NUKLEAR MALAYSIA

LAPORAN TAHUNAN
AGENSI NUKLEAR MALAYSIA

2021

MALAYSIAN NUCLEAR AGENCY
ANNUAL REPORT

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KANDUNGAN

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1.0 PROFIL AGENSI

AGENCY PROFILE

Visi, misi, objektif, nilai sepunya dan punca kuasa Nuklear Malaysia adalah seperti berikut:

The vision, mission, objectives, shared values, and source of authority of Nuklear Malaysia are as follows:

VISI

Menerajui penyelidikan, pembangunan, pengkomersialan dan inovasi (R&D&C&I) dalam sains dan teknologi nuklear untuk pembangunan negara yang mampan

Vision

Leading R&D&C&I in nuclear science and technology for national sustainable development

MISI

Mencipta kekayaan, menjana pengetahuan baru dan memacu pertumbuhan ekonomi dan kesejahteraan sosial menerusi sains dan teknologi nuklear ke arah kemakmuran bersama

Mission

Creating wealth, generating new knowledge and accelerating economic growth and societal well-being through nuclear science and technology towards a shared prosperity

OBJEKTIF

- Menjana produk dan teknologi baharu menerusi penyelidikan dan inovasi berasaskan agenda pembangunan negara;
- Mempertingkatkan kecemerlangan organisasi menerusi perancangan dan pengurusan berkualiti;
- Memperkasakan Nuklear Malaysia sebagai Organisasi Sokongan Teknikal Kebangsaan dalam bidang nuklear dan teknologi berkaitan; dan
- Memperkukuhkan hubungan dan kerjasama dengan organisasi antarabangsa.

Objective

- *To generate new products and technologies via research and innovation based on the national development agenda;*
- *To enhance organisational excellence through planning and quality management;*
- *To strengthen Nuklear Malaysia as a National Technical Support Organization in nuclear and relevant technological fields; and*
- *To strengthen relationships and cooperation with international organisations.*

FUNGSI

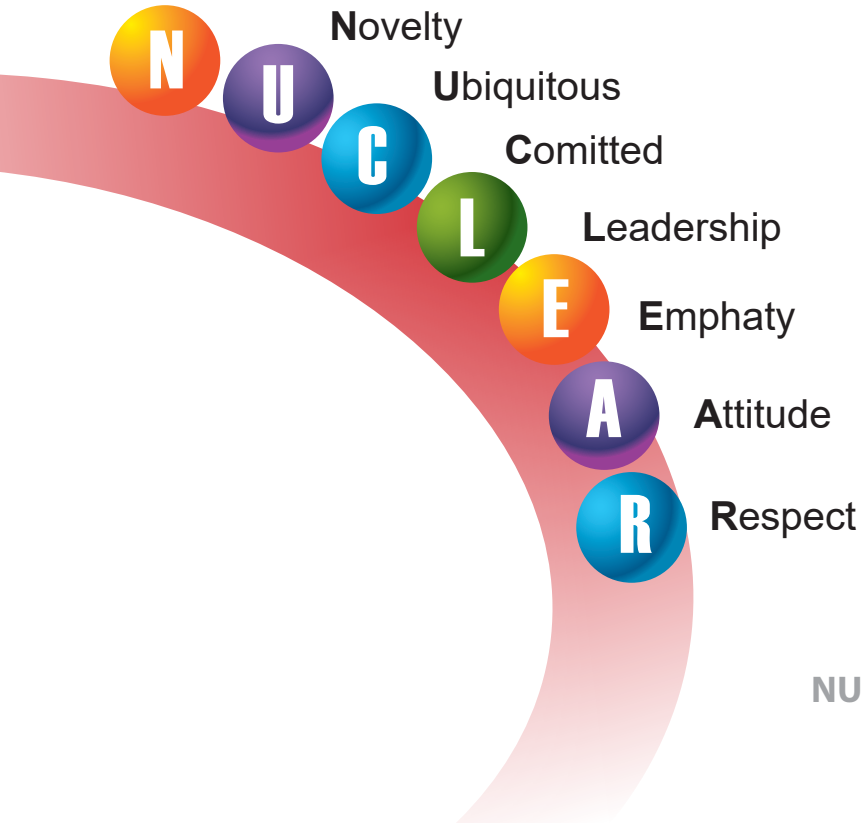
- Melaksanakan R&D&C&I dalam bidang sains dan teknologi nuklear;
- Memberi khidmat sokongan teknikal dan latihan dalam bidang nuklear dan teknologi yang berkaitan;
- Menyelaras dan mengurus hal ehwal nuklear kebangsaan dan antarabangsa, sebagai agensi penghubung Agensi Tenaga Atom Antarabangsa (IAEA) dan Pihak Berkuasa Kebangsaan bagi pelaksanaan Triti Pengharaman Menyeluruh Ujian Senjata Nuklear (CTBT); dan
- Menjadi Pusat Kebangsaan kepada Metrologi Sinaran dan Pengurusan Sisa Radioaktif.

PUNCA KUASA

Punca kuasa Nuklear Malaysia dinyatakan dalam Rang Undang-undang (RUU) Perbekalan B.30 Kementerian Sains, Teknologi dan Inovasi

NILAI SEPUNYA

Nuklear Malaysia telah mengenalpasti tujuh nilai sepunya untuk mencapai visi, misi dan objektif:



Function

- *To conduct R&D&C&I in the field of nuclear science and technology;*
- *To provide technical service and training in nuclear and related technology;*
- *To coordinate and manage nuclear affairs at national and international level as a liaison agency for the International Atomic Energy Agency (IAEA) and the National Authority for the implementation of the Comprehensive Nuclear-Test-Ban Treaty (CTBT); and*
- *To act as the National Centre for Radiation Metrology and as the National Radioactive Waste Management Center.*

Source of Authority

The source of authority for Nuklear Malaysia is stipulated in the RUU Perbekalan B.30, Ministry of Science, Technology and Innovation

Shared Value

Nuklear Malaysia has identified seven shared values towards achieving its vision, mission, and objectives:

CARTA ORGANISASI

ORGANISATIONAL CHART

KETUA PENGARAH
DIRECTOR GENERAL
Ts. Dr. Siti A'iasah Binti Hashim

TIMBALAN KETUA PENGARAH
(Program Penyelidikan & Pembangunan Teknologi)
DEPUTY DIRECTOR GENERAL (Research & Technology Development)
Dr. Abdul Rahim Bin Harun

PENGARAH
Bahagian Teknologi Perubatan (BTP)
DIRECTOR Medical Technology Division
Ts. Dr. Mohd Rodzi Bin Ali

PENGARAH
BahagianTeknologi Industri (BTI)
DIRECTOR Industrial Technology Division
Dr. Nor Pai'za Bin Mohamad Hasan

PENGARAH
Bahagian Teknologi Pemprosesan Sinaran (BTS)
DIRECTOR Radiation Processing Technology Division
Dr. Hasni Binti Hasan

PENGARAH
Bahagian Agroteknologi & Biosains (BAB)
DIRECTOR Agrotechnology & Biosciences Division
Ts. Dr. Azhar Bin Mohamad

PENGARAH
Bahagian Teknologi Sisa & Alam Sekitar (BAS)
DIRECTOR Waste Technology & Environment Division
Dr. Kamarudin Bin Samuding

TIMBALAN KETUA PENGARAH
(Program Perkhidmatan Teknikal)
DEPUTY DIRECTOR GENERAL (Technical Service Programme)
Dr. Rosli Bin Darmawan

PENGARAH
Bahagian Kejuruteraan (BKJ)
DIRECTOR Engineering Division
Ir. Izani Bin Mustapha

PENGARAH
Bahagian Keselamatan & Kesihatan Sinaran (BKS)
DIRECTOR Radiation Health & Safety Division
Ts. Dr. Husaini Bin Salleh

PENGARAH
Bahagian Sokongan Teknikal (BST)
DIRECTOR Technical Support Division
Ts. Dr. Ishak Bin Mansor

PENGARAH KANAN
(Program Pengkomersilan & Perancangan Teknologi)
SENIOR DIRECTOR (Commercialisation & Planning Technology)
(Vacant)

PENGARAH
Bahagian Perancangan & Hubungan Antarabangsa (BPA)
DIRECTOR Planning & International Relation Division
Dr. Faridah Bte Mohamad Idris

PENGARAH
Bahagian Pengkomersilan Teknologi (BKT)
DIRECTOR Technology Commercialisation Division
Dr. Shukri Bin Mohd

PENGARAH KANAN
(Program Pengurusan)
SENIOR DIRECTOR (Management Programme)
Dr. Muhammad Rawi Bin Mohamed Zin

PENGARAH
Bahagian Khidmat Pengurusan (BKP)
DIRECTOR Management Services Division
Rosleezam Bin Jamaudin

PENGARAH
Bahagian Pembangunan Sumber Manusia (BSM)
DIRECTOR Human Resource Development Division
Y.M. Raja Jamal Abdul Nasser Bin Raja Hedar

PENGARAH
Bahagian Pengurusan Maklumat (BPM)
DIRECTOR Information Management Division
Habibah Binti Adnan

PENGURUSAN TERTINGGI

TOP MANAGEMENT

KETUA PENGARAH
DIRECTOR GENERAL
Ts. Dr. Siti A'iasah Binti Hashim

TIMBALAN KETUA PENGARAH
(Program Penyelidikan & Pembangunan Teknologi)
DEPUTY DIRECTOR GENERAL (Research & Technology Development)
Dr. Abdul Rahim Bin Harun

TIMBALAN KETUA PENGARAH
(Program Perkhidmatan Teknikal)
DEPUTY DIRECTOR GENERAL (Technical Service Programme)
Dr. Rosli Bin Darmawan

PENGARAH KANAN
(Program Pengurusan)
SENIOR DIRECTOR (Management Programme)
Dr. Muhammad Rawi Bin Mohamed Zin

PENGARAH BAHAGIAN
DIVISION DIRECTOR

1

PENGARAH
Bahagian Teknologi Sisa & Alam Sekitar (BAS)

DIRECTOR
Waste Technology & Environment Division

Dr. Kamarudin Bin Samuding

2

PENGARAH
BahagianTeknologi Industri (BTI)

DIRECTOR
Industrial Technology Division

Dr. Nor Pai'za Bin Mohamad Hasan

3

PENGARAH
Bahagian Agroteknologi & Biosains (BAB)

DIRECTOR
Agrotechnology & Biosciences Division

Ts. Dr. Azhar Bin Mohamad

4

PENGARAH
Bahagian Sokongan Teknikal (BST)

DIRECTOR
Technical Support Division

Ts. Dr. Ishak Bin Mansor

5

PENGARAH
Bahagian Teknologi Perubatan (BTP)

DIRECTOR
Medical Technology Division

Ts. Dr. Mohd Rodzi Bin Ali

6

PENGARAH
Bahagian Keselamatan & Kesihatan Sinaran (BKS)

DIRECTOR
Radiation Health & Safety Division

Ts. Dr. Husaini Bin Salleh

7

PENGARAH
Bahagian Teknologi Pemprosesan Sinaran (BTS)

DIRECTOR
Radiation Processing Technology Division

Dr. Hasni Binti Hasan

8

PENGARAH
Bahagian Kejuruteraan (BKJ)

DIRECTOR
Engineering Division

Ir. Izani Bin Mustapha

10

PENGARAH
Bahagian Perancangan & Hubungan Antarabangsa (BPA)

DIRECTOR
Planning & International Relation Division

Dr. Faridah Bte Mohamad Idris

12

PENGARAH
Bahagian Pengurusan Maklumat (BPM)

DIRECTOR
Information Management Division

Habibah Binti Adnan

9

PENGARAH
Bahagian Pengkomersilan Teknologi (BKT)

DIRECTOR
Technology Commercialisation Division

Dr. Shukri Bin Mohd

11

PENGARAH
Bahagian Khidmat Pengurusan (BKP)

DIRECTOR
Management Services Division

Rosleezam Bin Jamaudin

13

PENGARAH
Bahagian Pembangunan Sumber Manusia (BSM)

DIRECTOR
Human Resource Development Division

Y.M. Raja Jamal Abdul Nasser Bin Raja Hedar

2.0 NOTA EKSEKUTIF

Pada tahun 2021, Malaysia masih lagi bergelut dengan pandemik COVID-19. Agensi Nuklear Malaysia (Nuklear Malaysia) telah membuat beberapa penyesuaian norma baharu kepada operasi harian, aktiviti penyelidikan dan penawaran perkhidmatan kepada pihak pelanggan. Keadaan semasa yang sukar dijangka membuatkan warga Nuklear Malaysia lebih berhati-hati dan cuba sedaya-upaya untuk menghasilkan output R&D, produk atau perkhidmatan yang dapat memberikan nilai tambah kepada hasil sedia ada.

EXECUTIVE NOTE

In 2021, Malaysia is still struggling with the COVID-19 pandemic. The Malaysian Nuclear Agency (Nuklear Malaysia) has made several adjustments to the new norms to day - to - day operations, research activities and service delivery to its client. The current difficult situation is expected to make Nuklear Malaysia more cautious and try their best to produce R&D output, products or services that can add value to existing results.

Nuklear Malaysia as a national research institution whose role is to promote, develop and encourage the use of nuclear technology

has risen to the challenge by successfully producing 28 research products, 28 processes, 59 procedures, 33 databases and 9 software. Meanwhile, 539 publications were published covering publications from all the latest research fields in nuclear science and technology.

Through the excellence of the international network, the year 2021 saw Nuklear Malaysia receive the recognition of the "IAEA and the Food and Agriculture Organization of the United Nations (FAO) on Mutation Breeding" and the "Excellent Researcher

"Nuklear Malaysia sebagai sebuah institusi penyelidikan kebangsaan yang berperanan untuk mempromosi, membangun dan menggalakkan penggunaan teknologi nuklear"

telah bangkit mendepani cabaran dengan berjaya menghasilkan 28 produk penyelidikan, 28 proses, 59 prosedur, 33 pangkalan data dan 9 perisian. Manakala 539 penerbitan pula diterbitkan yang meliputi penerbitan dari semua bidang penyelidikan terkini dalam sains dan teknologi nuklear.

Menerusi kecemerlangan jaringan antarabangsa, tahun 2021 menyaksikan Nuklear Malaysia menerima pengiktirafan "*IAEA and the Food and Agriculture Organisation of the United Nations (FAO) on Mutation Breeding"* dan *"Excellent Researcher of FNCA 2021 Breakthrough Prize".* Kedua-dua anugerah ini adalah berkaitan dengan kejayaan pengkomersialan varieti padi baharu IS21 yang dilancarkan oleh Perdana Menteri.

Nuklear Malaysia juga merasa bangga kerana diberi amanah menjadi barisan hadapan, menggalas tugas sebagai agensi angkat Pusat Pemberian Vaksin (PPV) di Bangi Avenue Convention Centre yang diselaraskan oleh Kementerian Sains, Teknologi dan Inovasi (MOSTI). Ini menunjukkan warga Nuklear Malaysia sentiasa bersedia memikul tanggungjawab dan menyokong penuh inisiatif Kerajaan Malaysia dalam apa jua keadaan.

Ts. Dr. Siti A'iasah binti Hashim
KETUA PENGARAH
AGENSI NUKLEAR MALAYSIA

of FNCA 2021 Breakthrough Prize". Both of these awards are related to the successful commercialization of the new IS21 rice variety launched by the Prime Minister.

Nuklear Malaysia is also proud to be entrusted to be at the forefront, taking on the task of hosting the Vaccine Administration Center (PPV) at the Bangi Avenue Convention Center coordinated by the Ministry of Science, Technology and Innovation (MOSTI). This shows that the people of Nuklear Malaysia are always ready to take responsibility and fully support the initiatives of the Malaysian Government in any situation.

Ts. Dr. Siti A'iasah binti Hashim
DIRECTOR GENERAL MALAYSIAN NUCLEAR AGENCY

3.0
DIARI KORPORAT
CORPORATE DIARY

3.0 DIARI KORPORAT

CORPORATE DIARY

Januari 2021 *January 2021*

22 Januari 2021

Bengkel Pengukuran Pencapaian SKT/KPI 2020 dan Penetapan SKT/KPI 2021, (Bilik Persidangan)

SKT/KPI 2020 Achievement Measurement Workshop and SKT/KPI 2021 (Conference Room)

29 Januari 2021

Majlis Perhimpunan Bulanan Bil.1 (Bilik Majlis)

Montly Assembly No.1 (Council Room)

Februari 2021 *February 2021*

2 Februari 2021

Flag-Off Misi Bantuan Banjir (Lobi Blok 11)

Flag-Off Flood Relief Mission (Lobby Block 11)

4 Februari 2021

Lawatan Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke Tapak Benih Padi NMR 152 (Sekinchan, Selangor)

Visit of the Director General, Ts. Dr. Siti A'iasah Hashim to Paddy Seed Site NMR 152 (Sekinchan, Selangor)

Februari 2021 *February 2021*

10 Februari 2021

Lawatan Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke Tapak Projek Pembangunan Disused Sealed Radioactive Source (DSRS), (Blok 33)

Visit of the Director General, Ts. Dr. Siti A'iasah Hashim to the Disused Sealed Radioactive Source (DSRS) Development Project Site (Block 33)

11 Februari 2021

Lawatan Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke Tapak Projek Solar Leasing (Parkir Kenderaan Nuklear Malaysia)

Visit of the Director General, Ts. Dr. Siti A'iasah Hashim to the Solar Leasing Project Site (Nuklear Malaysia Vehicle Parking)

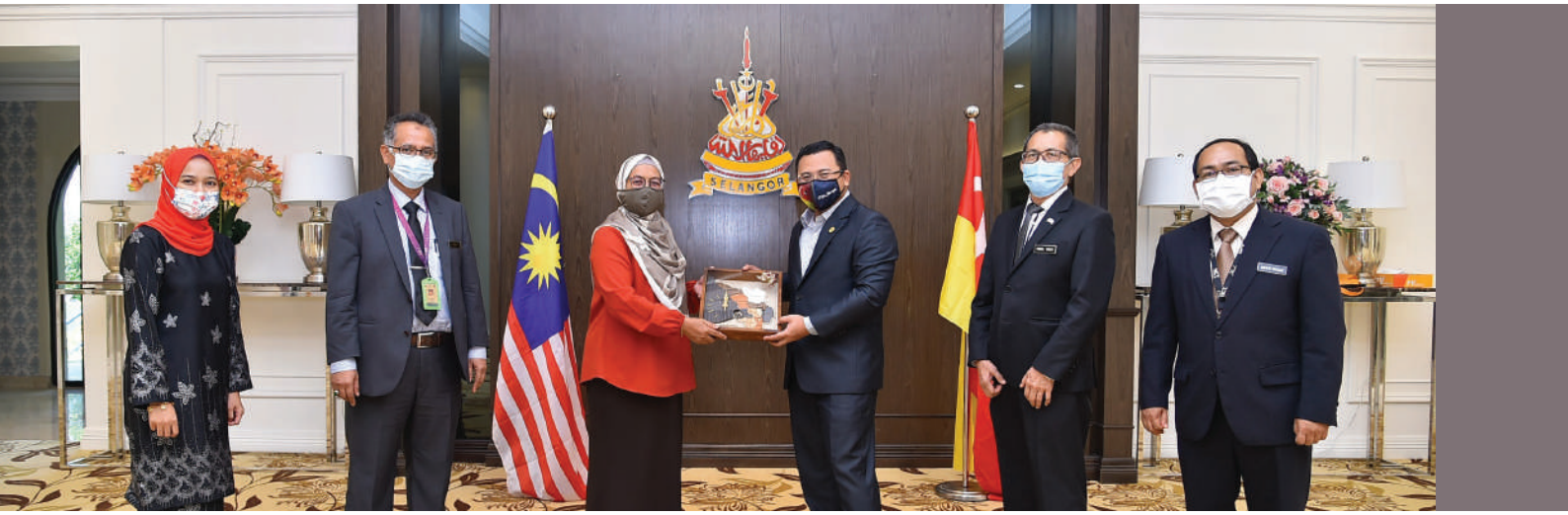
23 Februari 2021

Majlis Perhimpunan Bulanan Bil. 2 (Bilik Majlis)

Monthly Assembly No. 2 (Council Room)

Mac 2021 *March 2021*

4 Mac 2021



Kunjungan Hormat Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke atas Menteri Besar Selangor YAB Dato' Seri Amirudin Bin Shari (Kediaman Rasmi Menteri Besar Selangor)

Courtesy Call of the Director General, Ts. Dr. Siti A'iasah Hashim on the Chief Minister of Selangor YAB Dato 'Seri Amirudin Bin Shari (Official Residence of the Chief Minister of Selangor)

Mac 2021 *March 2021*

8 Mac 2021

Kunjungan Hormat Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke atas Panglima Wilayah Laut (1). (Pangkalan Tentera Laut Diraja Malaysia (TLDM) Kuantan, Pahang)

Courtesy Call of the Director General, Ts. Dr. Siti A'iasah Hashim on the Commander of the Marine Region (1) (Royal Malaysian Navy Base (RMN) Kuantan, Pahang)

9 Mac 2021

Sesi Webinar, An Afternoon with WiN President (Bilik Persidangan)

Webinar Session, An Afternoon with WiN President (Conference Room)

17 Mac 2021

Kunjungan Hormat Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke atas Panglima Angkatan BERSAMA (Markas Angkatan BERSAMA, Kuantan)

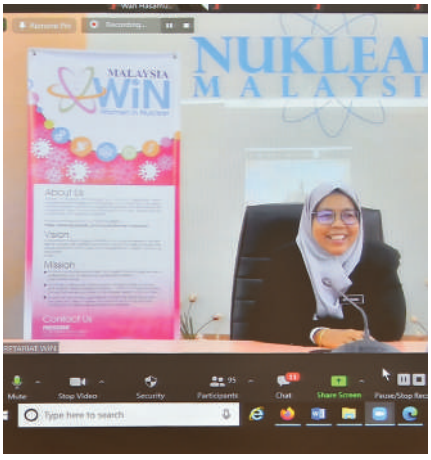
Courtesy Call of the Director General, Ts. Dr. Siti A'iasah Hashim on the Commander BERSAMA (BERSAMA Headquarters, Kuantan)

18 Mac 2021

Majlis Penyerahan Benih Padi Nuklear NMR152 (Rompin, Pahang)

NMR152 Nuclear Paddy Seed Handover Ceremony (Rompin, Pahang)

23 - 24 March 2021



WiN 5th Annual Conference (Bilik Persidangan)

WiN 5th Annual Conference (Conference Room)

25 Mac 2021

Majlis Perhimpunan Bulanan Bil. 3 (Dewan Tun Dr. Ismail)
Monthly Assembly No. 3 (Tun Dr. Ismail Hall)

29 Mac 2021

Majlis Bersama Jabatan Bil. 1 (Bilik Persidangan)
Joint Council of the Department No. 1 (Conference Room)

April 2021 *April 2021*

1 April 2021

Majlis Amanat Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim Bil. 1 Tahun 2021 (Bilik Persidangan)
Director General's Mandate Council, Ts. Dr. Siti A'iasah Hashim No. 1 of 2021 (Conference Room)

2 April 2021

Kunjungan Hormat Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke atas Ketua Pengarah Lembaga Perlesenan Tenaga Atom YBrs. Tuan Haji Mohd Pauzi bin Mohd Sobari (LPTA Dengkil)

Courtesy Call of the Director General, Ts. Dr. Siti A'iasah Hashim on the Director General of the YBrs. Atomic Energy Licensing Board. Tuan Haji Mohd Pauzi bin Mohd Sobari. (LPTA Dengkil)

3 April 2021

Lawatan Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke Projek MySI 19286 Cendawan (KOKULAC) (Pasir Puteh, Kelantan)

Visit of the Director General, Ts. Dr. Siti A'iasah Hashim to MySI 19286 Mushroom Project (KOKULAC). (Pasir Puteh, Kelantan)

4 April 2021

Kunjungan Hormat Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke atas YAB Bentara Kanan Menteri Besar Kelantan, Ustaz Dato' Haji Ahmad bin Yakob (Pejabat Menteri Besar Kelantan)

Courtesy Call of the Director General, Ts. Dr. Siti A'iasah Hashim on the YAB Bentara Kanan Menteri Besar Kelantan, Ustaz Dato 'Haji Ahmad bin Yakob. (Kelantan Chief Minister's Office)

12 April 2021

Mesyuarat Agung Tahunan ke-36 Kelab Nuklear Malaysia (Dewan Tun Dr. Ismail).

36th Annual General Meeting of the Nuklear Malaysia Club. (Tun Dr. Ismail Hall)

20 April 2021

Majlis Penyerahan Surat Pelantikan TKP Program Penyelidikan & Pembangunan Teknologi dan TKP Program Perkhidmatan Teknikal. (Bilik Majlis)

Ceremony of Submission of Appointment Letter for TKP Technology Research & Development Program and TKP Technical Services Program. (Council Room)

21 April 2021

Kunjungan Hormat dari Kedutaan Argentina TYT Manuel Balaguer Salas (Pejabat Ketua Pengarah)

Courtesy Call from the Argentine Embassy His Excellency Manuel Balaguer Salas (Director' General Office)

27 April 2021

Kunjungan Hormat Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke atas Ketua Pengarah MPOB Datuk Dr. Ahmad Parveez Hj. Ghulam Kadir. (Bilik Mesyuarat, MPOB).

Courtesy Call of the Director General, Ts. Dr. Siti A'iasah Hashim on the MPOB Director General Datuk Dr. Ahmad Parveez Hj. Ghulam Kadir (Meeting Room, MPOB)

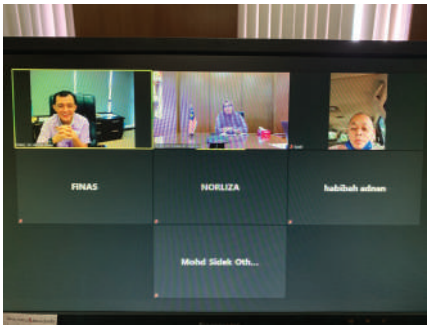
30 April 2021

Kunjungan Hormat Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke atas Ketua Pengarah Pertanian YBhg. Datuk Haji Mohd Nasir bin Warris
(Jabatan Pertanian, Presint 4, Putrajaya)

Courtesy Call of the Director General, Ts. Dr. Siti A'iasah Hashim on the Director General of Agriculture YBhg. Datuk Haji Mohd Nasir bin Warris (Department of Agriculture, Precinct 4, Putrajaya)

Mei 2021 *May 2021*

4 May 2021



Kunjungan Hormat (atas talian) Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke atas Ketua Pegawai Eksekutif FINAS Dr. Ahmad Idham Ahmad Nadzri (Bilik Majlis)

Courtesy Call (online) Director General, Ts. Dr. Siti A'iasah Hashim on the Chief Executive Officer of FINAS Dr. Ahmad Idham Ahmad Nadzri (Council Room)

5 May 2021

Program Ihya Ramadan 2021: Infaq Bubur Lambuk
(Blok 11 & Blok 12)

Ihya Ramadan 2021 Program: Infaq Lambuk Porridge (Block 11 & Block 12)

6 May 2021

Majlis Amanat Ketua Pengarah, Penyerahan Surat Keputusan Pemangkuan dan Kenaikan Pangkat (Bilik Seminar)

Director General's Mandate Ceremony, Submission of Acting Decision and Promotion Letter (Seminar Room)

11 May 2021

Majlis Penyerahan Sumbangan Raya kepada Pegawai Unit Keselamatan dan Fizikal (UKF) (Lobi Blok 11)

Eid' Contribution Presentation Ceremony to Security and Physical Unit (UKF) Officers (Block 11 Lobby)

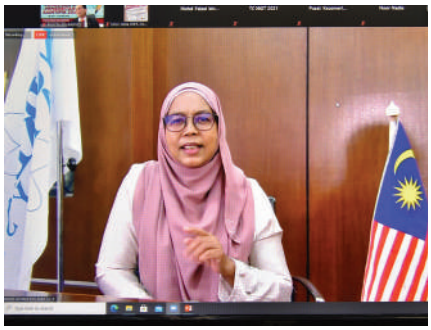
25 May 2021

Majlis Perhimpunan Bulanan Bil. 5 (Bilik Majlis)

Monthly Assembly No. 5 (Council Room)

Jun 2021 *June 2021*

29 Jun - 1 Julai 2021



Seminar dan Bengkel Penulisan & Penerbitan Saintifik (Bilik Majlis)

Scientific Writing & Publishing Seminars and Workshops (Council Room)

30 Jun 2021

Sesi Clock-Out Pengarah Kanan Pengurusan, Dr. Chantara Thevy Ratnam (Blok 11)

Clock-Out Session Senior Director of Management, Dr. Chantara Thevy Ratnam (Block 11)

Julai 2021 *July 2021*

10 Julai 2021

Lawatan Menteri Besar Selangor ke Pusat Pemberian Vaksin (PPV, BACC)

Selangor Chief Minister Visit to the Vaccination Center (PPV, BACC)

21 Julai 2021

Majlis Penyerahan Surat Pelantikan Pengarah BST, Pengarah BTI, Pengarah BKT dan Pengarah BPA (Bilik Majlis)

Ceremony of Submission of Appointment Letter of BST Director, BTI Director, BKT Director and BPA Director (Council Room)

29 Julai 2021

Majlis Perhimpunan Bulanan Bil. 7 (Bilik Majlis, Blok 11)

Monthly Assembly No. 7 (Council Room, Block 11)

Ogos 2021 *August 2021*

6 Ogos 2021

Sesi Temubual Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim dalam Slot SPM
(Wisma Berita Angkasapuri, Kuala Lumpur)

Director General Interview Session, Ts. Dr. Siti A'iasah Hashim in the SPM Slot
(Wisma Berita Angkasapuri, Kuala Lumpur)

16 Ogos 2021

Majlis Menandatangani MOU antara Nuklear Malaysia dan MPOB (Bilik Majlis).

MOU Signing Ceremony between Nuklear Malaysia and MPOB (Council Room)

17 Ogos 2021

Kunjungan Hormat Duta Besar Malaysia ke Austria Encik Ikram Bin Mohammad Ibrahim (Pejabat Ketua Pengarah)

Honorary Visit of Malaysian Ambassador to Austria Mr. Ikram Bin Mohammad Ibrahim (Office of the Director General)

19 Ogos 2021

Majlis Menandatangani MOU antara Nuklear Malaysia dan Jabatan Pertanian Malaysia (Nuklear Malaysia)

MOU Signing Ceremony between Nuklear Malaysia and Department of Agriculture (Nuklear Malaysia)

20 Ogos 2021

Penyerahan Vest Petugas dari Kelab Nuklear Malaysia. (Pusat Pemberian Vaksin, Bangi Avenue Convention Center)

Presentation of Officer's Vest from the Nuklear Malaysia Club. (Vaccination Center, Bangi Avenue Convention Center)

September 2021 *September 2021*

9 September 2021

Forum UV Radiation (Webinar) (Bilik Majlis)

UV Radiation Forum (Webinar) (Council Room).

21-22 September 2021

Seminar on Food Safety 2021 (Webinar) (Bilik Majlis)

Seminar on Food Safety 2021 (Webinar) (Council Room)

22 September 2021

Temubual Pengarah Kanan (Pengkomersialan), Encik Mohd Sidek bin Othman bersama Selangor.FM
(Pejabat Ketua Pengarah)

Interview with Senior Director (Commercialization), Mr. Mohd Sidek bin Othman with Selangor. FM (Head Director's Office)

Oktober 2021 *October 2021*

5 Oktober 2021

Majlis Penghargaan Petugas PPV (Pusat Pemberian Vaksin, Bangi Avenue Convention Center)

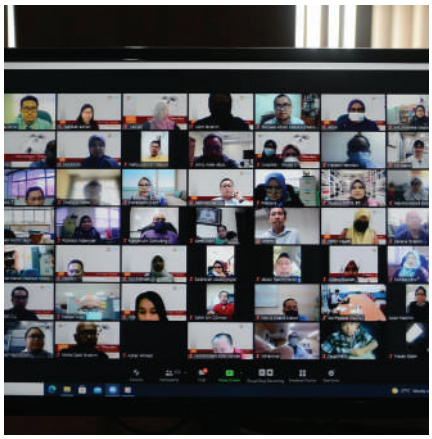
PPV Staff Appreciation Ceremony (Vaccination Center, Bangi Avenue Convention Center)

25 Oktober 2021

Kunjungan Hormat Jabatan Keselamatan, Kesihatan Pekerjaan, Alam Sekitar dan Kualiti (HSEQ) (Bilik Majlis)

Courtesy Call from the Department of Occupational Safety, Health, Environment and Quality (HSEQ) (Council Room)

26-28 Oktober 2021



Konvensyen Teknikal Nuklear Malaysia (NTC) 2021 (Bilik Majlis)

Nuklear Malaysia Technical Convention (NTC) 2021 (Council Room)

29 Oktober 2021

Kunjungan Hormat Exco Jawatankuasa Bertindak Pertanian dan Industri Makanan Negeri Sembilan YB Dato' Haji Bakri Bin Sawir (Bilik Tungsten)

Courtesy Call of the Exco of the Negeri Sembilan Agriculture and Food Industry Action Committee YB Dato' Haji Bakri Bin Sawir (Tungsten Room)

18 Oktober 2021

Penerimaan Watikah Pelantikan Pengarah Kanan (Program Pengurusan), Dr. Muhammad Rawi bin Mohamed Zin (Bilik Majlis)

Receipt of Letter of Appointment of Senior Director (Management Program), Dr. Muhammad Rawi bin Mohamed Zin (Council Room)

21 Oktober 2021

Penerimaan Watikah Pelantikan Pengarah Bahagian Teknologi Pemprosesan Sinaran (BTS), Dr. Hasni binti Hasan (Bilik Majlis)

Receipt of the Letter of Appointment of the Director of the Radiation Processing Technology Division (BTS), Dr. Hasni binti Hasan (Council Room)

November 2021 *November 2021*

8 November 2021

Lawatan Kerja Rasmi Menteri MOSTI, YB Dato' Sri Dr. Adham bin Baba (Nuklear Malaysia)

Official Working Visit of the Minister of MOSTI, YB Dato' Sri Dr. Adham bin Baba (Nuklear Malaysia)

9 November 2021

Majlis Amanat Ketua Pengarah, Penyampaian Surat Pemangkuan dan Kenaikan Pangkat (Bilik Persidangan)

Director General's Mandate Ceremony, Presentation of Acting Letter and Promotion (Conference Room)

16 dan 18 November 2021

WiNSEA Mentorship Series Talk
(Bilik Majlis)

WiNSEA Mentorship Series Talk (Council Room)

17 November 2021

Majlis Pecah Tanah Pembangunan Projek E-Beam (Alor Gajah, Melaka)

Groundbreaking Ceremony for E-Beam Project Development (Alor Gajah, Melaka)

20 November 2021

Majlis Pelancaran Benih Padi IS21 (Sekinchan, Selangor)

Launching Ceremony of IS21 Paddy Seed (Sekinchan, Selangor)

20 November 2021

22 November 2021

Webinar Quality Management Symposium (QMS) 2021 (Bilik Majlis)

Webinar Quality Management Symposium (QMS) 2021 (Council Room)

24 November 2021

Kursus Analisis Keperluan Latihan (TNA) (Bilik Seminar)

Training Needs Analysis (TNA) (Seminar room)

Disember 2021 *December 2021*

1 Disember 2021

Program Derma Darah anjuran PUSPANITA dan FIRST AIDER Nuklear Malaysia
(Bilik Zamrud)

Blood Donation Program, organized bu PUSPANITA and FIRST AIDER Nuklear Malaysia
(Emerald Room)

2 Disember 2021

Sesi Ramah Mesra YBTM MOSTI, Datuk Hj. Ahmad Amzad bin Hashim bersama Pemenang IAEA NST Education Competition (Bilik Majlis)

YBTM MOSTI Meet and Greet Session, Datuk Hj. Ahmad Amzad bin Hashim with the Winners of the IAEA NST Education Competition (Council Room)

4 Disember 2021

Kejohanan Boling Tertutup Nuklear Malaysia
(Airport Sport Complex, Nilai)

Nuklear Malaysia Closed Bowling Championship
(Airport Sport Complex, Nilai)

8 Disember 2021

Sesi Fotografi, Ice-Breaking dan Mesyuarat AKRAB Bil. 2 (Bilik Seminar)

Photography Session, Ice-Breaking and AKRAB Meeting No. 2 (Seminar Room).

9 Disember 2021

Mesyuarat Agung Tahunan KKPB Ke-28 (Dewan Tun Dr. Ismail).

28th Annual General Meeting of KKPB (Tun Dr. Ismail Hall).

13-14 Disember 2021

Program Perdana Teknologi Nuklear (TPS) 2021 (Bilik Persidangan)

Nuclear Technology Premier Program (TPS) 2021 (Conference Room)

15 Disember 2021

Pemenang Anugerah Khas Geran Malaysia Grand Challenge TPS 2021 (Bilik Majlis)

Winner of the Malaysia Grand Challenge TPS 2021 Grant Special Award (Council Room)

15 Disember 2021

Majlis Pelancaran Dokumen Wawasan Nuklear Malaysia (Bilik Seminar)

Launching Ceremony of Nuklear Malaysia Vision Document (Seminar Room)

20 Disember 2021

Kunjungan Hormat Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim ke atas Timbalan Ketua Menteri II Sabah Datuk Seri Panglima Dr. Jeffrey G. Kitingan (Kota Kinabalu, Sabah)

Courtesy Call of the Director General, Ts. Dr. Siti A'iasah Hashim on the Sabah Deputy Chief Minister II Datuk Seri Panglima Dr. Jeffrey G. Kitingan (Kota Kinabalu, Sabah)

21 Disember 2021

Perjumpaan Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim dengan Veteran TLDM Sabah (Kota Belud, Sabah)

Meeting of the Director General, Ts. Dr. Siti A'iasah Hashim with Sabah RMN Veteran (Kota Belud, Sabah)

21 Disember 2021

Mesyuarat Susulan bagi Membincangkan Kerjasama antara Lembaga Koko dan Nuklear Malaysia (Kota Kinabalu, Sabah)

Follow - up Meeting to Discuss Cooperation between the Cocoa Board and Nuklear Malaysia (Kota Kinabalu, Sabah)

22 Disember 2021

Lawatan ke Projek Jeti Terapung Biokomposit MySI (Bagang) (Semporna, Sabah)

Visit to MySI Biocomposite Floating Jetty Project (Bagang) (Semporna, Sabah)

29 Disember 2021

Majlis Menandatangani MOU bersama Asia Pacific University (Bilik Persidangan).

MOU Signing Ceremony with Asia Pacific University (Conference room)

30 Disember 2021

Majlis Perhimpunan Bulanan Bil. 6 (Dewan Tun Dr. Ismail)

Monthly Assembly No. 6 (Tun Dr. Ismail Hall)

30 Disember 2021

Majlis Penyerahan Sumbangan Mangsa Banjir Warga Nuklear Malaysia Anjuran PUSPANITA (Lobi Blok 11)

Donation Handover Ceremony to Nuklear Malaysia Flood Victims Organized by PUSPANITA (Block 11 Lobby)

31 Disember 2021

Majlis Sekalung Budi Sejambak Kasih Ketua Pengarah, Ts. Dr. Siti A'iasah Hashim (Dewan Tun Dr. Ismail)

Farewell Ceremony for Director General, Ts. Dr. Siti A'iasah Hashim (Tun Dr. Ismail Hall)

4.0 PENYELIDIKAN DAN PEMBANGUNAN TEKNOLOGI

RESEARCH AND TECHNOLOGY DEVELOPMENT

4.0 PENYELIDIKAN DAN PEMBANGUNAN TEKNOLOGI

RESEARCH AND TECHNOLOGY DEVELOPMENT

Aktiviti penyelidikan dan pembangunan teknologi (P&P) diteruskan dengan cemerlang pada tahun 2021. Hasil daripada aktiviti ini, pelbagai output dihasilkan dan mendapat pengiktirafan dari pelbagai pihak.

Research and technology development (R&D) activities continued excellence in year 2021. As a result of this activity, various outputs were produced and received recognition from various sides.

4.1 HASIL PENYELIDIKAN DAN PEMBANGUNAN TEKNOLOGI

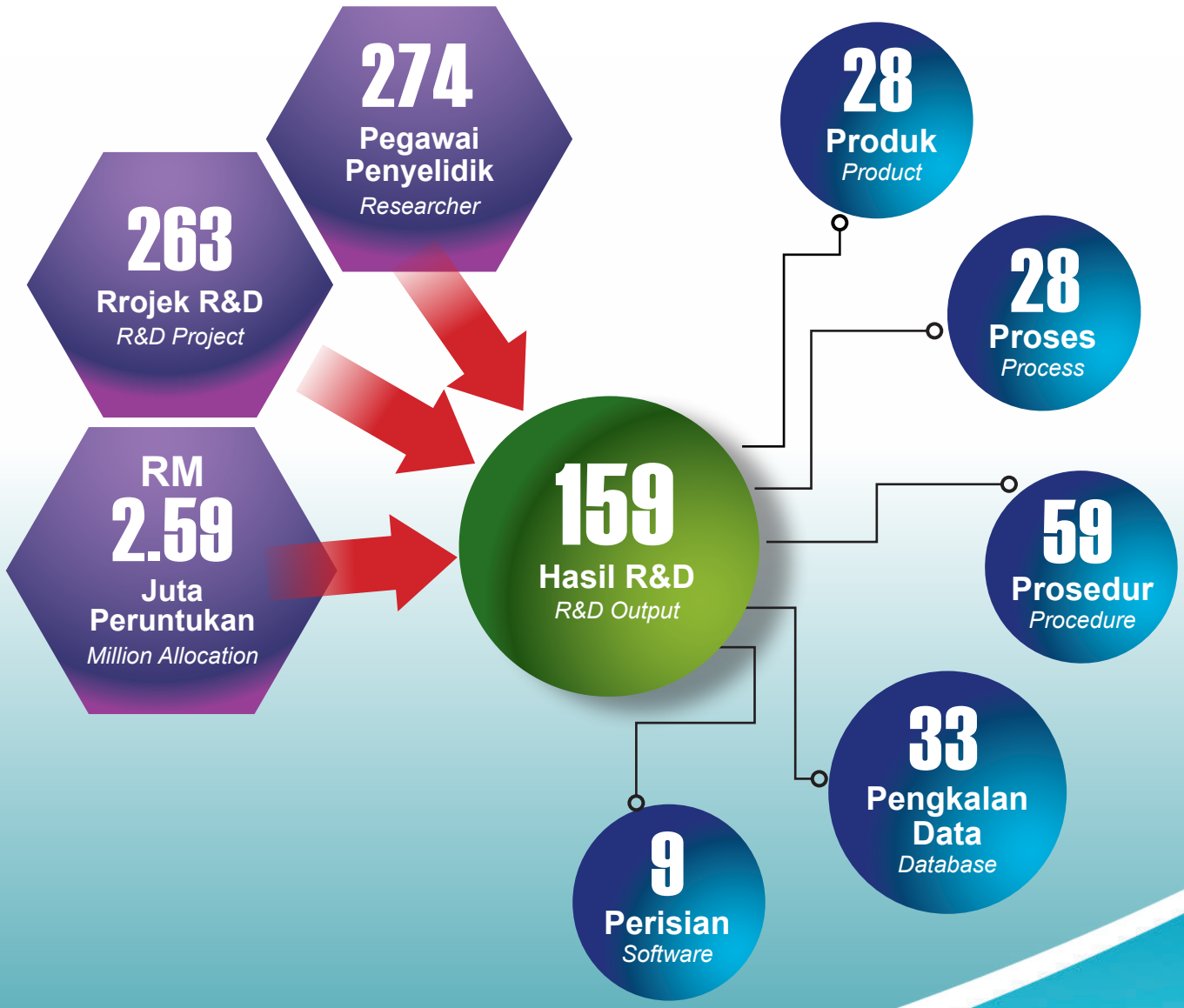
RESEARCH AND DEVELOPMENT TECHNOLOGY OUTPUT

Sebagai peneraju dalam penyelidikan sains dan teknologi (S&T) nuklear, Nuklear Malaysia terus komited dalam mencapai kecemerlangan P&Pnya. Aktiviti P&P giat dilaksanakan dalam pelbagai teknologi berkaitan seperti teknologi reaktor, industri, perubatan, sisa dan alam sekitar, agroteknologi dan biosains, keselamatan dan kesihatan sinaran, akselerator, kemudahan sokongan teknologi nuklear dan pemprosesan sinaran.

As a leader in nuclear science and technology (S&T) research, Nuklear Malaysia remains committed to achieving its R&D excellence. R&D activities are actively implemented in various related technologies such as reactor technology, industry, medicine, waste and environment, agrotechnology and bioscience, radiation safety and health, accelerators, nuclear technology support facilities and radiation processing.

Sebanyak 28 produk, 28 proses, 59 prosedur, 33 pangkalan data dan sembilan perisian telah berjaya dihasilkan. Maklumat dan perincian setiap hasil penyelidikan adalah seperti berikut:

A total of 28 products, 28 processes, 59 procedures, 33 databases and nine software were successfully produced. The information and details of each research result are as follows:



Jadual 4.1: Senarai Produk *Table 4.1: Product List*

Bil. *No.*	Hasil P&P *R&D Output*	Ketua Projek *Project Leader*
1	Produk Biobaja M100	Dr. Phua Choo Kwai Hoe
2	EDTMP Kit	Dr. Azahari bin Kasbollah
3	Sm-153	Dr. Azahari bin Kasbollah
4	Padi NMR151 & NMR152	Dr. Sobri bin Hussein
5	Pembangunan Prototaip "*Geo Tagging Survey Meter*"	Nor Arymaswati binti Abdullah
6	WINDR-53	Dr. Mohd Noorul Ikhsan bin Mohamed
7	Mutan Stabil Kenaf	Dr Zaiton binti Ahmad
8	Polisakarida Cendawan	Dr. Shaiful Azuar bin Mohamad
9	*Centralization of Fire Alarm System at Malaysian Nuclear Agency*	Noor Farhana Husna binti A Aziz
10	*Sterile and Pyrogen Free DTPA Kit*	Wan Hamirul Bahrin bin Wan Kamal
11	Mutan Stabil Rumput *Napier*	Dr. Zaiton binti Ahmad
12	Set Sistem Pintar Pengurusan Tanaman Padi	Shyful Azizi bin Abdul Rahman
13	I-SPECT – PAT	Dr. Nazrul Hizam bin Yusoff
14	*The Potential of Using Clay Based Radiation Shielding Materials (CBRSM) for X-ray and Gamma Rays Shielding Facilities (NM-R&D-19-012)*	Dr. Azuhar bin Ripin
15	*Development of Low Cost Survey Meter for Education*	Maslina binti Mohd Ibrahim
16	*Prototype Smart Mushroom House*	Dr. Azhar bin Mohamad
17	*Design and Development of High Voltage Power Supply for Radiation Detection*	Nor Arymaswati binti Abdullah
18	*Kinetic of Microorganism Inactivation in Domestic Sewage Sludge by Electron Beam Irradiation*	Sarala A/P Selambakkannu
19	*Fractionation and Speciation of Heavy Metals in Plants Grown on Soil Amended with Domestic Sewage Sludge*	Sarala A/P Selambakkannu
20	*Development of New Data Correlation Procedure for Monitoring Soil Condition Using Ground Penetrating Radar (GPR) and Nuclear Density Gauge (NDG)*	YM Tengku Sarah binti YM Tengku Amran
21	*Elevated Temperature Core Flood Rig*	Dr. Noraishah binti Othman
22	RT-NEMO	Dr. Noraishah binti Othman

23	*Development of Portable Gamma CT System for On-site Large Object Scanning*	Dr. Susan Maria Sipaun
24	*Development of New Delivery System for Targeted Cancer Therapy*	Dr. Siti Najila binti Mohd Janib
25	*Innocare Masks*	Ir. Dr. Mahdi Ezwan bin Mahmoud
26	*Biopolymer as Coating Materials for Packaging*	Dr. Norzita binti Yacob
27	*Synergistic Solvent Extraction of Cerium from Monazite Mineral*	Dr. Nurliana binti Roslan
28	*Wireless Nuclear Detector GM*	Ismail bin Mustapha

Jadual 4.2: Senarai Proses *Table 4.2: Process List*

Bil. *No.*	**Hasil P&P** *R&D Output*	**Ketua projek** *Project Leader*
1	Pembangunan Sistem Pengayaan Tritium dengan Menggunakan Kaedah Elektrolisis	Mohamad Syahiran bin Mustaffa
2	Penyelidikan dan Pembangunan Samarium-153 EDTMP	Dr. Azahari bin Kasbollah
3	Proses Penghasilan Anak Benih Kultur Tisu Pisang Berskala Besar	Norazlina binti Noordin
4	*Development of the Direct CO_2 Absorption Method for 14C Concentration Measurement in Aqueous Samples.*	Jeremy Andy anak Dominic Daung
5	*Production of Sterile and Pyrogen Free DTPA kit*	Wan Hamirul Bahrin bin Wan Kamal
6	Penyediaan Lateks Getah Asli Prapemvulkanan Hibrid Ultralembayung-Peroksida (Hidrid UVNRL-Peroksida)	Dr. Sofian bin Ibrahim
7	*Effect of Antioxidant on Aging Properties of UV Vulcanized Natural Rubber Latex (UVNRL)*	Mohd Noorwadi bin Mat Lazim
8	Pembangunan *IT Tools for Knowledge Retention*	Dr. Mohamad Safuan bin Sulaiman
9	Pembangunan Sistem Aplikasi Simulator (Sistem Simulasi): *Radiological Incidence Response Simulator using Virtual Reality (VR) Technology based on RANEPF Methodology*	Dr. Amy Hamijah binti Ab Hamid
10	Kaedah Penyaringan dan Pemilihan Mutan Cendawan (*Pleurotus sp.*)	Rosnani binti Abdul Rashid

12	*Vulcanization of Natural Rubber Latex by Direct Immersion UV Irradiation*	Dr. Chai Chee Keong
13	Radiografi Neutron (NR) menggunakan Reaktor TRIGA PUSPATI (RTP)	Dr. Khair'iah binti Yazid@Khalid
14	*Design Of UHPC with Different Silica Product Mainly for Sprayable UHPC as Rehabilitation and Repair Technique*	Noor Azreen bin Masenwat
15	*Development of New Delivery System for Targeted Cancer Therapy*	Dr. Siti Najila binti Mohd Janib
16	Penghasilan *Cold Kit Zoledronic Cold Kit*	Dr. Ng Yen
17	*Determination of Explosion Severity for Organic Dust*	Fazila binti Said
18	*Effects of Gamma Irradiation on Fungal Growth and Associated Pathogens on Mangrove*	Fazila binti Said
19	Rekabentuk Modul Perisian Sistem Sekuriti Nuklear Pintar Bersepadu	Dr. Maizura binti Ibrahim
20	*Neutron Diffraction (ND) for Material Characterization Using Reaktor TRIGA PUSPATI (RTP)*	Dr. Faridah binti Mohamad Idris
21	Rekabentuk Modul Perisian Sistem Sekuriti Nuklear Pintar Bersepadu	Dr. Maizura binti Ibrahim
22	*Upgrading of Existing Safety and Security Visualization (S2V) System for Integrated & Intelligent Nuclear Security*	Siti Nurbahyah binti Hamdan
23	*Design and Development of Nuclear/Radioactive Materials Movement and Monitoring (NRMM) System for Integrated & Intelligent Nuclear Security*	Mohd Hasnor bin Hasan
24	Pembangunan *IT-based Knowledge Book*	Siti Nurbahyah binti Hamdan
25	*Design & Development of the Knowledge-based Insiders Trustworthiness Evaluations System (KITES) for Integrated & Intelligent Nuclear Security*	Dr. Maizura binti Ibrahim
26	*Upgrading of the Existing Smart Alert System for Irradiation and Nuclear Facilities (NAFAS)*	Saa'idi bin Ismail
27	*Production and Quality Control of Chromium-51 (Cr-51) to Form Cr-51 EDTA for Determination of Glomerular Filtration Rate*	Muhammad Hanaffi bin Mohamad Mokhtar
28	Proses Penghasilan *Biofertilizer Treated Seeds*	Chong Saw Peng

Jadual 4.3: Senarai Prosedur *Table 4.3: List of Procedures*

Bil. *No.*	Hasil P&P *R&D Output*	Ketua Projek *Project Leader*
1	Pembangunan Sistem Pengayaan Tritium Dengan Menggunakan Kaedah Elektrolisis	Mohamad Syahiran bin Mustaffa
2	Set SO/Standard Penghasilan Benih Padi Asas	Shyful Azizi bin Abdul Rahman
3	Prosedur Operasi Standard bagi Kebolehkesanan dan Pengesahan Ketulenan Makanan	Mohd Noor Hidayat bin Adenan
4	*Uniformity of Content for Sodium Iodide (I-131) Capsule*	Dr. Azahari bin Kasbollah
5	*Uniformity of Mass for Sodium Iodide (I-131) Capsule*	Dr. Azahari bin Kasbollah
6	*Stannous Content for DTPA Kit*	Wan Hamirul Bahrin bin Wan Kamal
7	*Radiochemical Purity for DTPA Kit*	Wan Hamirul Bahrin bin Wan Kamal
9	Prosedur Pengeluaran Lu-177	Dr. Azahari bin Kasbollah
10	*Homogenous Substrate Seedling for Volvarie*lla	Dr. Azhar bin Mohamad
11	*Factor Affecting Beam Quality in Diagnostic Radiology*	Asmaliza binti Hashim
12	*Establishment of Correction Factor (CF) for Nanodot Optical Simulated Luminescent (OSLD) Dosimeters at Low Energy X-ray and Mammography X-ray Beam Qualities (NM-R&D-19-013)*	Wan Hazlinda binti Ismail
13	*Development of Mammographic Beam Quality Standard Lab*	Wan Hazlinda binti Ismail
14	Pembangunan *IT Tools for Knowledge Retention*	Dr. Mohamad Safuan Bin Sulaimanw
15	Pembangunan Sistem Aplikasi Simulator (Sistem Simulasi): *Radiological Incidence Response Simulator using Virtual Reality (VR) Technology based on RANEPF Methodology*	Dr. Amy Hamijah Bt. Ab Hamid
16	I-SPECT – PAT	Dr. Nazrul Hizam bin Yusoff
17	*Radiochemical Purity for MDP kit*	Muhammad Hanaffi bin Mohamad Mokhtar
18	*wwStannous Content for MDP kit*	Muhammad Hanaffi bin Mohamad Mokhtar

19	*Lead Equivalent Thickness Measurement for Nuclear Medicine Exposure Room and Related Facilities Using Cs-137 and Ge-68*	Norriza binti Md Isa
20	*Response of Nanodot on Standard Diagnostic Beam Quality (RQR, RQA, RQT)*	Norriza binti Md Isa
21	*A New Concept of Biodegradable Hybrid Microspheres Combining Both Chemotherapeutic and Radioactive Agents for Liver Cancer Treatment (FRGS 2019)*	Dr. Azahari bin Kasbollah
22	*Mechanistic Radiobiological Modelling of Cellular Radiation Responses by Functionalized Bismuthnanoparticles in Particle Beam Therapy (FRGS 2020)*	Dr. Azahari bin Kasbollah
23	*Temporal Toxic Element Deposition in Coastal Sediments Around Perai Industrial Area, Penang Using Natural Radioisotopes (Sedimentation Rate)*	Yii Mei Wo
24	*Development of Safety Assessment of Ultraviolet Radiation C (UVC)*	Wan Syazlin binti Wan Yunoh
25	*Development of Measurement Methodology for 5G Radiofrequency Electromagnetic field (RF EMF)*	Roha binti Tukimin
26	SOP Penyaringan Pokok Pisang terhadap Foc TR4	Norazlina binti Noordin
27	Prosedur Penyinaran Alur Elektron ke atas Produk Makanan Jenis Surimi	Ruzalina binti Baharin
28	*Develompent of Standard for Particulate Matter (PM2.5) Analysis by Energy Dis[Ersive X-Ray Fluorescence (EDXRF)*	Nur Aqilah binti Sapiee
29	*Graphene Synthesis by Electrochemical Exfoliation of Graphite*	Dr. Julie Andrianny binti Murshidi
30	*Synthesis of Metal Nanoparticles by Gamma Radiolysis Technique*	Dr. Kok Kuan Ying
31	*Development of Method for Particle Size Analysis (PSA) of PTFE Samples Using Surfactant*	Jacqueline Kones
32	*Correlation of Ground Penetrating Radar and Nuclear Density Gauge Data to Determine the Density of Asphalt Pavement*	YM Tengku Sarah binti YM Tengku Amran
33	Laporan *Subsurface Investigation using Ground Penetrating Radar (GPR) at Block 37 Intersection.*	YM Tengku Sarah binti YM Tengku Amran
34	Laporan *Subsurface Investigation using Ground Penetrating Radar (GPR) at Sub Station 1-3*	YM Tengku Sarah binti YM Tengku Amran
35	Laporan *Subsurface Investigation using Ground Penetrating Radar (GPR) at Blok 11*	YM Tengku Sarah binti YM Tengku Amran

36	Laporan *Concrete Inspection using Ground Penetrating Radar (GPR)*	YM Tengku Sarah binti YM Tengku Amran
37	*Subsurface Investigation using Ground Penetrating Radar (GPR) at* Taman Jenderam Aman, Dengkil, Selangor	Mohamad Syafiq bin Mohd Amin
38	*Design of UHPC with Different Silica Product Mainly for Sprayable UHPC as Rehabilitation and Repair Technique*	Noor Azreen bin Masenwat
39	*Eddy Current Testing (ET) Procedure for Metals Screening Technique Based on Electrical Conductivity Measurement According to %IACS (International Anneal Copper Standard)*	Shaharudin bin Sayuti
40	*Procedure for Production of Tetrofosmin Kit*	Siti Selina binti Abdul Hamid
41	Prosedur Pemprosesan Ho-166	Wan Anuar bin Wan Awang
42	*Development of New Delivery System for Targeted Cancer Therapy*	Dr. Siti Najila binti Mohd Janib
43	*Radiolabelling Zoledronic Acid with Tc-99m and Sm-153*	Dr. Ng Yen
44	*SOP of Irradiation of Shelf Stable Products*	Dr. Seri Chempaka binti Mohd. Yusof
45	Rekabentuk Modul Perisian Sistem Sekuriti Nuklear Pintar Bersepadu	Dr. Maizura binti Ibrahim
46	*Wireless Nuclear Detector GM*	Ismail bin Mustapha
47	*Synthesis and Characterization of Irradiated Metal Functionalized Graphene for Hydrogen Storage*	Suhaila Hani binti Ilias
48	*A Method for Preparation of Titania Fibers*	Dr. Cik Rohaida binti Che Hak
49	*Determination of Explosion Severity for Organic Dust*	Fazila binti Said
50	*Effects of Gamma Irradiation on Fungal Growth and Associated Pathogens on Mangrove*	Fazila binti Said
51	*Radionuclide Identification for Chromium-51*	Muhammad Hanaffi bin Mohamad Mokhtar
52	*Feasibility Studies of BaBrX:Eu2+ (X=Cl, F, I) Synthesis Process as Phosphor Material for Imaging Plate/Detector Application*	Dr. Izura Izzuddin
53	*Laboratory Procedure for Detection and Analysis of Gamma Emitting Radiation from Industrial Seal Radioactive Source (Cs-137, Co-60 and Am-241)*	Dr. Zalina binti Laili
54	Prosedur Operasi Standard Pengesanan Makanan Diiradiasi (Pes) Menggunakan Teknik *Photostimulated Luminescence* (PSL)	Ros Anita binti Ahmad Ramli
55	*Upgrading of Existing Safety and Security Visualization (S2V) System for Integrated & Intelligent Nuclear Security*	Siti Nurbahyah binti Hamdan

56	*Design and Development of Nuclear/Radioactive Materials Movement and Monitoring (NRMM) System for Integrated & Intelligent Nuclear Security*	Mohd Hasnor bin Hasan
57	Pembangunan *IT-based Knowledge Book*	Siti Nurbahyah binti Hamdan
58	*Design & Development of the Knowledge-based Insiders Trustworthiness Evaluations System (KITES) for Integrated & Intelligent Nuclear Security*	Dr. Maizura binti Ibrahim
59	*Upgrading of the Existing Smart Alert System for Irradiation And Nuclear Facilities (NAFAS)*	Saa'idi bin Ismail

Jadual 4.4: Senarai Pangkalan Data *Table 4.4: Database List*

Bil. *No.*	**Hasil P&P** *R&D Output*	**Ketua Projek** *Project Leader*
1	*Radiotracer Database*	Dr. Nazrul Hizam Yusoff
2	Laporan Pengujian Bahan Koleksi Emas Jabatan Muzium Malaysia(JMM), Kuala Lumpur Menggunakan Kaedah Pengujian Arus Pusar ((Eddy Current Testing (ET)) – Teknik Kekonduksian Elektrik	Shaharudin bin Sayuti
3	Laporan Pengujian Bahan Piala Bola Sepak HMS Malaya (Football Cup 1921) dan Piala Ragbi HMS Malaya (Rugby Cup 1921), Jabatan Muzium Malaysia (JMM), Kuala Lumpur Menggunakan Kaedah Pengujian Arus Pusar (*(Eddy Current Testing* (ET)) – Teknik Kekonduksian Elektrik	Shaharudin bin Sayuti
4	Laporan Awal Pengujian Kaedah Radiografi Industri Keatas Trofi Bola Sepak dan Ragbi Hms Malaya Tahun 1921, Bahan Koleksi Jabatan Muzium Malaysia (JMM), Kuala Lumpur,	Shaharudin bin Sayuti
5	Pencirian Bahan Buangan Kilang (*Chemical Finger Printing*) dan Pemetaan Taburan Kehadirannya dalam Alam Sekitar di Sg Selangkah Pasir Gudang Johor	Dr. Rahman bin Yaccup
6	*Development of a National Waste Facility: Site Investigation to Optain Preliminary Data From Potential Sites*	Dr. Rahman bin Yaccup
7	Pembangunan Sistem Pengayaan Tritium dengan Menggunakan Kaedah Elektrolisis	Mohamad Syahiran bin Mustaffa

8	Pembangunan Pangkalan Data Isotop Stabil untuk Air Tanah di Lembangan Langat, Selangor dengan menggunakan Kaedah Laser Spektroskopi	Mohd Muzamil bin Mohd Hashim
9	*National Forensic Library (NFL) for Gamma Emitting Radiation form Industrial Seal Radioactive Source (Cs-137, Co-60 and Am-241)*	Dr. Zalina binti Laili
10	*Data on Traceability of Honey in Peninsular Malaysia*	Siti Aminah binti Omar
11	*Data on Radionuclides and Trace Elements Distribution Around Heavy Industry in Klang Valley & Hulu Langat*	Muhammad Azfar bin Azman
12	*Data on Airborne Particulate Matter in the Indoor Environment of the museum.*	Dr. Zalina binti Laili
13	*Data on Air Quality & Environmental Impact Assessment of Industrial Activities in Klang Valley, Kuala Lumpur*	Md Suhaimi bin Elias
14	*Data on Elementals and Radionuclides Concentration in Lichens and Moses as Bio Indicator in Highlands of Peninsular Malaysia*	Shakirah binti Abd Shukor
15	*Data on Urban Tree Leaf (Akasia Tree) as Bio-indicator for Air Pollution around Heavy Industrial Area*	Azian binti Hashim
16	*Asia Pacific Marine Radioactivity Database (ASPAMARD)*	Norfaizal bin Mohamed
17	*Marine Radioactivity Information System (MARIS)*	Dr. Zal U'yun Wan Mahmood
18	*Data on Radionuclides (Cs-134, Cs-137, Ra-226, Ra-228, Th-232, U-238, K-40) in Malaysian Foods*	Yii Mei Wo
19	*Determination of Natural Radionuclides (NORM) and Heavy Metal Elements Concentration with an Assessment of Absorbed Dose and Radiation Hazard Index From Soil Around Sembrong, Catchment Area, Johor*	Mohd Izwan bin Abdul Adziz
20	IAEA/RCA/RAS/7037: *The Wetland and Land Use Management for Kuala Selangor Nature Park and Its Surroundings using Nuclear and Related Techniques Study*	Jalal Bin Sharib@Sarip
21	Perbandingan Dos Ekstrimiti Pekerja Sinaran Nuklear Malaysia Menggunakan Cincin TLD dan Dos Cincin OSL Nanodot	Ahmad Bazlie bin Abd Kadir

22	*Response of Nanodot on Standard Diagnostic Beam Quality (RQR, RQA, RQT)*	Norriza binti Md Isa
23	Data Jujukan DNA Gen-gen Pqq	Chong Saw Peng
24	Pangkalan Data Kesesuaian Makanan Diiradiasi (Pes) Menggunakan Teknik *Photostimulated Luminescence* (PSL)	Ros Anita binti Ahmad Ramli
25	Data Isotop Stabil bagi Madu Lebah dan Madu Kelulut di Semenanjung Malaysia	Mohd Noor Hidayat bin Adenan
26	*Development of Irradiation Database System for ALURTRON User*	Siti Zulaiha binti Hairaldin
27	*Establishing of Internal Dosimetry Laboratory for Determining Intake of Radionuclide in Human Body using Thyroid Counter*	Noor Ezati binti Shuib
28	Kajian Pengukuran dan Pemetaan in-situ dan Dos Kumulatif di Tapak Repositori Sisa Radioaktif, Mukim Kledang, Perak	Nur Khairunisa binti Zahidi
29	Kajian Kepekatan Radon dalam Kolam Air Panas	Faizal Azrin bin Abdul Razalim
30	Sistem Pengurusan Pekerja Sinaran (SPPS)	Suzilawati binti Muhd Sarowi
31	Pembangunan Sistem Pengukuran Dos Dalaman Menggunakan Pembilang Seluruh Tubuh (WBC)	Azimawati binti Ahmad
32	Fasa Pertama : Rekabentuk Pangkalan Data *Microbiological Test Laboratory Management System* (MBioTest)	Dr. Mohamad Safuan bin Sulaiman
33	A *Dynamic Simulation Model to Optimise Radioactive Waste Management*	Kang Wee Siang

Jadual 4.5: Senarai Perisian *Table 4.5: List of Software*

Bil. *No.*	Hasil P&P *R&D Output*	Ketua Projek *Project Leader*
1	*I-SPECT Software*	Dr. Nazrul Hizam bin Yusoff
2	*Software Development for UT Signal Features Extraction - UT Signal Recognition*	Suhairy bin Sani
3	*Centralization of Fire Alarm System at Malaysian Nuclear Agency*	Noor Farhana Husna binti A Aziz
4	Pembangunan Perisian OSLD QC Tool bagi Pengurusan Data Analisis Dosimeter OSL	Konsoh@John Konsoh Sangau
5	Model Asalan Geografi Madu Lebah dan Madu Kelulut Semenanjung Malaysia	Mohd Noor Hidayat bin Adenan
6	*Source-code of Digital Technical Document*	Harzawardi bin Hasim
7	*Development of Portable Gamma CT System for On-Site Large Object Scanning*	Dr. Susan Maria Sipaun
8	Perisian *Simulation for EPS 3000 Radiation Facility*	Mohd Idris bin Taib

4.2 DANA PENYELIDIKAN

RESEARCH FUND

Geran pembiayaan dalaman, pembiayaan di peringkat kebangsaan dan antarabangsa yang dianugerahkan kepada penyelidik adalah salah satu penanda kerancakkan aktiviti penyelidikan agensi. Nuklear Malaysia telah menerima beberapa suntikan dana bagi menjalankan penyelidikannya. Senarai dana yang diterima adalah seperti dalam jadual di bawah.

Internal funding grants, funding at the national and international levels awarded to researchers are one of the markers of the agency's research activities. Nuklear Malaysia has received several injections of funds to conduct its research. The list of funds received is as per the table below.

Jadual 4.6: Peruntukan P&P *Table 4.6: R&D Allocation*

Bil. *No.*	**Dana** *Fund*	**Jumlah Dana (RM)** *Total Fund (RM)*
1	Projek FRGS *FRGS Project*	187,833.00
2	Projek Smart Fund *Smart Fund Project*	570,820.60
3	Projek MOSTI R&D Fund *MOSTI R&D Fund Project*	51,800.00
4	Projek Kerjasama *Cooperation Project*	125,250.00
5	Projek MSI *MSI Project*	276,000.00
6	Pembangunan RMK (R&D) *Development RMK (R&D)*	16,905,764.00
7	IAEA TC	1,401,271.20
8	IAEA CRP	262,080.00
JUMLAH KESELURUHAN *Total*		**19,780,818.80**

4.3 HARTA INTELEK

INTELECTUAL PROPERTY

Nuklear Malaysia telah berjaya mendapatkan tujuh harta intelek bagi hasil penyelidikannya. Sebanyak tiga daripadanya telah dikomersialkan. Jadual di bawah menunjukkan senarai harta intelek yang telah diperolehi bagi tahun 2021.

Nuklear Malaysia has managed to acquire seven intellectual properties for the results of its research. A total of three of them have been commercialised. The table below shows the list of intellectual property acquired for 2021.

Jadual 4.7: Senarai Harta Intelek *Table 4.7: List of Intellectual Property*

Bil. *No.*	**Tajuk** *Title*	**Penyelidik** *Researcher*	**Status Pengkomersialan** *Commercialization Status*
1	*SOP Preparation Mother Culture BIOLIQUIFERT*	• Dr. Phua Choo Kwai Hoe • Dr. Khairuddin bin Abdul Rahim • Latifah binti Nordin • Ahmad Nazrul bin Abd Wahid	Ya *Yes*
2	*SOP Production BIOLIQUIFERT by Using "Biobooster" System*	• Dr. Phua Choo Kwai Hoe • Dr. Khairuddin bin Abdul Rahim • Latifah binti Nordin • Ahmad Nazrul bin Abd Wahid	Ya *Yes*
3	*SOP Preparation Mother Culture API*	• Dr. Phua Choo Kwai Hoe • Dr. Khairuddin bin Abdul Rahim • Latifah binti Nordin • Ahmad Nazrul bin Abd Wahid	Tidak *No*
4	*NMR152*	• Dr. Sobri bin Hussein	Ya *Yes*
5	*GLABELLAN*	• Dr. Sobri bin Hussein	Tidak *No*
6	*Method of Producing Photocatalytic Rutile Titanium Dioxide*	• Dr. Meor Yahaya bin Razali • Masliana binti Mohd Ibrahim • Wilfred @ Sylvester Paulus	Tidak *No*
7	*Process for Converting Radioactive Organic Waste Into Apatite Ceramics*	• Dr. Meor Yahaya bin Razali • Megat Harun Al Rashid bin Megat Ahmad	Tidak *No*

4.4 PROGRAM PERTUKARAN SAINTIFIK PENYELIDIK–INDUSTRI (RISE)

RESEARCH INDUSTRY SCIENTIFIC EXCHANGE PROGRAMME (RISE)

Program Pertukaran Saintifik Penyelidik – Industri (RISE) ialah platform yang menghubungkan penyelidik dengan pihak industri bagi membantu menyelesaikan masalah yang dihadapi oleh pihak industri. Perkongsian kepakaran ini bertujuan untuk meningkatkan inovasi dan produktiviti serta pembangunan kapasiti bagi kedua-dua pihak melalui penyelidikan, konsultasi, pemindahan teknologi atau latihan. Nuklear Malaysia telah berjaya menamatkan lapan projek RISE pada tahun ini seperti jadual di bawah.

The Research - Industry Scientific Exchange Programme (RISE) is a platform that connects researchers with the industry to help solve the problems faced by the industry. This expertise partnership aims to enhance innovation and productivity as well as capacity building for both parties through research, consultation, technology transfer or training. Nuklear Malaysia has successfully completed eight RISE projects this year as per the table below.

Jadual 4.8: Senarai Projek RISE yang telah Selesai

Table 4.8: List of Completed RISE

Bil. *No.*	Tajuk Projek *Project Title*	Syarikat *Company*	Penyelidik *Researcher*
1.	*Development of Company Capacity for HG Solution Company Sdn. Bhd. towards Implementation of Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) and Naturally Occurring Radioactive Material (NORM) Radiological Testing Laboratory*	HG Solution Company Sdn. Bhd.	• Norfaizal bin Mohamed @ Muhamad • Mohd Izwan bin Abdul Adziz
2.	*Development of In-Line Inspection Technology*	Advance Borneo Engineering Sdn. Bhd.	• Amry Amin bin Abas • Dr. Rasif bin Mohd Zain
3.	*Enhancement of Product and Operation Management through Quality Control System Development and Waste Processing as Secondary Product for Tasblock IBS Composite Manufacturing Plant*	Tasblock (M) Sdn. Bhd.	• Faizal bin Abd Rahman • Dr. Rasif bin Mohd Zain • Siti Salwa binti Mohammad Shirajuddin • Meor Yahaya bin Razali • Dr. Mohd Hamzah bin Harun

4.	*Improvement in Backsheet Materials using Green Technology*	HDTEC Energy Sdn. Bhd.	• Nor Azwin binti Shukri • Dr. Nor Azillah Fatimah binti Othman
5.	*Radio Frequency Radiation Assessment for Telecommunication Structure*	Avinn Engineering Services Sdn. Bhd.	• Roha binti Tukimin • Wan Nur Syazlin binti Wan Yunoh
6.	Pembangunan Benih Cendawan Baka Baru Volvariella secara Komersial	CT Ina Enterprise	• Dr. Azhar bin Mohamad • Dr. Seri Chempaka binti Mohd Yusof
7.	Pembangunan Benih Cendawan Baka Baru secara Komersial	AS Anugerah Resources	• Dr. Azhar bin Mohamad • Dr. Seri Chempaka binti Mohd Yusof
8.	*Improvement of Plant Production System through the use of Improved Varieties from Mutation Breeding and Tissue Culture/ Bioreactor Techniques.*	Kulim (M) Sdn. Bhd.	• Dr. Zaiton binti Ahmad • Norazlina binti Noordin • Dr. Sobri bin Hussein • Mustapha bin Akil • James Mackester anak Simoli • Wan Norhanis binti Ahmad Yarani

4.5 KEMUDAHAN/PERALATAN SAINTIFIK NUKLEAR MALAYSIA

Nuklear Malaysia dilengkapi dengan pelbagai peralatan saintifik bagi memastikan aktiviti penyelidikan berteknologi tinggi dapat dilaksanakan. Peralatan ini turut digunakan untuk memberi khidmat kepada pihak industri, institusi penyelidikan lain dan agensi-agensi berkaitan.

NUKLEAR MALAYSIA SCIENTIFIC FACILITIES/ EQUIPMENT

Nuklear Malaysia is equipped with various scientific equipment to enable it to conduct high-tech research activities. This equipment is also used to provide services to industry, other research institutions, and related agencies.

i SPEKTROMETRI JISIM PLASMA GANDINGAN ARUHAN (ICP-MS)

Spektrometri Jisim Plasma Gandingan Aruhan (ICP-MS) yang terdapat di makmal Kumpulan Aplikasi Kimia Analisis (ACA) adalah dari jenama Perkin Elmer, model NexIon 350x. Peralatan ini diperolehi menggunakan peruntukan Projek Thorium Flagship dan ditauliahkan pada tahun 2016.

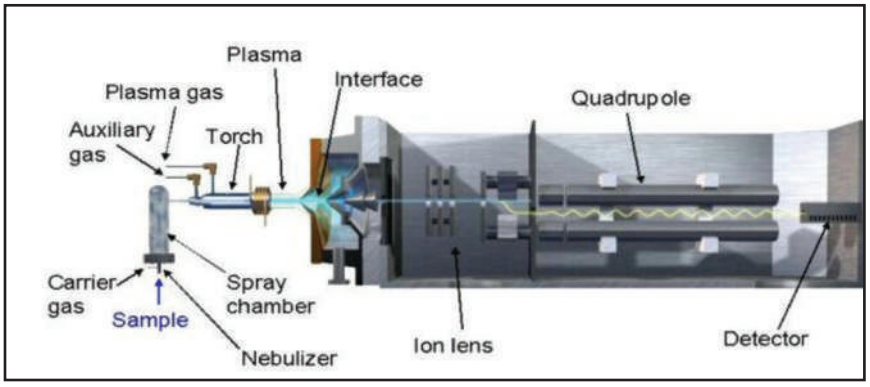
ICP-MS merupakan teknik menganalisis pelbagai unsur yang menggunakan plasma untuk memisahkan ion-ion yang terkandung dalam sampel cecair. Ion-ion diekstrak daripada plasma dan melalui spektrometri jisim untuk pengukuran berdasarkan nisbah jisim-kepada-caj (m/Q). Teknik ini mampu mengesan unsur-unsur pada peringkat bahagian per billion (ppb) (unit kepekatan) dan membolehkan pengukuran pelbagai unsur dalam sampel tunggal.

INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETRY

Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) available in the Analytical Chemistry Application Group (ACA) laboratory is of the Perkin Elmer brand, the NexIon 350x model. The equipment was procured from the Thorium Flagship Project funds and commissioned in 2016.

ICP-MS is a technique of analyzing various elements that uses plasma to separate the ions contained in a liquid sample. The ions are extracted from the plasma and through mass spectrometry for measurement based on the mass-to-charge ratio (m/Q). This technique is capable of detecting elements at the level of parts per billion (ppb) (units of concentration) and allows the measurement of multiple elements in a single sample.

ICP-MS di Makmal ACA
ICP-MS in the ACA Laboratory



ICP-MS skematik diagram
ICP-MS schematic diagram

Alat ini digunakan untuk ***This device is used to:***

Penentuan unsur berat dalam kajian sumber air dan air minuman.

Determination of heavy elements in the study of water and drinking water sources,

Penentuan unsur toksik dalam kajian pemakanan dan farmaseutikal.

Determination of toxic elements in nutritional and pharmaceutical studies,

Penentuan unsur dalam kajian alam sekitar.

Determination of elements in environmental studies,

Penentuan unsur dalam bidang industri dan pembuatan.

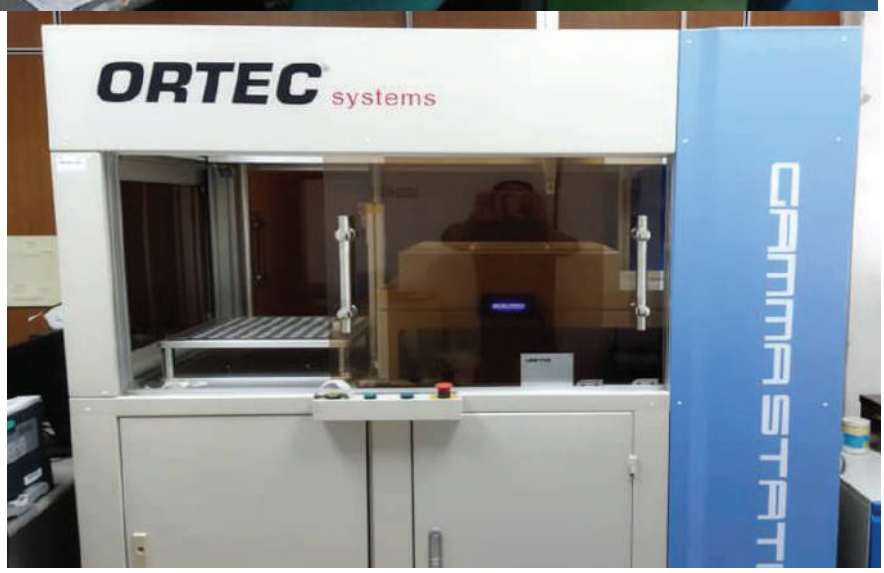
Determination of elements in the field of industry and manufacturing.

ICP-MS NexIon 350x ini turut diguna pakai dalam kajian yang berimpak tinggi pada tahun 2020, iaitu pencemaran Sungai Kim Kim di Johor Bahru. Sampel air serta efluen yang diambil dari sungai dan kilang di sekitarnya telah dianalisis menggunakan alat ICP-MS ini.

The ICP-MS NexIon 350x was also used in a high impact study last year, the pollution of the Kim Kim River in Johor Bahru. Water and wastewater samples from rivers and surrounding factories were analyzed with the instrument ICP-MS.

ii. SPEKTROMETER GAMA

Alat spektrometer gama di Unit Aplikasi Kimia Analisis (ACA) digunakan bagi penentuan dan pengukuran radionuklid daripada hasil tindak balas nukleus yang terjadi akibat penyinaran sampel dari reaktor TRIGA PUSPATI. Antara sampel yang sering dianalisis menggunakan alat ini terdiri daripada sampel alam sekitar seperti tanah, mineral dan sedimen, sampel biologi serta pelbagai jenis sampel/produk.



GAMMA SPECTROMETER

The gamma spectrometer at the Analytical Chemistry Application Unit (ACA) is used for the radionuclides determination and measurement, resulted from nuclear reactions that occurred from samples irradiation the TRIGA PUSPATI reactor. Among the samples that are often analyzed using this tool are of environmental samples such as soil, minerals, and sediments, biological samples, and various types of samples or products.

Antara kemudahan spektrometer gama yang terdapat di makmal ACA

Gamma spectrometer available at the ACA laboratory

iii. SISTEM PEMBILANG GAMA SPEKTROMETRI

GAMMA SPECTROMETRY COUNTING SYSTEM

Sistem Pembilang Gama Spektrometri digunakan untuk mengukur/ menentukan keaktifan radioaktif gama di dalam sampel makanan (cth: ^{134}Cs ,^{137}Cs), variasi sampel alam sekitar (tanih, sedimen, air, flora and fauna dan lain-lain) (cth: ^{226}Ra, ^{228}Ra, ^{40}K), sampel pengesan asap (smoke detector) (cth: ^{241}Am) dan sampel enap cemar (cth: ^{210}Pb, ^{210}Po).

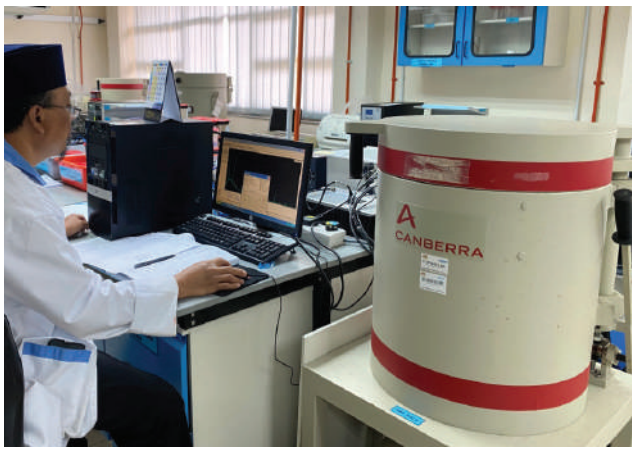
Gamma Spectrometry Counting System is used to measure / determine the radioactive activity of gamma in food samples (e.g., ^{134}Cs,^{137}Cs), variations of environmental samples (soil, sediment, water, flora and fauna, etc.) (e.g., ^{226}Ra, ^{228}Ra, ^{40}K), smoke detector samples (e.g., ^{241}Am) and sludge samples (e.g., ^{210}Pb, ^{210}Po).

Sistem Pembilang Gama Spektrometri

Gamma Spectrometry Counting System

Contoh sampel yang dianalisa menggunakan Sistem Pembilang Gama Spektrometri

Some of analyzed samples using the Spectrometric Gamma Counting System



Pembantu makmal/operator berpengalaman dan terlatih dalam menggendalikan Sistem Pembilang Gama Spektrometri

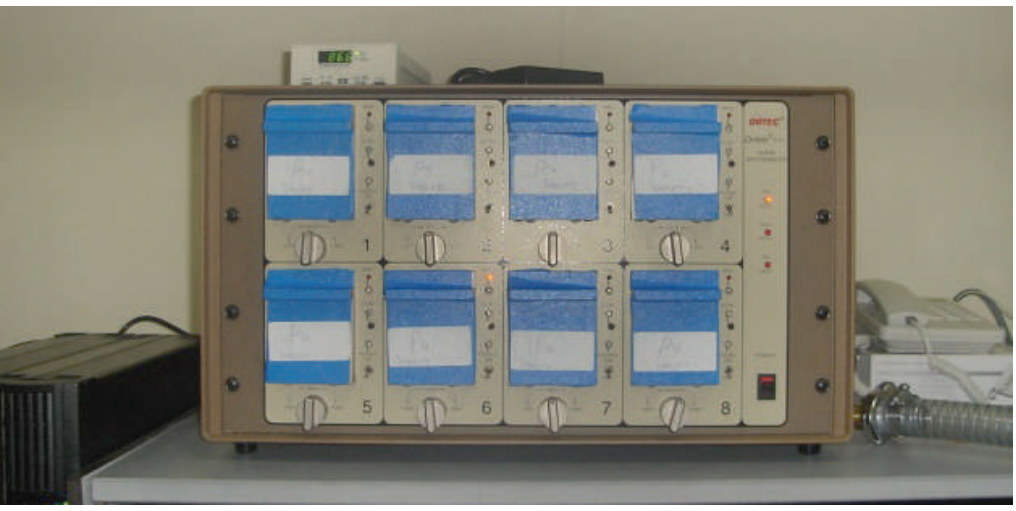
Experienced and trained laboratory assistant / operator operates the Spectrometric Gamma Counting System

iv. SISTEM SPEKTROMETRI ALFA

Sistem Spektrometri Alfa adalah peralatan yang digunakan untuk mengukur tahap pancaran sinaran keradioaktifan alfa dalam pelbagai sampel persekitaran seperti tanah, biota sedimen, flora, fauna dan lain-lain. Teknik ini biasa digunakan kerana kos peralatannya yang agak rendah, kepekaan tinggi disebabkan oleh latar belakang yang rendah dan pemilihan tinggi untuk zarah alfa terhadap jenis sinaran lain seperti polonium -210, isotop uranium, isotop thorium dan isotop plutonium.

Pengesan alfa, Passivated Implanted Planar Silicon (PIPS) yang digunakan mempunyai lapisan ion yang ditanam dengan pemecut, yang seterusnya dapat menghasilkan pengesan lasak dengan resolusi tenaga yang baik. Peralatan ini digunakan secara meluas untuk pengukuran sinaran bagi tujuan pemantauan seperti berikut:

i) Pemantauan Radioaktiviti Persekitaran
ii) Pemantauan Kakitangan Fizik Kesihatan
iii) Pemprosesan Kitaran Bahan Api Nuklear
iv) Nuklear Forensik
v) Ujian Geologi dan Minerologi
vi) Radiofarmaseutikal
vii) NORM/TENORM (Bahan Radioaktif Berlaku Secara Semulajadi)



Sistem Spektrometri Alfa dan Pengesan Alpha Passived Implanted Planar Silicon (PIPS)

Alpha Spectrometry Counting System with Alpha Passived Implanted Planar Silicon (PIPS)

ALPHA SPECTROMETRY SYSTEM

Alpha Spectrometry Systems is used to measure the levels of radioactive alpha radiation in various environmental samples such as soil, sediment biota, flora, fauna, and others. This technique is widely used because the cost of the equipment is relatively low, the sensitivity is high due to low background, and the selectivity for alpha particles is high compared to other types of radiation such as polonium-210, uranium isotopes, thorium isotopes, and plutonium isotopes.

The alpha detector, Passivated Implanted Planar Silicon (PIPS), has an ion layer implanted with an accelerator, which in turn can produce robust detectors with good energy resolution. This device is commonly used for radiation measurements for monitoring purposes:

i) Environmental Radioactivity Monitoring
ii) Health Physics Personnel Monitoring
iii) Nuclear Fuel Cycle processing
iv) Nuclear Forensics
v) Materials Testing - Geology and Minerology
vi) Radiopharmaceuticals
vii) NORM/TENORM (Naturally Occurring Radioactive Materials)

4.6 KUALITI DAN INOVASI

QUALITY AND INNOVATION

Walaupun berdepan dengan cabaran pandemik COVID-19, Nuklear Malaysia tetap meneruskan kecemerlangan dalam penyelidikan dan pembangunan. Ini dibuktikan melalui pencapaian dan anugerah yang diraih sama ada di peringkat antarabangsa atau kebangsaan. Pencapaian yang dikecapi adalah seperti berikut:

Despite the challenges of the COVID-19 pandemic, Nuklear Malaysia continues to excel in research and development. This is evidenced by the achievements and awards achieved either internationally or nationally. The achievements are as follows:

Jadual 4.9: Anugerah Inovasi di Peringkat Antarabangsa
Table 4.9: Innovation Awards at the International Level

Bil. *No.*	**Acara** *Event*	**Tajuk Projek** *Project Title*	**Anugerah** *Awards*	**Ahli Projek** *Project Members*
1.	*65th IAEA General Conference*	*Mutation Breeding*	*IAEA and The Food and Agriculture Organisation of The United Nations (FAO) on Mutation Breeding*	Dr. Sobri bin Hussin BAB
2	FNCA	Agroteknologi dan Biosains	*Excellent Researcher of FNCA 2021 Breakthrough Prize*	Dr. Sobri bin Hussin BAB
3	SIIF 2021	Lateks Getah Asli Pra-Pemvulkanan Hibrid Ultralembayung – Peroksida	Pingat Emas *Gold*	Dr. Sofian bin Ibrahim BTS
4	SIIF 2021	*High Durable Heavyweight Concrete (DURAshield)*	Pingat Perak *Silver*	Noor Azreen bin Masenwat BTI
5	SIIF 2021	*Acinetobacter sp, – 3rd Generation Multifunctional Biofertilizer. Probiotic for Plants: Solution to Crop Productivity and Quality*	Pingat Perak *Silver*	Dr. Phua Choo Kwai Hoe BAB
6	SIIF 2021	Kitogamas *as Tilapia Growth Promoter and Immune Enhancer*	Pingat Gangsa *Bronze*	Dr. Sarada binti Idris BTS
7	SIIF 2021	*Smart Monitoring of Radio Frequency Electromagnetic Fields (RF EMF) System*	Pingat Gangsa *Bronze*	Roha binti Tukimin BKS

Jadual 4.10: Anugerah Inovasi di Peringkat Kebangsaan
Table 4.10: Innovation Awards at the National Level

Bil. *No.*	Acara *Event*	Tajuk Projek *Project Title*	Anugerah *Award*	Ahli Projek *Project Members*
1.	Pertandingan *International Perlis Engineering Research & Learning Innovations Symposium (iPERLIS 2021)* pada 28 – 30 Mei 2021	*A Cascade Hyperbolic Recognition Using Hybrid Feature Extraction in Subsurface Maping*	Pingat Emas *Gold*	Mohamad Ridzuan bin Ahmad YM Tengku Sarah binti YM Tengku Amran
2.	Pertandingan *Virtual Research and Innovation Exhibition UNIMAP (EREKA 2021)* pada 18 Januari – 8 Februari 2021	*A Cascade Hyperbolic Recognition Using Hybrid Feature Extraction in Subsurface Mapping*	Pingat Gangsa *Bronze*	Mohamad Ridzuan bin Ahmad YM Tengku Sarah binti YM Tengku Amran
3.	Pertandingan Minggu Penyelidikan dan Inovasi 2021 (MPI 2021) pada 10 Mac 2021	*A Cascade Hyperbolic Recognition System of Buried Targets Using Hybrid Feature Extraction in GPR Subsurface Scanning*	Pingat Perak *Silver*	Mohamad Ridzuan bin Ahmad YM Tengku Sarah binti YM Tengku Amran
4.	*International Virtual Expo of Innovation Product & System Design 2021* (In-ViDE 2021), UNIMAP pada 22 November 2021	*GPR Roadscan: Portable Mounting System*	Pingat Emas *Gold*	YM Tengku Sarah binti YM Tengku Amran Mohamad Ridzuan bin Ahmad Mohd Syafiq bin Mohd Amin Mohd Fajri bin Osman Dr. Rasif bin Mohd Zain Khairul Nizam bin Mahat Dr. Hasimah binti Ali

5.	*International Virtual Expo of Innovation Product & System Design 2021* (In-ViDE 2021), UNIMAP pada 22 November 2021	*A Cascade Hyperbolic Recognition System of Buried Targets using Hybrid Feature Extraction in GPR Subsurface Scanning*	Pingat Perak *Silver*	Dr. Hasimah binti Ali Ahmad Firdaus bin Ahmad Zaidi Mohd Shuhanaz Zanar Azalan Shazmin Aniza binti Abdul Shukor YM Tengku Sarah binti Tengku Amran Norasmadi bin Abdul Rahim Mohamad Syafiq bin Mohd Amin
6.	*International Virtual Expo of Innovation Product & System Design 2021* (In-ViDE 2021), UNIMAP pada 22 November 2021	*GPR Roadscan: Portable Mounting Systems*	*RMC@ UniMaP Best Innovation Award*	YM Tengku Sarah binti YM Tengku Amran Mohamad Ridzuan bin Ahmad Mohd Syafiq bin Mohd Amin Mohd Fajri bin Osman Dr. Rasif bin Mohd Zain Khairul Nizam bin Mahat Dr. Hasimah bin Ali

Anugerah Kebangsaan yang Dimenangi
National Awards Won

4.7 MALAYSIA GRAND CHALLENGE (MGC)

MALAYSIA GRAND CHALLENGE (MGC)

MGC menerusi geran pembiayaan MOSTI, menyediakan platform kepada masyarakat untuk sama-sama cuba mengatasi permasalahan serta menambah baik kehidupan masyarakat, sistem ekonomi dan persekitaran sama ada di peringkat nasional mahupun global. Tiga projek Nuklear Malaysia menerima geran MGC dengan jumlah RM 8,662,450.00 bagi program *Accellerator Applications.*

MGC through the MOSTI funding grant, provides a platform for the community to work together to overcome problems and improve the lives of the community, economic system and environment both nationally and globally. Three Nuklear Malaysia projects received MGC grants with a total of RM 8,662,450.00 for the Accellerator Applications programme.

4.8 SENARAI PENERBITAN

LIST OF PUBLICATION

Nuklear Malaysia sekali lagi berjaya mencapai sasaran penerbitan tahunannya sebanyak 539 melebihi 500 sasaran yang telah ditetapkan. Senarai penerbitan adalah seperti berikut:

Nuklear Malaysia has once again achieved its annual publication target of 539 above the 500 targets set. The list of publications is as follows:

Jadual 4.11: Senarai Penerbitan *Table 4.11: List of Publication*

Bil. *No.*	Kategori *Category*	Bilangan *Count*
1.	Tesis *Thesis*	8
2.	Buku *Book*	1
3.	Bab Dalam Buku *Chapter in Book*	3
4.	Jurnal Kebangsaan *National Journal*	10
5.	Jurnal Antarabangsa *International Journal*	50
6.	Konferen Kebangsaan *National Conference*	136
7.	Konferen Antarabangsa *International Conference*	18
8.	Laporan Teknikal *Technical Report*	137
9.	Penerbitan Am *General Publication*	34
10.	Laporan Pelajar Latihan Industri *Industrial Training Student Report*	142
JUMLAH		539

5.0 PENGKOMERSIALAN TEKNOLOGI

TECHNOLOGY COMMERCIALIAZATION

5.0 PENGKOMERSIALAN TEKNOLOGI

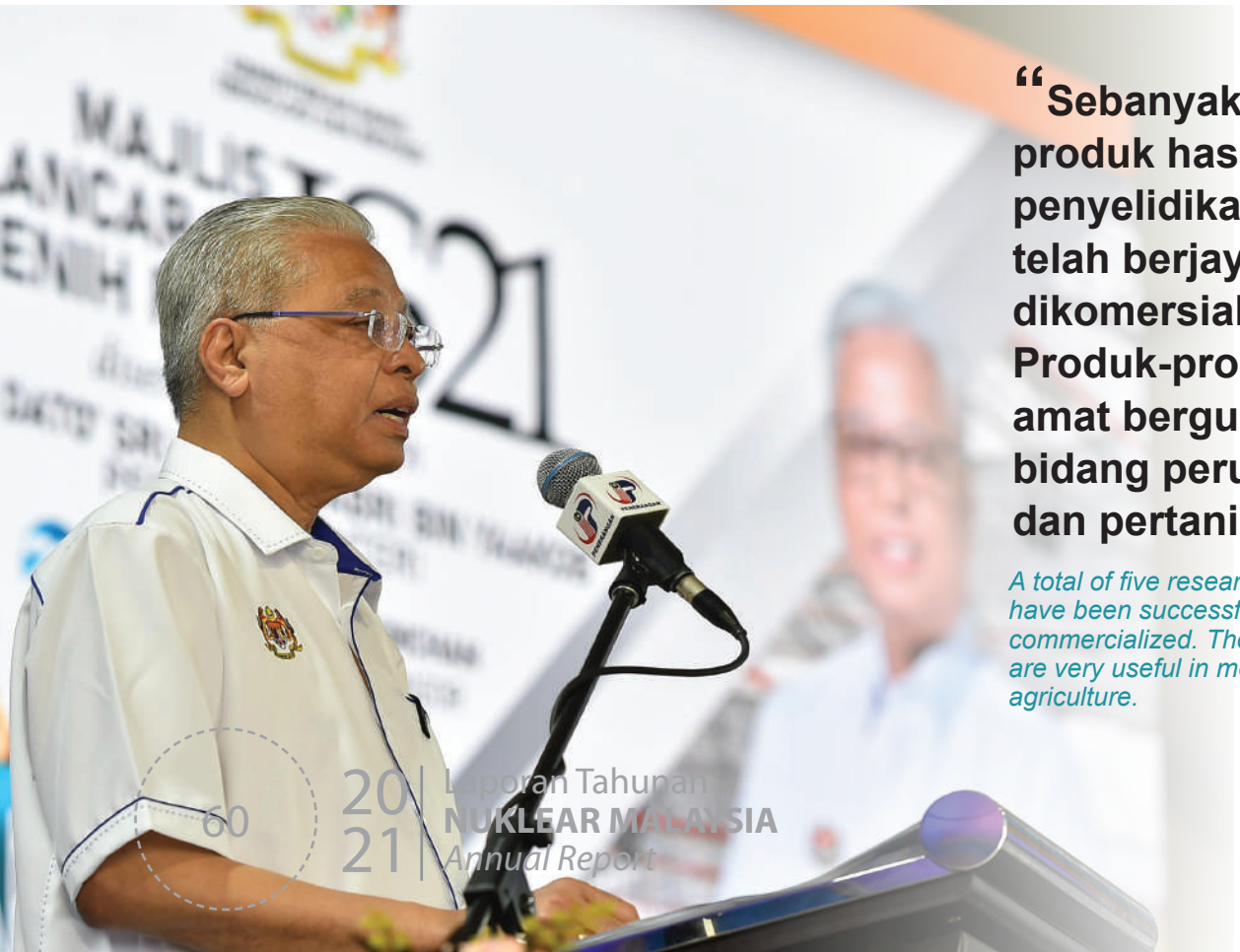
TECHNOLOGY COMMERCIALIZATION

Aktiviti P&P yang hendak dilaksanakan oleh mana-mana penyelidik perlulah mengambil kira keperluan pasaran dan kehendak industri berkaitan. Faktor ini akan membawa kepada kejayaan pengkomersialan hasil penyelidikan yang dilaksanakan. Pengkomersialan teknologi adalah salah satu aktiviti utama Nuklear Malaysia. Pada tahun 2021, aktiviti ini berjaya dilaksanakan dengan cemerlang berdasarkan kejayaan Nuklear Malaysia mengkomersialkan pelbagai produk yang dihasilkan, jumlah kerjasama dengan pemegang taruh dan khidmat berkaitan teknologi sinaran yang dilaksanakan kepada pelanggan.

R&D activities to be carried out by any researcher must take into account the demands of the market and the needs of the relevant industry. These factors will lead to the successful commercialization of the research results carried out. The commercialization of technology is one of Nuklear Malaysia's main activities. In 2021, this activity was successfully implemented with excellence based on the success of Nuklear Malaysia in commercializing various products produced, the amount of cooperation with stakeholders and radiation technology related services implemented to customers.

5.1. PENGKOMERSIALAN PRODUK PENYELIDIKAN

COMMERCIALIZATION OF RESEARCH PRODUCT



"Sebanyak lima produk hasil penyelidikan telah berjaya dikomersialkan. Produk-produk ini amat berguna dalam bidang perubatan dan pertanian".

A total of five research products have been successfully commercialized. These products are very useful in medicine and agriculture.

i. Baja BIO MIGROFAS M99

Baja Bio Migrofas M99 mengandungi Pseudomonas putida, sejenis mikroorganisma berfaedah pelbagai fungsi yang diperolehi dari tanah.

"Biobaja ini meningkatkan nutrien makro tersedia kepada tanaman melalui fungsi mikroorganisma dengan mengurangkan kebergantungan kepada baja kimia,"

menyokong pertumbuhan tanaman, mewujudkan rhizosfera yang sihat, memelihara kesihatan tanah, mesra alam dan mudah digunakan serta sesuai untuk pertanian organik. Nuklear Malaysia telah menjalin kerjasama dengan EGI Biotek Sdn. Bhd. dalam mengkomersialkan produk Migrofas M99 ini.

BIO MIGROFAS M99 Fertilizer

Migrofas M99 Bio Fertilizer contains Pseudomonas putida, a multi -functional beneficial microorganism derived from soil.

These biofertilizers increase the macro nutrients available to crops through the function of microorganisms by reducing the dependence of chemical fertilizers,

supporting plant growth, creating a healthy rhizosphere, preserving soil health, environmentally friendly and easy to use as well as suitable for organic farming. Nuklear Malaysia has entered into a partnership with EGI Biotek Sdn. Bhd. in commercializing this Migrofas M99 product..

ii. UVGI

UVGI

“Kotak Ultraviolet Germicidal Irradiation (UVGI) yang berupaya untuk menyinar pelitup muka bagi kegunaan hospital yang menerima pesakit COVID-19”.

Ujian kualiti pelitup muka yang menerima kesan sinaran dijadikan panduan pihak hospital yang ingin menggunakan sinaran sebagai kaedah penyahkuman. Kajian spesifikasi lampu UV diperlukan dalam pembangunan peti UVGI dan usaha ini dipelopori oleh pihak Nuklear Malaysia dan Kementerian Kesihatan Malaysia (KKM).

An Ultraviolet Germicidal Irradiation (UVGI) box capable of illuminating face masks for hospital use receiving COVID-19 patients.

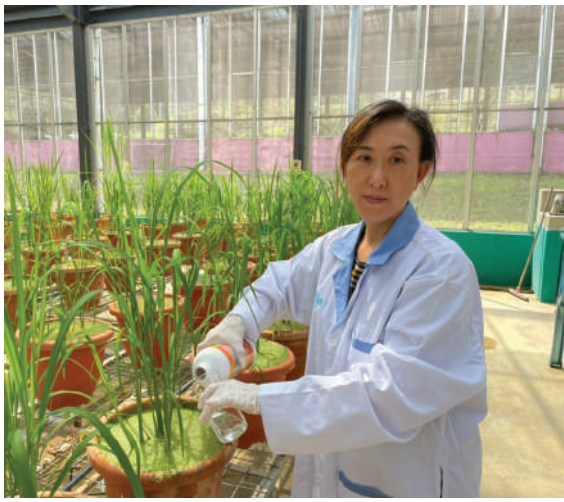
The quality test of face masks that receive the effects of radiation is used as a guide for hospitals that want to use radiation as a method of detoxification. A study of UV lamp specifications is required in the development of UVGI boxes, which will then be conducted by Nuklear Malaysia and the Ministry of Health Malaysia (MOH).

iii. Baja BIO GoGrow BioNPK

“GoGrow BioNPK Biobaja ialah produk dari satu strain bakteria AP1 (Acinetobacter baumanii) berfungsi mengikat nitrogen atmosfera (N) dan menukarnya ke nutrien tanaman”.

Produk ini mampu mengurai fosfat (P) dan kalium (K) dari tanah ke bentuk yang boleh diguna dalam tanaman. Selain mesra alam dan sesuai untuk pelbagai sistem penanaman (perladangan organik/ konvensional/fertigasi/padi sawah/ tanaman jangka pendek dan jangka panjang), baja ini menjadi penentang kepada bakteria penyakit layu. Nuklear Malaysia telah menjalin kerjasama dengan Enviro Clean Energy Sdn. Bhd. dalam mengkomersialkan produk baja bio GoGrow BioNPK.

GoGrow BioNPK Bio Fertilizer



GoGrow BioNPK Bio Fertilizer is a product of a bacterial strain AP1 (Acinetobacter baumanii) that binds atmospheric nitrogen (N) and converts it into plant nutrients.

This product is able to decompose phosphate (P) and potassium (K) from the soil into a form that can be used in crops. Besides being environmental friendly and suitable for various cultivation systems (organic / conventional / fertigation / paddy fields / short - term and long - term crops), the fertilizer is resistant to bacterial wilt. Nuklear Malaysia has joint into a partnership with Enviro Clean Energy Sdn. Bhd. in commercializing GoGrow BioNPK bio steel products.

iv. PADI IS21

Padi IS21 telah dilancarkan pada 20 November 2021 oleh Dato' Sri Ismail Sabri bin Yaakob, Perdana Menteri yang menggunakan teknologi nuklear yang dapat meningkatkan hasil tanaman.

> **"Padi IS21 memperolehi "Certificate of Registration of New Plant Variety and Grant Breeders Right" daripada Jabatan Pertanian yang tahan terhadap tanah kering, lebih kuat dan tahan serangan penyakit".**

Penggunaan biobaja Bioliquifert dan oligochitosan meningkatkan kesuburan tanah melalui aktiviti mikrob dan kecekapan pengambilan nutrien lebih tinggi membantu peningkatan hasil dan pendapatan petani serta mengurangkan penggunaan bahan kimia dan racun.

IS21 PADDY

IS21 paddy was launched on 20 November 2021 by the Prime Minister which uses this nuclear technology to increase crop yields.

"IS21 paddy awarded with a "Certificate of Registration of New Plant Variety and Grant Breeders Right" from the Department of Agriculture which stronger and resistant to dry soil and disease."

The use of Bioliquifert and oligochitosan increas soil fertility through microbial activity and the higher nutrient uptake efficiency helps increase farmers 'yields and income as well as reduce the use of chemicals and pesticides.

V. Sm-153 dan Kit EDTMP

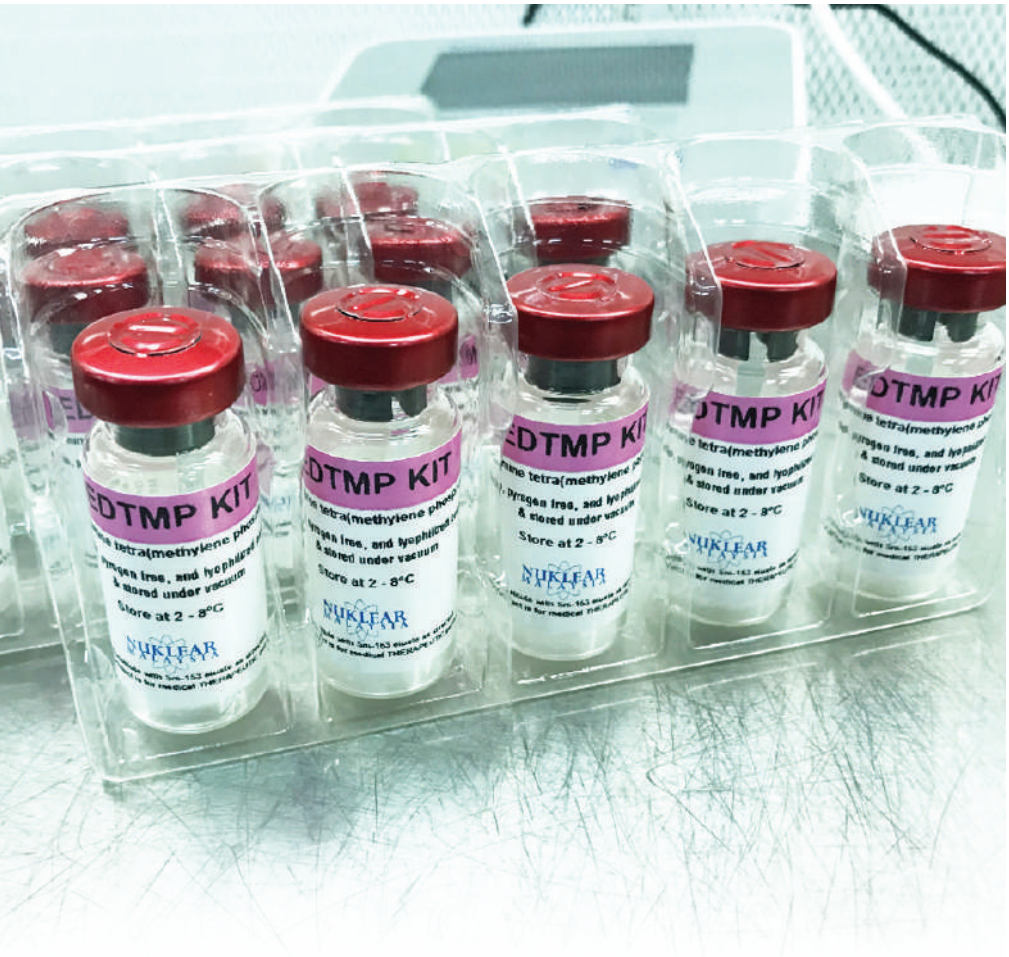
Sm-153 AND KIT EDTMP

Mulai 8 Julai 2021, Nuklear Malaysia mengeluar serta membekal Sm-153 dan Kit EDTMP pertama untuk pesakit kanser di Institut Kanser Negara (IKN).

> **“Samarium-153 EDTMP digunakan untuk membantu melegakan kesakitan tulang bagi pesakit yang menghidapi penyakit kanser tahap kronik”.**

Kebanyakan pesakit kanser (contohnya prostat, payudara atau paru-paru) harus menanggung kesakitan yang melampau pada tulang. Rawatan sinaran ini mampu melegakan kesakitan tersebut berbanding menggunakan steroid yang menjejaskan aktiviti fizikal pesakit.

Starting July 8, 2021, Nuklear Malaysia has produce and supply the first Sm-153 and EDTMP Kit for cancer patients at the National Cancer Institute (IKN). Samarium-153 EDTMP is used to help to relieve bone pain among patients with chronic stage cancer. Most cancer patients (e.g. prostate, breast or lung) have to endure extreme pain in the bones. This radiation treatment is able to relieve the pain compared using steroids that affect the patient’s physical activity.



5.2 PENDAPATAN AKAUN AMANAH

TRUST ACCOUNT INCOME

Tahun 2021, seluruh dunia masih bergelut dengan impak daripada pandemik COVID-19 terutama dalam bidang ekonomi. Aktiviti pengkomersialan Nuklear Malaysia turut terkesan dan mencatat penurunan dari segi jumlah aktiviti yang dilaksanakan dan pendapatan yang dijana. Situasi ini berlaku kerana kebanyakan khidmat yang ditawarkan tidak dikategorikan sebagai kategori perkhidmatan penting.

Nuklear Malaysia menjana hasil pendapatan sebanyak RM 7.85 juta. Perkhidmatan teknikal merupakan penyumbang tertinggi, diikuti dengan bekalan produk dan perkhidmatan pendidikan dan latihan.

By 2021, the whole world is still struggling with the impact of the COVID-19 pandemic especially in the economic field. Malaysian Nuclear Agency commercialization activities were also affected and recorded a decline in terms of the number of activities carried out and revenue generated. This situation occurs because most of the services offered are not categorized as essential service categories

Nuklear Malaysia generates revenue of RM 7.85 million. Technical services were the highest contributor, followed by the supply of education and training products and services.

Bil. *No.*	**Sumber Pendapatan** *Income Sources*	**Jumlah Pendapatan (RM Juta)** *Total of Income (RM Million)*
1	Bekalan Produk *Product Supply*	1,949,374.52
2	Pendidikan dan Latihan *Education and Training*	1,296,150.23
3	Perkhidmatan Teknikal Geran/Kontrak *Contract, Grant Technical Services*	3,479,063.04
4	Penyelidikan / Runding Cara *Research / Consultation*	1,046,450.86
5	Dividen daripada Pelaburan *Dividen from investment*	86,466.43
	Jumlah Keseluruhan *Grand Total*	**7,857,505.08**

Jumlah Pendapatan (RM Juta)
Total of Income (RM Million)

5.3 PEMINDAHAN TEKNOLOGI

TECHNOLOGY TRANSFER

Teknologi yang dibangunkan oleh Nuklear Malaysia turut dipindahkan kepada industri yang berkaitan. Aktiviti ini dilaksanakan melalui perjanjian kerjasama di antara Nuklear Malaysia dengan pelbagai syarikat tempatan seperti jadual dibawah.

The technology developed by Nuklear Malaysia was also transferred to related industries. This activity is implemented through a cooperation agreement between Nuklear Malaysia and various local companies as shown in the table below.

i. NDA

Bil. *No.*	Syarikat *Company*	Tajuk Perjanjian *Title of Agreement*	Tarikh Tandatangan *Date of Sign*
1	Suria Support Services Sdn. Bhd.	Projek Kerjasama Pemantauan Aras Sinaran Frekuensi Radio (RF) di Struktur Pemancar Telekomunikasi di Malaysia	3 Februari 2021
2	Sime Darby Plantation Technology Centre	Khidmat Perunding dan Penggunaan Kemudahan Rumah Kaca Transgenik *Bio Design Facility* untuk Projek Kajian Kelapa Sawit Diubah Suai Genetik	3 Mac 2021
3	Austral Techsmith Sdn Bhd	Projek Kerjasama Pemantauan Sinaran Frekuensi Radio (RF) bagi Struktur Pemancar Telekomunikasi di Sarawak	15 April 2021

Bil. *No.*	Syarikat *Company*	Tajuk Perjanjian *Title of Agreement*	Tarikh Tandatangan *Date of Sign*
4	Minda Wangsa Agro	Penanaman Cendawan *Volvariella Volvacea* secara Komersial	5 Mei 2021
5	Cyprium Wire Technology Sdn Bhd	Projek Pembangunan Kemudahan Radiasi yang dilengkapi dengan Mesin Penyinaran Alur Elektron di Kawasan Perindustrian Alor Gajah Melaka	16 Julai 2021
6	Uwais Medic Sdn Bhd	Pembangunan dan Pengkomersialan Produk Terapi LUI77 *Chloride*	15 September 2021

ii. MOA / MOU / NOTA KERJASAMA

MOA / MOU / COOPERATION NOTE

Bil	Syarikat *Company*	Tajuk perjanjian *Title of Agreement*	Tarikh Tandatangan *Date of Sign*
1	RFE Technology Sdn. Bhd.	Kerjasama bagi Pemantauan Sinaran Frekuensi Radio (RF) Struktur Pemancar Telekomunikasi Semenanjung Malaysia	16 April 2021
2	Nexus Solaris Sdn. Bhd.	Projek Kerjasama Pemantauan Aras Frekuensi Radio (RF) bagi Infrastruktur dan Peralatan Telekomunikasi	22 April 2021
3	Indah Iltizam Sdn. Bhd.	Projek Kerjasama Pemantauan Frekuensi Radio (RF) bagi Struktur Pemancar Telekomunikasi di Sarawak	4 Mei 2021
4	Mie Agro Farm Sdn. Bhd.	Perjanjian Khidmat Perundingan Pengeluaran Anak Benih Kultur Tisu Tanaman di Makmal Flora Vitro	1 Julai 2021
5	Enviro Clean Energy Sdn. Bhd.	Pengkomersialan Pengeluaran Biobaja Berasaskan Kultur Induk *Acinetobacterbaumanii* (AP1) secara Komersial	30 September 2021
6	EGI Biotek Sdn. Bhd.	Pengkomersialan Biobaja M99 dan Oligokitosan	1 Oktober 2021
7	Avinn Engineering Services Sdn. Bhd.	Kerjasama Penganjuran Kursus Anjuran Nuklear Malaysia di Sarawak	18 November 2021
8	Radiopharma Sdn. Bhd.	Pengkomersialan Iodin-131	31 Disember 2021

6.0 HUBUNGAN ANTARABANGSA

INTERNATIONAL RELATIONS

6.0 HUBUNGAN ANTARABANGSA

INTERNATIONAL RELATIONS

Nuklear Malaysia sentiasa komited dalam menyokong inisiatif MOSTI bagi meningkatkan pencapaian dan sumbangan negara dalam bidang sains dan teknologi di peringkat serantau dan antarabangsa. Ini dibuktikan dengan penglibatan aktif Nuklear Malaysia dalam aktiviti penyelidikan dan pembangunan teknologi serta pembangunan kapasiti yang dilaksanakan melalui pelbagai platform kerjasama antarabangsa dan serantau termasuk kerjasama di bawah IAEA dan Forum Kerjasama Nuklear di Asia (FNCA).

Nuklear Malaysia is always committed to support MOSTI initiative to enhance the country's achievements and contributions in the field of science and technology at regional and international levels. This is evidenced by Nuklear Malaysia's active involvement in technology research and development as well as capacity building activities implemented through various international and regional cooperation platforms such IAEA and Forum for Nuclear Cooperation in Asia (FNCA).

Nuklear Malaysia sentiasa menjadi pilihan untuk menjalinkan kerjasama dalam penganjuran program antarabangsa. Pandemik COVID-19 tidak menjadi penghalang untuk kerjasama ini terjalin dengan adanya platform maya bagi merealisasikan penganjuran program tersebut. Kerjasama yang terjalin dapat meningkatkan pengetahuan dan perkongsian pengalaman antara negara.

Nuklear Malaysia has always been an option for cooperation in the organization of international programs. The COVID-19 pandemic is not an obstacle to this cooperation with the existence of a virtual platform to realize the organization of the program. Cooperation can increase knowledge and experience sharing between countries.

6.1 PROGRAM KERJASAMA TEKNIKAL IAEA-MALAYSIA

IAEA - MALAYSIA TECHNICAL COOPERATION PROGRAMME

Program kerjasama teknikal adalah mekanisma utama untuk memindahkan teknologi nuklear kepada negara anggota. Melalui program itu, IAEA membantu Malaysia membina, mengukuhkan dan mengekalkan kapasiti manusia dan institusi untuk penggunaan teknologi nuklear yang selamat, aman dan terjamin dalam menyokong keutamaan pembangunan negara dalam bidang seperti kesihatan dan pemakanan, makanan dan pertanian, air dan alam sekitar, aplikasi perindustrian, keselamatan dan perlindungan, perancangan tenaga dan kuasa nuklear, dan pembangunan dan pengurusan pengetahuan nuklear dalam menyediakan sokongan melalui pembinaan kapasiti, perkongsian pengetahuan, pembinaan perkongsian, sokongan untuk rangkaian dan perolehan.

The technical cooperation programme is the primary mechanism for transferring nuclear technology to member states. Through the programme, the IAEA helps Malaysia to build, strengthen and maintain human and institutional capacities for the safe, peaceful and secure use of nuclear technology in support of national development priorities in areas such as health and nutrition, food and agriculture, water and the environment, industrial applications, safety and security, energy planning and nuclear power, and nuclear knowledge development and management on provides this support through capacity building, knowledge-sharing, partnership-building, support for networking, and procurement.

i. SENARAI PROJEK KERJASAMA TEKNIKAL (AKTIF)

LIST OF TECHNICAL COOPERATION PROJECTS (ACTIVE)

Bil	Projek *Project*	Jumlah *Total*
1	Serantau (Bukan Perjanjian) *Regional (Non Agreement)*	16
2	Perjanjian Serantau (RCA) *Regional Cooperative Agreement (RCA)*	19
3	Antara Wilayah *Interregional*	8
4	Projek Penyelidikan Terselaras (CRP) *Coordinated Research Projects (CRP)*	17
5	Kebangsaan *National*	6

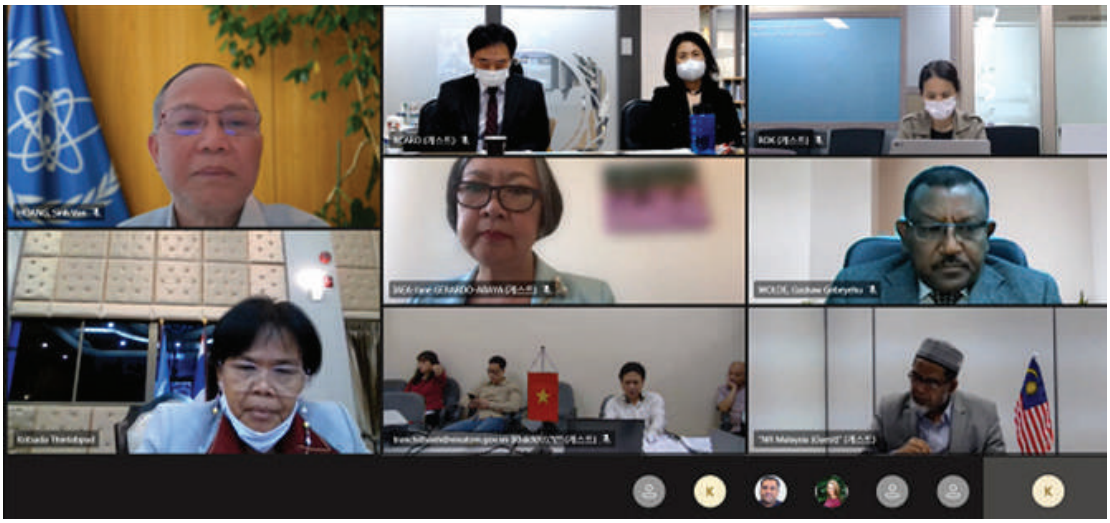
ii. SENARAI PROGRAM ANTARABANGSA IAEA

LIST OF IAEA INTERNATIONAL EVENTS

1 | 65th IAEA General Conference, 20-24 September 2021

2 | Bilateral Meeting on Technical Cooperation IAEA-MAL, 23 September 2021

3 | 43rd RCA National Representative Meeting, 28-29 April 2021



4 | 50th General Conference Meeting RCA, 16-17 September 2021

5 | 4th Meeting of the STF for the 50th Anniversary of the RCA, 17 November 2021

6 | 9th Meeting of the Working Group on RCA Medium-Term Strategy Coordination, 21-23 Julai 2021

7 | IAEA Board of Governance Meetings, 1 Mac 2021, 7 Jun 2021, 13 September 2021 & 24 November 2021

iii. PENCAPAIAN ANTARABANGSA

INTERNATIONAL ACHIEVEMENT

1 | FAO/IAEA Outstanding Achievement Award in Plant Mutation Breeding, 2021

6.2 FORUM KERJASAMA NUKLEAR ASIA (FNCA)

FNCA ialah rangka kerja untuk kerjasama antarabangsa bagi penggunaan tenaga atom secara aman, diketuai oleh Pejabat Kabinet dan Kementerian Pendidikan, Kebudayaan, Sukan, Sains dan Teknologi Jepun. Dua belas negara, iaitu Australia, Bangladesh, China, Indonesia, Jepun, Kazakhstan, Republik Korea, Malaysia, Mongolia, Filipina, Thailand dan Vietnam, sedang menjalankan aktiviti kerjasama di bawah perkongsian sama untuk penyelidikan bersama mengenai sains dan teknologi nuklear, pertukaran maklumat dan sokongan untuk pembangunan infrastruktur tenaga nuklear.

FORUM FOR NUCLEAR COOPERATION IN ASIA (FNCA)

FNCA is a framework for international cooperation for the peaceful use of atomic energy, led by the Cabinet Office and Ministry of Education, Culture, Sports, Science and Technology of Japan. Twelve countries, i.e. Australia, Bangladesh, China, Indonesia, Japan, Kazakhstan, Republic of Korea, Malaysia, Mongolia, Philippines, Thailand, and Vietnam, are conducting collaborative activities under equal partnership for joint research on nuclear science and technology, information exchange, and support for nuclear power infrastructure development.

i. SENARAI PROJEK FNCA

LIST OF FNCA PROJECT

Projek *Project*	**Maklumat Projek** *Project Information*
Mutation Breeding	Projek Pembiakan Mutasi telah dijalankan bertujuan untuk membangunkan varieti tanaman baharu yang mendapat permintaan tinggi di rantau Asia, seperti sorgum, kacang soya, orkid, pisang, dan padi, dengan menggunakan teknologi pembiakan mutasi. Teknologi ini melibatkan penyinaran sinar gama atau pancaran ion dan menyumbang kepada peningkatan pengeluaran makanan dan peningkatan kualiti tanaman di rantau ini. *The Mutation Breeding Project has been carried out with the aim of developing new crop varieties that are in high demand in the Asian region, such as sorghum, soybeans, orchids, bananas, and rice, by using mutation breeding technologies. These technologies involve gamma ray or ion beam irradiation and contribute to increased food production and improved crop quality in the region.*
Radiation Processing and Polymer Modification for Agricultural, Environmental and Medical Applications Project	Projek pemprosesan sinaran dan pengubahsuaian polimer menjalankan aktiviti penyelidikan dengan sasaran menggalakkan pembangunan dan penggunaan praktikal produk baharu melalui penggunaan meluas pemprosesan sinaran dalam bidang pertanian, alam sekitar dan perubatan selaras dengan keperluan negara anggota. *The radiation processing and polymer modification project conducts research activities with the target of promoting development and practical use of new products through a wide utilization of radiation processing in the agricultural, environmental and medical fields in line with the needs of the member countries.*

Research on Climate Change Using Nuclear and Isotopic Techniques	Matlamat keseluruhan projek adalah untuk lebih memahami mekanisma dan proses kebolehubahan iklim masa lalu dengan menjalankan eksperimen dan analisis berasaskan nuklear dan isotop yang menyokong penyelidikan terhadap perubahan iklim masa lalu, dan berkongsi kepakaran untuk mentafsir pengetahuan baharu. Penyelidikan pelbagai disiplin ini menggabungkan radionuklid, analisis isotop stabil dan teknik analisis konvensional dengan kaedah ekologi untuk mendapatkan set data yang membolehkan pembinaan semula rekod iklim resolusi tinggi, daripada pelbagai proksi atau penunjuk berbeza yang telah diarkibkan dalam persekitaran. *The overall aim of the project is to better understand the mechanisms and processes of past climate variability through undertaking nuclear and isotopic based experiments and analyses that support research into past climate change, and sharing the expertise to interpret the new knowledge.* *This multi-disciplinary research combines radionuclide, stable isotope analysis and conventional analytical techniques with ecological methods to obtain datasets that allow reconstructions of high resolution climate records, from a variety of different proxies or indicators that have been archived in the environment.*
Radiation Oncology	Projek Onkologi Radiasi sedang menjalankan ujian klinikal kolaboratif mengenai penggunaan onkologi sinaran untuk kanser serviks rahim, kanser nasofaring dan kanser payudara, yang kesemuanya mempunyai insiden yang tinggi di rantau Asia. Dengan mewujudkan protokol rawatan optimum untuk terapi sinaran dan kemoterapi melalui ujian klinikal ini, pasukan projek menyasarkan untuk meningkatkan keberkesanan rawatan kanser dan tahap serta kualiti terapi sinaran di negara anggota FNCA. Khususnya, mereka telah menetapkan lima jenis protokol setakat ini untuk ujian klinikal untuk kanser serviks rahim, yang mempunyai kadar insiden dan kematian tertinggi dalam kalangan wanita. *The Radiation Oncology Project is carrying out collaborative clinical trials on the use of radiation oncology for uterine cervix cancer, nasopharyngeal cancer, and breast cancer, all of which have a high incidence in the Asian region. By establishing optimal treatment protocols for radiation therapy and chemotherapy through these clinical trials, the project team aims to improve cancer treatment efficacy and the level and quality of radiation therapies in FNCA member countries. In particular, they have established five types of protocols to date for the clinical trials for uterine cervix cancer, which has the highest incidence and death rates in women.*

Research Reactor Utilization	Projek Penggunaan Reaktor Penyelidikan (RRU) berkongsi maklumat seperti ciri dan status penggunaan reaktor penyelidikan sesebuah negara dengan tujuan untuk meningkatkan pengetahuan penyelidikan dan kemahiran teknikal penyelidik dan jurutera di negara anggota FNCA. *The Research Reactor Utilization (RRU) project shares information such as the characteristics and usage status of a country's research reactors with the aim of improving the research knowledge and technical skills of researchers and engineers in FNCA member countries.*
Radiation Safety and Radioactive Waste Management	Projek ini bertujuan untuk meningkatkan keselamatan Pengurusan Sisa Radioaktif di kawasan Asia, negara yang mengambil bahagian telah bertukar-tukar dan berkongsi pelbagai maklumat dan pengalaman berharga mengenai pengurusan sisa radioaktif, yang membawa kepada promosi pemahaman yang baik tentang sudut pandangan teknikal di kalangan negara FNCA. *The project aims for enhancing the safety of Radioactive Waste Management in the Asian area, participating countries have exchanged and shared various precious information and experiences on radioactive waste management, which lead to the promotion of good comprehension of the technical viewpoint among FNCA countries*
Nuclear Security and Safeguards	Projek Keselamatan dan Perlindungan Nuklear sedang mengukuhkan keselamatan dan perlindungan nuklear di rantau Asia melalui langkah-langkah seperti perkongsian pengalaman, pengetahuan, dan maklumat yang berkaitan daripada negara yang mengambil bahagian dan promosi pembangunan sumber manusia di negara tersebut. Dalam tahun-tahun kebelakangan ini, negara-negara yang mengambil bahagian telah berkongsi maklumat mengenai inisiatif baru-baru ini dan mengadakan perbincangan terperinci tentang rancangan aktiviti masa depan dan aktiviti koperasi dengan forensik nuklear, keselamatan siber, keselamatan sumber sinaran dan Protokol Tambahan (AP) sebagai tema utama. *The Nuclear Security and Safeguards Project is strengthening nuclear security and safeguards in the Asian region through measures such as the sharing of relevant experiences, knowledge, and information from the participating countries and the promotion of human resource development in those countries. In recent years, the participating countries have shared information on their recent initiatives and held detailed discussions about future activity plans and cooperative activities with nuclear forensics, cyber security, radiation source security, and the Additional Protocol (AP) as the major themes.*

ii. SENARAI PROGRAM FNCA

LIST OF FNCA EVENTS

1 22nd FNCA Ministerial Level Meeting, 9 Disember 2021

Ini adalah perhimpunan wakil peringkat menteri dalam bidang sains dan teknologi yang bertanggungjawab dalam aktiviti yang menggunakan tenaga nuklear dan sinaran. Dasar kerjasama FNCA dan dasar tenaga nuklear negara peserta dibincangkan.

This is a gathering of ministerial level representatives in science and technology who are in charge of activities which use nuclear energy and radiation. FNCA's cooperation policies and participating countries' nuclear energy policies are discussed.

2 22nd FNCA Senior Officials Meeting (SOM), 30 Jun 2021

Wakil dari setiap negara yang mengambil bahagian berkumpul untuk mengadakan perbincangan awal mengenai persediaan, tema, topik khusus untuk Mesyuarat Peringkat Menteri.

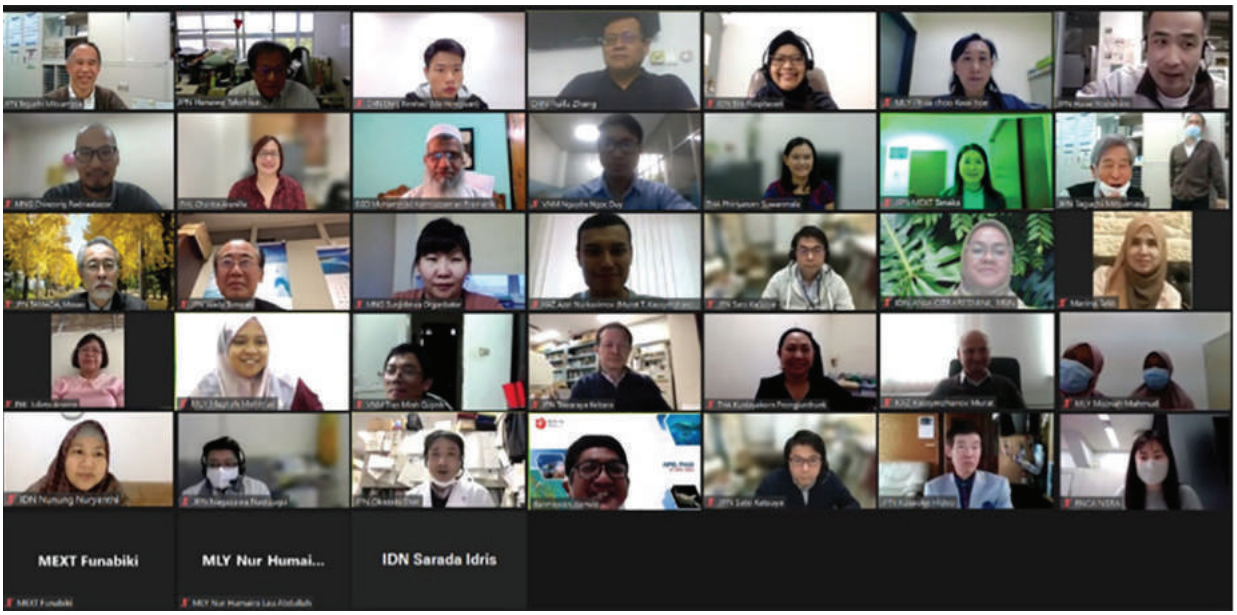
The representative from each participating country gather to hold preliminary discussion on preparation, theme, specific topics for The Ministerial Level Meeting.

3 21st FNCA Coordinators Meeting, 30 Jun 2021

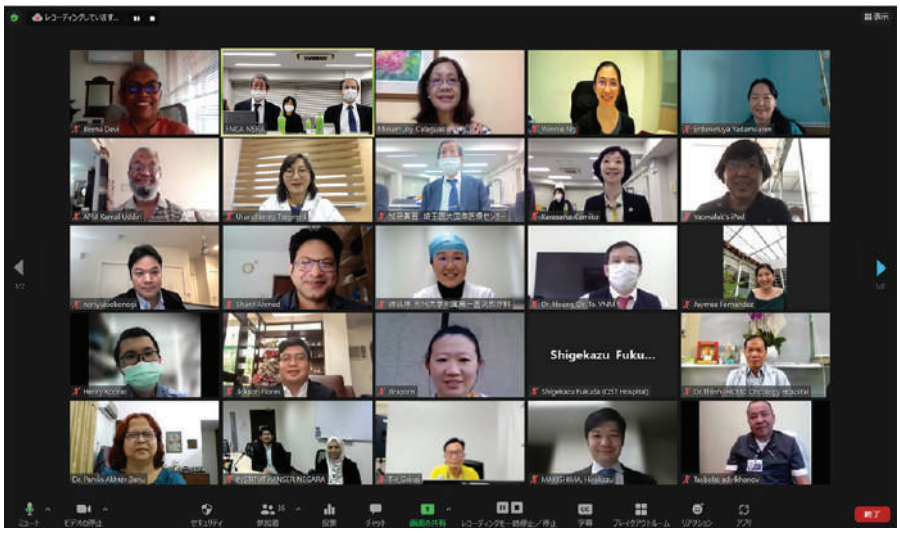
Seorang penyelaras dilantik bagi setiap negara yang mengambil bahagian untuk menyelia aktiviti projek FNCA dalam pelbagai bidang nuklear. Penyelaras berkumpul untuk menilai kemajuan projek individu dan membincangkan keputusan, penilaian dan dasar masa depan mereka.

A coordinator is appointed for each participating country to oversee FNCA project activities in various nuclear fields. Coordinators gather to assess the progress of individual projects and discuss their results, evaluations and future policies.

4 FNCA 2021 Workshop on Radiation Processing and Polymer Modification for Agricultural, Environmental and Medical Applications Project, 29 - 30 November 2021



5 **FNCA FY2021 Online Workshop on Radiation Oncology, 26 November 2021**



6 **FNCA 2021 Online Workshop on Research Reactor Utilization Project, 24-25 November 2021**

7 **Workshop on Research on Climate Change using Nuclear and Isotopic Technologies**

8 **FNCA2021 Workshop on Radiation Safety and Radioactive Waste Management (RS&RWM) Project, 9-10 November 2021**

iii. PENCAPAIAN

ACHIEVEMENT

Excellent Research Team of the Year

"Excellent Research Team of the Year" awards were presented for the projects conducted by the two countries listed below in recognition of their achievements after the Best Research Team.

Indonesia
Radiation Processing & Polymer Modification Project

Malaysia
Mutation Breeding Project


Workstation 1

7.0 PERKHIDMATAN TEKNIKAL

TECHNICAL SERVICES

7.0 PERKHIDMATAN TEKNIKAL

TECHNICAL SERVICES

Perkhidmatan teknikal adalah salah satu aktiviti utama yang penting bagi menyokong aktiviti teras Nuklear Malaysia iaitu penyelidikan.

Pusat Teknologi Reaktor (PTR), SINAGAMA, ALURTRON, RAYMINTEX ialah kemudahan dan pusat khidmat yang menjadi sebahagian daripada aktiviti penyelidikan dan pembangunan teknologi nuklear.

Manakala, sokongan teknikal daripada Pusat Teknologi Maklumat (ITC), Pusat Instrumentasi dan Automasi (PIA), kejuruteraan dan lain-lain turut menjadi sebahagian daripada tulang belakang aktiviti di Nuklear Malaysia khususnya Penyelidikan dan Pembangunan (P&P)

Technical services are one of the key activities that are important to support Nuklear Malaysia's core activities, namely research.

Reactor Technology Center (PTR), SINAGAMA, ALURTRON, RAYMINTEX are facilities and service centers that are part of nuclear technology research and development activities.

Meanwhile, technical support from the Information Technology Center (ITC), Instrumentation and Automation Center (PIA), engineering and others are also part of the backbone of activities at Nuklear Malaysia, especially R&D.

7.1. PUSAT TEKNOLOGI REAKTOR (PTR)

REACTOR TECHNOLOGY CENTER (PTR)

Sepanjang tahun 2021, aktiviti yang dilaksanakan di PTR dibahagikan kepada empat perkara utama:

Throughout 2021, the activities implemented at PTR are divided into four main areas:

i. PELAKSANAAN PROJEK

PROJECT IMPLEMENTATION

1

Pembangunan bukan fizikal: RMK9, RMK10, RMK11, dan RMK12

Non - physical development: RMK9, RMK10, RMK11, and RMK12

2

Operasi dan penyenggaraan asset

Operation and maintenance of assets

3

Pembangunan teknologi & inovasi

Technology development & innovation

- Merancang dan menyediakan program pembangunan reaktor penyelidikan jenis Multi-Purpose Reactor (MPR)

Planning and preparing a Multi-Purpose Reactor (MPR) research reactor development program.

- Memperkukuhkan pengoperasian selamat dan mempromosi penggunaan RTP

Strengthen safe operation and promote the use of RTP.

- Melaksanakan Program Pengurusan Penuaan terhadap struktur, sistem dan komponen RTP

Implement the Aging Management Program on the structure, system and components of RTP.

- Memperkukuh Keselamatan, Sekuriti & Kawalgunaan kemudahan RTP

Strengthen the Security, Security & Control of RTP facilities

- Melaksanakan kajian terhadap sistem teknologi reaktor berinovasi dan termaju

Conduct research on innovative and advanced reactor technology systems.

4

Khidmat dan kepakaran dan lain-lain tugas berkaitan

Services and expertise and other related tasks

ii. KHIDMAT PENYINARAN

IRRADIATION SERVICES

Sebanyak 2901 sampel telah disinarkan di pelbagai fasiliti penyinaran di kemudahan RTP

A total of 2901 samples were irradiated at various irradiation facilities at the RTP facility.

Jadual 7.1: Penyinaran Sampel di Pelbagai Fasiliti

Radiation of Samples at Various Facilities

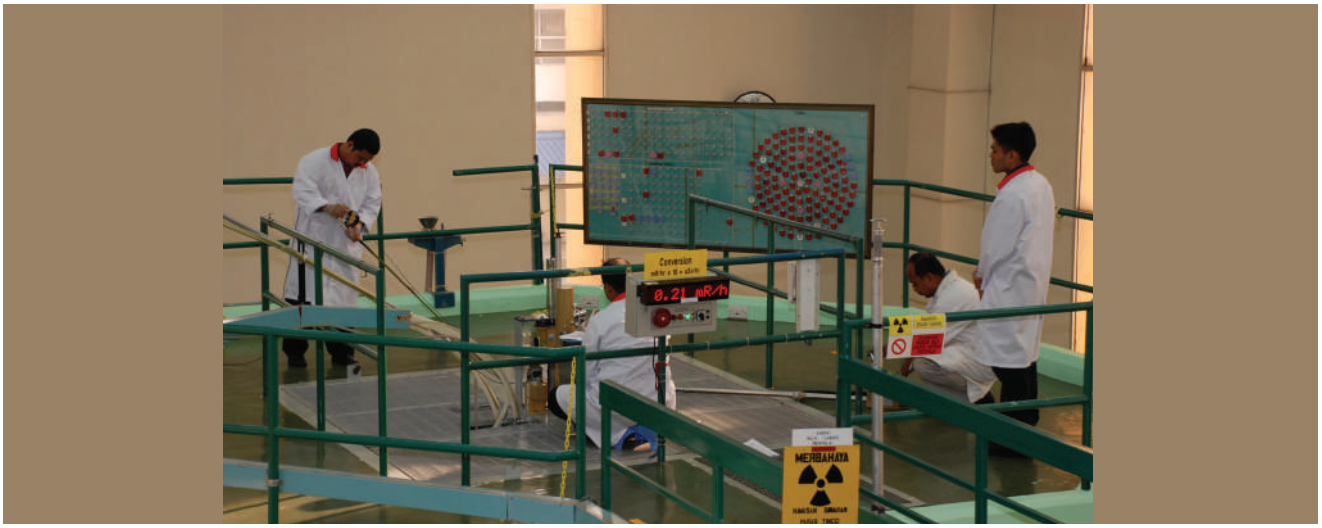
Bulan/ *Month*	**Penyinaran Sampel / *Sample Irradiation***											
	RR	**PTS**	**NUR**	**SANS**	**TC**	**CT**	**DT**	**IC**	**BP**			
									#1	**#2**	**#3**	**#4**
Jan	10	1007										
Feb												
Mac	340	34										
Apr	37	79		1								
Mei	1	65		1			2					
Jun												
Jul						1	2					
Ogos	174	40					5					
Sep	324	155	2	2			2		1			
Nov	225				76	1	2					
Dis	262	13	17				4		16			
Jumlah/ *Total*	**1373**	**1393**	**19**	**4**	**76**	**2**	**17**	**0**	**17**	**0**	**0**	**0**

iii. OPERASI

OPERATION

RTP telah dikendalikan selama 352.8 jam sepanjang tahun 2021

RTP has operated for 352.8 hours throughout 2021.



iv. HASIL R&D&C

R&D&C OUTPUTS

Jadual 7.2: Senarai Hasil R&D&C

List of R&D&C Outputs

Bil *No*	**Hasil** *Output*	**Butiran** *Details*	**Jumlah** *Total*
1	Perisian *Software*	Algoritma pengawal kuasa baharu untuk RTP / *New power controller algorithm for RTP*	1
2	Pangkalan Data *Databases*	Sistem pemantauan suhu dalam talian / *Online temperature monitoring system*	1
3	Prosedur *Procedures*	RTP-P-5.10: Pelaporan Kerosakan Peralatan Sekuriti / *RTP-P-5.10: Security Equipment Damage Reporting*	1
4	Paten *Patent*	Reka bentuk padat bahan api dupleks TRISO thoria-urania Microheterogeneous untuk HTR berprestasi tinggi [UKM. IKB.800-4/1/4076] / *Design of Microheterogeneous thoria-urania TRISO duplex fuel compact for high performance HTR [UKM.IKB.800 - 4/1/4076]*	1

7.2 TRITI PENGHARAMAN MENYELURUH UJIAN SENJATA NUKLEAR (CTBT)

Nuklear Malaysia terus melaksanakan tanggungjawabnya dalam pengendalian pengoperasian dan penyelenggaraan Stesen Pemantauan Radionuklid (RN42) di Cameron Highlands, Pahang. Stesen RN42 adalah salah satu daripada 321 stesen pemantauan yang diperuntukkan di bawah Triti Pengharam Menyeluruh Ujian Senjata Nuklear (CTBT) bagi memantau dan mengesan sebarang bentuk ujian senjata dan letupan nuklear secara global. Nuklear Malaysia juga bertanggungjawab terhadap operasi Pusat Data Kebangsaan CTBT (MY-NDC) yang berperanan menyalurkan maklumat teknikal mengenai verifikasi ujian senjata dan letupan nuklear serta kejadian yang berkaitan dengan penggunaan data CTBT.

Stesen RN42 dan MY-NDC beroperasi hampir setiap hari sepanjang 2021 dengan peratusan penghantaran data radionuklid tersedia yang tinggi telah direkodkan oleh Stesen RN42 bagi tahun 2021 dan bilangan hari MY-NDC beroperasi yang tinggi seperti ditunjukkan dalam Rajah 7.1.

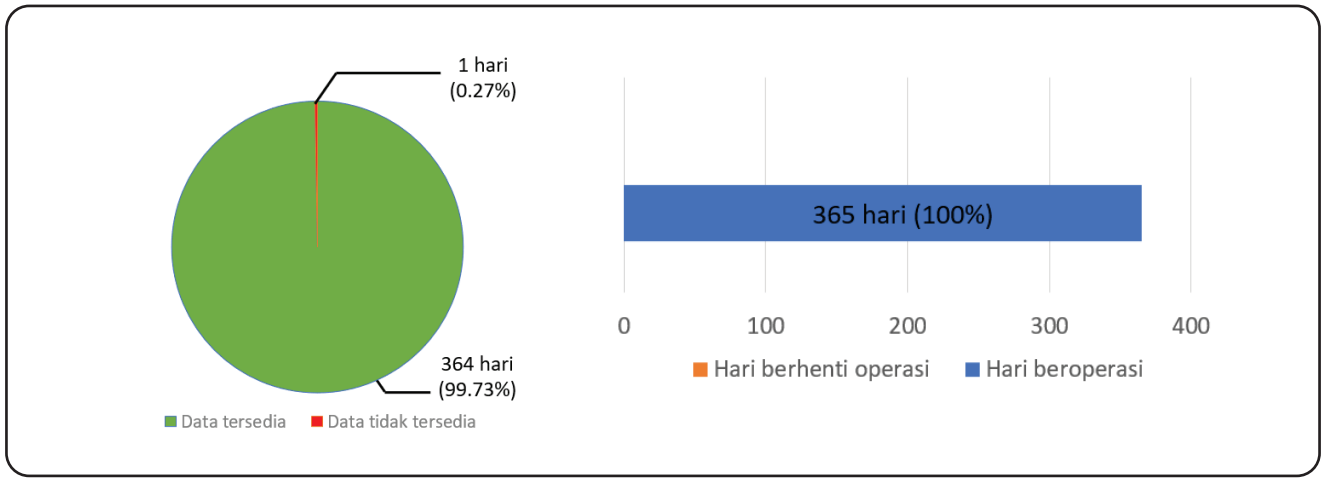
COMPREHENSIVE NUCLEAR WEAPONS TESTING TREATY (CTBT)

Nuklear Malaysia continues to perform its responsibilities in the operation and maintenance of the Radionuclide Monitoring Station (RN42) in Cameron Highlands, Pahang. Station RN42 is one of 321 monitoring stations provided under the Comprehensive Nuclear Weapons Testing Treaty (CTBT) to monitor and detect any form of nuclear weapons and explosion testing globally. Nuklear Malaysia is also responsible for the operation of the CTBT National Data Center (MY-NDC) which serves to provide technical information on the verification of weapons tests and nuclear explosions as well as incidents related to the use of CTBT data.

Station RN42 and MY-NDC operated almost daily throughout 2021 with a high percentage of available radionuclide data transmissions recorded by Station RN42 for 2021 and a high number of MY-NDC operating days as shown in Figure 7.1.

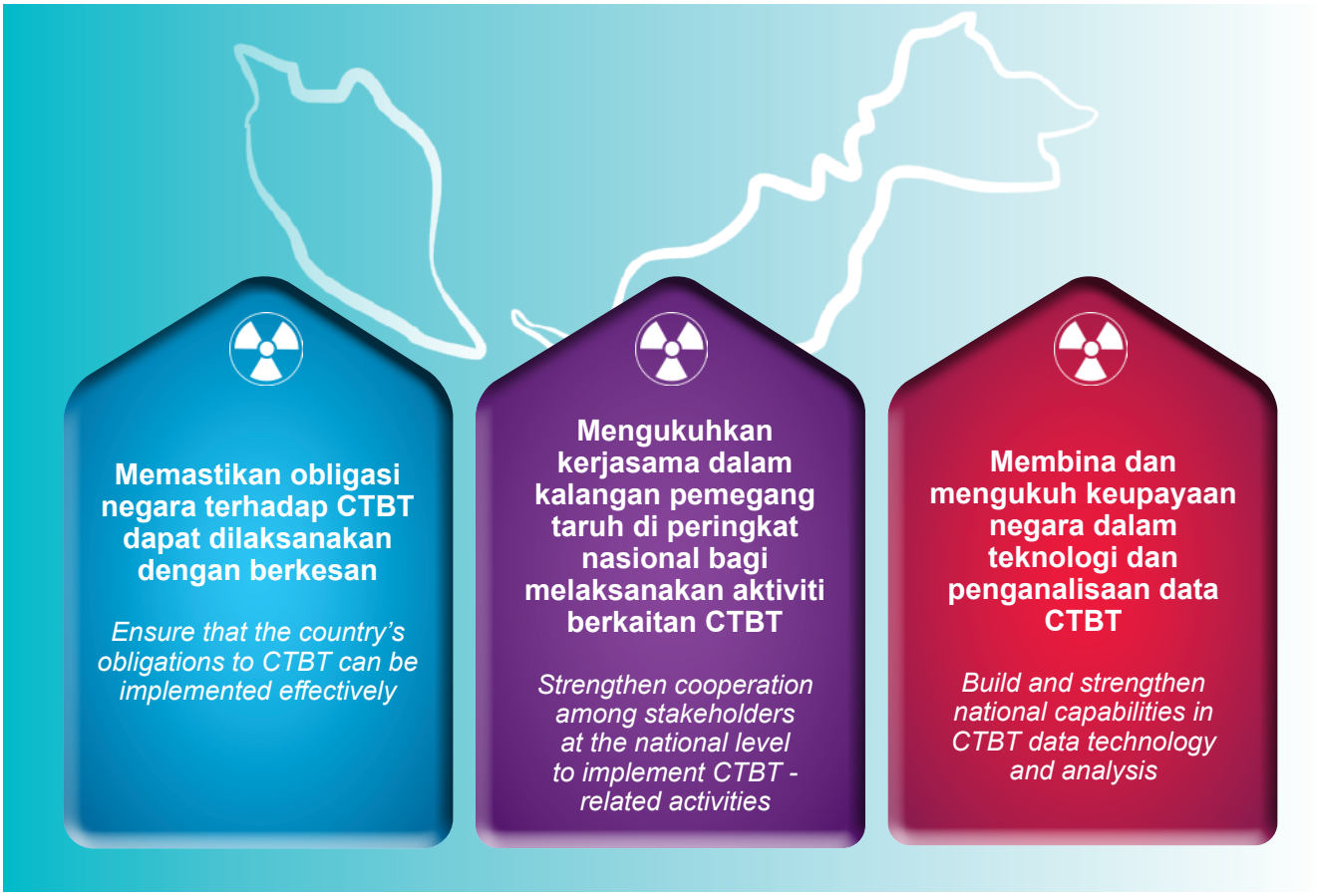
Rajah 7.1: Bilangan data tersedia di Stesen RN42 (kiri) dan bilangan hari beroperasi MY-NDC (kanan)

Number of available data at RN42 Station (left) and MY-NDC operating days (right)



IMPAK AKTIVITI CTBT TERHADAP NEGARA

Impact of CTBT activities on the country:



7.3 MAKMAL STANDARD DOSIMETRI SEKUNDER (SSDL)

SECONDARY DOSIMETRY STANDARD LABORATORY (SSDL)

Makmal Standard Dosimetri Sekunder (SSDL) adalah salah satu makmal di bawah Kumpulan Metrologi Sinaran (KMS). SSDL kekal diiktiraf sebagai makmal standard kebangsaan untuk sinaran mengion. Ini bagi memenuhi keperluan Akta Perlesenan Tenaga Atom 1984 (Akta 304), Akta Keselamatan Dan Kesihatan Pekerjaan 1994 (Akta 514) dan Akta Sistem Pengukuran Kebangsaan 2007 (Akta 675).

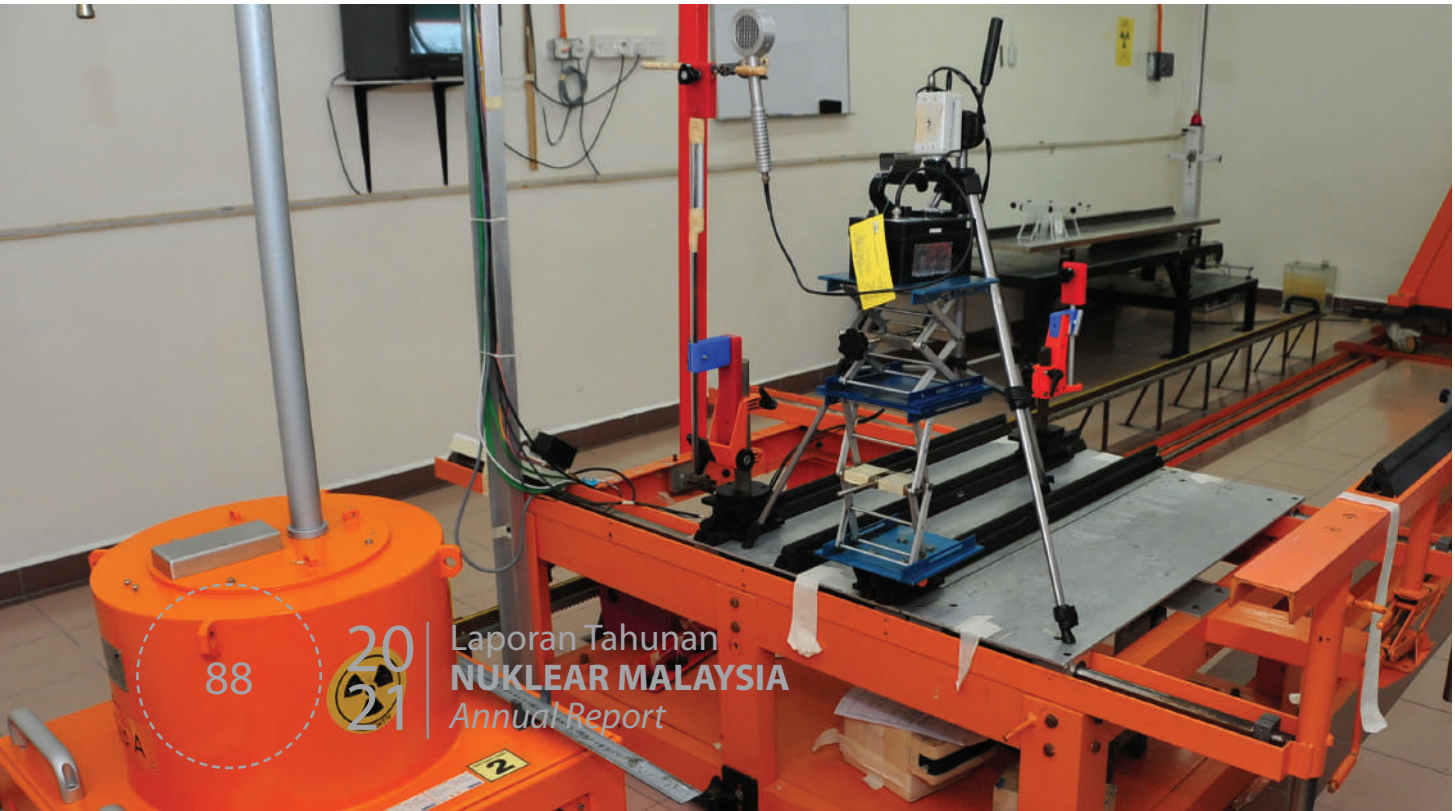
The Secondary Dosimetry Standard Laboratory (SSDL) is one of the laboratories under the Radiation Metrology Group (KMS). SSDLs remain recognized as the national standard laboratory for ionizing radiation. This is to meet the requirements of the Atomic Energy Licensing Act 1984 (Act 304), Occupational Safety and Health Act 1994 (Act 514) and the National Measurement System Act 2007 (Act 675).

i. PERKHIDMATAN

SERVICES

Selain daripada khidmat dalam negara, SSDL juga mendapat kepercayaan daripada syarikat-syarikat swasta di luar negara bagi memberi khidmat kalibrasi dan khidmat berkaitan. Sehingga 2021, pelbagai syarikat dari negara-negara seperti Singapura, Thailand, Indonesia, Emiriah Arab Bersatu, Filipina, Brunei Darussalam, India dan Sri Lanka telah mendapat perkhidmatan kalibrasi dan perkhidmatan berkaitan dari SSDL. Senarai syarikat adalah seperti jadual berikut:

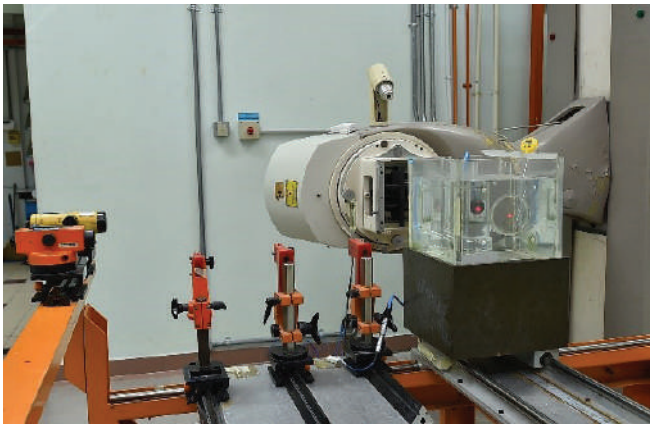
Apart from domestic services, SSDL also has the trust of abroad private companies to provide calibration and related services. Until 2021, various companies from Singapore, Thailand, Indonesia, United Arab Emirates, Philippines, Brunei Darussalam, India and Sri Lanka have received calibration and related services from SSDL. The list of companies are as follows:

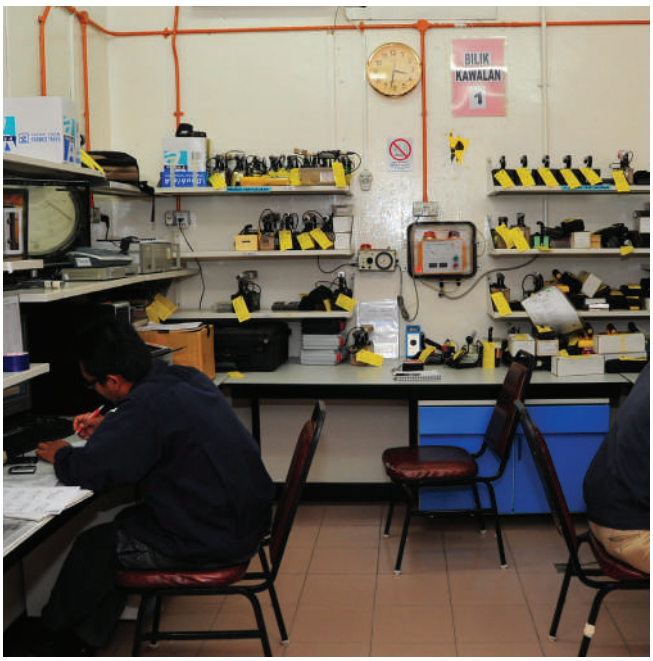


Jadual 7.3: Senarai Pelanggan Luar Negara untuk Khidmat Kalibrasi dan Perkhidmatan Berkaitan SSDL

List of Overseas Customers for Calibration Services and SSDL Related Services.

Bil. *No.*	**Negara** *Country*	**Nama Syarikat** *Company Name*	**Jenis Khidmat** *Type of Service*
1	Singapura	• BAKER HUGHES INTEQ • ALEXANDRA HEALTH PTE LTD. • DUKE -NUS GRADUATE MEDICAL SCHOOL SINGAPORE • ENVIRONMENT LABORATORY IMPACT (E.L.I) SERVICES PTE LTD. • EXXONMOBIL ASIA PACIFIC PTE LTD. • SIEMENS HEALTHCARE PTE LTD. • TRACERCO ASIA	Kalibrasi *Calibration*
2	Thailand	• THAILAND INSTITUTE NUCLEAR TECHNOLOGY • SCHLUMBERGER INDUSTRIES (THAILAND) LTD. • BAKER HUGHES OPERATIONS (THAILAND) LTD.	Kalibrasi *Calibration*
3	Indonesia	• NUKLINDO LAB. • PT CAIRNHILL SERVIECH INTI	Kalibrasi *Calibration*
4	Emiriah Arab Bersatu	FEDERAL AUTHORITY FOR NUCLEAR REGULATION	Kalibrasi *Calibration*
5	Filipina	• TI (PHILIPPINES) INC. CLARK • DEPARTMENT OF HEALTH PHILIPPINES	Kalibrasi *Calibration*
6	Brunei Darussalam	SAFETY HEALTH AND ENVIROMENTS NATIONAL AUTHORITY (SHENA)	Kalibrasi *Calibration*
7	India	• TRIMED SOLUTION (I) PVT. LTD. • APT MEDICAL SYSTEMS PVT. LTD.	Kalibrasi *Calibration*
8	Sri Lanka	ANSELL Sri Lanka Pte. Ltd.	Lain-lain Khidmat *Other Services*




BILIK
KAWALAN
1


BILIK
KAWALAN
1


Typ A
RADIOACTIVE

7.4 PERKHIDMATAN TEKNOLOGI MAKLUMAT

Perkhidmatan ICT di Nuklear Malaysia lebih tertumpu kepada proses pendigitalan perkhidmatan. Proses ini menyokong inisiatif kerajaan dalam MyDigital Blueprint (MyDigital) seiring dengan usaha yang terkandung dalam Pelan Strategik Pendigitalan Sektor Awam (PSPSA) dan juga usaha Kerajaan Malaysia ke arah Inisiatif Data Raya Sektor Awam. Inisiatif ini juga telah diberi penekanan khusus dalam perancangan RMK12.

Pusat Teknologi Maklumat (PTM) telah mula membangunkan Pelan Strategik Pendigitalan Nuklear Malaysia (PSPNM) pada tahun 2021 bagi merangka dan merancang keperluan strategik pendigitalan agensi seiring dengan keperluan PSPSA. Sebagai salah satu usaha pendigitalan ini, sebanyak 43 perkhidmatan E2E telah dikenalpasti dalam Nuklear Malaysia untuk diketengahkan sebagai sokongan kepada inisiatif pendigitalan negara.

Di samping itu, PTM turut memastikan ketersediaan dan kebolehpercayaan perkhidmatan ICT melalui perancangan naik taraf talian internet yang lebih pantas dan selamat. Perancangan naik taraf kepada 700Mbps yang disokong dengan penarafan pensijilan ISMS 27001 dan versi baru Dasar Keselamatan ICT (DKICT) 5.0 mampu memberi impak positif terhadap perlaksanaan pendigitalan agensi untuk negara.

Selain itu, perancangan yang kondusif juga telah dilakukan terutama dalam memperbaiki dan memantapkan lagi infrastruktur ICT agensi termasuk keperluan perkakasan seperti komputer, rangkaian, dan pelayan (server). Manakala pemantapan perisian seperti lesen perisian, perisian saintifik dan sistem aplikasi dan web juga dalam proses perlaksanaan. Pemantapan dan pemantauan tadbir urus ICT terus dipertingkatkan melalui Jawatankuasa Pemandu ICT (JPICT) agensi serta Jawatankuasa Teknikal (JT) dan Pemandu ICT MOSTI (JPICT MOSTI). Kepakaran warga PTM juga telah mencapai satu tahap yang membanggakan kerana menjadi sumber rujukan agensi lain di peringkat kementerian dan antarabangsa.

INFORMATION TECHNOLOGY SERVICES

ICT services in Nuklear Malaysia are more focused on the process of digitizing services. This process supports the government's initiative in the MyDigital Blueprint (MyDigital) in line with the efforts contained in the Public Sector Digitization Strategic Plan (PSPSA) as well as the Malaysian Government's efforts towards the Public Sector Public Data Initiative. This initiative has also been given special emphasis in the planning of the RMK12.

Thus, PTM has organized work in the development of a document on the Malaysian Nuclear Digitization Strategic Plan (PSPNM) in 2021 to formulate the strategic needs of agency digitization base of the requirements of PSPSA. As one of these digitization efforts, a total of 43 E2E services have been identified in Nuklear Malaysia to be featured in support of national digitization initiatives.

In addition, PTM also ensures that ICT services are always available and reliable through planning to upgrade internet lines that are faster and safer. Plans to upgrade to 700Mbps supported by the ISMS 27001 certification rating and the new version of the ICT Security Policy (DKICT) 5.0 are able to have a positive impact on the implementation of agency digitization for the country

A conducive planning has also been done especially in improving and strengthening the agency's ICT infrastructure, including hardware requirements such as computers, networks, and servers. While the consolidation of software such as software licenses, scientific software and application and web systems are also in the process of

implementation. The strengthening and monitoring of ICT governance is further enhanced through the agency's ICT Steering Committee (JPICT) as well as the MOSTI Technical Committee (JT) and ICT Steering Committee (JPICT MOSTI). The expertise of PTM staff has also reached a level of pride as it has become a reference for other agencies at the ministry and international levels..

7.5 LOJI RAYMINTEX

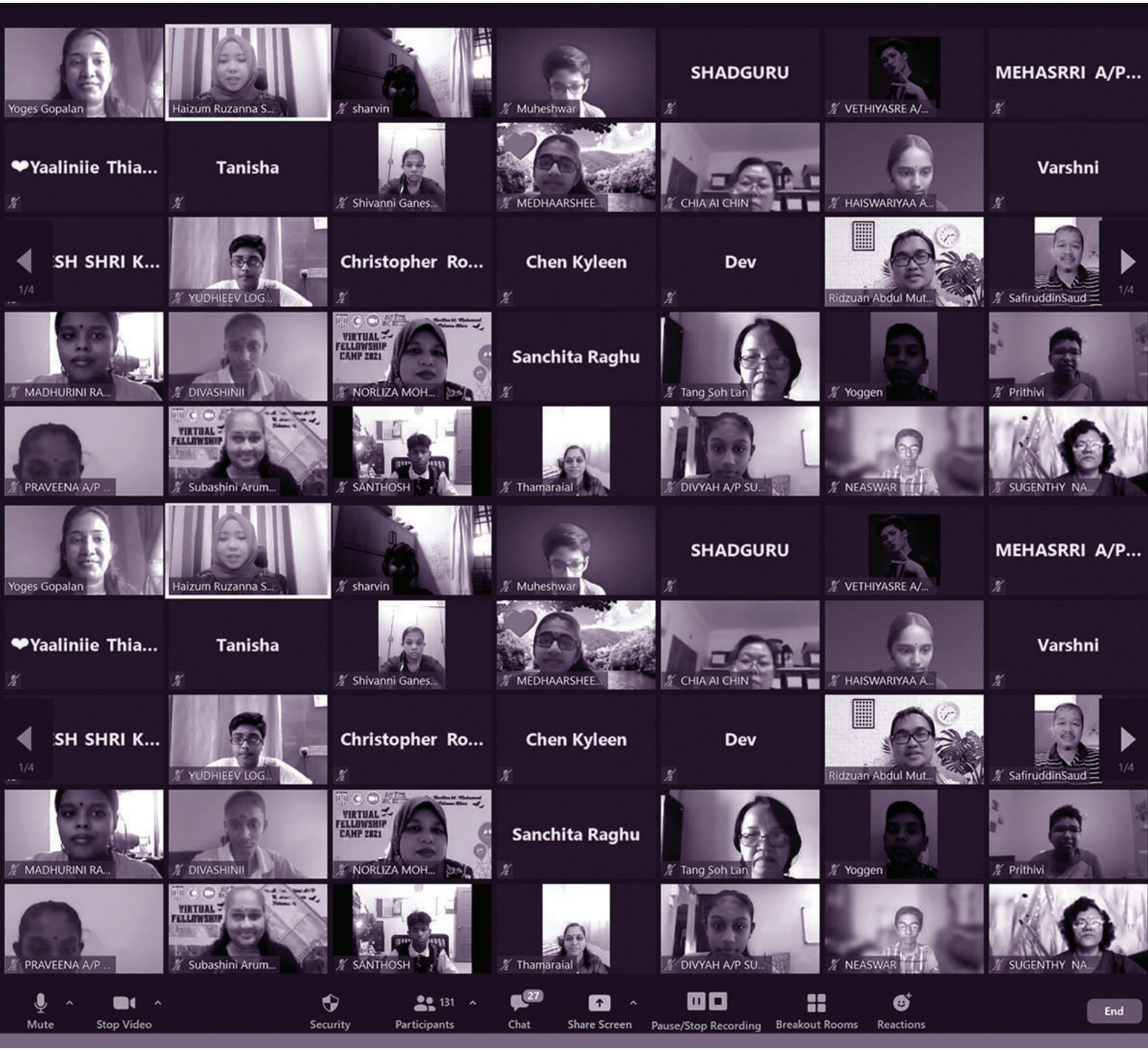
Loji RAYMINTEX merupakan sebuah loji perintis pemvulkanan lateks getah asli dengan sinaran gama (radiation vulcanization of natural rubber latex, RVNRL) yang telah ditauliahkan di Nuklear Malaysia pada tahun 1996. Loji RAYMINTEX terus menjadi pemain utama dalam pembangunan dan pengkomersialan teknologi RVNRL di Malaysia. Selain sinaran gama, Loji RAYMINTEX juga telah mula menjalankan penyelidikan penyediaan RVNRL menggunakan sumber sinaran lain seperti alur elektron dan ultralembayung.

RAYMINTEX PLANT

RAYMINTEX Plant is a pilot plant for radiation vulcanization of natural rubber latex (RVNRL). It was commissioned at Nuklear Malaysia in 1996. RAYMINTEX Plants plays a major role in development and commercialization of RVNRL technology in Malaysia. Besides gamma radiation, RAYMINTEX Plant has started to research in RVNRL preparation based on other radiation sources such as electron beam and ultraviolet.

Pada tahun 2021, projek bertajuk "Lateks Getah Asli Pra-pemvulkanan Hibrid Ultralembayung-Peroksida" telah memenangi pingat emas di Seoul International Invention Fair 2021. Selain itu, Loji RAYMINTEX juga telah menandatangani perjanjian kerjasama dengan TWH Energy Sdn. Bhd. untuk membangunkan teknologi RVNRL berasaskan alur elektron.

In 2021, researchers in RAYMINTEX Plant have won silver medal for a project titled "Hybrid UV-peroxide Pre-vulcanized Natural Rubber Latex" in Hari Inovasi & Kreativiti Nuklear Malaysia 2021. The same project has won gold medal in Seoul International Invention Fair 2021. RAYMINTEX Plant has also signed a memorandum of agreement (MoA) with TWH Energy Sdn Bhd to implement a project titled "Development and Pre-commercialization of Radiation Vulcanization of Natural Rubber Latex (RVNRL) Technology" of which this project is based on electron beam.


Yoges Gopalan
Haizum Ruzanna S...
sharvin
Muheshwar
SHADGURU
VETHIYASRE A/...
MEHASRRI A/P...
❤Yaaliniie Thia...
Tanisha
Shivanni Ganes...
MEDHAARSHEE...
CHIA AI CHIN
HAISWARIYAA A...
Varshni
SH SHRI K...
1/4
YUDHIEEV LOG...
Christopher Ro...
Chen Kyleen
Dev
Ridzuan Abdul Mut...
SafiruddinSaud
1/4
MADHURINI RA...
DIVASHINII
VIRTUAL FELLOWSHIP CAMP 2021
NORLIZA MOH...
Sanchita Raghu
Tang Soh Lan
Yoggen
Prithivi
PRAVEENA A/P ...
VIRTUAL FELLOWSHIP
Subashini Arum...
SANTHOSH
Thamaraial
DIVYAH A/P SU...
NEASWAR
SUGENTHY NA...
Yoges Gopalan
Haizum Ruzanna S...
sharvin
Muheshwar
SHADGURU
VETHIYASRE A/...
MEHASRRI A/P...
❤Yaaliniie Thia...
Tanisha
Shivanni Ganes...
MEDHAARSHEE...
CHIA AI CHIN
HAISWARIYAA A...
Varshni
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YUDHIEEV LOG...
Christopher Ro...
Chen Kyleen
Dev
Ridzuan Abdul Mut...
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VIRTUAL FELLOWSHIP
Subashini Arum...
SANTHOSH
Thamaraial
DIVYAH A/P SU...
NEASWAR
SUGENTHY NA...
Mute
Stop Video
Security
131
Participants
27
Chat
Share Screen
Pause/Stop Recording
Breakout Rooms
Reactions
End

8.0 PENGURUSAN DAN PENTADBIRAN

MANAGEMENT AND ADMINISTRATION

8.0 PENGURUSAN DAN PENTADBIRAN

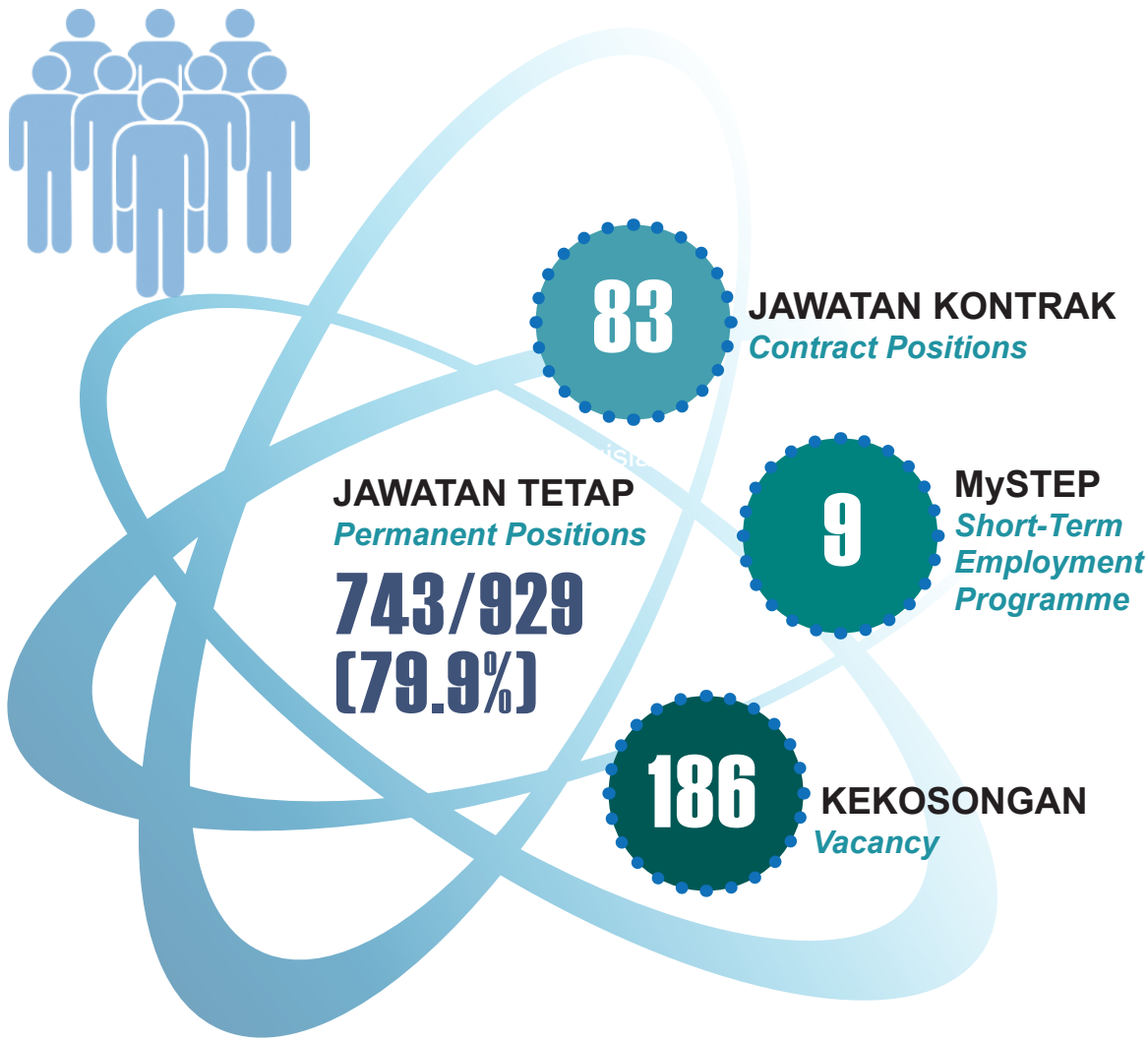
MANAGEMENT AND ADMINISTRATION

Pengurusan dan pentadbiran akan memastikan kejayaan dalam memacu kecemerlangan Nuklear Malaysia sebagai sebuah institusi penyelidikan yang terkemuka. Kualiti kepimpinan yang berwawasan dan kewangan mampan juga mempengaruhi dalam melahirkan modal insan yang cemerlang.

Management and administration will ensure success in driving the excellence of Nuklear Malaysia as a leading research institution. The quality of visionary leadership and sustainable financial also influences in producing excellent human capital.

8.1 PERJAWATAN

CURRENT FILLING



8.2 PRESTASI KEWANGAN

FINANCIAL PERFORMANCE

BELANJA MENGURUS

Operating Budget:

RM77 juta (101.46%)

BELANJA PEMBANGUNAN

Development Budget:

RM12.1 juta (78%)

PRESTASI PEMBAYARAN

Payment Achievement:

100% dalam tempoh 14 hari (12 bulan)

100% within 14 days (12 month)

8.3 PEMBANGUNAN MODAL INSAN

HUMAN RESOURCE DEVELOPMENT

Pembangunan modal insan adalah salah satu aktiviti utama Nuklear Malaysia. Aspek ini penting untuk memastikan Nuklear Malaysia mempunyai kakitangan khususnya penyelidik yang mempunyai kepakaran yang diiktiraf bukan sahaja di dalam negara bahkan hingga ke peringkat antarabangsa. Kepakaran penyelidik Nuklear Malaysia amat penting bagi meraih kepercayaan masyarakat terhadap teknologi nuklear.

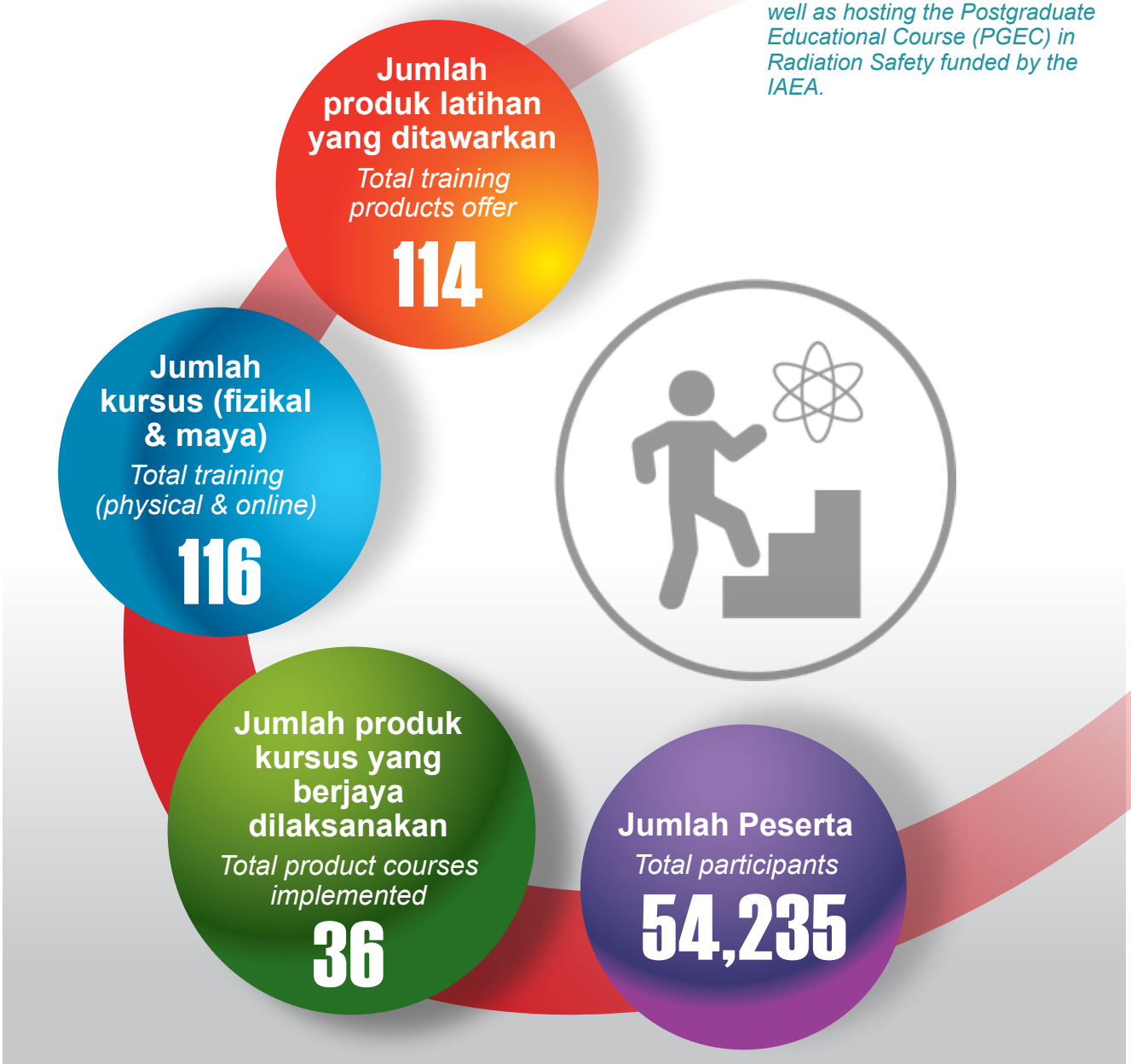
Human capital development is one of Nuklear Malaysia's main activities. This aspect is important to ensure that Nuklear Malaysia has staff, especially researchers with recognized expertise not only in the country but also internationally. The expertise of Nuklear Malaysia researchers is very important to gain public trust in nuclear technology

i. PROGRAM PEMBELAJARAN KEBANGSAAN DAN ANTARABANGSA

NATIONAL AND INTERNATIONAL EDUCATION PROGRAMS

Pusat Kecemerlangan Nuklear (CoNE) telah menganjurkan program pembelajaran di peringkat kebangsaan dan antarabangsa termasuk program bersekutu/pakatan bestari, melatih pakar bidang, melatih peserta dalam dan luar negara dan Kursus Pendidikan Pra Ijazah (PGEC) tajaan IAEA dalam keselamatan sinaran.

The Center of Nuklear Excellence (CoNE) has organized numerous national and international learning programs which include allied programs/smart alliances, training of field experts, and national and international participants as well as hosting the Postgraduate Educational Course (PGEC) in Radiation Safety funded by the IAEA.



ii. KHIDMAT PAKAR TEKNIKAL

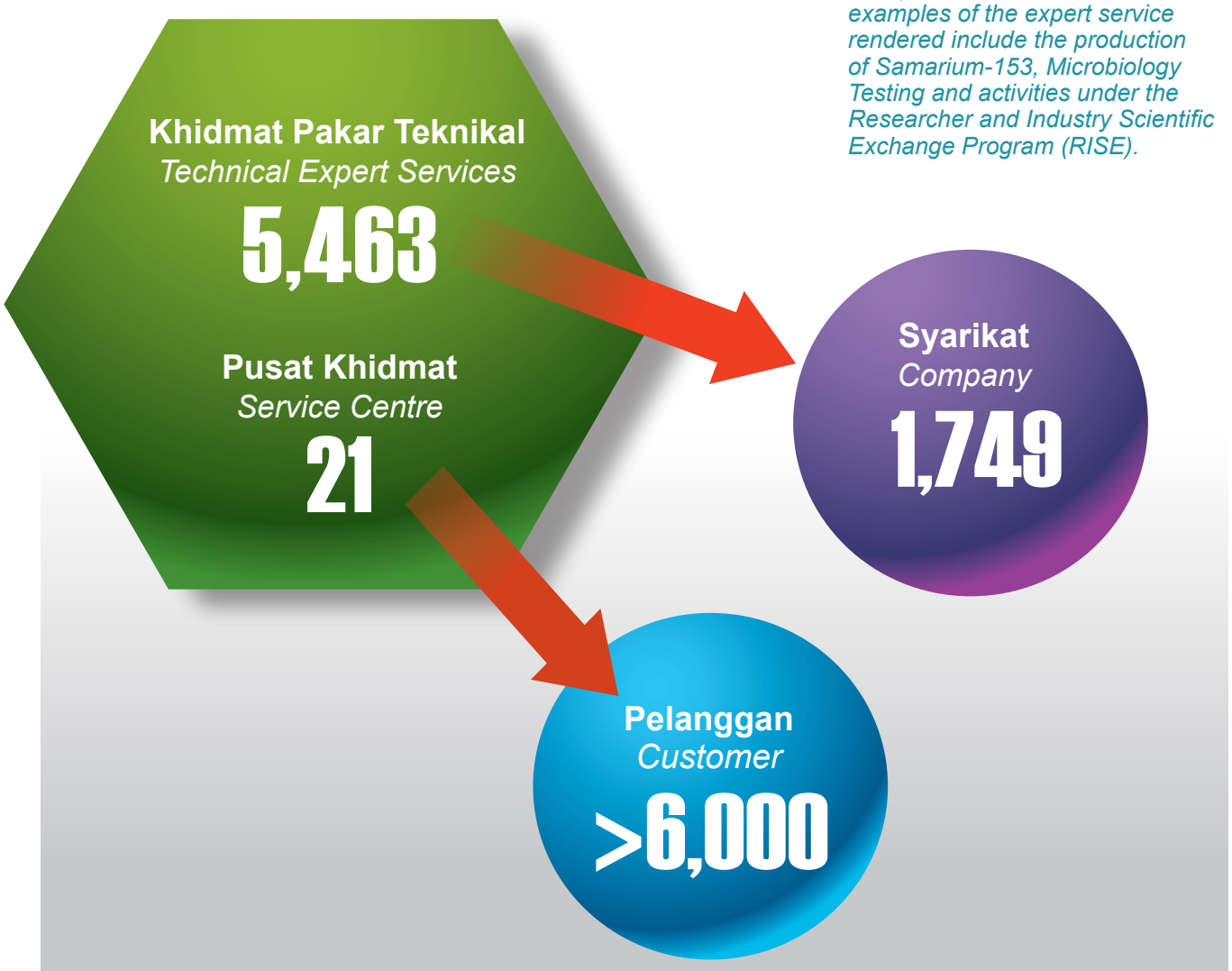
Nuklear Malaysia telah berjaya memberikan 5463 khidmat pakar teknikal, konsultasi dan latihan kepada 1749 syarikat yang terdiri daripada sektor perkilangan, pembuatan, semikonduktor, minyak dan gas, perubatan, pertanian, telekomunikasi, universiti dan agensi kerajaan.

Manakala, lebih 6000 pelanggan di dalam dan luar negara telah menerima pelbagai khidmat pakar teknikal, konsultasi dan latihan melalui 21 pusat khidmat Nuklear Malaysia. Antara perkhidmatan kepakaran yang diberikan kepada pelanggan adalah dalam penghasilan Samarium-153, perkhidmatan Ujian Mikrobiologi dan aktiviti di bawah Program Pertukaran Saintifik Penyelidik dan Industri (RISE).

TECHNICAL EXPERT SERVICES

Nuklear Malaysia has successfully provided 5463 training, technical and consultancy services to 1749 companies from various sectors which include manufacturing, semiconductor, oil and gas, medicine, agriculture, telecommunications, universities and government agencies.

At the same time, more than 6000 customers in Malaysia and abroad have received various technical expert services, consultation and training through the 21 Nuklear Malaysia service centers. Some examples of the expert service rendered include the production of Samarium-153, Microbiology Testing and activities under the Researcher and Industry Scientific Exchange Program (RISE).



iii. KHIDMAT KEPAKARAN

EXPERT SERVICE

Sejumlah 1501 perkhidmatan kepakaran berkaitan teknologi nuklear yang melibatkan 117 orang pegawai penyelidik. Antara perkhidmatan yang diberikan adalah sebagai konsultan / juruperunding sinaran, panel/penilai, pewasit / pemeriksaan luar dan lain-lain khidmat kepakaran.

A total of 1501 nuclear technology-related expert service involving 117 Research Officers has been rendered. Among the services provided are as advisers/radiation consultants, panellists/ assessors, external auditors/examiners and others.

iv. LATIHAN INDUSTRI

INDUSTRIAL TRAINING

Nuklear Malaysia turut mendapat kepercayaan institusi pengajian tinggi tempatan untuk menjadi tempat latihan bagi para pelajarnya. Seramai 182 orang pelajar daripada 25 institusi pengajian tinggi awam dan swasta telah menjalani latihan industri dan 39 orang pelajar lepasan ijazah telah melaksanakan kajian penyelidikan di Nuklear Malaysia.

A total of 182 students from 25 public and private institutions of higher learning have undergone industrial training and 39 postgraduate students have conducted research at Nuklear Malaysia.

Pelaksanaan Kajian Penyelidikan Mengikut Pengajian

Research conducted by study programme

8.4 MERAKYATKAN TEKNOLOGI NUKLEAR

HUMANISING NUCLEAR TECHNOLOGY

Program promosi dan penyebaran maklumat amat penting bagi Nuklear Malaysia. Program ini diperlukan untuk mendedahkan masyarakat tempatan terhadap teknologi nuklear dan seterusnya meraih kepercayaan serta penerimaan mereka terhadap teknologi ini. Walaupun dalam kekangan akibat pandemik COVID-19, Nuklear Malaysia tetap berusaha untuk memastikan aktiviti promosi dan penyebaran maklumat terus dilaksanakan. Pada tahun ini, aktiviti berkaitan dijalankan secara maya.

Promotion and information dissemination programs are very important for Nuklear Malaysia. This program is needed to expose the local community to nuclear technology and further gain their trust and acceptance of this technology. Despite the constraints caused by the COVID-19 pandemic, Nuklear Malaysia continues to strive to ensure that promotional activities and dissemination of information continue to be implemented. During the year, related activities were conducted virtually.

i. MINGGU SAINS NEGARA (MSN)

NATIONAL SCIENCE WEEK

Pelaksanaan MSN 2021 sudah memasuki tahun keempat penganjurannya. Program ini dilaksanakan secara atas talian dengan menggunakan platform yang disediakan oleh MOSTI.

Tema 'Sains Untuk Kesihatan' diperkenalkan pada tahun ini mengambil kira peranan sains bukan sahaja dalam mengekang penularan COVID-19 tetapi juga adaptasi terhadap perubahan gaya hidup masyarakat.

Program berlangsung pada 1 hingga 7 April 2021. Majlis perasmian diadakan secara rakaman oleh YB Timbalan Menteri MOSTI, YB Datuk Haji Ahmad bin Amzad Hashim pada 1 April 2021. Majlis penutup pula disempurnakan secara rakaman oleh YB Menteri MOSTI, YB Khairy bin Jamaluddin pada 7 April 2021. Nuklear Malaysia selaku agensi pelaksana turut serta menjayakan program ini. Sebanyak 2,756 jumlah engagement untuk semua program yang dijalankan.

The implementation of MSN 2021 has entered its fourth year of organization. The program is implemented online using a platform provided by MOSTI. The 'Science For Health' theme introduced this year takes into account the role of science not only in curbing the spread of COVID-19 but also adapting to lifestyle changes in society. The program took place from 1 to 7 April 2021. The opening ceremony was recorded by YB Deputy Minister of MOSTI, YB Datuk Haji Ahmad bin Amzad Hashim on 1 April 2021. The closing ceremony was recorded by YB Minister of MOSTI, YB Khairy bin Jamaluddin on 7 April 2021. Nuclear Malaysia as the implementing agency also participated in the success of this program. A total of 2,756 total engagements for all programs conducted.

Nuklear Malaysia telah menyertai sesi pameran secara maya, penerbitan risalah terdiri dari majalah terbitan Nuklear Malaysia dan brosur perihal produk dan perkhidmatan yang ditawarkan oleh Nuklear Malaysia. Selain itu, Nuklear Malaysia turut menyertai tujuh daripada lapan bidang utama yang ditawarkan oleh MOSTI seperti Bengkel Sains Nuklear untuk Guru Sains, Bengkel Keselamatan Sinaran dan Kimia, Forum Selamatkah makan makanan disinar?, Seminar Nuklear BFF, Pembelajaran Sembang Santai Saintis: Nuklear di bidang Perubatan, Sembang Santai Saintis: Simulator Reaktor TRIGA PUSPATI dan Imbasan Minggu Sains Negara 2020.

Nuklear Malaysia participated in a virtual exhibition session, publishing brochures consisting of Nuklear Malaysia magazines and brochures on products and services offered by Nuklear Malaysia. Apart from that, Nuklear Malaysia also participated in seven of the eight main areas offered by MOSTI such as: Nuclear Science Workshop for Science Teachers, Radiation and Chemistry Safety Workshop, Forum Is it safe to eat irradiated food ?, BFF Nuclear Seminar, Scientist Casual Chat Learning: Nuclear in Medicine, Scientist Casual Chat: TRIGA PUSPATI Reactor Simulator and National Science Week 2020 Scan.

ii. PROGRAM SEMBANG SANTAI SAINTIS (3S)

SEMBANG SANTAI SAINTIS (3S) PROGRAMME

Nuklear Malaysia secara proaktifnya telah berjaya menganjurkan 13 siri webinar Sembang Santai Saintis (3'S) dengan penyertaan seramai 2745 peserta dari kalangan orang awam, guru dan pelajar seluruh Malaysia bagi tahun 2021. Program 3'S yang juga merupakan salah satu teras penting dalam Program Jangkauan Luar Pendidikan Nuklear (NEO) ini dilaksanakan menggunakan kaedah pembelajaran secara maya. Seramai 13 pegawai penyelidik dari Nuklear Malaysia telah terlibat secara langsung untuk menjayakan program ini dengan berkongsi ilmu dan kepakaran masing-masing selain memotivasikan pelajar untuk menceburi bidang sains dan teknologi (S&T).

Nuklear Malaysia has proactively organised 13 series of Sembang Santai Saintis (3'S) webinars with 2745 participants from the public, teachers and students throughout Malaysia for the year 2021. The 3'S programme, one of the essential cores in the Nuclear Education Outreach Programme (NEO), was implemented using virtual learning methods. A total of 13 research officers from Nuklear Malaysia are also involved directly in sharing their knowledge and expertise and motivating students to venture into science and technology (S&T).

Pelbagai pengisian menarik seperti sesi perkongsian ilmu, tayangan video pembelajaran, sesi soal jawab dan permainan kuiz interaktif juga turut disediakan bagi meningkatkan lagi keterujaan dan semangat untuk belajar. Program 3'S dilihat berhasil mencapai matlamat utama perlaksanaannya iaitu memupuk minat dalam sains serta melengkapkan peserta

dengan pengetahuan yang tepat mengenai teknologi nuklear. Oleh itu, diharapkan siri webinar 3'S ini dapat diperluaskan lagi agar dapat memberi manfaat kepada orang awam khususnya guru dan pelajar untuk menguasai konsep sains dengan cepat dan mudah, di samping mengubah stigma negatif mengenai teknologi nuklear.

iii. PERTANDINGAN PENDIDIKAN SAINS DAN TEKNOLOGI NUKLEAR UNTUK GURU DAN PELAJAR SEKOLAH MENENGAH

NUCLEAR SCIENCE AND TECHNOLOGY EDUCATION COMPETITION FOR SECONDARY LEVEL STUDENTS AND TEACHERS

IAEA telah menganjurkan satu pertandingan Sains dan Teknologi Nuklear untuk guru dan pelajar sekolah menengah pada tahun 2021. Sebagai negara anggota yang aktif, Malaysia turut menghantar penyertaan mereka melalui beberapa wakil yang terdiri daripada guru dan pelajar sekolah menengah di seluruh negara.

The IAEA has organized a Nuclear Science and Technology competition for secondary school teachers and students in 2021. As an active member state, Malaysia also sent their entries through several representatives comprising secondary school teachers and students across the country.

Pertandingan di dalam format video itu telah menarik lebih 50 penyertaan untuk semua kategori pertandingan daripada pelbagai negara di seluruh dunia. Antara tema pertandingan yang dipilih adalah peranan teknologi nuklear dalam memenuhi Sasaran Pembangunan Lestari (SDG) bagi pelajar sekolah dan kaedah pengajaran sains dan teknologi nuklear yang berkesan bagi guru sains sekolah menengah.

The competition in the video format has attracted over 50 entries for all competition categories from various countries around the world. Among the selected competition themes are the role of nuclear technology in meeting the Sustainable Development Targets (SDGs) for school students and effective teaching methods of nuclear science and technology for secondary school science teachers.

8.5 PELAWAT NUKLEAR MALAYSIA

Kesan kepada pandemik COVID-19, Nuklear Malaysia hanya menerima kunjungan sekitar 14 orang pelawat daripada pelbagai agensi kerajaan dan swasta. Menerusi lawatan ilmiah ini, inistiatif Nuklear Malaysia dalam menyebar luas maklumat mengenai Sains dan Teknologi (S&T) khususnya terhadap teknologi nuklear dapat diperluaskan kepada masyarakat secara berterusan secara fizikal.

Kunjungan pelawat ke Nuklear Malaysia bukan sahaja membuka ruang dan peluang kepada mereka untuk berinteraksi secara langsung dengan pegawai penyelidik, malah dapat melihat sendiri kemudahan serta produk inovasi teknologi nuklear secara dekat

VISITORS TO NUKLEAR MALAYSIA

Affected from COVID-19 pandemic, Nuklear Malaysia only received around 14 visitors from various government and private agencies. Through these visits, Nuklear Malaysia's initiative to disseminate information on Science and Technology (S&T) especially on nuclear technology can be conveyed to the community continuously through physically.

A visit to Nuklear Malaysia not only provide visitors the opportunity to interact directly with research officers, but also to see for themselves the facilities and products of nuclear technology innovation.

8.6 NUKLEAR MALAYSIA @ MEDIA

NUKLEAR MALAYSIA @ MEDIA

Media merupakan elemen penting bagi Nuklear Malaysia. Kerjasama dan hubungan baik bersama penggiat industri menjadikan Nuklear Malaysia sentiasa dikenali umum sebagai institusi penyelidikan terunggul di Malaysia.

The media is an important element of Nuklear Malaysia. Cooperation and good relations with industry players have made Nuklear Malaysia always known as the leading research institution in Malaysia.

Aktiviti Nuklear Malaysia untuk Media Cetak dan Media Eletronik:

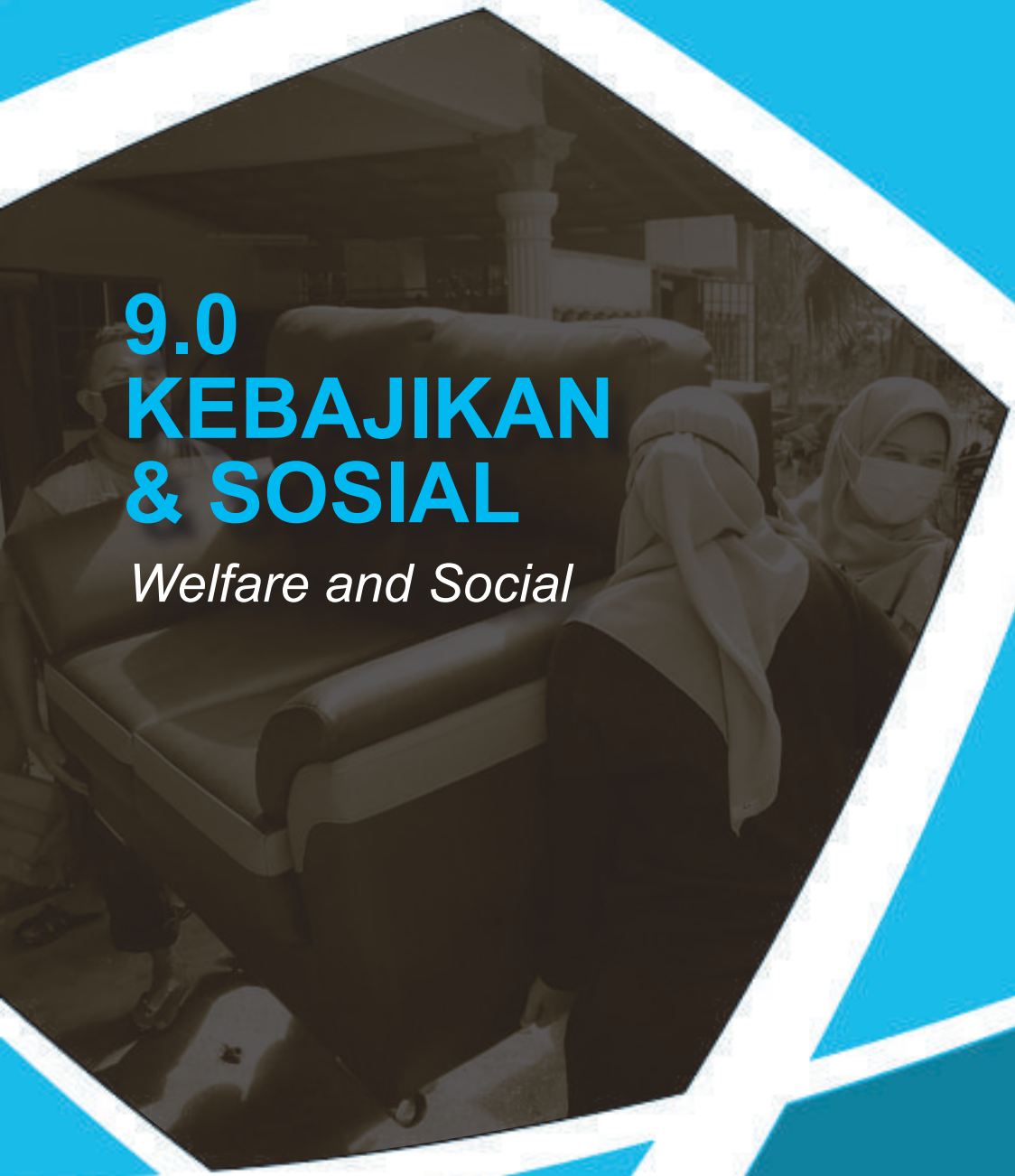
Nuklear Malaysia activity on electronic media and printed media:

3 Sidang Media
Media Conference

76 Liputan Media Cetak & Elektronik
Printed and Electronic Media

738 Muat Naik Media Sosial
Media Socials Uploads

20 Tembubual Khas Media Cetak & Elektronik
Special Interview Printed & Electronic Media



9.0 KEBAJIKAN & SOSIAL

Welfare and Social

9.0 KEBAJIKAN DAN SOSIAL

WELFARE AND SOCIAL

9.1 GALERI AKRAB

AKRAB GALLERY

Seminar AKRAB 2021
AKRAB Seminar 2021

Majlis bacaan surah Yaasin untuk Ghaza secara atas talian anjuran AKRAB Nuklear Malaysia bersama PUSPANITA Nuklear Malaysia
Online yaasin recitation for Gaza, jointly organized by AKRAB Nuklear Malaysia and Nuklear Malaysia PUSPANITA

Program sembang Santai@ Akrab pada 12 Ogos 2021
"Sembang Santai AKRAB" on 12th August 2021

Mesyuarat AKRAB Bil 2/2021 pada 7 Disember 2021
AKRAB 2nd Meeting on 7th December 2021

Watikah pelantikan ahli AKRAB baharu pada 7 Disember 2021
New AKRAB members conferment on 7th December 2021

9.2 GALERI KELAB SUKAN DAN KEBAJIKAN

SPORT AND WELFARE CLUB GALLERY

Pemberian sumbangan kepada warga Nuklear Malaysia yang dijangkiti COVID-19, Februari 2021 hingga Disember 2021, Nuklear Malaysia

"Helping Hand" for COVID-19 survivors among staffs, from February 2021 to December 2021, Nuklear Malaysia

Mesyuarat Agong Tahunan Ke-36 Kelab Sukan dan Kebajikan Nuklear Malaysia, 12 April 2021, Dewan Tun Ismail, Nuklear Malaysia

Welfare & Sports Club Annual General Meeting, held on 12nd April 2021 (Tun Dr. Ismail Hall) Nuklear Malaysia

Pemberian bubur lambuk kepada warga Nuklear Malaysia dan komuniti setempat, 5 Mei 2021, Nuklear Malaysia

"Bubur Lambuk" distribution to staffs and local communities, 5th May 2021, Nuklear Malaysia

Penyampaian Sumbangan Warga Nuklear Malaysia untuk petugas-petugas di Pusat Pemberian Vaksin BACC pada 21 Ogos 2021, Bangi Avenue Convention Centre, Bangi

Appreciation for frontliners among staffs at Bangi Avenue Convention Center Bangi, 21st August 2021

Pertandingan liga penalti antara bahagian Nuklear Malaysia, 30 Oktober 2021, padang bola Nuklear Malaysia

Inter-division penalty league, 30th October 2021, Football Field Nuklear Malaysia

9.3 GALERI KOPERASI KAKITANGAN PUSPATI BERHAD

KOPERASI KAKITANGAN PUSPATI BERHAD GALLERY

Sumbangan sarung tangan kepada petugas di Pusat Pemberian Vaksin, 28 Julai 2021, Bangi Avenue Convention Centre (BACC)

Contributing boxes of medical gloves to frontliners tasked at Bangi Avenue Convention Center (BACC) on 28th July 2021

Mesyuarat Agung Koperasi Kakitangan Puspati Berhad kali ke-28, 9 Disember 2021, Dewan Tun Dr Ismail, Nuklear Malaysia

The 28th Annual General Meeting for Koperasi Kakitangan Puspati Berhad held on 9th December 2021, Tun Dr. Ismail Hall, Nuklear Malaysia

Pemberian sumbangan kumpulan wang kebajikan anggota dan khairat kematian

Handing over of death benefits for next of kin among staffs

9.4 GALERI PUSPANITA

PUSPANITA GALLERY

Program Ihya' Ramadan 2021- Infak Bubur Lambuk - Rakan Komuniti Anda, 6 Mei 2021, Nuklear Malaysia

Ihya Ramadan Program 2021 – Sharing Bubur Lambuk with Communities on 6th May 2021, Nuklear Malaysia

Sumbangan Kit Suci Wanita, 10 - 31 Mac 2021. Anjuran bersama Kelab Nuklear Malaysia. Sumbangan kit tuala wanita diedarkan sempena menyambut Hari Wanita Sedunia

Distributing Women Hygiene Kit to the less fortunate in conjunction with World Women Day, 10th until 31st March 2021 organized with Nuklear Malaysia Club

Mesyuarat Agung Tahunan PUSPANITA MOSTI KE - 38, 1 April 2021, Dewan MOSTI, Putrajaya

38th PUSPANITA MOSTI Annual General Meeting, 1st April 2021, MOSTI Hall, Putrajaya

Program Lawatan ke Kompleks Karangkraf Kuala Lumpur, 27-30 April 2021, Jalan Conlay, Kuala Lumpur

A tour to Kuala Lumpur Craft Complex with PUSPANITA, 27th – 30th April 2021, Jalan Conlay, Kuala Lumpur