk meningkatkan kompetensi, keupayaan dan keyakinan pegawai penyelidik agar dapat menjadi pakar rujuk dalam bidang sains dan teknologi nuklear, Nuklear Malaysia menyediakan pelbagai saluran dan peluang untuk melanjutkan pengajian pasca-ijazah di peringkat sarjana dan doktor falsafah melalui program latihan formal. Program latihan formal ini dilaksana melalui pelbagai tajaan seperti Hadiah Latihan Persekutuan (HLP) oleh Jabatan Perkhidmatan Awam Malaysia (JPA); program Latihan Dalam Perkhidmatan (LDP) oleh MOSTI; biasiswa Majlis Amanah Rakyat Malaysia (MARA); biasiswa oleh KEPCO *International Nuclear Graduate School* (K-INGS), Republik Korea; biasiswa oleh Tokyo Institute of Technology (TITECH), Jepun. Selain dari itu, terdapat juga pegawai yang menyara sendiri dengan menggunakan kemudahan Cuti Belajar Bergaji Penuh Tanpa Biasiswa. Rajah 14.4 menunjukkan bilangan pegawai yang mengikuti latihan formal mengikut kategori penajaan bagi tahun 2015.

In an effort to enhance the competencies, capabilities and confidence of researchers to be an expert in the field of nuclear science and technology, Nuclear Malaysia provides various channels and opportunities to continue their studies at the masters and doctorate post-graduate levels through the formal training programs. This formal training program implemented through the various sponsorships such as the Federal Training Reward (HLP) by the Malaysian Public Service Department (JPA); In-Service Training program (LDP) by MOSTI; scholarship of the Majlis Amanah Rakyat Malaysia (MARA); scholarship by the KEPCO International Nuclear Graduate School (K-INGS), Republic of Korea; scholarship by the Tokyo Institute of Technology (TITECH), Japan. In addition there are also officers who are self-funded by utilising the Fully Paid Study Leave Without Scholarship facility. Figure14.4 shows the number of officers attending formal training by category of sponsorships for the year 2015.



Rajah 14.4: Pengajian Latihan Formal 2015 mengikut Tajaan
Figure14.4: Formal Training Studies 2015 by Sponsorship

Seramai 84 pegawai mengikuti pengajian lanjutan bagi tahun 2015 dengan pengagihan 42 pegawai di peringkat sarjana dan 42 pegawai di peringkat doktor falsafah. Selaras dengan aplikasi teknologi nuklear yang meliputi pelbagai aspek kehidupan, bidang-bidang pengajian yang diikuti pegawai pula mencakupi pelbagai bidang sains, teknologi dan kejuruteraan yang luas. Kepelbagaian bidang pengajian mengikut peringkat pengajian ditunjukkan di dalam Jadual 14.2.

A total of 84 officers undergo their further studies for the year 2015 with the distribution of 42 officers at the masters level and 42 officers at the doctorate level. In accordance with the application of nuclear technology which covers many aspects of life, the fields of study undertaken by the officers encompass various fields of science, technology and engineering areas. The diversity fields of these studies by level of study are shown in Table 14.2.

Jadual 14.2: Bidang Pengajian Latihan Formal bagi Tahun 2015
Table 14.2: Field of Study of Formal Training for the year 2015

Bidang Pengajian / Field of Study	**Doktor Falsafah / PhD**	**Sarjana / Master**	**Jumlah Pegawai/ Number of Officers**
Sains & Kejuruteraan Nuklear / Nuclear Science & Engineering	4	5	9
Sains Fizik & Fizik Gunaan / Physics & Applied Physics	3	4	7
Bidang Pengajian / Field of Study	Doktor Falsafah / PhD	Sarjana / Master	Jumlah Pegawai/ Number of Officers
Sains Bahan / Material Science	5	1	6
Kejuruteraan Bahan / Material Engineering	5		5
Kejuruteraan Kimia / Chemical Engineering	3	2	5
Kejuruteraan Mekanikal / Mechanical Engineering	1	4	5

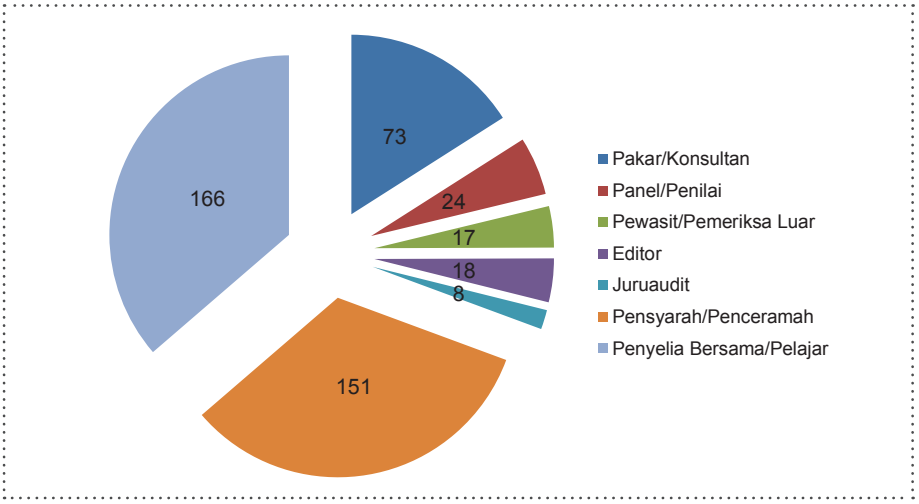
Sains Komputer & Teknologi Maklumat / Computer Science & IT	1	4	5
Geologi / Geology	2	2	4
Kejuruteraan Elektrik, Elektronik, Sistem / Electrical, Electronic, System Engineering	2	2	4
Kejuruteraan Alam Sekitar / Environmental Engineering	1	2	3
Kejuruteraan Polimer / Polymer Engineering	3		3
Keselamatan Sinaran / Radiation Safety		3	3
Pengurusan Teknologi Nuklear / Nuclear Technology Management	1	2	3
Sains Kimia / Chemical Science	2	1	3
Sains Sosial / Social Science		3	3
Sains & Pengurusan Industri / Industrial Science & Management	2	1	3
Bioteknologi / Biotechnology	1	1	2
Fizik Nuklear / Nuclear Physics	2		2
Kejuruteraan Awam / Civil Engineering		2	2
Pengurusan Sisa Radioaktif / Radioactive Waste Management	1	1	2
Sains Sekitaran / Environmental Science	1	1	2
Fizik Perubatan / Medical Physics	1		1
Instrumentasi / Instrumentation		1	1
Sains Perubatan / Medical Science	1		1
Jumlah / Total	42	42	84

Dengan terlaksananya aktiviti-aktiviti pembangunan modal insan, Nuklear Malaysia juga dapat membangunkan kepakaran pegawai dalam bidang sains dan teknologi nuklear. Sehingga Disember 2015, seramai 282 orang pegawai telah menyumbangkan khidmat kepakaran mereka melalui 1011 aktiviti. Aktiviti kepakaran yang diberikan meliputi khidmat sebagai pakar, konsultan, panel penilai, pewasit, pemeriksa luar, juruaudit, editor, pensyarah, penceramah dan

With the implementation of the activities of human capital development, Nuklear Malaysia also able to develop personnel expertise in the field of nuclear science and technology. As of December 2015, a total of 282 officers had contributed their expertise through 1011 activities. These activities are comprising of the serving as an expert, consultant, evaluation panel, referee, external examiner, editor, auditor, lecturer, speaker and also co-supervisor for the student of doctorate, master's, bachelor and

penyelia bersama bagi pelajar peringkat doktor falsafah, sarjana, sarjana muda serta diploma. rajah 14.5 menunjukkan bilangan pegawai Nuklear Malaysia yang menyumbang khidmat kepakaran mengikut peranan aktiviti.

diploma program. Figure 14.5 shows the number of officers of Nuklear Malaysia that contributing expertise by the role of activities.



Rajah 14.5: Bilangan Pegawai Nuklear Malaysia yang Memberi Khidmat Kepakaran Mengikut Aktiviti bagi Tahun 2015
Figure 14.5: Number of Nuklear Malaysia Officers Delivering Expert Services by Activity for the Year 2015

Selain daripada tugas untuk meningkatkan kemahiran dan kepakaran warga Nuklear Malaysia, agensi juga bertanggungjawab untuk melatih para pelajar institusi pengajian tinggi (IPT) dalam bidang sains dan teknologi nuklear. Kepelbagaian aktiviti R&D dalam bidang sains dan teknologi nuklear serta teknologi yang berkaitan menjadikan Nuklear Malaysia sebagai pilihan popular bagi pelajar IPT untuk menjalani latihan industri, projek tahun akhir dan kajian penyelidikan secara bersama di agensi ini.

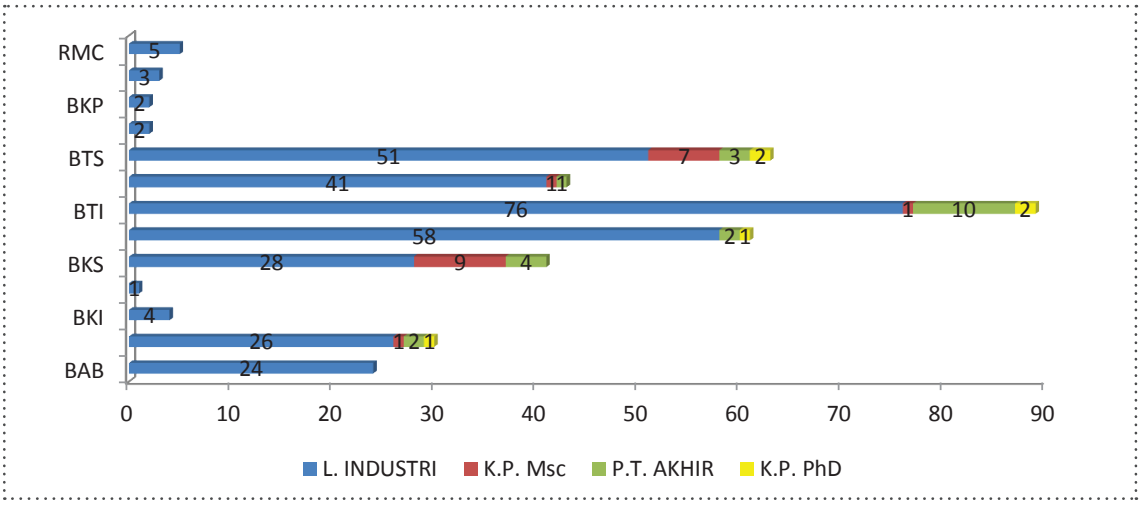
Namun begitu, disebabkan oleh keupayaan sumber yang terhad, daripada 702 permohonan yang diterima pada tahun 2015, hanya 368 pelajar berjaya ditempatkan di 13 bahagian atau unit di Nuklear Malaysia. Daripada 368 orang pelajar tersebut, enam pelajar mengikuti pengajian di peringkat doktor falsafah; 19 pelajar sarjana; 307 pelajar sarjana muda; 35 pelajar diploma; manakala seorang pelajar di peringkat sijil. Bilangan pelajar latihan industri dan kajian penyelidikan bagi tahun 2015 ditunjukkan di dalam Jadual 14.4 manakala penempatan pelajar mengikut bahagian atau unit ditunjukkan di dalam Rajah 14.5.

Apart from enhancement of skills and the expertise of employee in Nuklear Malaysia, the agency is also responsible for training the students of institutions of higher learning (HLI) in the field of nuclear science and technology. The diversity of the R & D activities in the field of nuclear science and technology as well as related technologies has made Nuklear Malaysia as a popular option for the university students to undertake their industrial training, final year projects or collaborative research studies at this agency.

However, due to the limited resources capability, out of a total 702 applications received in 2015, only 368 students are successfully placed in 13 divisions or units at Nuklear Malaysia. Out of these 368 students, six students pursued their study at doctorate level; 19 students at master level; 307 students at undergraduate level; 35 students at diploma level; while one student at certificate level. The number of industrial training and research studies students for the year 2015 are shown in Table 14.4, while the placement of students by division or unit are shown in Figure 14.5

Jadual 14.3: Bilangan Pelajar Latihan Industri dan Kajian Penyelidikan mengikut IPT dan Peringkat Pengajian bagi Tahun 2015
Table 14.3: Number of Industrial Training and Research Studies Students by Higher Learning Insitutions and Level of Education for Year 2015

UiTM	1		87	7		95
Institusi Institution	**Doktor Falsafah PhD**	**Sarjana MSc**	**Sarjana Muda BSc**	**Diploma Diploma**	**Sijil Certificate**	**Jumlah Total**
UPM	1	2	50			53
UTM	2	2	38			42
UKM		7	20			27
USM			16			16
UniMAP	1		11	1		13
UMT			11			11
UPSI				8		8
UMS			7			7
UMP			4	3		7
UM			6			6
USIM			6			6
UPNM			5			5
UNIMAS			3			3
UTHM			3			3
UMK			2			2
UIAM		1	1			2
Lain-lain IPT / Others HLI	1	7	37	16	1	62
Jumlah / Total	**6**	**19**	**307**	**35**	**1**	**368**



Rajah 14.6: Penempatan Pelajar mengikut Bahagian/Unit dan Jenis Latihan
Figure 14.6: Placement of Students by Division/Unit and Type of Training

14.3) Pengurusan Maklumat

14.3.1) Pengurusan Maklumat

Nuklear Malaysia sedang mengadakan kerjasama dengan Dewan Bahasa dan Pustaka (DBP) bagi melaksanakan Program Penerbitan Buku Berkelompok Sains Nuklear. Di bawah program ini, pihak DBP menerbitkan buku-buku yang ditulis oleh pegawai penyelidik di agensi ini. Program seumpama ini bermatlamat untuk mewujudkan budaya menulis buku ilmiah dengan menggunakan data yang terkumpul daripada aktiviti penyelidikan

Malah, progarm ini dilaksanakan untuk memperluaskan kemahiran dan teknik penulisan yang lebih berkualiti. Dalam masa yang sama, agensi ini juga telah mengambil beberapa inisiatif lain seperti mengadakan bengkel penulisan buku untuk penulis-penulis. Aspek sebegini dapat dilihat sebagai satu langkah untuk memberikan pendedahan dan panduan kepada penulis-penulis mengenai cara penulisan ilmiah di samping menyuntik keyakinan serta semangat kepada pegawai penyelidik untuk menulis buku berdasarkan kepakaran masing-masing.

14.3) Information Management

14.3.1) Information Management

Nuklear Malaysia is collaborating with Dewan Bahasa dan Pustaka (DBP) to implement the Group Nuclear Science Book Publishing Programme. Under this programme, DBP publishes books written by research officers of this agency. Such programs aim to create a culture of writing scientific books using the data which are collected from research activities.

Indeed, this programme is implemented to expand the skills and techniques of writing for a better quality. At the same time, the agency has also taken several other initiatives such as conducting book writing workshop for the authors. This aspect can be seen as a step to provide exposure and guidance to the authors about scientific writing technique besides increasing the confidence and spirit to research officers to write books based on their respective expertise.

Foto 14.6: Bengkel Pemurnian dan Editorial Buku-buku Sains Nuklear di Hotel Avilion Legacy, Melaka
Photo 14.6: Workshop on Editing and and Nuclear Science Books Editorial in Avilion Legacy Hotel, Malacca

Pada tahun 2015, Nuklear Malaysia dengan kerjasama DBP telah berjaya menganjurkan Bengkel Pemurnian dan Editorial Buku-buku Sains Nuklear di Hotel Avilion Legacy, Melaka. Bengkel ini adalah sebagai landasan untuk memperluaskan kemahiran dan teknik penulisan di kalangan pegawai penyelidik di samping memperoleh manuskrip buku yang berkualiti.

In 2015, Nuclear Malaysia in collaboration with DBP has successfully organized Workshop on Editing and Nuklear Science Books Editorial in Avilion Legacy Hotel, Malacca. This workshop is a platform to expand writing tskills and techniques writing among a research officers in obtaining a quality book manuscript.

Foto 14.7: Perkongsian Idea dan Teknik Menulis oleh Penceramah dari DBP
Photo 14.7: Sharing Idea and Writing Techniques by Speakers from DBP

Dalam usaha memantapkan bidang penulisan saintifik, Nuklear Malaysia telah memainkan peranan dengan menganjurkan Bengkel Penulisan dan Penerbitan Ilmiah. Bengkel yang diadakan sebanyak dua siri iaitu pada bulan Jun dan September ini di Nuklear Malaysia, bermatlamat untuk mencungkil bakat-bakat baru dalam kalangan pegawai penyelidik dalam bidang penulisan.

In order to strengthen the scientific writing, Nukear Malaysia has been instrumental in organizing Workshop on Scientific Writing and Publishing. The workshop was held in two series namely, in June and September at Nuklear Malaysia and aims to unearth new talents among researchers in the field of writing.

Foto 14.8: Bengkel Penulisan dan Penerbitan Ilmiah di Nuklear Malaysia
Photo 14.8: Book Writing Workshop at Nuklear Malaysia

Selain itu, penerbitan merupakan salah satu output utama penyelidikan dan pembangunan yang merupakan aktiviti teras Nuklear Malaysia. Sehubungan dengan ini, Agensi ini sentiasa membuat pengumpulan dan pendokumentasian kesemua bahan penerbitan teknikal dan bukan teknikal yang dihasilkan oleh para penyelidik. Pada tahun 2015, sebanyak 702 penerbitan kebangsaan dan antarabangsa telah diterima dari para penyelidik. Ini tidak termasuk buku, laporan dan majalah yang diterbikan oleh pusat penerbitan Nuklear Malaysia. Antara penerbitan yang berjaya dihasilkan oleh Pusat Penerbitan Nuklear Malaysia adalah Warta Nuklear Malaysia, Nada Nuklear, Nuklear Malaysia in the News 2015, Laporan Tahunan 2014 dan buku-buku seperti ditunjukkan di Jadual 14.4.

Besides that, publication is one of the main outputs of research and development which is a core activity of Nuklear Malaysia. In this regard, the Agency is constantly compiles and documents of all the technical and non-technical publications produced by researchers. In 2015, a total of 702 national and international publications have been received from the researchers. This does not include books, reports and magazines issued by Nuklear Malaysia Publication Centre. Among the publications that successfully produced by Nuclear Malaysia Publication Centre are Warta Nuklear Malaysia, Nada Nuklear, Nuklear Malaysia in the News 2015, Annual Report 2014 and books as shown in Table 14.4.

Jadual 14.4: Senarai Buku 2015
Table 14.4: List of Book 2015

Bil./Num.	Tajuk / Title
1	Transformasi Industri Gaharu Malaysia melalui Sains, Teknologi dan Inovasi.
2	Pemetaan Keradioaktifan Marin Semenanjung Malaysia
3	Sinaran Keradioaktifan Alam Sekitar
4	Ujian Tanpa Musnah (UTM) Terhadap Konkrit Struktur
5	*Transforming Malaysian Gaharu Industry with Science, Technology and Innovation*
6	Bahan Radioaktif Tabii dan Manusia
7	Pemprosesan Sinaran Bagi Adunan Polimer Polivinil Klorida dan Getah Terepoksida

Bahagian Pengurusan Maklumat (BPM) telah diberi peruntukkan sebanyak RM 1.32 juta di bawah RMK10 untuk menjalankan Program Pemantapan Pengurusan Pengetahuan Nuklear (NKM) bagi memenuhi keperluan Agensi Tenaga Atom Antarabangsa (IAEA). Program NKM dilaksanakan bagi memastikan misi untuk menjadi Pusat Rujukan

2015, Information Management Division (BPM) receive on allocation of RM 1.32 million under the RMK10 to run Enhancement Programme of Nuclear Knowledge Management (NKM) to meet the requirements of the International Atomic Energy Agency (IAEA). NKM programme conducted to ensure that the mission to be the National

Nuklear Kebangsaan *(nuclear one-stop centre)* yang menyediakan berbagai koleksi dan maklumat mengenai aktiviti penyelidikan nuklear tercapai. Faktor-faktor seperti pengurusan pengetahuan nuklear yang kompleks, kos yang tinggi, jangka hayat bahan yang lama, dan pembangunan teknologi yang pesat telah mendorong Nuklear Malaysia untuk melaksanakan program ini.

Reference Centre for Nuclear (nuclear one-stop centre that provides a wide range of collections and information regarding the activities of nuclear research is achieved. Factors such as a complex nuclear knowledge management, high cost, long lifespan of materials, and rapid technology development has prompted the Nuklear Malaysia to implement this program.

Foto 14.9: Menandatangani Memorandum Persefahaman (MoU
Photo 14.9: Signing of Memorandum of Understanding (MoU)

Nuklear Malaysia juga mengambil inisiatif untuk membuat Memorandum Persefahaman (MoU) bersama dengan pihak Dewan Bahasa dan Pustaka (DBP) pada tahun 2015. Nuklear Malaysia dan DBP telah bersetuju bahawa kerjasama dan usaha sama ini akan memberi manfaat kepada kedua-dua belah pihak. Bagi mencapai objektif memorandum ini, kedua-dua pihak akan bekerjasama dan berusaha atas dasar kepentingan bersama bagi memastikan semua aspek tercapai khususnya dalam lingkungan undang-undang, perlembagaan, peraturan-peraturan atau dasar masing-masing.

Dalam memorandum ini juga, kedua-dua pihak tertakluk kepada terma-terma di dalam perjanjian ini dan bersetuju untuk mengadakan hubungan

Nuklear Malaysia also took the initiative to create a Memorandum of Understanding (MoU) with Dewan Bahasa dan Pustaka (DBP) in 2015. Nuklear Malaysia and DBP was agreed this cooperation and collaboration will be beneficial to both parties. To achieve the objectives of this memorandum, these two parties will cooperate and work on the basis of mutual interest to ensure that all aspects, particularly in law, the constitution, regulations or policies will be achieved

In this memorandum, both parties are subject to the terms of this agreement and agreed to cooperate in the field of research, education, training and publications. Both parties have also agreed in sharing and exchanging necessary information and produce publications related to the sciences,

dan kerjasama dalam bidang penyelidikan, pendidikan latihan dan penerbitan. Kedua-dua pihak juga telah bersetuju untuk saling berkongsi dan bertukar-tukar maklumat yang diperlukan dan menghasilkan penerbitan yang berkaitan dengan bidang sains, sains sosial, kemanusiaan serta bidang-bidang lain mengikut undang-undang yang diguna pakai di Malaysia.

social sciences, humanities and other fields in accordance with the laws applicable in Malaysia.

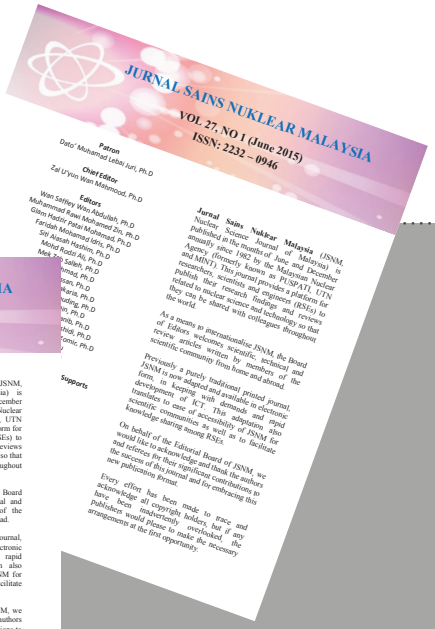


Foto 14.10: Jurnal Sains Nuklear Malaysia (EJSNM)
Photo 14.10: Nuklear Malaysia Science Journal

Foto 14.11: Nada Nuklear Malaysia
Photo 14.11: Nada Nuklear Malaysia

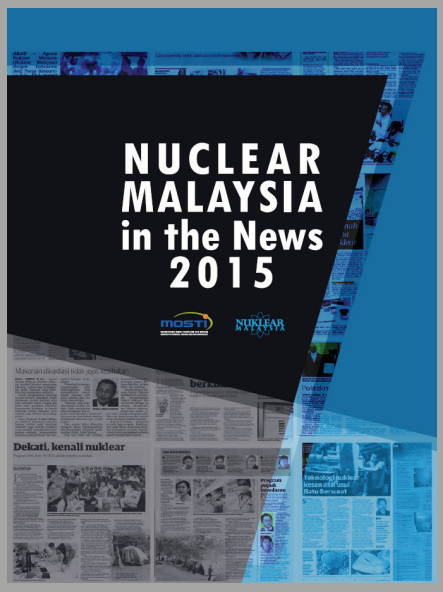


Foto 14.12: Nuclear Malaysia in the News 2015
Photo 14.12: Nuclear Malaysia in the News 2015

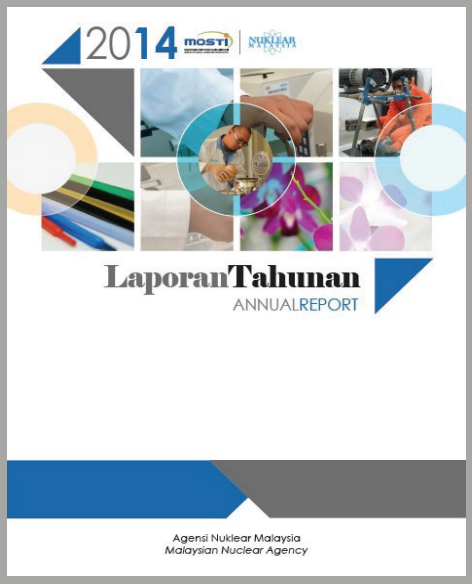


Foto 14.13: Laporan Tahunan
Photo 14.13: Annual Report

Foto 14,14; Warta Nuklear
Photo 14.14: Nuclear Magazine

Nuklear Malaysia juga terlibat dalam Sistem Maklumat Nuklear Antarabangsa (INIS). Jumlah bahan INIS yang terkumpul adalah sebanyak 550 input. Selain daripada itu, input bahan berteks penuh Sastera Bukan Konvensional (NCL) pula adalah sebanyak 230 bahan dalam sistem perpustakaan Nuklear Malaysia.

Sementara itu, INIS turut dipromosikan di institusi pengajian tinggi (IPT) dan institusi penyelidikan di Malaysia. Kempen INIS telah dilakukan di beberapa buah IPT seperti di Universiti Malaysia Sarawak (UNiMAS), Universiti Tenaga Nasional (UNITEN), dan Universiti Kebangsaan Malaysia (UKM). Sementara itu, Perkhidmatan Penyebaran Maklumat Terpilih (SDI) pula terkumpul sebanyak 1000 input.

Nuklear Malaysia also participates in International Nuclear Information System (INIS). Total number of accumulated INIS input was 550. In addition, for Non Conventional Literature (NCL), a total of 230 full-text material input was recorded at Nuclear Malaysia's library system.

Besides that, INIS is also promoted in the institutions of higher learning (IHL) and research institutes in Malaysia. INIS campaign was conducted at several IHL such as Universiti Malaysia Sarawak (UNiMAS), Universiti Tenaga Nasional (UNITEN), and National University of Malaysia (UKM). Meanwhile, Selective Information Dissemination Service (SDI) is also accumulated by 1000 input.

14.3.2) Program Penggalakan Sains

Selain itu, Nuklear Malaysia bergiat secara aktif dalam pameran kesedaran awam di peringkat sekolah. Bagi tujuan tersebut, pihak Nuklear Malaysia telah menganjurkan 25 pameran kesedaran awam di beberapa buah sekolah yang terpilih di seluruh Malaysia. Sementara itu, Nuklear Malaysia telah melaksanakan tiga Program Penggalakan Sains MOSTI iaitu, tiga sesi Program Perkhemahan Nuklear 3V (Veni,Vidi,Vici), Jelajah Ikon Saintis(JIS) dan *Nuclear Science & Technology for Secondary Schools (NST4SS).*

Perkhemahan tiga hari dua malam bertempat di Danau Nuklear Malaysia telah dianjurkan untuk pelaksanaan aktitiviti Program 3V. Menerusi program ini, ianya memberi peluang kepada pelajar dan guru sains untuk mengenali sains dan teknologi nuklear serta aplikasinya dalam kehidupan seharian. Perkhemahan informatif ini menggabungkan pelbagai aktiviti seperti pertandingan mengukur tahap radiasi dan sebagainya. Pelajar juga diberi peluang untuk bertemu dengan saintis nuklear dan melawat kemudahan penyelidikan yang ada di Nuklear Malaysia. Adalah diharapkan program ini secara tidak langsung akan menyemai minat dan membuka minda pelajar untuk menceburi kerjaya di bidang Sains dan Teknologi.

14.3.2) Science Encouragement Programme

Additionally, Nuklear Malaysia actively participates in public awareness exhibitions at school level. For this purpose, Nuklear Malaysia has organised 25 public awareness exhibitions in some selected schools throughout Malaysia. Meanwhile , Nuclear Malaysia has conducted three MOSTI's Science Encouragement Programme, namely ; three sessions of 3V Nuclear Camp (Veni, Vidi, Vici), Jelajah Ikon Saintis (JIS) and Nuclear Science & Technology for Secondary Schools (NST4SS).

A three days and two night camping at Danau Nuklear Malaysia was organised for the implementention of 3V programme activities. Through this programme, it provides an opportunity for science teachers and students to know nuclear science and technology and its application in everyday life. This informative campaign combines various activities such as competitions to measure radiation levels and so on. Students were also given opportunity to meet nuclear scientists and visit the research facilities available in Nuklear Malaysia. It is hoped that, this programme will indirectly nurture interest and open student's mind to embark on careers in the field of Science and Technology.

Jadual 14.5: Kalendar Program 3V
Table 14.5: 3V Programme Calendar

Sesi / Session	Tarikh / Date
Sesi 1/ Session 1	7 - 9 Jun 2015/ 7 - 9 June 2015
Sesi 2/ Session 2	20 - 22 September/ 20 - 22 September 2015

Foto 14.15: Aktiviti-aktiviti Program 3V yang Melibatkan Pelajar
Photo 14.15: 3V Programme Activities that Involving Students

Foto 14.16: Program Veni,Vidi,Vici
Photo 14.16: Veni,Vidi,Vici Programme

Nuklear Malaysia bersama MOSTI telah menganjurkan sesi perkongsian ilmu antara saintis terpilih dan pelajar sekolah menengah melalui program JIS. Program JIS bertujuan untuk memberi pendedahan kepada pelajar tentang kerjaya dan kejayaan saintis dengan hasrat meningkatkan minat pelajar dalam bidang sains dan teknologi. Sesi jelajah ikon saintis ini menyediakan peluang yang unik kepada pelajar-pelajar untuk mendapat inspirasi daripada saintis yang terpilih.

Semasa program JIS ini, dua orang ikon saintis daripada bidang-bidang yang berbeza dibawa ke sekolah-sekolah yang terpilih. Ikon saintis berkenaan

Nuklear Malaysia together with MOSTI has organized knowledge sharing sessions between selected scientists and secondary school students through the JIS programme. JIS programme aims at providing exposure to e students about the career and successes of scientists with the intention to increase students' interest in science and technology. These scientist icon sessions provides a unique opportunity for students to gain inspiration from the selected scientists.

During this JIS programme, two scientists icon from different disciplines were brought to the selected

akan berkongsi penyelidikan, pengetahuan dan pengalaman mereka dengan pelajar untuk menanam minat pelajar agar memilih bidang sains sebagai kerjaya mereka pada masa hadapan. Perkongsian ilmu ini juga akan membantu guru-guru sains untuk mengetahui perkembangan sains dan teknologi terkini.

schools. The scientists will be sharing their research, knowledge and experience with students to cultivate students interest to choose science as their career in the future. This knowledge sharing will also help science teachers to learn about the latestdevelopment in science and technology.

Foto 14.17: Program Jelajah Ikon Saintis
Photo 14.17: JIS Programme

Jadual 14.6: Senarai Ikon Saintis
Table 14.6: List of Scientist Icon

Nama / Name	Bahagian/Fakulti Division/Faculty	Agensi / Agency
1. Dr. Mohamad Nazri Bin Abdul Halif	Matematik Kejuruteraan / Mathematic Engineering	Universiti Malaysia Perlis (UNIMAP)
2. Dr. Azahari Bin Kasbollah	Teknologi Perubatan / Medical Technology	Nuklear Malaysia
3. Dr. Wee Boon Siong	Sains & Teknologi / Science & Technology	Universiti Malaysia Sarawak (UNIMAS)
4. Dr. Siti Najila Binti Mohd Najib	Teknologi Perubatan / Medical Technology	Nuklear Malaysia
5. Dr. Mohd Hasbi Bin Ab. Rahim	Sains Industri / Industry Science	Universiti Malaysia Pahang (UMP)
6. Dr. Khairul Anuar Bin Mohd Salleh	Teknologi Industri / Industry Technology	Nuklear Malaysia

14.3.3) Pengurusan Pengetahuan (KM)

Pengurusan Pengetahuan (KM) adalah satu elemen yang terpenting kepada agensi ini yang di beri perhatian utama. Bagi memantapkan lagi KM di agensi ini, pelbagai aktiviti telah dilaksanakan sepanjang tahun 2015. Aktiviti-aktiviti yang dilaksanakan adalah bertujuan untuk memberi pendedahan kepada kakitangan Nuklear Malaysia mengenai pentingnya menerapkan nilai KM dalam urusan kerja seharian atau organisasi.

14.3.3) Knowledge Management (KM)

Knowledge Management(KM) is one of the most important element of this agency that given primary emphasis. In order to strengthen the KM of this agency, various activities have been implemented during 2015. The activities carried out are intended at providing exposure to to all staff of Nuklear Malaysia about the importance of implementing KM in managing daily work or organisation.

Tambahan lagi, penerapan nilai KM ini akan memberikan pemahaman lebih baik kepada kakitangan mengenai pengetahuan asas dalam aspek pengurusan pengetahuan dan perkongsian amalan terbaik yang dipraktikkan oleh beberapa bahagian di agensi ini. Antara aktiviti yang telah dijayakan sepanjang tahun 2015 adalah *Pilot Project NST4SS* serta lawatan KM ke Arkib Negara dan Petronas, KLCC.

In addition, the implementation of the KM values will provide better understanding on basic knowledge in KM aspect and sharing the best practices by several divisions in this agency. Among activities implemented during 2015 were Pilot Project NST4SS as well as KM visit to National Archives and Petronas, KLCC.

Foto 14.18: Pilot Project NST4SS
Photo 14.18: Pilot Project NST4SS

Foto 14.19: Lawatan KM ke Arkib Negara
Photo 14.19: KM Visit to National Archives

Foto 14.20: Lawatan KM ke Petronas, KLCC
Photo 14.20: KM Visit to Petronas, KLCC

14.4) Pengurusan Korporat

14.4.1) Pemantapan Imej Agensi

Seperti tahun-tahun terdahulu, pada tahun 2015 pelbagai aktiviti peningkatan imej organisasi telah dilaksanakan. Aktiviti ini termasuklah menganjurkan program seperti lawatan ke Nuklear Malaysia, publisiti media, pameran, menjalankan soalselidik dan hebahan berita melalui laman web serta media sosial. Aktiviti sedemikian dilaksanakan untuk mempromosikan output R&D dan perkhidmatan Nuklear Malaysia kepada umum di samping meningkatkan visibiliti dan penerimaan awam terhadap teknologi nuklear.

14.4) Corporate Management

14.4.1) Organisational Image Enhancement

Similar to previous years, various image enhancement activities were implemented in the year 2015. These activities include organizing programs such as visits to Nuklear Malaysia, media publicity, exhibitions conducting questionnaires and announcement of news through websites as well as social media. Such activities were implemented in order to promote the Nuklear Malaysia's R&D ouput and services to the public while enhancing the visibility and public acceptance of nuclear technology.

Jadual 14.7: Aktiviti Pemantapan Imej 2015
Table: 14.7: Image Enhancement Activities in 2015

Aktiviti Activities	Bilangan Number
Lawatan ke Nuklear Malaysia Visits to Nuklear Malaysia	3927 pelawat (105 lawatan) 3927 visitors (105 visits)
Berita laman web Nuklear Malaysia Nuklear Malaysia website news	55 e-berita 55 e-news
Publisiti media Media Publicity	115 liputan 115 coverages

KOMUNIKASI KORPORAT

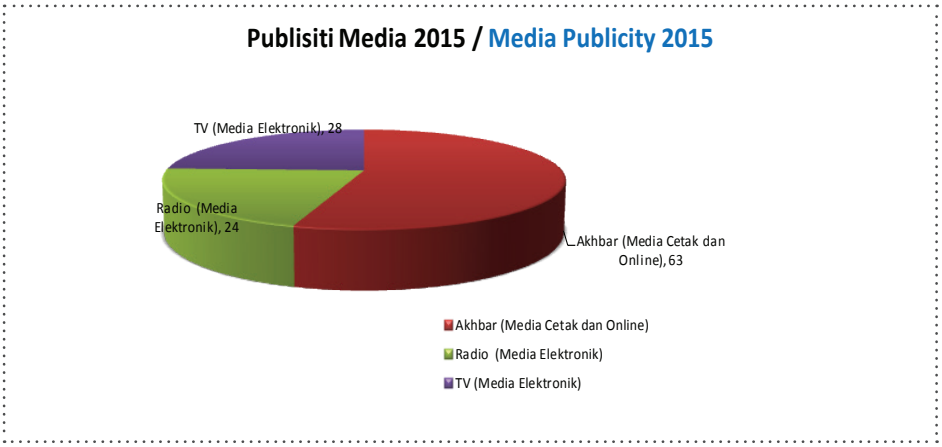
14.4.2) Publisiti Media

Publisiti media merupakan platform yang penting bagi peningkatan imej korporat Nuklear Malaysia. Penyebaran pelbagai informasi berkaitan Agensi ini juga dilakukan melalui kolum jaringan maklumat seperti media massa dan media sosial. Kaedah ini diamalkan sebagai salah satu alternatif untuk merapatkan masyarakat umum dengan agensi ini.

CORPORATE COMMUNICATION

14.4.2) Media Coverage

Media publicity is an important platform for enhancing the corporate image of Nuklear Malaysia. Dissemination of various information related to this Agency is implemented through information network columns such as mass media and social media. This method is practiced as an alternative to bridge the public with this agency'.



Rajah 14.7: Liputan Media Sepanjang tahun 2015
Figure 14.7: Media Coverages throughout 2015

Jadual 14.8: Publisiti Media 2015
Table: 14.8: Media Publicity 2015

PUBLISITI MEDIA 2015	MEDIA PUBLICITY 2015
Program Media bertemu pakar - Temuramah media bersama pakar Nuklear Malaysia boleh mengenengahkan produk R&D yang telah mereka hasilkan. Program ini akan memberi impak positif terhadap Teknologi Nuklear di Malaysia.	Media meet experts Program – Interviews Nuclear Malaysia's experts with the media can highlight their R&D products. This program will have a positive impact on Nuclear Technology in Malaysia.
6.4.2015 – Manfaatkan Teknologi Nuklear - Temuramah Utusan Malaysia bersama pemenang Malaysia Technology Expo (MTE) anjuran MARS.	**6.4.2015** – Take Advantage of Nuclear Technology Utusan Malaysia interview with the winners of the Malaysia Technology Expo (MTE) organized by the MARS
4.7.2015 - Sisa bijih timah boleh jana tenaga nuklear. - Temuramah Berita Harian bersama Dr. Muhd Noor bin Muhd Yunus.	**4.7.2015** - Waste tin can generate nuclear energy - Utusan Malaysia interviews with Dr. Muhd Noor bin Muhd Yunus.
10.8.2015 - Diagnosis Pokok Bernilai / Cari Gaharu Guna Nuklear. - Temuramah Utusan Malaysia bersama Dr. Jaafar Abdullah.	**10.8.2015** - Diagnosis Valuable Trees / Find agarwood using Nuclear – Utusan Malaysia interviews with Dr. Jaafar Abdullah
14.9.2015 - Pokok Mutan : Nuklear Malaysia Berjaya menggunakan teknologi sinaran gama menghasilkan benih pokok baharu - Temuramah Utusan Malaysia bersama Dr. Sobri Hussein.	**14.9.2015** - Mutant Trees : Nuklear Malaysia successfully using gamma ray technology to produce a new tree seedlings - Utusan Malaysia interviews with Dr. Sobri Husseins
30.11.2015 - Kongsi dan Komersialkan Teknologi Gaharu - Temuramah Utusan Malaysia bersama Chong Saw Peng	**30.11.2015** - Share and commercialize Agarwood Technology - Utusan Malaysia interviews with Chong Saw Peng
28.12.2015 - Rawatan Nuklear : Rawat Penyakit Lebih Berkesan - Temuramah Utusan Malaysia bersama Dr. Azahari Kasbollah	**28.12.2015** - Nuclear Treatment : Treat Disease More Effectively - Utusan Malaysia interviews with Dr. Azahari Kasbollah

Foto 14.21: Nuklear Malaysia dalam Rancangan Agro Jurnal RTM TV1
Photo 14.21: Nuklear Malaysia in RTM TV1 Agro Jurnal Programme

Foto 14.22: Temubual Khas Berita Nasional RTM Bersama Ybhg. Dato' Dr. Muhamad Lebai Juri, Ketua Pengarah Nuklear Malaysia dari PWTC Kuala Lumpur.
Photo 14.22: Special interview by RTM National News with Ybhg. Dato' Dr. Muhamad Lebai Juri, Director General Nuklear Malaysia from PWTC Kuala Lumpur

Foto 14.23: Ybhg. Dato' Dr. Muhamad Lebai Juri, Ketua Pengarah Nuklear Malaysia dalam Selamat Pagi Malaysia untuk Topik "Keperluan Melahirkan Saintis 2020"
Photo 14.23: Ybhg. Dato' Dr. Muhamad Lebai Juri, Director General Nuklear Malaysia in Selamat Pagi Malaysia for a Topic of "Requirements to Produce a Scientist 2020"

MUHD Noor menyampaikan cenderahati kepada penceramah pada Seminar Penulisan dan Penerbitan Saintifik di Melaka, semalam.

Janakuasa nuklear dalam penilaian

Melaka: Belum ada kata pu-tus pelaksanaan mengenai janakuasa elektrik menggu-nakan tenaga nuklear men-jelang 2026 dan Agensi Nuk-lear Malaysia (Nuklear Ma-laysia) dilaporkan masih menunggu kelulusan dari Pada kerajaan.

Timbalan Ketua Penga-rahnya Muhd Noor Mohd Yunus berkata, keputusan itu bergantung kepada ka-jian dilakukan pihak Malay-sia Nuclear Power Corpo-ration (MNPC).

"Biasanya kajian sebegini mengambil masa tidak ku-rang dari 10 hingga 15 tahun. "Apabila kajian itu siap kelak dan Parlimen tidak meluluskannya, maka kita tidak boleh meneruskan projek terbabit kerana pra-syarat yang sudah ditetap-kan perlu mendapat kelu-lusan Parlimen," katanya ketika ditemui pada sidang media selepas Seminar Pe-nulisan dan Penerbitan Saintifik, semalam.

Seminar kali kesembilan itu anjuran bersama Nuklear Malaysia, Dewan Bahasa dan Pustaka (DBP) serta Mala-ysian Radiation Protection Association (MARPA).

Bertemakan 'Menjunjung Hasil Karya' seminar itu di-adakan bagi memantapkan lagi karya saintifik karya-wan di samping membina profesionalisme dalam bi-dang penerbitan saintifik.

Muhd Noor berkata, pel-bagai faktor perlu diambil kira termasuk penempatan serta persekitaran sebelum rancangan itu dilaksanakan.

Kini, enam negara iaitu Russia, Jepun, Korea Selatan, Perancis, Kanada dan Ame-rika Syarikat mempunyai janakuasa nuklear.

Foto 14.24: Liputan akhbar Harian Metro bersempena dengan Majlis Perasmian Seminar Penulisan dan Penerbitan Saintifik 2015 di Hotel Hatten, Melaka
Photo 14.24: Media coverage of Harian Metro in conjunction with an Opening Ceremony of Writing and Scientific Publication 2015 at Hatten Hotel, Melaka

Foto 14.25: Temuramah Ybhg. Dato' Dr. Muhamad Lebai Juri, Ketua Pengarah Nuklear Malaysia oleh Astro Awani bersempena Program Pelancaran Pusat Kecemerlangan Nuklear Malaysia – Proton

Photo 14.25: Interview of Ybhg. Dato' Dr. Muhamad Lebai Juri, Director General Nuklear Malaysia by Astro Awani in conjunction with launching of Nuklear Malaysia Excellence Centre-Proton


R&D teknologi nuklear capai 10 peratus akhir tahun

Foto 14.26; Liputan akhbar Utusan Malaysia bersempena dengan Pelancaran Pusat Kecemerlangan Nuklear Malaysia – Proton

Photo 14.26: Media coverage of Utusan Malaysia in conjunction with a Launching of Nuklear Malaysia Excellence Centre-Proton

14.4.3 Program Promosi

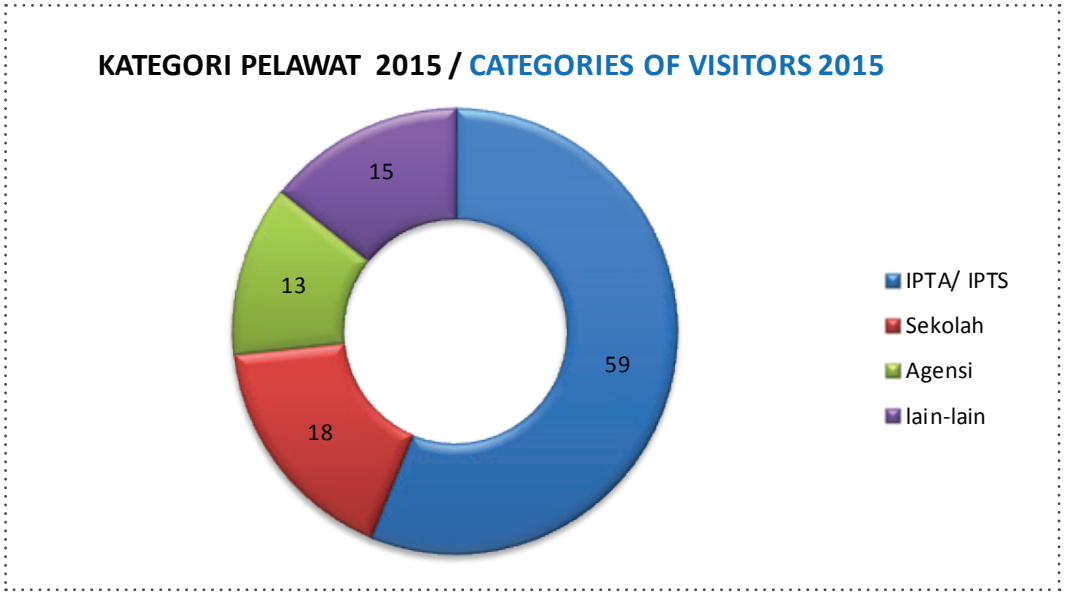
Program Lawatan

Nuklear Malaysia sentiasa mengalu-alukan kehadiran masyarakat umum terutamanya mereka yang tinggal di luar bandar untuk berkunjung ke agensi ini. Pelbagai program diwujudkan untuk menarik minat masyarakat ke agensi ini dalam usaha untuk menjadikan Nuklear Malaysia sebagai sebuah hub bagi ilmu sains nuklear. Pada tahun 2015, Nuklear Malaysia telah menerima seramai 3927 pelawat yang terdiri daripada penuntut universiti, pelajar sekolah serta pegawai dari badan berkanun, agensi dan sebagainya.

14.4.3 Promotional Programmes

Visiting Programme

Nuklear Malaysia always welcome the public, especially those living in rural areas to visit this agency. Various programs were created to attract people to the agency in an effort to make Nuklear Malaysia as a hub for nuclear science. In the year 2015, Nuklear Malaysia has received a total of 3927 visitors consisting of university students, school children as well as staff of statutory bodies, agencies and etc.



Rajah 14.8: Kategori Pelawat pada tahun 2015
Figure 14.8: Categories of Visitors in 2015

Foto 14.27: Lawatan daripada Tentera Darat Filipina
Photo 14.27: Visit from Philippines Army

Foto 14.28: Lawatan daripada Universiti Kuala Lumpur (UNiKL)
Photo 14.28: Visit from University of Kuala Lumpur (UNiKL)

Foto 14.29: Lawatan daripada Markas Tentera Darat
Photo 14.29: Visit from Army Headquarters

Foto 14.30: Lawatan daripada Pejabat Ketua Pegawai Keselamatan Malaysia, Selangor Darul Ehsan
Photo 14.30: Visit from the Office of Malaysia Chief Security Officer, Selangor Darul Ehsan

14.5 Prestasi Kewangan

Nuklear Malaysia telah menerima peruntukan mengurus sejumlah RM81.13juta. Ini termasuk peruntukan dasar sedia ada sejumlah RM75.53 juta, dasar baru sejumlah RM3.09 juta dan one-off sejumlah RM2.51 juta.

Perbelanjaan peruntukan dasar sedia ada dasar baru dan one- off masing-masing telah mencatat 99.17%, 99.70% dan 93.95%. Perbelanjaan keseluruhan bagi peruntukan mengurus ini adalah sebanyak RM80.34 juta (99.03%)

Pada tahun 2015, RM7.36 juta telah diperuntukan untuk pembangunan dan ianya telah mencatat prestasi yang baik dengan jumlah perbelanjaan sebanyak RM7.34 juta (99.72%).

14.5 Financial Performance

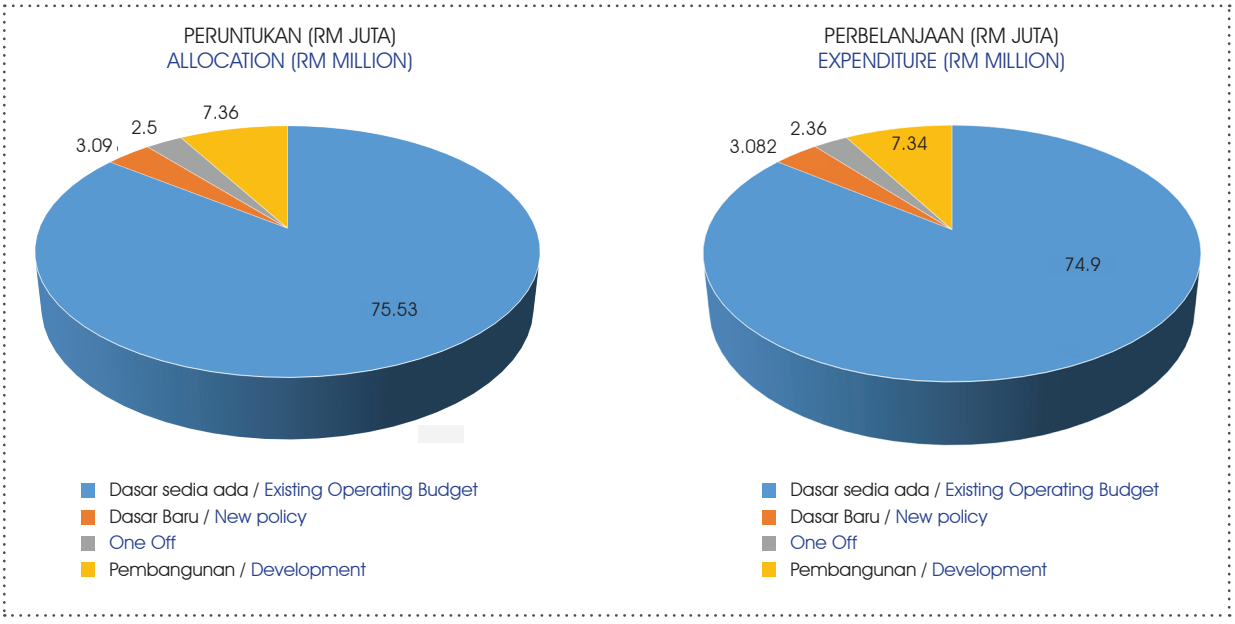
Nuklear Malaysia received operating budget allocation with a total of RM81.13 million. This includes allocation of existing policy which amounts RM75.53 million, new policy which amounts RM3.09 million and one-off which amounts RM2.21 million.

The expenditure for existing policy, new policy and one-off allocations had recorded 99.17%, 99.70% and 93.95%, respectively. The overall expenditure for operating budget was RM80.34 million (99.03%).

In the year 2015, RM7.36 million was allocated for development and it has recorded good performance with a total expenditure of RM7.34 million (99.72%).

Jadual 14.9: Prestasi Kewangan
Table 14.9: Financial Performance

Bil./ No.	Sumber/ Source	Peruntukan (RM juta) Allocation (RMmillion)	Perbelanjaan(RM juta/ Expenditure (RM (million)	Peratus Perbelanjaan/ Expenditure (%)
1	Mengurus/ Operational a) Dasar Sedia Ada Existing Operating Budget	75.53	74.90	99.17
	b) Dasar Baru New Policy	3.09	3.08	99.70
	c) One-Off	2.50	2.36	93.95
2	Pembangunan Development	7.36	7.34	99.72



Rajah 14.9: Sumber Kewangan
Figure 14.9: Financial Source

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