NUKLEAR MALAYSIA

Annual Report
LAPORAN TAHUNAN 2019

Agensi Nuklear Malaysia, Kementerian Tenaga, Sains, Teknologi, Alam Sekitar dan Perubahan Iklim (MESTECC)
Malaysian Nuclear Agency, Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC)

LAPORAN TAHUNAN
AGENSI NUKLEAR MALAYSIA

ANNUAL REPORT
MALAYSIAN NUCLEAR AGENCY

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KANDUNGAN

Bil.	Tajuk	M/s.
1.	Visi,Misi,Objektif, Fungsi	iv
2.	Nota Eksekutif	1
3.	Carta Organisasi	2
4.	Pengurusan Tertinggi	3
5.	Barisan Pengurusan	4
6.	Pengenalan	6
7.	Kecemerlangan Penyelidikan, Pembangunan dan Pengkomersialan Teknologi (P&P&P)	7
8.	Kemudahan Utama, Loji dan Pusat Khidmat	22
9.	Pencapaian Inovasi dan Pengiktirafan Kepakaran	45
10.	Pencapaian Antarabangsa	52
11.	Nuklear Malaysia Bantu Krisis	57
12.	Merakyatkan Teknologi Nuklear	62
13.	Nuklear Malaysia@Media	65
14.	Kebajikan, Sukan dan Rekreasi	68

CONTENT

No.	Title	Pg.
1.	Vision,Mision,Objective, Function	74
2.	Executive Note	75
3.	Organisational Chart	76
4.	Top Management	77
5.	Management Team	78
6.	Introduction	80
7.	Excellence in Research, Development and Technology Commercialisation (R&D&C)	81
8.	Main Facilities, Plants and Service Centres	96
9.	Achievements in Innovation and Recognition of Expertise	119
10.	International Achievements	126
11.	Nuklear Malaysia Aids in Crisis	131
12.	Humanising Nuclear Technology	136
13.	Nuklear Malaysia@Media	139
14.	Welfare, Sports and Recreation	142

VISI

- Sains dan teknologi nuklear untuk penjanaan ilmu, kemakmuran dan kesejahteraan masyarakat dan negara

MISI

- Meneraju kecemerlangan dalam penyelidikan dan penggunaan teknologi nuklear untuk pembangunan lestari

OBJEKTIF

- Menjana produk dan teknologi baru melalui penyelidikan dan inovasi berdasarkan agenda pembangunan negara
- Mencapai pendapatan minimum 30% dari bajet mengurus tahunan menerusi pemindahan dan pengkomersialan teknologi
- Meningkatkan kecemerlangan organisasi melalui perancangan dan pengurusan berkualiti

FUNGSI

- Menjalankan penyelidikan dan pembangunan (P&P), latihan dan perkhidmatan dalam teknologi nuklear untuk pembangunan negara;
- Organisasi sokongan teknikal nasional untuk teknologi nuklear dan yang berkaitan;
- Mempromosikan aplikasi, pemindahan dan pengkomersialan teknologi nuklear;
- Pusat rujukan forensik nuklear kebangsaan;
- Pusat pengurusan nasional untuk sisa radioaktif dan bahan api nuklear yang dibelanjakan;
- Badan penghubung untuk Badan Tenaga Atom Antarabangsa (IAEA) di peringkat nasional dan atarabangsa;
- Pihak berkuasa tempatan untuk pelaksanaan Perjanjian Larangan Uji Nuklear Komprehensif (CTBT);
- Pusat Metrologi Sinaran Nasional.

NOTA **EKSEKUTIF**

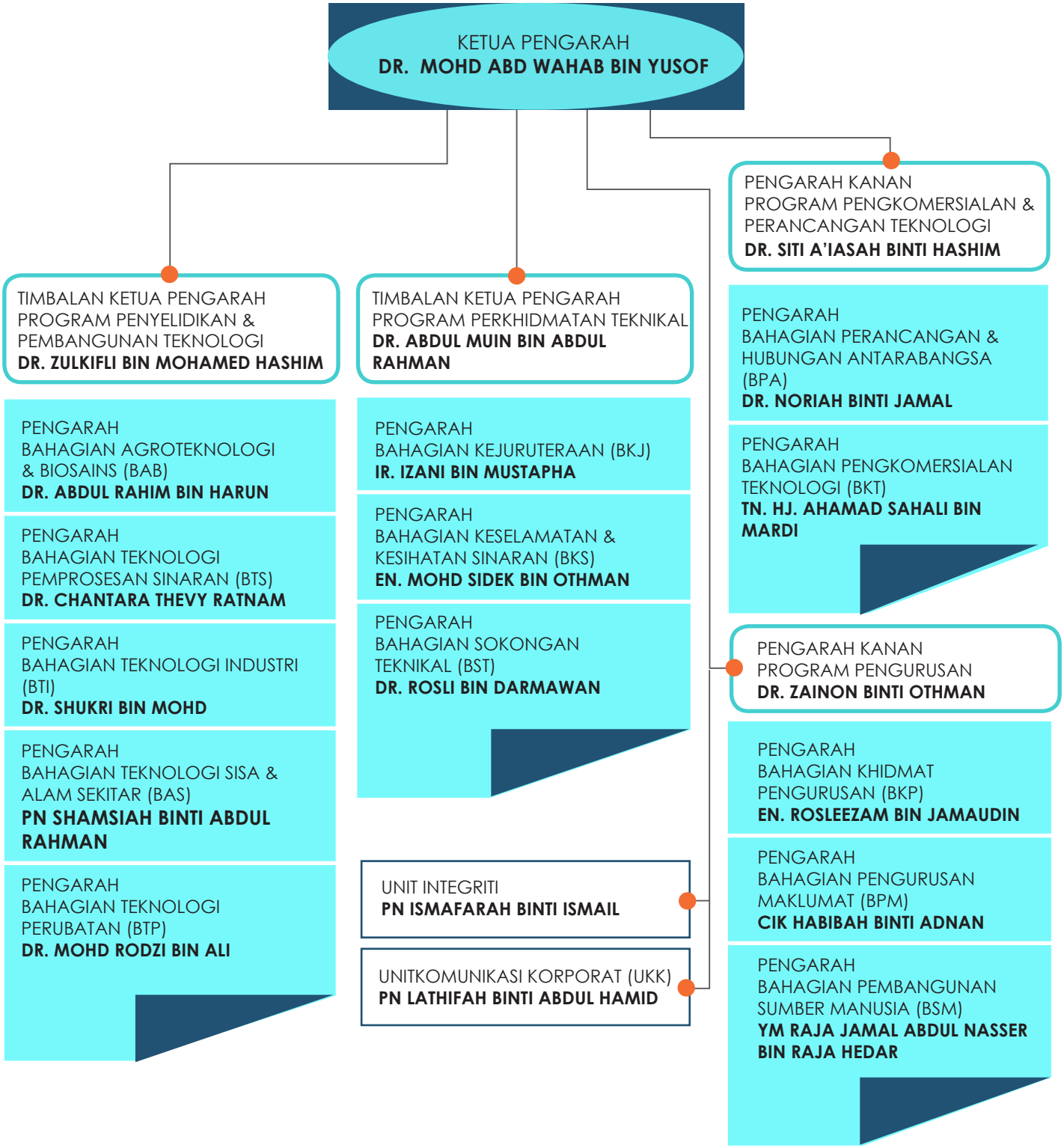
Setelah hampir lima dekad, Agensi Nuklear Malaysia (Nuklear Malaysia) telah banyak mempamerkan kejayaan sepanjang penubuhannya. Nuklear Malaysia berjaya mengekalkan identiti sebagai peneraju dalam bidang sains dan teknologi nuklear terutamanya dalam penyelidikan dan pembangunan, inovasi dan pengkomersialan teknologi.

Bukan sekadar sebuah institusi penyelidikan kebangsaan yang berperanan untuk mempromosi, membangun dan menggalakkan penggunaan teknologi, Nuklear Malaysia turut memberikan khidmat dan latihan kepakaran dalam bidang ini. Selain itu, Nuklear Malaysia turut menyelaras dan mengurus hal ehwal nuklear di peringkat kebangsaan dan antarabangsa serta bertindak sebagai pihak berkuasa kebangsaan bagi pelaksanaan Comprehensive Nuclear-Test-Ban Treaty (CTBT).

Sepanjang tahun 2019, Nuklear Malaysia telah menghasilkan 24 produk penyelidikan, 9 proses, 20 prosedur, lima pangkalan data dan tiga perisian. Manakala jumlah penerbitan pula adalah sebanyak 653, meliputi buku, bab dalam buku, tesis, jurnal, pembentangan antarabangsa dan kebangsaan, prosiding, penerbitan am serta lain-lain penerbitan dari semua bidang penyelidikan terkini dalam sains dan teknologi nuklear. Bagi meneruskan kecemerlangannya, Nuklear Malaysia akan terus menggiatkan mempromosi kemudahan dan kepakaran teknologi nuklear di seluruh Malaysia. Ini akan memberi impak positif dalam jaringan kerjasama antara agensi dan pihak industri bagi meningkatkan kualiti penyelidikan dan pengkomersialan pada masa akan datang.

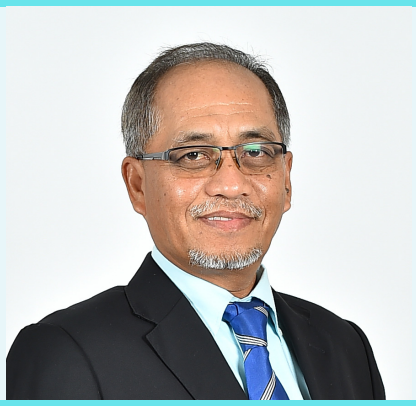
YBrs. Dr. Mohd Abd Wahab bin Yusof
KETUA PENGARAH, AGENSI NUKLEAR MALAYSIA
KEMENTERIAN TENAGA, SAINS, TEKNOLOGI, ALAM SEKITAR DAN PERUBAHAN IKLIM (MESTECC).

CARTA ORGANISASI



PENGURUSAN TERTINGGI

KETUA PENGARAH
DR. MOHD ABD WAHAB BIN YUSOF



TIMBALAN KETUA PENGARAH
PROGRAM PENYELIDIKAN & PEMBANGUNAN TEKNOLOGI
DR. ZULKIFLI BIN MOHAMED HASHIM

TIMBALAN KETUA PENGARAH
PROGRAM PERKHIDMATAN TEKNIKAL
DR. ABDUL MUIN BIN ABDUL RAHMAN

PENGARAH KANAN
PROGRAM PENGURUSAN
DR. ZAINON BINTI OTHMAN

PENGARAH KANAN
PROGRAM PENGKOMERSIALAN & PERANCANGAN TEKNOLOGI
DR. SITI A'IASAH BINTI HASHIM

BARISAN **PENGURUSAN**

1

2

3

1 Pengarah
Bahagian Agroteknologi
& Biosains (BAB)
DR. ABDUL RAHIM BIN HARUN

2 Pengarah
Bahagian Perancangan &
Hubungan Antarabangsa (BPA)
DR. NORIAH BINTI JAMAL

3 Pengarah
Bahagian Teknologi
Pemprosesan Sinaran (BTS)
DR. CHANTARA THEVY RATNAM

4 Pengarah
Bahagian Teknologi Industri (BTI)
DR. SHUKRI BIN MOHD

5 Pengarah
Bahagian Teknologi
Perubatan (BTP)
DR. MOHD RODZI BIN ALI

6 Pengarah
Bahagian Pengkomersialan
Teknologi (BKT)
TN. HJ. AHAMAD SAHALI BIN MARDI

7 Pengarah
Bahagian Teknologi Sisa
dan Alam Sekitar (BAS)
PN. SHAMSIAH BINTI ABDUL RAHMAN

4

5

6

7

BARISAN **PENGURUSAN**

8

9

10

11

12

13

8 Pengarah
Bahagian Keselamatan &
Kesihatan Sinaran (BKS)
EN. MOHD SIDEK BIN OTHMAN

9 Pengarah
Bahagian Sokongan
Teknikal (BST)
DR. ROSLI BIN DARMAWAN

10 Pengarah
Bahagian Pembangunan
Sumber manusia (BSM)
YM RAJA JAMAL ABDUL
NASSER BIN RAJA HEDAR

11 Pengarah
Bahagian Kejuruteraan (BKJ)
IR. IZANI BIN MUSTAPHA

12 Pengarah
Bahagian Khidmat
Pengurusan (BKP)
EN. ROSLEEZAM BIN JAMAUDIN

13 Pengarah
Bahagian Pengurusan
Maklumat (BPM)
CIK HABIBAH BINTI ADNAN

PENGENALAN

"Teknologi Nuklear Pemacu Wawasan Negara"

Dengan misi meneraju kecemerlangan dalam penyelidikan dan penggunaan teknologi nuklear untuk pembangunan lestari, Nuklear Malaysia terus mengorak langkah memperkasa P&P sains dan teknologi (S&T) nuklear untuk penjanaan ilmu, kemakmuran dan kesejahteraan masyarakat dan negara.

Kecemerlangan Nuklear Malaysia adalah berdasarkan pengalaman 48 tahun dalam pembangunan S&T nuklear, serta 38 tahun dalam pengendalian reaktor penyelidikan.

Pengurusan dan Pentadbiran

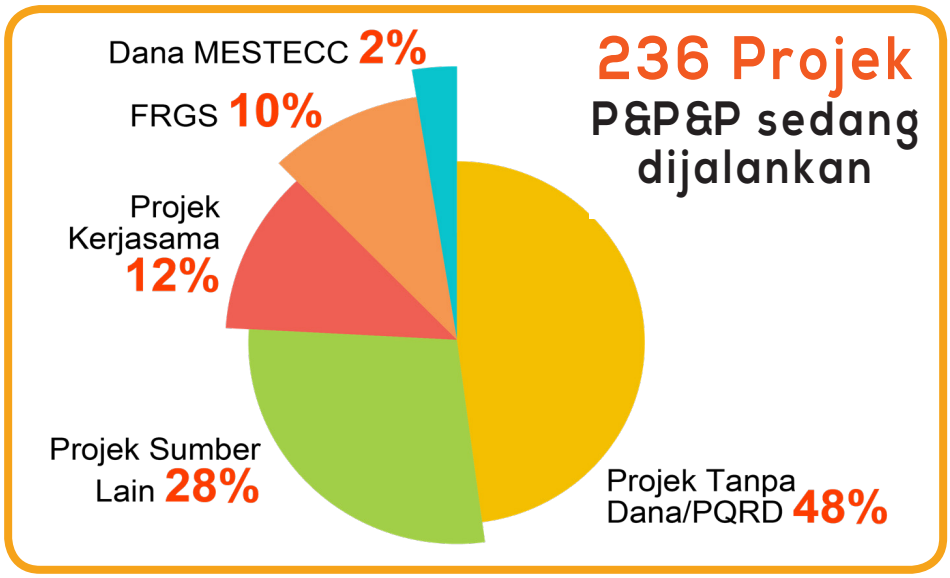
Kecemerlangan pengurusan dan pentadbiran Nuklear Malaysia diteruskan sejajar dengan misi, visi, objektif dan fungsinya.

1. **95.15%** **(RM8.2 juta)**
   Belanja Pembangunan
2. **95%** **(RM82 juta)**
   Belanja Mengurus
3. **100%**
   Laporan Audit
4. **82.6%** **(769/930)**
   Jawatan Tetap
5. **85** **jawatan**
   Jawatan Kontrak &
   Pekerja Sambilan Harian

KECEMERLANGAN PENYELIDIKAN, PEMBANGUNAN DAN PENGKOMERSIALAN TEKNOLOGI (P&P&P)

Aktiviti P&P&P yang dilaksanakan di Nuklear Malaysia terus menyumbang kepada pelaksanaan dan pencapaian Dasar Sains dan Teknologi Inovasi Negara (DSTIN). Nuklear Malaysia memberi penekanan kepada pembangunan modal insan bagi memastikan semua aktiviti P&P seiring dengan arus perdana. Ini sebagai pemangkin kepada peningkatan ekonomi dan daya saing ke arah sebuah negara industri berpendapatan tinggi sepenuhnya.

Penyelidikan dan Pembangunan



Output P&P&P

Produk

24 Produk

9 Proses

18 Prosedur

3 Perisian

5 Pangkalan Data

Welded Alunode

Bolted Alunode

Screwed Alunode

Benih stevia varieti baharu S10A

Biobaja M99

NuRust

Bioliquifert

Tiang Sokongan Lada Hitam

HippoScan

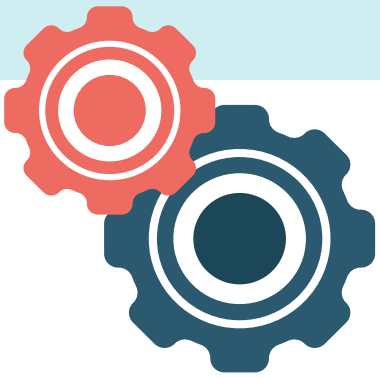
GoGrow BioNPK Biobaja

Aquacage

Riverprotec

Proses

1. Penyinaran Gamma, Elektron dan Neutron produk komersil dan sampel penyelidikan
2. *'Fitosanitary treatment'* buah-buahan segar
3. Proses rawatan menggunakan sinaran bagi pengeksportan buah-buahan segar ke Amerika Syarikat
4. *Development of elite mother culture mushroom for commercialization*
5. *Freeze dried peptide kit*
6. Proses penyinaran *X-ray* untuk mencit berdasarkan tiga produk perkakasan penyinaran (satu untuk perkakasan *wholebody irradiation for mice,* satu perkakasan untuk *whole body irradiation for rat,* satu perkakasan untuk *abdominal irradiation for mice)*
7. Pengacuan sebatian pukal berasaskan kenaf
8. Taut silang sinaran untuk panel suria
9. Penghasilan pengesan glukosa melalui penyinaran gentian optik tersalut *pyriole/pVA-glucose oxidase*



Prosedur

1. Prosedur Ujian Kawalan Kualiti Sm -153 dan Ethylenediamine Tetra (Methylene Phosphonic Acid (EDTMP) untuk Perubatan
2. Prosedur Ujian Kawalan Kualiti I-131 untuk Perubatan
3. Prosedur Validasi Ujian Mikrobiologi ke atas Produk Kapsul I-131 untuk Perubatan
4. Prosedur Validasi Ujian Mikrobiologi ke atas Produk Sm-153 EDTMP untuk Perubatan
5. Prosedur Kawalan Kualiti Pelabelan Radio
6. Kit Peptida Beku Kering
7. Prosedur Manual Penstoran Kitar Semula Nadir Bumi
8. Prosedur Piawai Kerja Penyediaan Sampel Mikroskop Pengimbas Elektron
9. Prosedur Piawai Kerja Operasi Mikroskop Pengimbas Elektron
10. Prosedur Pengujian Pengukuran Ketebalan Dinding Paip Berdasarkan Pengesan Digital Tersusun (Dda) dengan Sinar-X
11. Prosedur Pengujian Pengukuran Ketebalan Dinding Paip Berdasarkan Radiografi Berkomputer
12. Manual Operasi Pencelup: Inovasi Baru Mesra Berskala Makmal bagi Sistem Salutan Pencelup Panas
13. Prosedur Pengeksportan Buah Rambutan Segar ke USA
14. Prosedur Piawai Operasi Penghasilan Teh Volvariella
15. Prosedur Piawai Operasi Pengekstratan dan Penulenan Mutasi Stevia
16. Saringan in Vitro Cendawan Volvariella Volvacea
17. Saringan in Vitro Cendawan Volvariella Volvacea Pleurotus Sp
18. Prosedur Sel Aktif Mudah Alih

Perisian

Ombakwarna:
Perisian grafik dan analisis

Perisian Perolehan Data
Fleksi-Automatik

TRIMON: Kod Monte Carlo Deterministik Bersepadu untuk Pengurusan Teras Reaktor TRIGA

Pangkalan Data

Database *on the radiosensitivity of Napier grass to acute and chronic gamma irradiation*

Database *on the Acoustic Emission (AE) of ship hull*

Internal Database of
Fire Hazards at the RTP

MY-Fuel ***Database***

Validated questionnaire, *Survey data, Full paper*

Penerbitan 2019

Penerbitan merupakan salah satu kaedah Pengurusan Pengetahuan (KM) yang dilaksanakan di Nuklear Malaysia. Ini bagi memastikan semua maklumat dapat diuruskan dengan baik seterusnya dapat digunakan sebagai kesinambungan untuk rujukan akan datang.

Nuklear Malaysia berjaya menghasilkan
653 penerbitan

4	Tesis
3	Buku
1	Bab dalam Buku
31	Journal Kebangsaan
95	Journal Antarabangsa
106	Konferen Kebangsaan
50	Konferen Antarabangsa
178	Laporan Teknikal
8	Penerbitan Am
177	Laporan Pelajar Latihan Industri

Kecemerlangan Aktiviti Pengkomersialan

Nuklear Malaysia menjana pendapatan sebanyak RM10.43 juta melalui perkhidmatan profesional. Khidmat pakar teknikal merupakan penyumbang tertinggi, diikuti dengan bekalan produk dan perkhidmatan latihan.

Menjana pendapatan akaun amanah sebanyak
RM 10.43 juta

20 NDA

5 MoA/MoU/Nota Kerjasama

Pelancaran produk/Perkhidmatan sedia dikomersialkan

Sumber Pendapatan	Jumlah Pendapatan (juta)
• Bekalan Produk	RM2.218
• Pendidikan dan Latihan	RM2.715
• Perkhidmatan Teknikal Kontrak/Geran	RM4.282
• Penyelidikan/Runding Cara	RM1.092
• Dividen daripada Pelaburan	RM0.126
Jumlah	**RM10.433**

1. Bekalan Produk

- Makmal Standard Dosimetri Sekunder (SSDL)
- RAYMINTEX: Loji Pemvulkanan Lateks Getah Asli Menggunakan Sinaran Gama (RVNRL)
- Bekalan Radioisotop

2. Pendidikan dan Latihan

Pusat Latihan telah menganjurkan program pembelajaran di peringkat kebangsaan dan antarabangsa termasuk program bersekutu/pakatan bestari, melatih pakar bidang, melatih peserta Program Kerjasama Teknikal Malaysia (MTCP) dengan negara lain dan Kursus Pendidikan Pra Ijazah (PGEC) tajaan IAEA dalam keselamatan sinaran.

Jumlah produk latihan	Jumlah kursus	Jumlah peserta
32	**116**	**2515**

3. Khidmat Pakar Teknikal

Nuklear Malaysia telah berjaya memberikan 7837 khidmat pakar teknikal, konsultasi dan latihan kepada 2454 syarikat yang terdiri daripada sektor perkilangan, pembuatan, semikonduktor, minyak dan gas, perubatan, pertanian, telekomunikasi, universiti dan agensi kerajaan. Manakala, lebih 5000 pelanggan di dalam dan luar negara telah menerima pelbagai khidmat pakar teknikal, konsultasi dan latihan melalui 21 pusat khidmat Nuklear Malaysia. Sebagai contoh, 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).

P&P&P Terpilih 2019

1 *Padi **NMR151** dan **NMR152***

Sebagai sebuah institusi penyelidikan yang bertaraf antarabangsa, usaha yang telah dilaksanakan adalah untuk mengkomersialkan produk penyelidikan.

Nuklear Malaysia telah berjaya membangunkan varieti padi baharu NMR 151 dan NMR 152 yang mampu bertahan mengikut perubahan cuaca ekstrem di Malaysia. Hasil penyelidikan ini dapat membantu golongan petani meningkatkan pendapatan melalui pengurangan kos operasi penanaman benih padi antara lima hingga sepuluh peratus dan pertambahan hasil tuaian sebanyak lima puluh lima peratus. Penyelidikan selama lebih 10 tahun telah berjaya menghasilkan beberapa varieti baharu padi yang mempunyai nilai tambah yang tinggi seperti varieti padi NMR 152 dan NMR 151 yang telah berjaya didaftarkan di bawah Akta Perlindungan Varieti Baharu Tumbuhan 2004.

2 *Pembangunan benih cendawan **varieti baharu volvariella volvacea** secara pengkomersialan oleh penyelidik Nuklear Malaysia*

Volvariella Volvacea adalah cendawan hibrid yang dibangunkan oleh Nuklear Malaysia. Benih hibrid ini menggunakan kaedah pembiakan tisu kultur. Tempoh pembiakan cuma dalam dua minggu sahaja sebelum mendapatkan hasilnya. Teknik penanaman adalah menggunakan konsep ringkas 3T iaitu Tanam, Tunggu dan Tuai yang menjadikan inovasi teknologi bagi tanaman ini lebih istimewa.

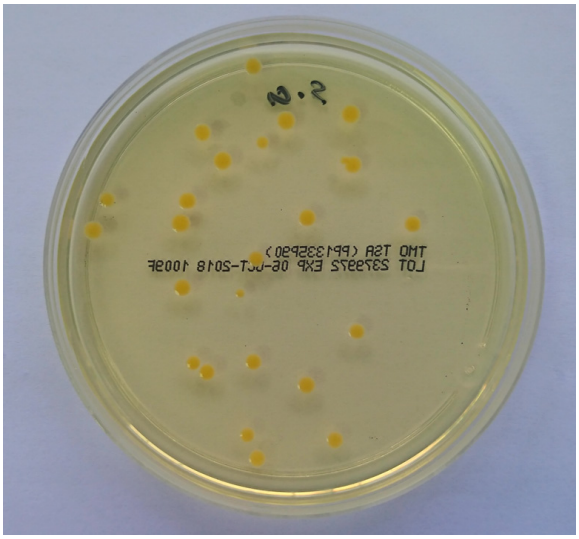
3 Penghasilan **Samarium-153**

Radiofarmaseutikal Samarium-153 *Ethylenediamine Tetramethylene Phosphonate (Sm-153 EDTMP)* dihasilkan secara *in-house* untuk dibekalkan kepada Institut Kanser Negara (IKN) sebagai rawatan paliatif kepada pesakit kanser. Samarium-153 dihasilkan oleh RTP melalui pengaktifan neutron daripada bahan mentah Samarium-152 trioksida. Samarium-153 mempunyai separuh hayat selama 46.3 jam. Samarium-153 bertindak mengeluarkan zarah beta yang berfungsi untuk mengurangkan kesakitan akibat kanser. Sinar gama pula berfungsi sebagai agen pengimejan yang membolehkan pesakit melakukan pengimejan melalui kamera gama. Radioisotop ini dapat membantu meningkatkan kualiti hidup pesakit kanser yang kronik (terminal).

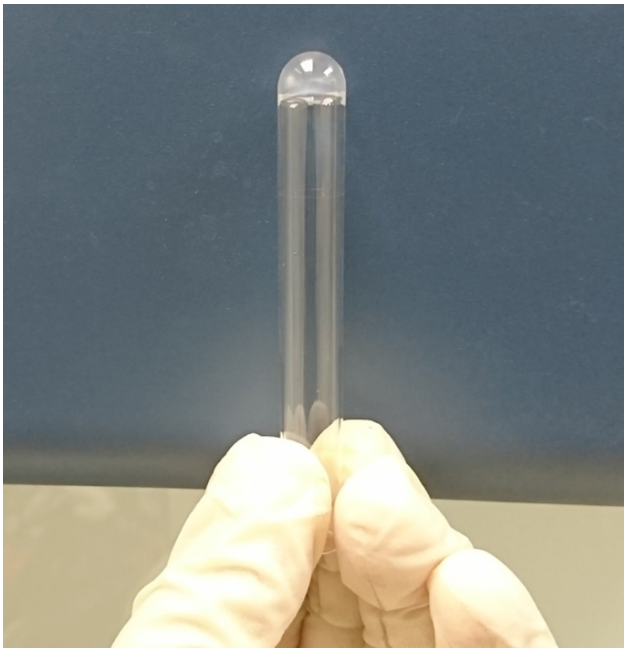
Kepakaran **NuklearMalaysia** menghasilkan **Samarium-153** *Ethylenediamine Tetramethylene* Phosphonate (Sm-153 EDTMP) secara *in-house* untuk dibekalkan kepada Institut Kanser Negara sebagai rawatan paliatif kepada pesakit kanser

4 Perkhidmatan **Ujian Mikrobiologi**

Makmal Kawalan Mutu Mikrobiologi memberikan perkhidmatan ujian mikrob kepada sampel pelanggan. Ujian yang dijalankan menggunakan kaedah gel klot adalah untuk kesterilan, biobeban (bakteria atau fungus), endotoksin bakteria. Manakala ujian pemantauan persekitaran mikrobiologi adalah menggunakan kaedah *settle plate* atau *press plate*. Ujian mikrobiologi yang dijalankan umumnya untuk memastikan produk yang dihasilkan adalah memenuhi piawaian.



Rujukanutamayangseringdigunakanadalah *Farmakopia British (BP)* dan *Farmakopia Amerika (USP)*. Sejak mendapat persijilan *Good Manufacturing Practice (GMP)* bagi produk Tc-99m yang juga merupakan perintis bagi produk radiofarmaseutikal, secara tidak langsung Makmal Mikrobiologi menjadi makmal rujukan bagi ujian mikrob yang melibatkan produk radiofarmaseutikal. Ini dapat dilihat dengan pertambahan permintaan ujian yang diterima dari pihak yang mempunyai kemudahan siklotron untuk perubatan seperti Institut Kanser Negara, Hospital Beacon serta syarikat Bio-Molecular.



Perkhidmatan ujian mikrobiologi oleh **Nuklear Malaysia**
ke atas produk radiofarmaseutikal yang dihasilkan di kemudahan siklotron
Institut Kanser Negara dan hospital swasta

5 Pelancaran **GoGrow BioNPK Biobaja**

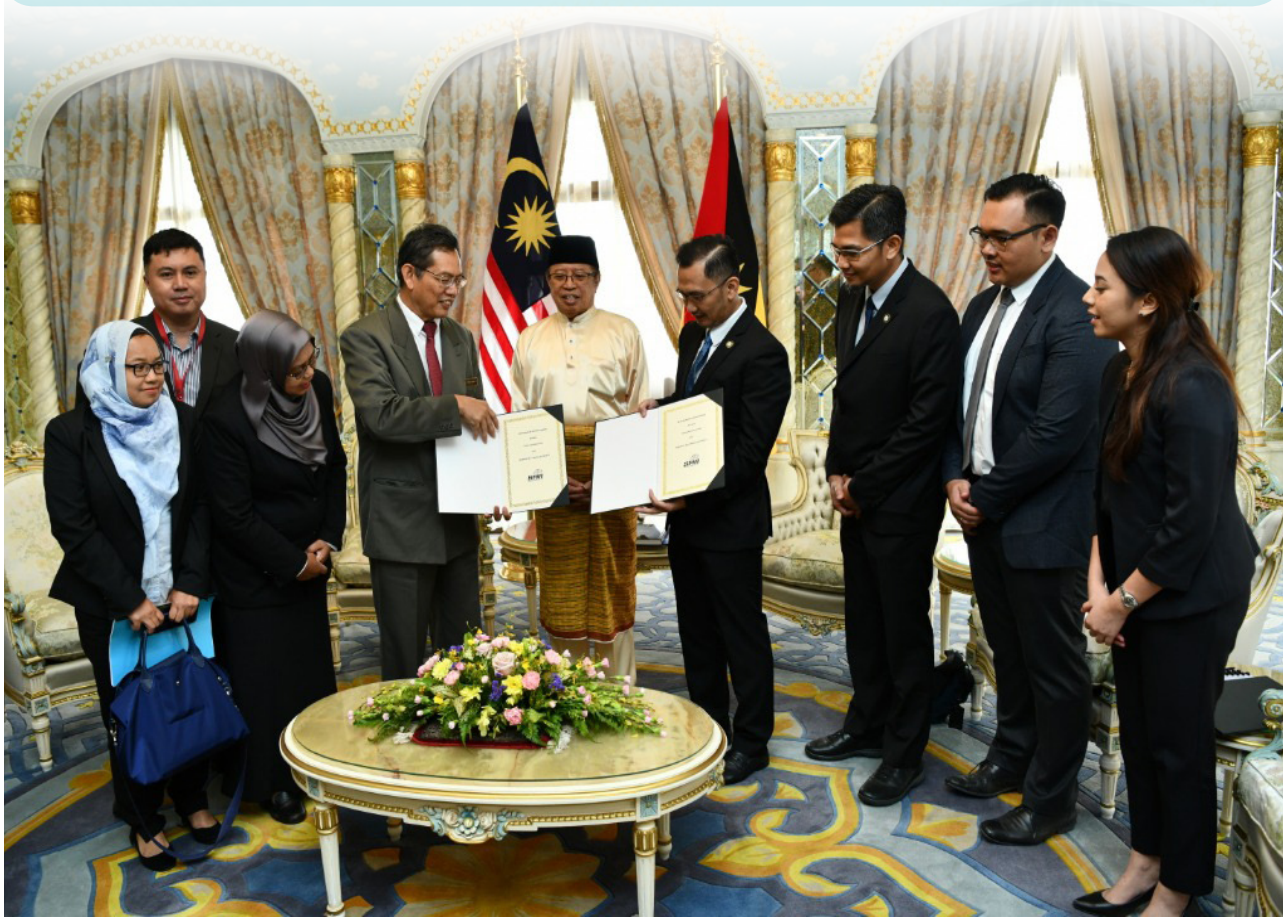
Pelancaran GoGrow BioNPK Biobaja oleh Ketua Setiausaha, Kementerian Tenaga, Sains, Teknologi, Alam Sekitar & Perubahan Iklim (MESTECC), **Datuk Seri Dr. Mohd Azhar Bin Haji Yahaya,** pada Hari Inovasi Nuklear Malaysia 2019

Kerjasama dengan Kerajaan Negeri

Nuklear Malaysia telah menjalinkan kerjasama dengan Kerajaan Negeri Sarawak, Selangor dan Sabah.

Sarawak

Kunjungan hormat Ketua Pengarah Nuklear Malaysia, YBrs. Dr. Mohd Abd Wahab bin Yusof bersama Sarawak Multimedia Authority (SMA) ke Pejabat Ketua Menteri Sarawak, YAB Datuk Patinggi Dr. Abang Haji Abdul Rahman Zohari Bin Tun Datuk Abang Haji Openg di Wisma Bapa Malaysia, Kuching, Sarawak telah diadakan pada 14 Jun 2019. Semasa kunjungan tersebut, pertukaran dokumen memorandum persefahaman di antara SMA dengan Nuklear Malaysia bagi projek pemantauan aras sinaran frekuensi radio struktur telekomunikasi di Sarawak turut diadakan. Tandatangan dokumen telah diadakan di SMA Kuching manakala pertukaran memorandum ini diadakan di Wisma Bapa Malaysia.



Selangor

Kunjungan hormat Ketua Pengarah Nuklear Malaysia, YBrs. Dr. Mohd Abd Wahab bin Yusof bersama Timbalan Ketua Pengarah Program Penyelidikan dan Pembangunan Teknologi, YBrs. Dr. Zulkifli Bin Mohamed Hashim dan Pengarah Bahagian Agroteknologi dan Biosains (BAB), YBrs. Dr. Abdul Rahim Bin Harun dan pegawai Nuklear Malaysia ke atas Pengerusi Jawatankuasa Tetap Infrastruktur dan Kemudahan Awam, Pemodenan Pertanian Dan Industri Asas Tani, YB. Tuan Ir Izham bin Hashim, telah diadakan di Pejabat Setiausaha Kerajaan Negeri Selangor pada 1 Julai 2019. Kunjungan ini bagi memperkenalkan kepakaran Nuklear Malaysia khususnya dalam bidang Agroteknologi & Biosains kepada Kerajaan Negeri Selangor.

Sabah

Ketua Pengarah Nuklear Malaysia, YBrs. Dr. Mohd Abd Wahab bin Yusof telah mengadakan perjumpaan rasmi bersama Timbalan Ketua Menteri Sabah merangkap Menteri Perdagangan dan Perindustrian Sabah, YB. Datuk Seri Panglima Wilfred Madius Tangau di Wisma Kewangan, Kota Kinabalu, Sabah pada 22 November 2019. Tujuan perjumpaan ini diadakan adalah untuk perbincangan projek kerjasama penanaman benih padi NMR151 dan NMR152 di Sabah yang juga turut terlibat sama adalah Jabatan Pertanian Sabah.

Program Pertukaran Saintifik Penyelidik dan Industri **(RISE)**

Program RISE adalah inisiatif oleh MESTECC untuk mewujudkan kerjasama yang lebih erat antara penyelidik di institusi penyelidikan awam dan industri. Kumpulan sasar bagi program RISE adalah syarikat yang berdaftar di Malaysia, penyelidik tempatan, syarikat berkaitan kerajaan dan syarikat yang dibatasi oleh jaminan kerajaan. Program ini adalah wadah kepada pegawai penyelidik untuk memberikan khidmat kepakaran kepada industri. Terdapat 14 buah syarikat yang telah memberikan kerjasama dalam program ini yang melibatkan seramai 37 orang pegawai penyelidik.

Program
Researcher-Industry Scientific Exchange (RISE)

14
Syarikat

37
Pegawai terlibat dengan RISE

KEMUDAHAN UTAMA, LOJI DAN PUSAT KHIDMAT

Kemudahan Utama & Loji

1. SINAGAMA

Data Pencapaian 2019

Operasi SINAGAMA adalah di bawah kawalan sistem ISO 9001:2015.

Penyinaran gama telah dilakukan terhadap 84,374.77kg herba, 1,146,790.63kg makanan, 195,641.72kg bukan perubatan dan 1,094.82m^3 perubatan.

Aktiviti

Penyinaran gama sebagai proses nyah cemar terhadap produk makanan dan herba dan proses sterilisasi terhadap produk peranti perubatan dan farmaseutikal.

2. GGH

Data Pencapaian 2019

Berkerjasama dengan IAEA di dalam bidang P&P, serta latihan dalam bidang aplikasi dan sains nuklear terutamanya dalam pembaikbakaan tumbuhan menggunakan sinaran gama kronik. Rumah Hijau Gama (GGH) diiktiraf sebagai IAEA Collaborating Center (ICC). Tempoh perjanjian Nuklear Malaysia sebagai ICC bermula dari tahun 2019 sehingga 2023.

Aktiviti

Seramai empat felo dan dua pelawat saintifik IAEA telah menjalani latihan teknik biak baka mutasi di Rumah Hijau Gama.

3. ALURTRON

Data Pencapaian 2019

Operasi ALURTRON adalah di bawah kawalan sistem ISO 9001:2015.

Penjanaan voltan tinggi dilakukan sebanyak 1112.4 jam dengan tempoh penyinaraan 833.7 jam.

R&D

Menjalankan kajian awalan untuk produk makanan surimi pada suhu rendah bagi tujuan nyah cemar secara kerjasama dengan Universiti Putra Malaysia (UPM) dan syarikat pengeluar makanan.

4. LENDT

Kumpulan Teknologi NDT Termaju

Data Pencapaian 2019

Pengiktirafan sebagai IAEA Collaborating Centre for Advanced Non-Destructive (2019 – 2023).

Aktiviti

1. Khidmat konsultansi ISO17020
2. *IAEA/RCA Training Course on Radiographic Testing RT–D Level 2 for Personnel Certified to Radiographic Testing RT-F Level 2*
3. Projek *RCA RAS1022 Strengthening Regional Capacity in Non-Destructive Testing and Examination using Nuclear and Related Technique for Safer, Reliable, More Efficient and Sustainable Industries Including Civil Engineering (2019 – 2022)*

R&D

Quantitative Evaluation of Multi-scale Defects via Gradient-field Transient Eddy Current Testing with Uniform Field Excitation (National Natural Science Foundation of China - NSFC)

5. RAS

Makmal Radiokimia dan Alam Sekitar

Data Pencapaian 2019

1. Sijil/Laporan analisis dikeluarkan: 3,283
2. Jumlah sampel diterima untuk dianalisis: 6,469
3. Soal-selidik kepuasan pelanggan RAS: 85.6%
4. Akreditasi MS ISO/IEC 17025:2017 pada 4 Mac 2020

Aktiviti

Memberikan khidmat pengukuran keradioaktifan di dalam sampel makanan, air minuman dan alam sekitar.

R&D

1. *Level, Trends and Effects of Natural and Anthropogenic Radionuclides in the Malaysian Marine Environment (K41017-RC22192:IAEA CRP).*
2. *Assessment of Toxic element in Coastal Sediments Around Perai Industrial Area, Penang using Natural Radioisotopes (K41016-RC20884:IAEA CRP).*
3. *Enhancing Regional Capabilities for Marine Radioactivity Monitoring and Assessment of the Potential Effect of Radioactive Releases from Nuclear Facilities in Asia-Pacific Marine Ecosystems (IAEA/RCA/RAS/7/028).*
4. *Assessing and Improving Soil and Water Quality to Minimize Land Degradation and and Enhance Crop Productivity using Nuclear Techniques (IAEA/RCA RAS 5084).*

6. Kemudahan Pengeluaran Isotop

Data Pencapaian 2019

1. Pemasangan 330 unit Ir-192 untuk kegunaan radiografi industri.
2. Melaksanakan enam siri pengeluaran produk radionuklid Sm-153 (6 x 150 mCi). Produk sedia untuk digunakan ke atas pesakit.
3. Berjaya memperolehi persijilan GMP bagi fasiliti pengeluaran kapsul I-131.

Aktiviti

1. Pemasangan dilaksanakan pada setiap bulan sepanjang tahun 2019. Projek kerjasama dengan Edaran Prestasi Sdn. Bhd.
2. Fasiliti telah diaudit pada bulan Mac 2019 oleh NPRA. Kerja kerja penambahbaikan dapatan audit Projek kerjasama dengan Radiopharma Sdn. Bhd.

R&D

Pengeluaran Sm-153 bergantung kepada permintaan daripada pengguna. Projek kerjasaama dengan Institut Kanser Negara (IKN).

7. Biological Dosimetry Laboratory

Data Pencapaian 2019

Menganalisis sampel melibatkan siasatan kemalangan sinaran mengion dari pihak industri di Malaysia.

Aktiviti

1. Makmal kebangsaan yang melakukan ujian aberasi kromosom ke atas pekerja sinaran di Malaysia.
2. Membantu Kementerian Kesihatan Malaysia (KKM) dalam penyediaan Pelan Tindakan Kecemasan Radiologikal dan Nuklear untuk semua hospital dan klinik kesihatan di Selangor. Pelan ini tertakluk di bawah 'Focus Area' # *19 dalam International Health Regulation (IHR) untuk Program Malaysia Joint External Evaluation (JEE) 2019 oleh pihak World Health Organization (WHO).*

R&D

1. *Chromosome Aberration in Interventional Radiology Staff Occupationally Exposed To Low Dose Ionizing Radiation - NMRR-18-230-40243 (IIR)*

8. RN-42-CTBTO

Data Pencapaian 2019

Melakukan tiga kali penyelenggaraan cegahan (PM) pada Mac 2019, Jun 2019 dan September 2019.

Aktiviti

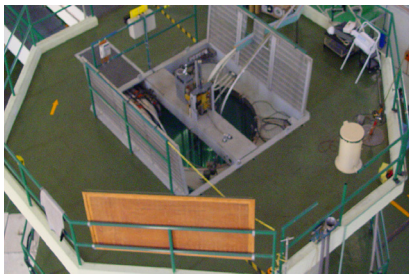
Menjalankan penyelengaraan tahunan bersama pakar yang dilantik oleh CTBTO yang melibatkan penggantian pengesan, bearing alat pensampel udara *(Snow White Air Sampler)*, data logger pensampel udara dan menjalankan penyelengaraan rutin

R&D

1. Menjalankan analisis data profail tahunan Radionuclide Be-7 di stesen RN42
2. *Knowledge Book (KM) Radionuclide Monitoring Station (RN42) Tanah Rata, Cameron Highlands as the part of the Comprehensive Nuclear-Test-BanTeaty : Malaysia's Experiences.*

9. RTP

Reaktor Triga PUSPATI



Data Pencapaian 2019

Operasi dan kendalian RTP dilakukan dengan selamatnya dengan tempoh kendalian selama 625 jam dengan purata kuasa 587.34kW digunakan untuk penyinaran sebanyak 2910 sampel.

Aktiviti

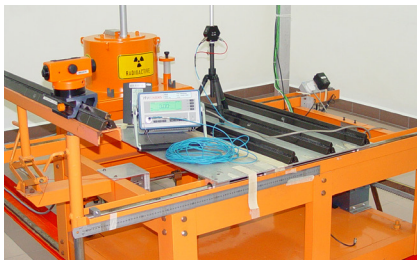
Aktiviti penyinaran dilakukan dengan menggunakan kemudahan di dalam teras dan luar teras bahan api.

R&D

1. Membantu menyinarkan sampel sarang burung walit, beras dan madu untuk projek penyelidikan berkaitan penjejakan dan keaslian makanan (NAA).
2. Pengeluaran radioisotope samarium-153 dan bromine-82 dari RTP untuk kegunaan R&D dalam bidang perubatan dan industri.
3. Penggunaan kemudahan penyinaran alur neutron untuk pencirian bahan dan forensik.

10. SSDL

Makmal Dosimetri Standard Sekunder



Data Pencapaian 2019

Sijil kalibrasi alat sebanyak 3501 keping telah dikeluarkan, alat meter tinjau/dosimeter sebanyak 3600 unit telah di kalibrasi dan pembekalan sebanyak 196034 unit lencana OSL, 16634 unit Lencana TLD, 11425 unit cincin/cip TLD dan 18312 unit dosimeter dos aras tinggi telah dilaksanakan.

Aktiviti

1. Makmal kalibrasi SSDL menjalankan kalibrasi dosimeter aras perlindungan dan aras terapi yang melibatkan penggunaan sinar gama, sinar-x, beta, neutron dan cemaran (Zarah alfa & beta).
2. Ditauliahkan Sijil akreditasi ISO/IEC 17025:2017
3. Menjalankan sebanyak lima latihan dalaman, 23 taklimat/perbincangan, lima kursus dalaman dan empat pembentangan dalaman yang turut melibatkan pelatih luar yang menjalani latihan di SSDL.
4. Seramai dua Felo IAEA, tiga pelajar PGEC dan dua pelajar IPT tempatan telah menjalankan projek dan latihan di SSDL.

R&D

1. Projek Pembangunan OSLD QC Tool.
2. Pengeksportan buah-buahan diiradiasi ke pasaran United States of America (USA).
3. *Promoting Food Irradiation by Electron Beam and X Ray Technology to Enhance Food Safety, Security and Trade*.

11. Makmal Fizik Perubatan

Data Pencapaian 2019

1. Ujian Kawalan Mutu (QC)
   - Bil. Sijil/laporan/sticker yang dikeluarkan - 118
   - Bil. Alat QC - 118 alat

2. Tentukuran Diagnostik
   - Bil. Sijil/laporan yang dikeluarkan - 385
   - Bil. Peralatan ujian dikalibrasi - 315 alat

3. Radiation Protection
   - Bil. Sijil/laporan yang dikeluarkan - 139
   - Bil. Ujian LET - 138 Bilik/sample

4. Tentukuran Perubatan Nuklear
   - Bil. Sijil/laporan yang dikeluarkan - 58
   - Bil. Alat QC - 58 alat

Aktiviti

1. Ujian Kawalan Mutu (QC).
2. 2. Tentukuran Diagnostik / Diagnostic Calibration.
3. Perlindungan Sinaran.
4. Tentukuran Perubatan Nuklear.

R&D

1. *Characterizing the Role of Hypoxia on Radioresistance Mechanism in MDA-MB-231 Breast Cancer Cells Exposed to X-Radiation.*
2. *Determination the Effect of Octreotide as in Human Breast Cancer Therapy in Vitro and in Vivo.*
3. *Radiation Protection and Safety for Staff in Fluoroscopy: Connection of Heel Effect and Scattered Radiation Profile.*
4. *Establishment of the Dosimetric Characteristics of Ge-doped Optical Fibre for Use in The High Energy Electron Beams Audit Service for Radiotherapy Centres in Malaysia.*
5. *Development of Lead Equivalent Thickness Test Procedures in Diagnostic Radiology Using Mobile X-ray Apparatus.*
6. *Developing Quality Control (QC) Procedures for Computed Radiography (CR) & Direct Radiography (DR) Systems (Extended Scope of Testing for H License Requirements.*
7. *Establishment of Correction Factor for Nanodot Optically Stimulated Luminescent Dosimeter (OSLD) at Low Energy X-ray and Mammography X-ray Beam Qualities.*
8. *Determination of Homogeneity Coefficient for Standard Radiation Qualities RQR, RQA and RQT.*
9. *The Potential of Using Clay Based Radiation Shielding Materials (CBRSM) for X-ray and Gamma Rays Shielding Facilities.*

12. MTEG
Makmal Teknologi Bahan

Data Pencapaian 2019

Jumlah khidmat telah diberikan kepada 85 pelanggan melibatkan 500 sampel dianalisis termasuk tujuh rundingan pakar.

Aktiviti

1. Menjalankan P&P dan pra pengkomersilan produk NuRust dan aloi aluminium untuk perlindungan kakisan.
2. Memberi khidmat analisis dan perundingan kepada pelanggan dalam dan luar.

R&D

1. *Harnessing Nuclear Science and Technology for Preservation and Conservation of Cultural Heritage (RAS 1021.*
2. *Radiation Processing of Electrocatalysts for the Enhancement of Catalytic Performance in Renewable Energy Devices (CRP23130).*
3. *Establishment of National Forensic Library (NFL) and Laboratory Procedure for Detection and Analysis of Gamma Emitting Radiation from Industrial Sealed Radioactive Source (Cesium-137, Cobalt-60 and Am-241) (J02013).*

13. CoNE
Pusat Kecemerlangan Nuklear

Data Pencapaian 2019

Sebanyak 116 kursus telah diadakan dengan 2515 peserta

Aktiviti

1. Penawaran program latihan teknikal dalam bidang teknologi nuklear dan teknologi berkaitan kepada industri, awam dan swasta.
2. Projek bersekutu latihan bersama syarikat kerjasama telah mengendalikan sebanyak 20 kursus.
3. Kursus PGEC kali ke-16 telah berjaya di jalankan dengan melatih 30 peserta antarabangsa (14 buah negara) dan tempatan.
4. Menguruskan program sangkutan saintifik bagi 4 orang pelatih antarabangsa.

14. WasTeC
Pusat Pelupusan Sisa

Data Pencapaian 2019

1. Jumlah khidmat pelupusan sisa radioaktif yang telah diberikan kepada 56 pelanggan yang terdiri daripada 54 pelanggan luar dan dua pelanggan dalaman.
2. Jumlah sisa bahan radioaktif yang diterima untuk dilupuskan terdiri daripada 180 unit radioisotop terkedap, 72.48 L sisa cecair dan 118.30 kg sisa pepejal

Aktiviti

1. Sebanyak 56 khidmat telah diberikan oleh WasTeC secara keseluruhannya 87.5% khidmat berjaya dilaksanakan dalam tempoh 14 hari bekerja.
2. Pelangan yang memohon untuk pelupusan sisa radioaktif mestilah mendapat kebenaran dan kelulusan daripada pihak berkuasa Lembaga Perlesenan Tenaga Atom (LPTA) terlebih dahulu sebelum dihantar ke WasTeC, Nuklear Malaysia
3. Permohonan pelupusan yang diluluskan akan diterima oleh WasTeC dan direkodkan butiran maklumat untuk disimpan sebagai data inventori sisa radioaktif kebangsaan di Nuklear Malaysia.

R&D

1. Kajian unjuran (projection) dan ramalan (forecast) sisa radioaktif untuk data inventori bagi pembinaan tapak repositori sisa radioaktif kekal kebangsaan.
2. Kajian penataran Loji Rawatan E*fluent Low Level Effluent Treatment Plant* (LLETP) untuk meningkatkan keupayaan sistem rawatan efluen.
3. Kajian kebolehlaksanaan merawat *efluan thorium* menggunakan rawatan *Flocculation-Coagulation* sedia ada di LLETP.
4. Kajian naik taraf kawalan perlindungan sinaran dan sekuriti di kemudahan interim stor dan kawasan pengendalian punca radioaktif terkedap di WasTec.

Pusat Khidmat

1. ALURTRON

Ciri Perkhidmatan

Memberi khidmat penyinaran alur elektron kepada pengguna P&P dan komersial. Mempunyai dua mesin alur elektron satu bertenaga tinggi 3.0 MeV (EPS-3000) dan satu bertenaga rendah 200 KeV (Curetron). Loji ini telah mendapat pensijilan Quality Management System ISO 9001:2000 semenjak 2003. ALURTRON menyediakan perkhidmatan penyinaran sinar elektron untuk merawat produk siap. Kemudahan ini dilengkapi dengan sistem pengendalian untuk merawat produk seperti tiub, wayar dan kabel.

Lokasi

BLOK 43, KOMPLEK DENGKIL

2. ACA

Aplikasi Kimia Analisis

Ciri Perkhidmatan

Memberi perkhidmatan analisis mengenalpasti unsur secara kuantitatif dan qualitatif dengan menggunakan teknik nuklear serta non-nuklear terhadap sampel alam sekitar misalnya air, udara, tanah, sedimen, mineral, flora, fauna dan sebagainya. Pakar dalam perkhidmatan NAA (Neutron Activation Analysis), ICPMS (Inductive Coupled Plasma Mass Spectrometry), ICPMS NAA (Gamma Spek), AAS (Atomic Absorption Spectroscopy, CHNS (Carbon, Hidgrogen, Nitrogen, Sulfur Analyser), IC (Ion Chromatograph).

Lokasi

BLOK 20, KOMPLEK BANGI

3. BRI

Makmal Bekalan Radioisotop

Ciri Perkhidmatan

Bertanggungjawab dalam membangun, mengeluar dan mengedar radioisotop, radiofarmaseutikal dan kit radiofarmaseutikal untuk hospital dan pengguna industri lain di seluruh Malaysia.

Lokasi

BLOK 20, KOMPLEK BANGI

4. BIOTEST/BIODOSE

Makmal Ujian Biologi

Ciri Perkhidmatan

Memberi perkhidmatan pakar dalam ujian mikrobiologi bagi produk radiofarmaseutikal dan peranti perubatan. Selain itu, khidmat nasihat/konsultansi mengenai ujian juga diberikan kepada pelanggan. Makmal biodose menjalankan ujian aberasi kromosom menggunakan teknik disentrik. LPTA mewajibkan pekerja yang disyaki mendapat dedahan melebihi dos tahunan untuk menjalani ujian ini bagi menilai dos yang terserap.

Lokasi

BLOK 24, KOMPLEK BANGI

5. KFK

Kumpulan Fizik Kesihatan

Ciri Perkhidmatan

Memberikan khidmat pakar kepada pihak industri berkaitan keselamatan dan kesihatan sinaran, pemantauan radiologi alam sekitar dan industri, ujian kebocoran, nyahcemaran, dan sewaan alat berkaitan keselamatan sinaran mengion.

Lokasi

BLOK 19/17, KOMPLEK BANGI

6. KMS

Kumpulan Metrologi Sinaran

Ciri Perkhidmatan

Memberi perkhidmatan kepakaran berdasarkan Makmal Standard Sekunder Radiologi diagnostik dan perubatan nuklear di Malaysia dan di rantau Asia. Perkhidmatan kalibarasi peralatan ujian dan tinjuan sinaran mengion yang digunakan dalam bidang industri dan radiologi diagnostik. Makmal ini juga menawarkan piawaian dalam perubatan nuklear untuk khidmat kalibrasi peralatan perubatan nuklear seperti kalibrator dos, pembilang sintilasi, pembilang ambilan radioisotop, *well counter*, monitor kaki dan tangan. Makmal ini telah mendapat akreditasi MS ISO/IEC 17025:2005.

Lokasi

BLOK 32, KOMPLEK BANGI

7. NDT

Pusat Teknologi Ujian Tanpa Musnah

Ciri Perkhidmatan

Pusat NDT memberi perkhidmatan ujian dan latihan dalam teknik tanpa musnah (NDT). Kaedah ini digunakan untuk mengesan atau mengukur kecacatan sesuatu bahan atau sistem tanpa merosakkan bahan atau sistem yang diuji. Kaedah ini memainkan peranan penting dalam teknologi pembuatan, kawalan kualiti dan penentuan jangka hayat sesuatu loji. Ia digunakan secara meluas di dalam industri pembuatan, petrokimia, sumber kuasa, pengangkutan dan kejututeraan awam.

Lokasi

BLOK 29/59, KOMPLEK BANGI

8. PAT

Pusat Teknologi Penilaian Loji

Ciri Perkhidmatan

Pusat Khidmat PAT menawarkan perkhidmatan pengukuran dan pengujian paip, tangki, turus penyulingan dan lain-lain komponen industri di kilang/loji pemprosesan minyak, gas, petrokimia, rawatan air dan stesen janakuasa tenaga. Teknologi pengukuran nuklear ini menggunakan tolok nuklear (gama dan neutron) serta teknik penyurih (radiotracer) dimana kebocoran paip, kerosakan mekanikal, aras bahan proses atau pemendapan bahan dalam tangki dapat ditentukan. Teknik penyurih dapat menentukan kadar aliran bahan dalam paip serta agihan masa mastautin bahan dalam tangki. Selain itu, PAT menyediakan khidmat pengimbasan tomografi berkomputer (CT Scan) menggunakan sinar gama dan sinar-X bagi menghasilkan imej keratan rentas sesuatu bahan dan komponen. Perkhidmatan Simulasi Komputer Computational Fluid Dynamics (CFD) juga diberikan bagi membuat ramalan prestasi proses industri.

Lokasi

BLOK 29/60, KOMPLEK BANGI

9.MTEC

Makmal Teknologi Bahan

Ciri Perkhidmatan

Pusat Khidmat ini memberikan perkhidmatan kepakaran dalam pencirian bahan di dalam makmal dan di lapangan. Penyelidikan asas dan gunaan dilakukan dalam topik seramik, metal, kekaratan, bahan nano, perisai sinaran, kerusakan sinaran, bahan elektronik, instrumentasi nuklear dan simulasi serta pemodelan kelakuan bahan.

Lokasi

BLOK 34, KOMPLEK BANGI

10.E-TAG

Kumpulan Aplikasi Penyurih Alam Sekitar

Ciri Perkhidmatan

Makmal Isotope Ratio Mass Spectrometer (IRMS) Berupaya Untuk Mengukur Isotop Stabil Ringan Oksigen (18O/16O) Dan Hidrogen (2H/1H) Untuk Sampel Air dari pelbagai sumber serta Untuk Mengukur Hampir Kesemua Isotop Stabil Ringan Yang Utama seperti Hidrogen, Karbon, Nitrogen, Oksigen Dan Sulfur.

Lokasi

BLOK 29, KOMPLEK BANGI

11.RAS

Makmal Radiokimia Dan Alam Sekitar

Ciri Perkhidmatan

Makmal ini menawarkan khidmat analisis radionuklid pemancar alfa, beta dan gama dalam berbagai jenis matrik sampel seperti tanah, sedimen, air, makanan, fauna dan flora. Makmal kebangsaan yang diiktiraf oleh Kementerian Kesihatan Malaysia (KKM) ini menjalankan ujian pencemaran radioaktif dalam makanan import. Makmal ini juga menyediakan perkhidmatan analisis kandungan gros alfa/gros beta dalam air mineral dan air minuman berbungkus bagi memenuhi keperluan pelesenan di bawah Akta Makanan 1983 KKM sebelum dijual kepada orang awam. Selain dari itu, makmal ini juga berkeupayaan untuk membuat ujian kecekapan sistem penapisan air menggunakan radioisotop Sr-90 dan Ra-226 sebagai penyurih.

Makmal RAS mempunyai sistem Pengurusan dan jaminan kualiti tersendiri di mana ianya telah mendapat akreditasi MS ISO/IEC 17025:2005 dari Jabatan Standard Malaysia sejak Disember 2005 untuk analisis radionuklid jenis pemancar sinar gama. Untuk radionuklid pemancar sinar alfa dan beta, makmal terlibat/mengambil bahagian dalam aktiviti ujian perbandingan antara makmal yang dianjurkan oleh Agensi Tenaga Atom Antarabangsa (IAEA) dan lain-lain badan yang kompeten.

Lokasi

BLOK 23, KOMPLEK BANGI

12.TAB

Kumpulan Teknologi Agro-Biotek

Ciri Perkhidmatan

Pusat khidmat ini mengaplikasian teknologi nuklear dalam bidang agroteknologi dan biosains terutama menyediakan perkhidmatan penyinaran, pengesanan makanan teriradiasi, penghasilan produk biobaja, khidmat konsultansi berkenaan kultur tisu dan bioreaktor dan lain-lain khidmat.

Lokasi

BLOK 44, KOMPLEK DENGKIL

13.SINAGAMA

Loji Penyinaran Sinagama

Ciri Perkhidmatan

SINAGAMA adalah pusat kemudahan penyinaran bertaraf komersial yang menawarkan perkhidmatan dan penyelidikan seperti berikut:

- Pensterilan produk-produk perubatan dan bahan untuk pembungkusan,
- Nyahkontaminasi produk makanan, farmaseutikal, herba dan makanan haiwan,
- Penghapusan serangga perosak dalam komoditi makanan,
- Rawatan barangan kuarantin yang dikhuatiri mengandungi unsur-unsur yang boleh mendatangkan penyakit pada tumbuhan di negara ini,
- Pensterilan tisu dan tulang untuk kegunaan Tisu Bank Kebangsaan dan hospital-hospital,
- Sterilisasi bahan sisa pertanian untuk kegunaan alternatif seperti substrat biobaja, substrat cendawan dan makanan haiwan.

Loji yang menggunakan punca gama Kobalt-60 ini telah mendapat pentauliahan sijil pengurusan kualiti ISO 9001:2008, sistem kualiti piawaian ISO 13485:2003. Oleh yang demikian, penyinaran di SINAGAMA adalah mengikut garis panduan antarabangsa. Loji ini juga berdaftar dengan Kementerian Kesihatan Malaysia sebagai Premis Iradiasi Makanan. Pada tahun 2004, loji penyinaran ini telah dinaiktaraf kepada JS 10000 (IR-219), yang mana boleh menyinarkan pelbagai produk yang memerlukan dos berbeza pada satu-satu masa.

Lokasi

BLOK 42, KOMPLEK DENGKIL

14.RAYMINTEX

Sinaran Pemvulkanan Susu Getah Asli

Ciri Perkhidmatan

RAYMINTEX merupakan sebuah loji perintis yang menjalankan pemvulkanan susu getah asli menggunakan sinaran gama. Loji ini telah ditauliahkan pada Mac 1996. Ia berupaya menghasilkan susu getah asli tervulkan menggunakan sinaran gama (RVNRL) sebanyak 6000 tan dalam setahun, sekiranya dimuatkan dengan punca radioaktif kobalt-60 sehingga 1 MCi, yang dapat dibekalkan kepada industri pembuatan produk celupan susu getah untuk tujuan promosi, pengkomersilan dan pemindahan teknologi.

Lokasi

BLOK 47, KOMPLEK DENGKIL

15.WASTEC

Pusat Pembangunan Teknologi Sisa

Ciri Perkhidmatan

Pusat rawatan sisa radioaktif kebangsaan yang ada di Nuklear Malaysia dibina sejak tahun 1985 setelah berkuatkuasanya Akta Perlesenan Tenaga Atom 1984. Tujuan utama penubuhannya adalah untuk melindungi pekerja dan orang ramai serta alam sekitar daripada bahaya sinaran mengion melalui pengurusan sisa radioaktif yang berkesan dan bersepadu. Perkhidmatam pengurusan sisa radioaktif yang ditawarkan adalah memenuhi syarat yang telah ditetapkan oleh Akta Perlesenan Tenaga Atom 1984. Pusat ini juga dilengkapi dengan pelbagai kemudahan untuk perkhidmatan pengurusan sisa radioaktif dan perundingan yang berkaitan dengan pengurusan sisa radioaktif.

Lokasi

BLOK 30, KOMPLEK BANGI

16.NIR

Makmal Sinaran Tidak Mengion

Ciri Perkhidmatan

Perkhidmatan yang ditawarkan meliputi penilaian keselamatan sinaran tidak mengion dari struktur pemancar telekomunikasi (Frekuensi Radio), kabel voltan tinggi (frekuensi lampau rendah) dan dari pelbagai sumber di pelbagai sektor pembuatan, penyiaran, barangan pengguna dan kesihatan. Selain itu, Kumpulan NIR menjalankan kerjasama dengan beberapa buah syarikat dalam penilaian keselamatan frekuensi radio (RF) dan juga dalam khidmat memberi ceramah tentang keselamatan NIR.

Lokasi

BLOK 13, KOMPLEK BANGI

17.SSDL

Makmal Dosimetri Standard Sekunder

Ciri Perkhidmatan

SSDL telah dilantik sebagai telah dilantik oleh pihak Institut Metrologi Kebangsaan Malaysia (NMIM) sebagai 'designated institute' untuk pusat rujukan sinaran mengion kebangsaan. Kalibrasi yang dijalankan melibatkan peralatan pengukur sinaran yang digunakan dalam perlindungan Sinaran, Radioterapi dan Diagnostik radiologi.

Penyedia Dosimetri peribadi dan kawasan kepada 70% pengguna di Malaysia dan Brunei Darusalam. Dosimeter yang digunakan adalah OSLD dan TLD.

Menyediakan khidmat kalibrasi dan pembekalan dosimeter dos aras tinggi, *Fricke dan Ceric Cerous* kepada industri pemprosesan sinaran di Malaysia juga memberikan perkhidmatan Pemetaan dos loji penyinaran.

Makmal Dosimetri Standard Sekunder (Secondary Standard Dosimetry Laboratory-SSDL) memenuhi keperluan Akta 304 (Akta Perlesenan Tenaga Atom 1984 dan Akta 675 (Akta Sistem Pengukuran Kebangsaan 2007).

SSDL telah menjadi ahli kepada *'International Atomic Energy Agency (IAEA) / World Health Organization (WHO) Network of Secondary Standard Dosimetry Laboratories'* sejak tahun 1981 dan ahli kepada *Asia Pacific Metrology Programme (APMP)* sejak tahun 2005.

Lokasi

BLOK 19/32, KOMPLEK BANGI

18. PDC

Pusat Pembangunan Prototaip & Loji

Ciri Perkhidmatan

Pusat khidmat ini adalah tempat yang menjadi rujukan untuk pembangunan kemudahan radiasi/nuklear. Antara khidmat yang ditawarkan:

- Pembangunan prototaip.
- Pembangunan loji rintis, kemudahan rintis dan sistem rintis.
- Rekabentuk kejuruteraan mekanikal dan khidmat lukisan kejuruteraan.
- Khidmat fabrikasi logam, plastik dan kaca.
- Perundingan kejuruteraan mekanikal.
- Pemasangan, pengujian & pentauliahan komponen, prototaip, sistem dan kemudahan khas.
- Khidmat penanggalan peralatan penyinaran (X-ray dan gamma).

Lokasi

BLOK 19/32, KOMPLEK BANGI

19. PIA

Pusat Instrumentasi Dan Automasi

Ciri Perkhidmatan

Memberikan perkhidmata penyelenggaraan cegahan dan baik pulih peralatan nuklear dan peralatan saintifik. Disamping itu Menjalankan khidmat kalibrasi peralatan nuklear seperti mesin X-Ray dan sebagainya. Terlibat secara lansung dalam melakukan ujian kebocoran dan juru perunding sinaran.

Lokasi

BLOK 37, KOMPLEK BANGI

20. Pusat Kecemerlangan Nuklear

Ciri Perkhidmatan

Pusat ini melaksanakan program latihan berkaitan teknologi nuklear dan teknologi berkaitan, meningkatkan kemahiran yang diperlukan, menggalakkan kesedaran keselamatan yang lebih besar dan mewujudkan tenaga kerja yang cekap dalam memainkan peranan yang lebih besar dalam agenda pembangunan negara. Menawarkan program dalam sektor berikut:

- Keselamatan dan kesihatan sinaran
- Keselamatan persekitaran dan kesihatan
- Sinar X-perubatan
- Ujian Tanpa Musnah (NDT)
- Instrumentasi dan kejuruteraan
- Pengurusan teknologi

Bilangan produk latihan adalah melebihi 100 produk dengan bilangan peserta/pelatih seramai melebihi 2500 orang setahun.

Lokasi

BLOK 57, KOMPLEK DENGKIL

21. MTS

Makmal Teknologi Sinaran

Ciri Perkhidmatan

Makmal bagi khidmat pengujian dan pemprosesan bahan polimer. Pusat ini memiliki peralatan memproses dan pengujian saintifik aras tinggi. Tenaga kerja di makmal ini juga terdiri daripada pakar-pakar yang mahir dalam penggunaan mesin dan juga analisa data makmal.

Lokasi

BLOK 42, KOMPLEK DENGKIL

Pensijilan dan Akreditasi

Nuklear Malaysia telah lama mengamalkan budaya kualiti terutama dalam meningkatkan mutu perkhidmatan. Persijlan *International Standard Organisation* (ISO) yang pertama di Nuklear Malaysia diperoleh pada tahun 1991 bagi sistem Pengurusan Kualiti di SINAGAMA.

Bermula dari situ, ia kemudiannya diikuti beberapa proses lain. Antara persijilan dan akreditasi ISO yang telah diperolehi oleh Nuklear Malaysia ialah ISO 9001, ISO 13485, ISO 27001, ISO 22301, ISO/IEC 17025 dan ISO/IEC 17020. Sehingga kini, Nuklear Malaysia telah memperolehi dan berjaya mengekalkan sebanyak 12 persijilan dan akreditasi ISO untuk pusat khidmat di Nuklear Malaysia. Terbaharu Kumpulan Sinaran Tidak Mengion, Bahagian Keselamatan dan Kesihatan Sinaran (BKS) telah Berjaya memperoleh akreditasi ISO/IEC 17020 : 2012.

Nuklear Malaysia adalah

agensi kerajaan terawal berjaya memperolehi

Pensijilan ISO 22301:2012

Business Continuity Management System (BCMS)

Tahun 2019
12 pensijilan dan akreditasi

1.	ISO 9001:2015	SINAGAMA
2.	ISO 13485: 2016	SINAGAMA
3.	ISO 9001:2015	ALURTRON
4.	ISO 9001:2015	RAYMINTEX
5.	ISO 9001:2015	WasTeC
6.	ISO 9001:2015	Pusat Kecemerlangan Nuklear
7.	ISO/IEC 17025:2017	Makmal Radiokimia & Alam Sekitar (RAS)
8.	ISO/IEC 17025:2017	Makmal Stardard Dosimetri Sekunder (SSDL)
9.	ISO/IEC 17025:2017	Makmal Tentukuran Fizik Perubatan (KFP)
10.	ISO/IEC 27001:2013	Pusat IT
11.	ISO 22301:2012	Nuklear Malaysia
12.	ISO/IEC 17020: 2012	Kumpulan Sinaran Tidak Mengion(NIR)

Kemudahan Penyinaran Ion **dengan peranti Plasma Focus**

Plasma focus adalah akselerator plasma terdenyut yang menggunakan arus elektrik tinggi untuk memanas dan memampatkan gas sehingga mencapai suhu tinggi (10 juta Kelvin), ketumpatan dan tekanan tinggi (ribuan atm). Dalam keadaan ekstrem sedemikian, gas tersebut akan memancarkan cahaya ultraungu, X-ray, elektron dan alur ion. Sekiranya gas yang digunakan itu adalah deuterium, *plasma* yang termampat akan mencetus proses *fusion* nuklear dan akan menghasilkan neutron. Manakala apabila gas argon digunakan, sinar X akan terhasil. Ini menunjukkan bahawa peranti ini mempunyai sifat yang versatil dan sesuai digunakan untuk tujuan radiografi, ubahsuai bahan, teknologi nano dan aplikasi lain. Peranti ini tidak memerlukan kos tinggi untuk dibina dan diselenggara. Ia mudah dikendalikan kerana kecil dan mudah alih serta berteknologi mudah.

Kemudahan penyinaran mengion dengan peranti *plasma focus* untuk penyinaran sampel kajian sains bahan telah berjaya dibangunkan mengikut rekabentuk dan fabrikasi yang dibangunkan di Nuklear Malaysia. Kejayaan ini ini membolehkan penaiktarafan pemecut elektron daripada 140 keV kepada 250 keV bagi aplikasi rawatan permukaan, aktiviti pembelajaran dan latihan dalam bidang fizik zarah dan pemecut elektron.

Kemudahan penyinaran mengion dengan ***peranti plasma focus*** untuk penyinaran sampel kajian sains bahan berjaya dibangunkan di Nuklear Malaysia

HEAVY DENSITY HOTCELL

Hotcell adalah sebuah kemudahan pengendalian bahan nuklear yang memastikan keselamatan kakitangan terlibat dalam pengendalian apa-apa bahan radioaktif. Kemudahan ini adalah kemudahan radioaktif yang dilindungi dengan membendung udara kawalan untuk mengelakkan pendedahan dan pencemaran bahan-bahan radioaktif. Bagi memastikannya tidak membahayakan kakitangan terlibat, *hotcell* dilengkapi dengan manipulator kawalan jauh untuk pengendalian dan tingkap plumbum kaca untuk pemantauan.

Nuklear Malaysia telah membangunkan *Heavy Density Hotcell* yang pertama di Malaysia. Ia dibangunkan sendiri oleh pakar Nuklear Malaysia menggunakan peruntukan Thorium Flagship MESTECC dengan kos RM2.02 juta. Kemudahan ini berupaya mengendalikan bahan radioaktif tidak terkedap beraktiviti sehingga 7400 GBq Cobalt -60.

Antara ciri-ciri yang terdapat pada *Heavy Density Hotcell* ini adalah:

1.	4.4 meter (P) x 3.9 meter (L) x 3.825 meter (T)
2.	Perisaian separa kekal jenis Alfa-gama
3.	Dinding: Konkrit berketumpatan tinggi ketebalan satu meter dengan rekabentuk saling kunci
4.	Pintu: Plumbum berketebalan 200mm dan Boronated HDPE berketebalan 50mm
5.	Tetingkap: Larutan Zink Bromida, $ZnBr^2$ lutsinar bergred nuklear
6.	Sistem kendalian mekanikal kawalan jauh
7.	Pemeriksaan bahan api terpakai
8.	Fabrikasi bahan api
9.	Pemeriksaan pasca penyinaran

Membangunkan kemudahan **Heavy Density Hotcell** yang pertama di Malaysia menggunakan kepakaran **Nuklear Malaysia.**

REAKTOR TRIGA PUSPATI

Pada tahun 2019, pelbagai aktiviti telah dijalankan di Reaktor Triga PUSPATI (RTP), seperti aktiviti penyelidikan dan pembangunan, penyinaran sampel, latihan modal insan, penyenggaraan kemudahan dan perlesenan.

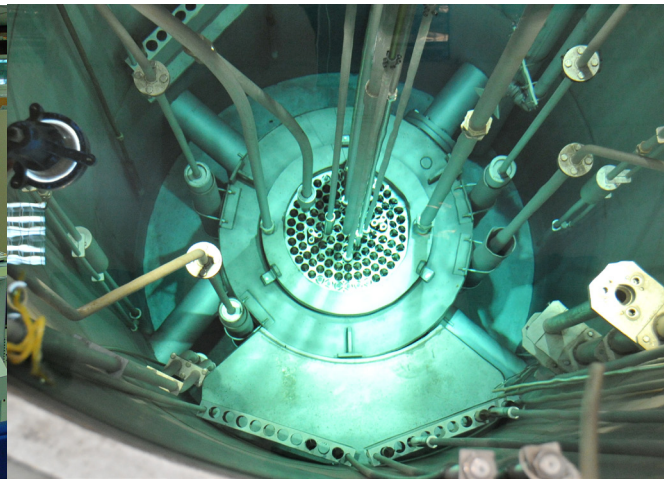
RTP telah dikendalikan dengan selamat dan berjaya mengeluarkan 300 GBq radioisotop Samarium-153 bagi tujuan perubatan. Selain itu ia juga telah melakukan penyinaran neutron untuk 3000 sampel bagi analisa pengaktifan neutron terhadap sampel alam sekitar, mineral, sedimen tanah, sarang burung dan lain-lain.

Hasil penyelidikan dan kepakaran pegawai penyelidik di RTP berjaya menghasilkan rekabentuk Grid susunan bahan api nuklear dan *Fuel Transfer Cask (FTC)*.

Tujuannya adalah bagi memindah bahan api nuklear terpakai dari teras RTP ke kolam bahan api nuklear terpakai dengan mengambilkira faktor keselamatan. Selain itu, rekabentuk kolam bahan api nuklear yang dibangunkan oleh Pusat Teknologi Reaktor juga berdasarkan keupayaan dan pengalaman mengendalikan reaktor nuklear penyelidikan selama 38 tahun. Rekabentuk ini telah mengambil kira aspek keselamatan bahan api nuklear dan juga radiologi terhadap alam sekitar dan orang awam.

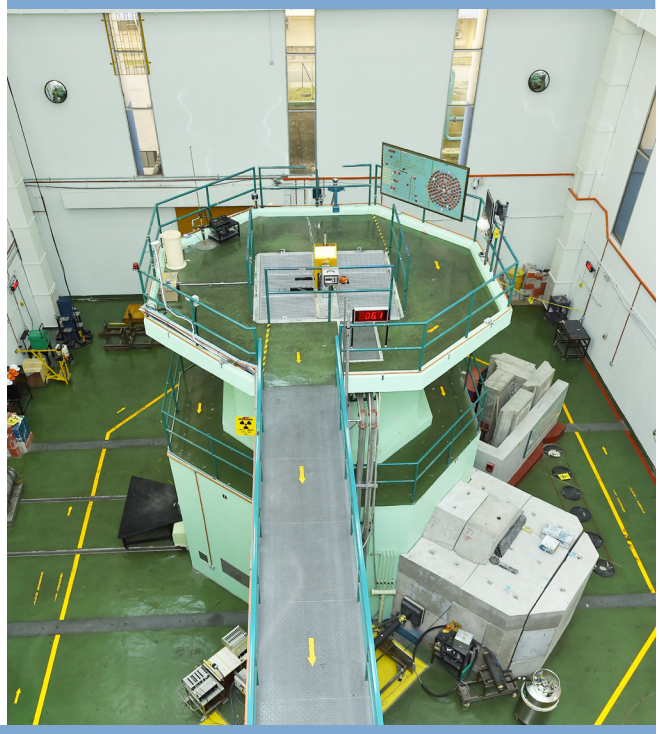
Penyenggaraan reaktor dilakukan dua kali setahun bagi memenuhi pematuhan lesen yang dikeluarkan oleh LPTA. Pada tahun 2019, penyenggaraan tahunan diadakan pada 20 Januari hingga 24 Februari dan 3 hingga 14 Julai.

Sebagai kemudahan utama yang terdapat di Nuklear Malaysia yang kerap menerima pelatih dan pelawat. Sejumlah 400 orang pelajar IPTA/IPTS telah dilatih dalam bidang Teknologi Reaktor. Selain itu, seramai 5121 pelawat daripada pelbagai latar belakang seperti agensi kerajaan, syarikat swasta, pelajar universiti, peserta kursus dan pelawat dari luar negara telah melawat kemudahan ini pada tahun 2019.



Rekabentuk **Grid susunan bahan api nuklear dan *Fuel Transfer Cask (FTC)*** bagi mengangkat dan memindah bahan api nuklear terpakai dari teras RTP ke kolam bahan api nuklear terpakai adalah hasil kepakaran pegawai penyelidik **Nuklear Malaysia**

Reaktor TRIGA PUSPATI berjaya mengeluarkan **300GBq** radioisotop Samarium-153 bagi tujuan perubatan



Kolam Penyimpanan Bahan Api Nuklear Terpakai

Rekabentuk kolam bahan api nuklear bagi tujuan **penyimpanan bahan api nuklear terpakai secara selamat** telah dibangunkan oleh Pusat Teknologi Reaktor berdasarkan keupayaan dan pengalaman mengendalikan reaktor nuklear penyelidikan selama 38 tahun

PENCAPAIAN INOVASI & PENGIKTIRAFAN KEPAKARAN

Dalam merealisasikan potensi sains dan teknologi, Nuklear Malaysia mengguna pakal kemahiran dan kepakarannya untuk menjana dan menyebar luas hasil penyelidikan di peringkat kebangsaan dan antarabangsa. Dengan itu, Nuklear Malaysia telah memenangi 12 anugerah di pertandingan inovasi peringkat kebangsaan dan antarabangsa:

1. Malaysia Technology Expo (MTE 2019)

No.	Peserta	Tajuk Projek	Pingat
1.	1. Dr. Ng Yen 2. Wan Hamirul Bahrin bin Wan Kamal 3. Manisah binti Saedon 4. Kong Khei Chong	*Innovative Methods for Rapid Production of Gallium-68 Radiopharmaceuticals for Cancer Imaging*	**EMAS**
2.	1. Azuhar bin Ripin 2. Mohd Khalid bin Matori 3. Harziera binti Halid	*Smart Radiation Shielding Materials (Mullite-Barite Ceramics (MBC) Derived from Malaysian Kaolin*	**PERAK**
3.	1. Khaironie binti Mohamed Takip 2. Wilfred @ Sylvester Paulus 3. Dr. Roshasnorlyza binti Hazan 4. Jacqueline Kones 5. Norhazirah binti Azhar 6. Nur Aqilah binti Sapiee	*TRINAF: Gardening Aids from Mineral (Xenotime) Digestion Process*	**GANGSA**
4.	1. Azhani binti Mohd Razali 2. Dr. Nazrul Hizam bin Yusoff 3. Roslan bin Yahya 4. Lahasen @ Norman Shah bin Dahing 5. Engku Mohd Fahmi bin Engku Chik 6. Airwan Affandi bin Mahmood 7. Nurliyana binti Abdullah 8. Mahadi bin Mustapha	*Flex-Si: An Innovative Scanner for Industrial Pipe Inspection*	**GANGSA**

2. *International Invention, Innovation & Technology Exhibition (ITEX 2019)*

No.	Peserta	Tajuk Projek	Pingat
1.	Dr. Zainon binti Othman	*Geographical Origin of Malaysian Agroproducts using Isotopic and Elemental FingerprintT*	**PERAK**
2.	Dr. Mazleha binti Maskin	*COMPASS-M: Development of Probabilistic Safety Assessment for Plant Safety and Reliability*	**EMAS**
3.	Dr. Noraishah binti Othman	*LOW-CO$T CORE FLOOD RIG: Radiotracer Technology (LCCF-RT)*	**PERAK**
4.	Dr. Julia binti Abdul Karim	*TRIMON – An Integration of Deterministic-Monte Carlo Code for TRIGA Core Management*	**PERAK**

3. Ekspo Penyelidikan, Pembangunan dan Inovasi Negeri Selangor 2019

No.	Peserta	Tajuk Projek	Pencapaian
1.	Dr. Mek Zah binti Salleh	*Development and the potential application of palm acrylate*	Tempat ke-5 Kluster Sains Hayat Kategori Industri /
2.	Dr. Norasalwa binti Zakaria	*Underwater Gamma Scanner for In-Pool Fuel Characterization*	Tempat ke – 8 Kluster Pemesinan & Peralatan Kategori Industri
3.	Dr. Ng Yen	*Advanced Kit-based Production Methods for Preparation of Radiopharmaceuticals Used in Cancer Imaging and Therapy*	Sijil Penyertaan
4.	En. Mohd Faizal bin Abd Rahman	*RIVERPROTEC : Mangrove Forest Ecosystem Preservation Via Advance Biocomposite Product Development*	Johan Pemenang Anugerah Utama Kluster Sains Hayat Kategori Industri mendapat geran P&P RM50,000.00
5.	Dr. Shaiful Azuar bin Mohamad	*Nuclear Technology in Agriculture*	Tempat ke-3 Kluster Sains Hayat Kategori Industri

4. UPNM: Defence, Security and Sustainability Exhibition (DSS 2019)

No.	Peserta	Tajuk Pameran	Pingat
1.	1. Dr. Amy Hamijah binti Ab Hamid 2. Siti Hawa binti Mat Zain	Sistem Simulasi Tindak Balas Insiden Radiologikal Malaysia	**EMAS**
2.	1. Muhammad Hazim bin Muhammad Sayuti 2. Siti Salwa binti Mohammad Shirajuddin	*Development of Economic Source via Reinforcement of Riverbank using Riverprotec*	**EMAS**
3.	1. Mohd Hamzah bin Harun 2. Khairul Azhar bin Abdul Halim	*Radiation Curing Materials for Bullet Proof Vest Application*	**GANGSA**
4.	1. Azhani binti Mohd Rozali 2. Dr. Nazrul Hizam bin Yusoff 3. Mohamad Rabaie bin Shari 4. Nurliyana binti Abdullah	*'Flexi-Si' dan Computed Tomography for Safety Inspection*	**GANGSA**
5.	1. Faisal Izwan bin Abdul Rashid 2. Muhammed Zulfakar bin Zolkaffly	*Malaysia's Experience in implementing the Comprehensive Nuclear-Test-Ban Treaty (CTBT) in supporting global effort to curb proliferation of nuclear weapons and advancing nuclear disarmament*	***MERIT***

Pengiktirafan Lembaga Teknologis

Lembaga Teknologis Malaysia (MBOT) adalah sebuah badan profesional bertanggungjawab mengiktiraf Teknologis Profesional (Professional Technologists) serta Juruteknik Bertauliah (Certified Technician). Inisiatif ini merupakan satu strategi untuk memartabatkan bidang teknikal melalui pengiktirafan kepada profesional sebagai profesion iktisas selaras dengan saranan Rancangan Malaysia Kesepuluh (RMK-10).

12 orang
Profesional Teknologis (PT)

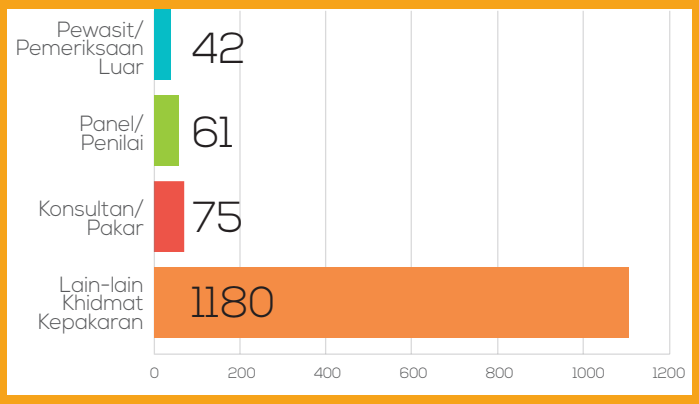
19 orang
Graduat Teknologis (GT)

Khidmat Kepakaran

Sejumlah 1358 perkhidmatan kepakaran berkaitan teknologi nuklear yang melibatkan 212 orang Pegawai Penyelidik. Antara perkhidmatan yang diberikan adalah sebagai konsultan/juruperunding sinaran, panel/penilai, pewasit/pemeriksaan luar dan lain-lain khidmat kepakaran.

212 orang

Pegawai penyelidik memberi khidmat pakar berkaitan teknologi nuklear



Latihan Industri

76 orang pelajar dari **23** institusi pengajian tinggi awam dan swasta telah menjalani latihan industri. Manakala **37 orang** pelajar telah melaksanakan kajian penyelidikan di Nuklear Malaysia.

Pelaksanaan Kajian Penyelidikan Mengikut Pengajian

19
Ijazah pertama

5
Sarjana

8
PhD

Program Pementoran MESTECC 2019

Program pementoran adalah salah satu inisiatif untuk memberi bimbingan, sokongan dan bantuan secara profesional oleh mentor (terlatih, berkemahiran dan beretika) bagi pembangunan diri menti (pegawai yang memerlukan bimbingan). Program ini dilaksanakan dengan tujuan untuk memantapkan kecekapan pegawai dalam melaksanakan tugas selaras dengan Pekeliling Perkhidmatan Awam Bilangan 18 Tahun 2005: Aplikasi Psikologi dalam Pengurusan Sumber Manusia Sektor Awam. Timbalan Ketua Pengarah, Program PP&T, YBrs. Dr. Abdul Muin bin Abdul Rahman, telah dinobatkan sebagai mentor terbaik di peringkat MESTECC.

Pementoran adalah program latihan dalam perkhidmatan yang menggunakan konsep berkongsi pengetahuan, kemahiran dan pengalaman tersirat antara pekerja lama dengan pekerja baru. Objektif program pementoran yang dilaksanakan oleh MESTECC adalah untuk; membimbing pegawai dalam peningkatan prestasi kerjaya dan psikososial, meningkatkan kemahiran dalam aspek profesional, budaya, peribadi dan sosial, membina keperibadian tinggi dalam kalangan warga organisasi, membudayakan kerja kelas pertama dan berprestasi tinggi dalam organisasi, menerapkan amalan pembelajaran berterusan, dan meningkatkan imej dan reputasi pegawai dan organisasi. Anugerah Mentor Terbaik 2018-2019 telah dianugerahkan kepada Pengarah Kanan Program Pengurusan, YBrs. Dr. Chantara Thevy Ratnam dan Anugerah Menti Terbaik pula dianugerahkan kepada Pegawai Penyelidik Gred Q44, Puan Nor Azilah Fatimah binti Othman. Pemilihan pemenang anugerah ini telah dinilai oleh pegawai daripada Jabatan Perkhidmatan Awam (JPA) semasa pembentangan pegawai dalam Bengkel Pemilihan Mentor dan Menti terbaik MESTECC pada 20 Jun 2019 di Dewan Perhimpunan MESTECC.

Mentor Terbaik
Program Perantis MESTECC 2019

Dr Abdul Muin bin Abdul Rahman

Timbalan Ketua Pengarah,
Program Penyelidikan dan Pembangunan Teknologi, Nuklear Malaysia

PENCAPAIAN ANTARABANGSA

Nuklear Malaysia sentiasa komited dalam menyokong inisiatif MESTECC 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 Agensi Tenaga Atom Antarabangsa (IAEA) dan Forum Kerjasama Nuklear di Asia (*Forum for Nuclear Cooperation in Asia, FNCA*). Berdasarkan kepakaran dan infrastruktur yang dimilikinya, Nuklear Malaysia sentiasa menjadi pilihan sebagai tuan rumah bagi penganjuran mesyuarat, bengkel dan kursus latihan yang melibatkan peserta antarabangsa. Sejak 2011, Nuklear Malaysia telah diberi kepercayaan oleh IAEA untuk menganjurkan *Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources* (PGEC). Kursus ini dianjurkan setiap tahun bertujuan untuk membina keupayaan dalam perlindungan dan keselamatan sinaran yang juga melibatkan penyertaan pelatih-pelatih dari negara serantau. Selain itu, Nuklear Malaysia juga telah menerima pengiktirafan IAEA sebagai *IAEA Collaborating Centre (ICC) in Radiation Processing of Polymers, Waste Polymers and Biocomposites, ICC in Advanced Non-Destructive Testing and ICC for Plant Mutation Breeding Using Chronic Gamma Irradiation*. ICC berperanan sebagai rakan kerjasama strategik IAEA dalam melaksanakan program kerjasama IAEA bagi memacu pembangunan penyelidikan, pembangunan dan latihan dalam sains dan teknologi nuklear untuk tujuan aman.

IAEA

1) Penglibatan dan pelaksanaan Projek Kerjasama

Penglibatan/Penganjuran/ Pengiktirafan	Butiran	Aktiviti
Projek Kebangsaan	Bil. Projek: 6	• Penyertaan kursus fellowship dan lawatan saintifik
Projek Serantau – Bukan Perjanjian	Bil. Projek: 21	• Penerimaan misi pakar dan peralatan
Projek Serantau – RCA	Bil. Projek: 14	• Penyertaan kursus dan mesyuarat peringkat rantau Asia Pasifik
Projek Antara-Rantau	Bil. Projek: 7	• Penyertaan kursus dan mesyuarat peringkat antara rantau
Coordinated Research Projects (CRP)	Bil. Projek : 18	• Penyertaan mesyuarat

2) Penganjuran/Penyertaan Aktiviti Antarabangsa

Penyertaan Aktiviti Antarabangsa (Utama)

1. *41st Meeting of National RCA Representatives, 26-29 Mac 2019, Colombo, Sri Lanka*
2. *48th RCA General Conference Meeting, 13 September 2019, Vienna, Austria*
3. *6th Meeting of the Working Group on RCA MTS Coordination, 29 Julai- 1 Ogos 2019, Seoul, Korea*
4. *63rd IAEA General Conference, 16-20 September 2019*

Penganjuran Aktiviti Antarabangsa

1. *First Project Coordination Meeting for IAEA Regional Project RAS1023: Developing and Upscaling of Radiation Grafted Materials for Water Treatment, Putrajaya, 18-22 Februari 2019*
2. *IAEA/RCA Regional Workshop on Implementations of Quality Management Systems, Pulau Pinang, 29 April hingga 3 Mei 2019*
3. *Regional Workshop On Disseminating Technologies Packages On Improved Varieties As Well As Nutrient And Water Saving Technologies Kuantan, Pahang, 29 April hingga 3 Mei 2019*
4. *IAEA/RCA Regional Training Course on RT-D Level 2 for Personnel Already Certified to RT-F Level 2, Bangi, Selangor, 10 hingga 21 Jun 2019*

5. *Regional Training Course for Teachers to Introduce Nuclear Sciences in Secondary Schools through Innovative Approaches, Kuala Lumpur, 1-12 July 2019*
6. *16th Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources (PGEC16), 17 Jun – 13 Disember 2019, Selangor*
7. *Interregional Training Course on Advanced Methodologies for Orphan Source Search and Recovery, Bangi, 1-5 July 2019*
8. *Technical Meeting on Quality Assurance and Quality Control in Management Systems for Irradiation Facilities, Bangi, 5-9 Aug 2019*
9. *Regional Training Course on Optimization of Adult and Pediatrics Nuclear Medicine and Molecular Imaging Procedures, Kuala Lumpur , 11 - 15 November 2019*

Program Fellowship dan Lawatan Saintifik Antarabangsa

1. 19 pelatih dari negara luar temasuk Sri Lanka, Nepal, Nicaragua, Uganda dan Mali menyertai program fellowship dibawah penyeliaan pegawai penyelidik Nuklear Malaysia

2) Pengiktirafan Antarabangsa

1. *IAEA Collaborating Centre (ICC)*	Nuklear Malaysia telah menerima pengiktirafan sebagai ICC pada 16 September 2020 dalam bidang 1. *Gamma Green House Facility* 2. *Advance Non-Destructive Testing Facility* 3. *Radiation Processing of Polymers Facility*

FNCA

1) Penglibatan Projek

Bil. Projek : 7

2) Penganjuran/Penyertaan Aktiviti Antarabangsa

Penyertaan Aktiviti Antarabangsa
1. *20th FNCA Coordinators Meeting 6 Mac 2019, Tokyo, Japan*
2. *20th FNCA Senior Officer Meeting (SOM), 19 Julai 2019, Tokyo, Japan*
3. *20th FNCA Ministerial Level Meeting, 6 Disember 2019, Tokyo, Japan*

Penganjuran Aktiviti Antarabangsa
1. *FNCA Mutation Breeding Workshop, Kuala Lumpur, 2 hingga 6 September 2019*

CTBT

1) Penglibatan Projek/Aktivit

1. *National Data Centre Preparedness Exercise 2019*

2) Penyertaan Aktiviti Antarabangsa

1. *52nd CTBTO Working Group B pada 25 Mac -5 April 2019, Austria*
2. *53rd CTBTO Working Group B pada 26 Ogos -6 Sept 2019, Austria*
3. *CTBTO Infrasound Technology Workshop 2019, 10 – 14 November 2019, Jordan*
4. *Technical Training for Radionuclide Station Operators with ORTEC Equipment, 5-7 Nov 2019, USA*

Regional Training Course for Teachers to introduce Nuclear Science in Secondary Schools through Innovative Approaches

Perkembangan dunia pendidikan telah membolehkan teknologi bergabung. Untuk memanfaatkan peluang tersebut, Agensi Tenaga Atom Antarabangsa (IAEA) bekerjasama dengan Nuklear Malaysia telah mengadakan '*Regional Training Course for Teachers to introduce Nuclear Science in Secondary Schools through innovative Aproaches*' yang diadakan pada 1 Julai hingga 12 Julai 2019. Kursus selama 2 minggu itu disasarkan untuk guru sains menengah wilayah dengan tujuan untuk melatih mereka mengenai sains nuklear dan kaedah inovatif dalam mengajar sains nuklear.

Program khas ini dibuat khusus untuk menampung paradigma yang sentiasa berubah dalam pengajaran sains nuklear di kalangan guru. Selain itu, ia juga telah menyediakan platform di kalangan guru untuk berkongsi amalan terbaik mereka dalam menyusun strategi pengajaran sains nuklear kepada pelajar mereka. IAEA mensasarkan 1 juta pelajar dari negara-negara serantau mendapat manfaat menjelang 2021.

NUKLEAR MALAYSIA BANTU KRISIS

Aplikasi Teknologi Nuklear untuk Kelestarian Alam Sekitar

Nuklear Malaysia membantu Jabatan Alam Sekitar (JAS) dalam mengenalpasti dan mencirikan bahan pencemaran dalam bentuk sisa pepejal, cecair dan gas serta menghasilkan "fingerprint", sisa buangan dari kilang terpilih dalam kes pencemaran di kawasan perindustrian Pasir Gudang, Johor. Data yang diperolehi dapat membantu JAS mengenalpasti punca pencemaran.

Pembangunan Alat Prediktif dan Protokol Pengawasan Bersepadu Menggunakan

'Isotope Fingerprinting' dan Geofizik Teknik dalam Menilai Ciri-Ciri Hidrogeologi di Tapak Semulajadi Berisiko Tanah Runtuh

Kaedah bersepadu isotop dan geofizik yang dibangunkan dapat mengesan dan memantau punca keretakan bangunan dan pergerakan tanah di SMK Batu 6, Bentong, Pahang. Hasil daripada teknik geofizik menunjukkan sistem hidrologi yang berbeza, manakala hasil daripada teknik isotop pula menunjukkan tiada hubungan antara air bawah tanah dan air paip. Dengan itu, pemendapan tanah berlaku di sekolah berkenaan bukannya daripada kebocoran paip air tetapi daripada tindakan air tanah yang disumbangkan oleh air hujan atau air tanah semula jadi.

Pencarian Kubur Lama Kerabat Sultan Pahang

Hasrat kajian pencarian kubur lama kerabat Sultan Pahang di Teluk Cempedak, Kuantan, Pahang telah disuarakan oleh pejabat Kebawah Duli Yang Maha Mulia Sultan Pahang pada 18 Jun 2019 kepada Nuklear Malaysia melalui Kementerian Pertahanan Malaysia (MINDEF). Kepakaran Nuklear Malaysia dalam bidang geofizik telah menggunakan Radar Penembus Tanah (GPR) untuk mencari kubur lama kerabat Sultan Pahang berkenaan. Nuklear Malaysia telah membangunkan kepakaran ini sejak tahun 2003. Alat ini mampu mengesan objek yang berada di bawah tanah sedalam lima meter dengan tepat tanpa memusnahkan kawasan berkenaan. Hasil pencarian tersebut telah menemukan 33 kubur yang berada dalam keadaan tersusun.

Penggunaan Teknologi Nuklear dalam Penentuan Asalan Batu Bersurat Piagam

Kajian penentuan asalan batu bersurat piagam di Terengganu dengan menggunakan Teknik Neutron Teraruh Sinar Gama Segera *(Neutron-Induced Prompt Gamma-Ray Techniques)*. Kelebihan menggunakan teknik ini adalah dilakukan secara *in-situ,* pengukuran tanpa sentuh dan mempunyai aspek keselamatan sinaran yang tinggi. Hasil kajian komposisi unsur batu tersebut mendapati batu bersurat adalah daripada jenis batuan "dolerite" yang berasal dari sekitar Hulu Sungai Lawit dan Panchor, Empangan Kenyir, Terengganu.

Pengukuran Kandungan Partikel Halus, Kasar Penentuan Unsur dalam Debu Udara

Penentuan kandungan partikel halus (PM2.5), partikel kasar (PM2.5-10) dan unsur di dalam debu udara di dalam Muzium Negara, Kuala Lumpur dan Muzium Lukut, Negeri Sembilan bertujuan untuk membantu pihak muzium menghasilkan piawai/garis panduan berkaitan pengawalan debu udara bagi memelihara artifak muzium.

Projek Kebocoran Paip Bawah Tanah "District Cooling System" TNB Bangsar

Penentuan kedudukan kebocoran paip "district cooling system" bawah tanah kepunyaan Tenaga Nasional Berhad (TNB) di Bangsar, Kuala Lumpur dilaksanakan menggunakan teknologi penyurih *(radiotracer technology*, RT). Dengan bantuan Teknik ini, masalah yang tidak dapat diselesaikan oleh TNB dengan menggunakan teknik konvensional sebelum ini dapat diatasi.

MERAKYATKAN TEKNOLOGI NUKLEAR

Nuklear Malaysia menjalankan aktiviti promosi dan penyebaran maklumat untuk meningkatkan tahap kesedaran awam terhadap S&T nuklear secara berterusan. Aktiviti ini dijalankan di bawah Program Pembudayaan Sains Teknologi dan Inovasi (STI) melalui Program Gerakan Inovasi Nasional (GIN). Selain itu, Nuklear Malaysia juga menerima pelawat luar dari pelbagai agensi dan institusi pendidikan. Antara aktiviti yang dijalankan ialah:

Minggu Sains Negara

Nuklear Malaysia telah diberi mandat oleh MESTECC untuk menerajui Minggu Sains Negara (MSN) 2019 di peringkat Negeri Sembilan. MSN ini di sajikan dengan pelbagai aktiviti kesedaran awam dan pameran sains. Di samping itu, pameran sains juga diadakan di atas jemputan sekolah seluruh Malaysia. Salah satu inisiatif dengan menerapkan aktivti interaktif sains, teknologi, kejuruteraan dan matematik (STEM) di bawah satu bumbung yang bertempat di Mini Science Technology & Discovery Centre, AEON Mall Nilai, Negeri Sembilan. Program ini berlangsung pada 1 hingga 7 Ogos dan telah dirasmikan oleh Menteri Besar Negeri Sembilan, YAB Dato' Seri Haji Aminuddin bin Harun.

ESTECC Education in Schools

Nuklear Malaysia terlibat dalam Program ESTECC *Education in Schools* dengan menggunakan modul sedia ada untuk sekolah menengah dan membangunkan modul khas untuk sekolah rendah. Pengisian program dapat memberi pendedahan dan menimbulkan minat pelajar terhadap Sains, Teknologi, Kejuruteraan, dan Matematik (STEM). Program ini menyediakan peluang yang unik kepada pelajar bagi mendapatkan inspirasi daripada aktiviti yang dilakukan melalui perkongsian penyelidikan, pengetahuan dan pengalaman untuk menanam minat pelajar sekolah memilih bidang sains sebagai kerjaya pada masa hadapan. Program ini dapat memberi manfaat kepada 51,836 pelajar terlibat dalam pelbagai aktiviti seperti pameran, bengkel, ceramah, lawatan dan sebagainya. Perkongsian ilmu ini juga membantu guru sains untuk mengetahui perkembangan sains terkini.

Nuclear BFF

Program ini adalah program jangkauan luar bagi pelajar-pelajar berkeperluan khas. Modul pembelajarannya dihasilkan dan dipraktikkan oleh pakar Nuklear Malaysia. Aktiviti ini melibatkan 842 pelajar OKU di 16 sekolah di Negeri Sembilan dan Pahang.

Pelawat Nuklear Malaysia

Nuklear Malaysia menerima kunjungan sekitar 19,040 orang pelawat daripada pelbagai kategori antaranya pelajar IPTA/ IPTS dalam dan luar negara selain lawatan 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.

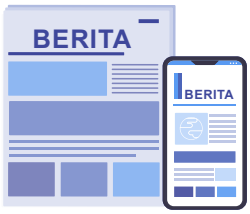
Kunjungan pelawat ke Nuklear Malaysia bukan sahaja membuka ruang dan peluang kepada mereka untuk berinteraksi secara langsung dengan pegawai penyelidik, malah dapat melihat sendiri kemudahan serta produk inovasi teknologi nuklear secara dekat.

NUKLEAR MALAYSIA @ MEDIA

Kejayaan Nuklear malaysia di paparkan di media cetak dan media sosial.

Liputan Media

44
Liputan Akhbar



8
Siaran Radio

19
Siaran TV

556
Muat Naik Facebook & Instagram

KARISMA

Nurul Husna Mahmud
nurul_husna@hmetro.com.my

'JODOH' BERSAMA TENAGA ATOM

Dr Siti Aiasah kendali fasiliti, teknologi nuklear selama 20 tahun

Mendengar saja radiasi atau nuklear, pada kebanyakan orang kedua-duanya cukup menggerunkan, namun bagi Presiden Women In Nuclear Malaysia (WiN) Dr Siti Aiasah Hashim itu adalah dunianya.

Keterujaan beliau untuk mengenali dunia radiasi sudah terbit sejak zaman sekolah lagi dan mengakui ia bermula dengan perdebatan bersama rakan sekelasnya ketika itu.

Bekas pelajar cemerlang Sekolah Tun Fatimah Johor itu berkata, tidak sangka 'jodohnya' bersama tenaga atom itu cukup kuat menerusi pertemuan kembali dengan senior yang ketika itu berkhidmat bersama Agensi Nuklear Malaysia.

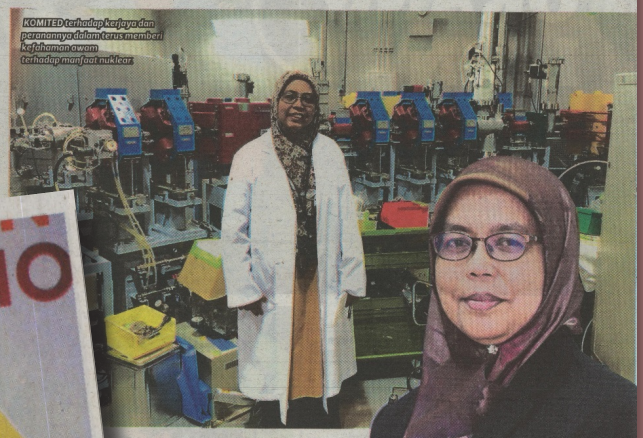
"Sebenarnya ad-

berhampiran dengan kediaman memudahkan menguruskan urusan harian.

"Tidak lama kemudian sekitar tahun 1992, waktu itu Malaysia baru saja menerima hadiah berupa sebuah mesin alur elektron melalui kerjasama dengan Japan International Cooperation Agency (JICA). Itu adalah titik permulaan penggunaan teknologi penyinaran alur electron bertenaga tinggi.

"Jadi ketika itu Agensi Nuklear Malaysia memang mencari jurutera dan saya cuba nasib sehinggalah diterima kerana tiada calon lelaki datang ketika itu.

"Dulu, peluang untuk perempuan terutama dalam bidang kejuruteraan agak terhad. Wanita perlu bergelut dengan persepsi masyarakat bahawa industri berat bukanlah lapangan wajar untuk kami.



KOMITED terhadap kerjaya dan peranannya dalam terus memberi kefahaman awam terhadap manfaat nuklear

"Saya juga mempunyai hubungan baik dengan jurutera dan penyelidik dari negara terbabit dalam bidang akselerator seperti Jepun, Russia, Australia dan banyak lagi.

"Satu lagi pengalaman menarik ketika mula berkhidmat sebagai jurutera fasiliti, saya ketika itu baru sebulan

Abang Johari, flanked by Abd Wahab (left) and Zulkifli, launches the Radiation Protection Conferenc

Renewable energ the way forwar for M'sia — Ab

Rintos Mail

KUCHING: Malaysia has to relook its energy policy if the country is to achieve a 'Clean Malaysia' status, says Chief Minister Datuk Patinggi Abang Johari Tun Openg.

He said the country cannot be too dependent on fossil fuels, which are fast depleting and have great impact on the environment, adding he believed renewable energy was the way forward due to its minimal impact on the environment and carbon emission.

"That is why in Sarawak, we are giving strong emphasis on renewable energy, having built our dams to produce hydro power. Currently, we have three fully-operational hydroelectric dams, which are Batang Ai, Bakun and Murum while the Baleh Dam is coming up.

"These four dams have the potential to generate a tota of about 22,000 megawat of electricity," he said at t opening of Radiation Protect Conference and Workshop, yesterday.

He said aside from gener electric power, water from

Nuklear Malaysia kaji 5G akhir tahun ini

Kuala Lumpur: Agensi Nuklear Malaysia (Nuklear Malaysia) akan menjalankan kajian terperinci dan penilaian keselamatan terhadap penggunaan teknologi mudah alih generasi kelima atau 5G selewat-lewatnya akhir tahun ini.

Ketua Pengarah Nuklear Malaysia Dr Mohd Abd Wahab Yusof berkata, penilaian dan kajian itu akan dijalankan bersama dengan Kementerian Kesihatan (KKM) serta pihak berkaitan.

Katanya, penggunaan teknologi 5G secara umumnya memberi banyak manfaat kepada masyarakat namun tidak boleh menolak kebimbangan orang ramai terhadap isu kesela-

matan dan kesihatan.

"Ketika ini, kajian terperinci berkaitan penggunaan 5G belum dilakukan dengan meluas di negara luar kerana ia adalah teknologi yang baharu saja diperkenalkan.

"Justeru, kita akan melakukan kajian terperinci dan penilaian keselamatan' bagi memastikan masyarakat di negara mendapat maklumat yang sahih sekali gus dapat menerima teknologi terbaru itu dengan lebih terbuka," katanya.

Beliau berkata media selepas merasmikan Persidangan Antarabangsa Sinaran Tidak Mengion (ICNIR 2019) anjuran Persatuan Pelindungan Sinaran Malaysia (MARPA) di ibu negara, semalam.

Penggunaan teknologi 5G beri banyak manfaat kepada masyarakat


spm
Nadi Seri Pagi
Selamat Pagi Malaysia


SARAWAK
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SARAWAK fm

KEBAJIKAN, SUKAN DAN REKREASI

Latihan Menembak Tahunan

Pertandingan Larian Tertutup
Nuklear Malaysia

Pertandingan Memanah
Hari Kebangsaan

Pesta Air Putrajaya

Majlis Makan Malam Kelab Sukan dan Kebajikan Nuklear Malaysia

Senamrobik dan Gotong Royong Sempena *World Environmental Health Day*

Ekspedisi Royal Belum

Anak Angkat Ramadan: Jom Beli Baju Raya

Hike For Health Gunung Datuk Rembau

Glam Raya Nuklear Malaysia

NUKLEAR MALAYSIA

ANNUAL REPORT 2019

Malaysian Nuclear Agency, Ministry of Energy, Science, Technology and Climate Change (MESTECC)

VISION

- Nuclear science and technology for knowledge generation, wealth creation and societal and national well-being

MISSION

- Excellence in research and nuclear technology applications for sustainable development

OBJECTIVE

- To generate new products and technologies through research and innovation based on the national development agenda
- To achieve an income, at minimum 30% of the annual operating budget, through transfer and commercialization of technology
- To enhance organisational excellence through planning and quality management

FUNCTION

- Conducts research and development (R&D), training and provide services in nuclear technology for national development;
- National Technical Support Organization for nuclear and related technology;
- Promotes the application, transfer and commercialization of nuclear technology;
- National Reference Centre for Nuclear Forensics;
- National Management Centre for Radioactive Waste and Spent Nuclear Fuel;
- Liaison agency for the International Atomic Energy Agency (IAEA) at National and International Level;
- National Authority for the implementation of the Comprehensive Nuclear-Test-Ban Treaty (CTBT).
- National Centre for Radiation Metrology

EXECUTIVE NOTE

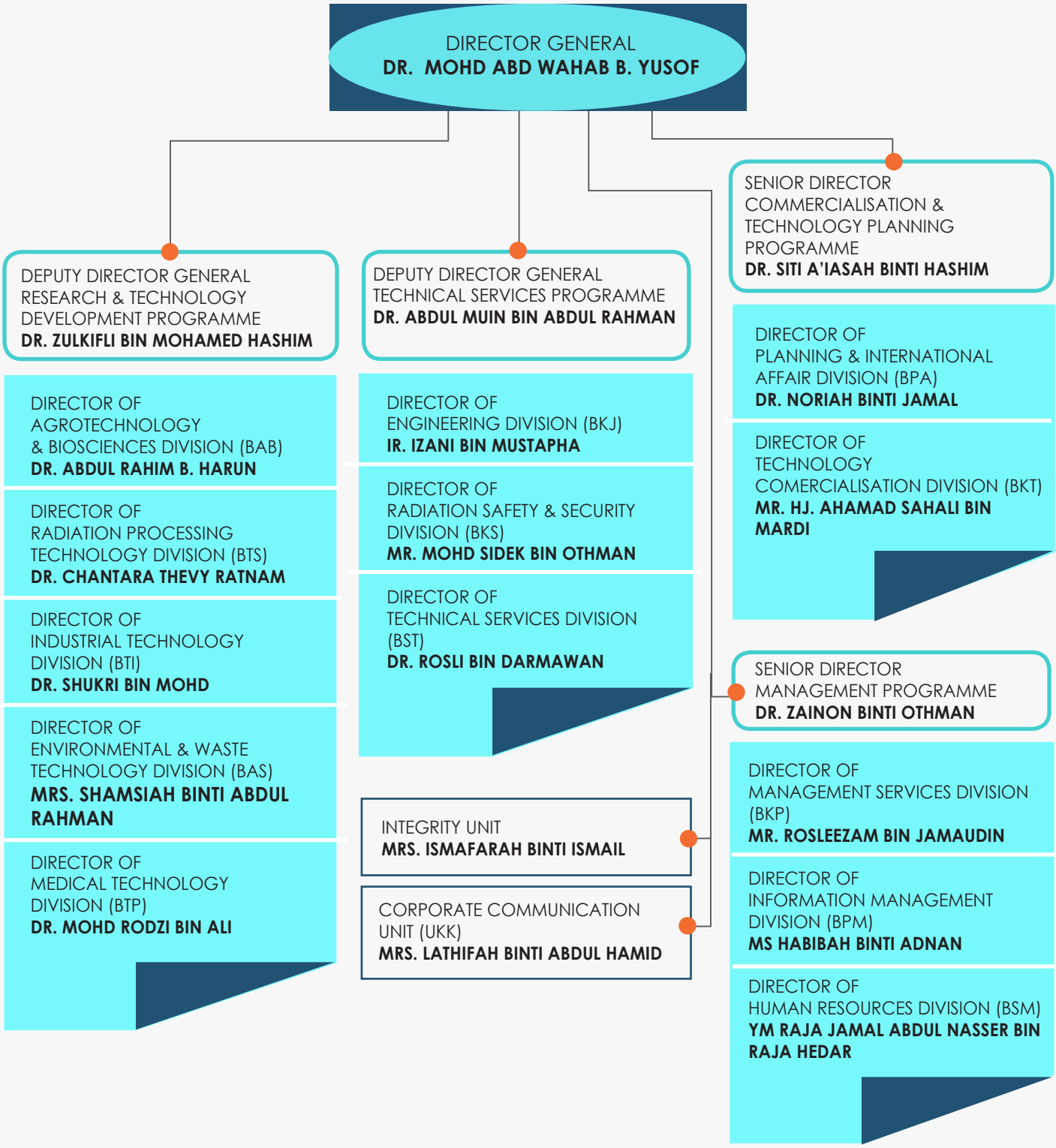
For the past five decades, Malaysian Nuclear Agency (Nuklear Malaysia) has had many successes. It has managed to preserve its identity as a pioneer in the field of nuclear science and technology, in the area of research and development, innovation, and the commercialisation of technology.

Not only a national research institute entrusted with the promotion, development, and advancement in the use of nuclear technology, it is also tasked with the provision and training in Nuklear Malaysia expertise throughout the country. Nuklear Malaysia is also responsible for managing national and international nuclear related issues pertaining to the fulfilment of the Comprehensive Nuclear-Test-Ban Treaty (CTBT).

Throughout the year 2019, Nuklear Malaysia has produced 24 research products, nine processes, 20 procedures, five databases, and three software. Nuklear Malaysia has also published 653, encompassing books, book chapters, theses, journal articles, national and international conference presentations, proceedings, general publications, and other publications pertaining to the current development and advancement of nuclear science and technology. To retain its edge in the research, development, and commercialisation of nuclear technology, Nuklear Malaysia is involved in promoting its available facilities and expertise relating to nuclear technology in Malaysia. This will have a positive impact on the collaborative efforts between Nuklear Malaysia and its industrial partners that would lead to improved research and commercialisation endeavours in the near future.

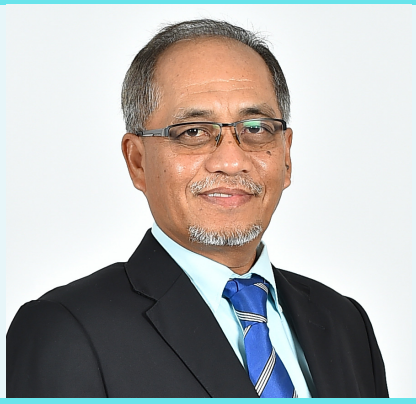
Dr. Mohd Abd Wahab bin Yusof
DIRECTOR GENERAL, MALAYSIAN NUCLEAR AGENCY
MINISTRY OF ENERGY, SCIENCE, TECHNOLOGY, ENVIRONMENT AND CLIMATE CHANGE(MESTECC).

ORGANISATIONAL **CHART**



TOP MANAGEMENT

DIRECTOR GENERAL
DR. MOHD ABD WAHAB BIN YUSOF



DEPUTY DIRECTOR GENERAL
RESEARCH & TECHNOLOGY DEVELOPMENT PROGRAMME
DR. ZULKIFLI BIN MOHAMED HASHIM

DEPUTY DIRECTOR GENERAL
TECHNICAL SERVICES PROGRAMME
DR. ABDUL MUIN BIN ABDUL RAHMAN

SENIOR DIRECTOR
MANAGEMENT PROGRAMME
DR. ZAINON BINTI OTHMAN

SENIOR DIRECTOR
COMMERCIALISATION &
TECHNOLOGY PLANNING PROGRAMME
DR. SITI A'IASAH BINTI HASHIM

MANAGEMENT **TEAM**

1

2

3

1 Director of Agrotechnology & Biosciences Division (BAB)
DR. ABDUL RAHIM BIN HARUN

2 Director of Planning & International Affair Division (BPA)
DR. NORIAH BINTI JAMAL

3 Director of Radiation Procession Technology Division (BTS)
DR. CHANTARA THEVY RATNAM

4 Director of Industrial Technology Division (BTI)
DR. SHUKRI BIN MOHD

5 Director of Medical Technology Division (BTP)
DR. MOHD RODZI BIN ALI

6 Director of Technology Commercialisation Division (BKT)
MR. HJ. AHAMAD SAHALI BIN MARDI (BKT)

7 Director of Environmental & Waste Technology Division (BAS)
MRS. SHAMSIAH BINTI ABDUL RAHMAN

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MANAGEMENT **TEAM**

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8 Director of Radiation Safety & Security Division (BKS)
MR. MOHD SIDEK BIN OTHMAN

9 Director of Technical Services Division (BST)
DR. ROSLI BIN DARMAWAN

10 Director of Human Resources Division (BSM)
YM RAJA JAMAL ABDUL NASSER BIN RAJA HEDAR

11 Director of Engineering Division (BKJ)
IR. IZANI BIN MUSTAPHA

12 Director of Management Services Division (BKP)
MR. ROSLEEZAM BIN JAMAUDIN

13 Director of Information Management Division (BPM)
MS. HABIBAH BINTI ADNAN

INTRODUCTION

"Nuclear Technology Propels the Nation Vision"

With a mission to excel in the research and use of nuclear technology for sustainable development, Nuklear Malaysia continues to advance nuclear science R&D for knowledge generation, wealth creation and societal and national well-being.

Nuklear Malaysia's outstanding achievements are based on 48 years of experience in the development of nuclear S&T, as well as 38 years in research reactor operation.

Management and Administration

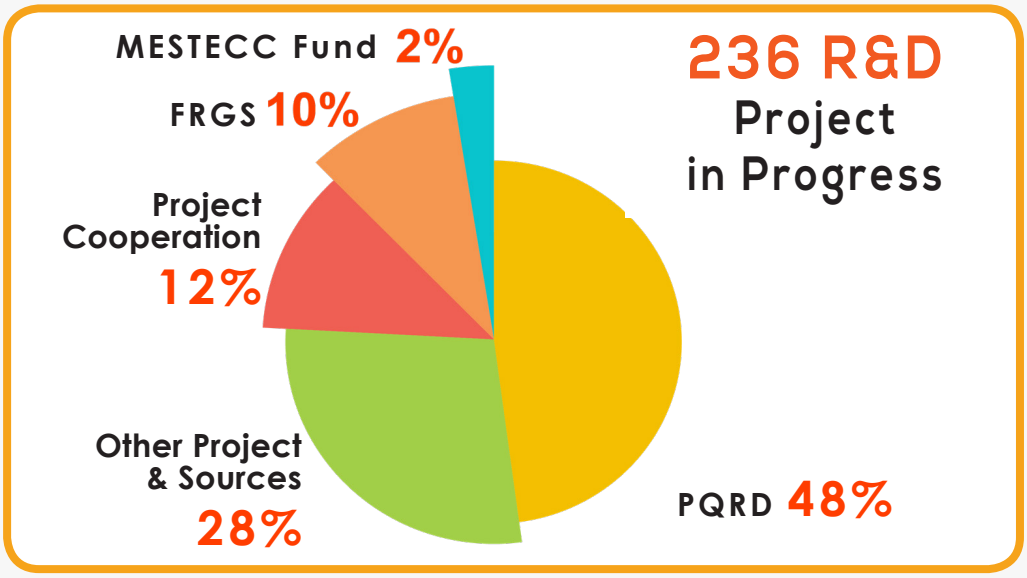
Excellence in management and administration at Nuclear Malaysia continues, in line with its mission, vision, objectives and functions.

1. **95.15%** **(RM8.2 million)** Operating Budget
2. **95%** **(RM82 million)** Management Budget
3. **100%** Audit Report
4. **82.6%** **(769/930)** Permanent Positions
5. **85** **Position** Contracts & Part Time Positions

EXCELLENCE IN RESEARCH, DEVELOPMENT AND TECHNOLOGY COMMERCIALISATION (R&D&C)

R&D activities undertaken at Nuklear Malaysia continue to contribute to the implementation and achievement of the National Science and Technology Innovation Policy (DSTIN). Nuklear Malaysia emphasize human capital development to ensure all R&D activities are in line with the S&T and national interest. This serves as a catalyst for economic growth and competitiveness towards becoming a fully-industrialized high-income nation.

Research and Development



R&D Output

Products


Welded Alunode


Bolted Alunode


Screwed Alunode


Benih stevia varieti baharu S10A


Biobaja M99


NuRust


Bioliquifert


Tiang Sokongan Lada Hitam


GoGrow BioNPK Biobaja


Aquacage


Riverprotec

Processes

1. Gamma, electron and neutron irradiation of commercial products and research samples
2. Phytosanitary treatment of fresh fruits
3. Irradiaiton-based treatment of fresh fruits for exportation to the US
4. Development of elite mother culture mushroom for commercialization
5. Freeze dried peptide kit
6. X-ray irradiation process for mice based on three irradiation device (wholebody irradiation for mice, whole body irradiation for rat and abdominal irradiation for mice)
7. Kenaf based bulk moulding compound
8. Radiation crosslinking of backsheet solar panel
9. Production of glucose sensor by irradiation of pyriole/pVA-glucose oxidase coated optical fibre

Procedures

1.	Quality Control Pprocedure for Sm-153 and Ethylenediamine Tetra Methylene Phosphonic Acid (EDTMP) for Medical Use
2.	Quality Control Procedure for Iodine-131 for Medical Use
3.	Validation Procedure for Microbiology Testing on Iodine-131 for Medical Use
4.	Validation Procedure for Microbiology Testing on Sm-153 EDTMP for Medical Use
5.	Radiolabelling and Quality Control Procedure
6.	Freeze Dried Peptide Kit
7.	A Procedure Manual for Rare Earth Recycling Storage
8.	Standard Operating Procedure for Scanning Electron Microscope Sample Preparation
9.	Standard Operating Procedure for Scanning Electron Microscope Operation
10.	Radiographic Testing – Digital (Rt-D) Inspection Procedure: Pipe Wall Thickness Measurement Using Digital Detector Array (Dda) With X-Ray
11.	Radiographic Testing – Digital (Rt-D) Inspection Procedure: Pipe Wall Thickness Measurement Using Computed Radiography (Cr) With X-Ray
12.	Operation Manual for Dipper: A New Lab-Scale Friendly Invention in Hot Dip Coating System
13.	Exportation Procedure for the Exportation of Rambutans to the USA
14.	Standard Operating Procedure for Volvariella Tea Production
15.	Standard Operating Procedure for Extraction and Purification of Mutant Stevia
16.	In vitro screening of Volvariella Volvacea mushroom
17.	In vitro screening of Volvariella Volvacea Pleurotus Sp mushroom
18.	Procedure for Mobile Hot Cell

Software

Ombakwarna:
Graphic Analysis Software

Data Acquisition Software
Flexi-Automatic

TRIMON: An Integration of Deterministic-Monte Carlo Code for TRIGA Reactor Core Management

Database

Database on the radiosensitivity of Napier grass to acute and chronic gamma irradiation

Database on the Acoustic Emission (AE) of ship hull

Internal Database of Fire Hazards at the RTP

MY-Fuel Database

Validated questionnaire, Survey data, Full paper

Publications 2019

Publication is one of the forms of knowledge management implemented at Nuklear Malaysia. Its implementation would ensure that all materials will be handled properly and can be used for future reference.

Nuklear Malaysia has successfully published
653 publications

4	Thesis
3	Books
1	Chapter in books
31	National Journals
95	International Journals
106	National Conference
50	International Conference
178	Technical Report
8	General Publications
177	Industrial Training Student Report

Excellence in Commercial Activities

Nuklear Malaysia generated RM10.43 million in revenue through professional services. The provision of technical service/expertise was the highest income generator followed by supply of product then training services.

RM 10.43 million
income

20 NDA

5 MoA/MoU/Cooperation Note/ Product Launching/Ready for Commercialisation

Source of Income	Total Revenue (million)
• Supply of product	RM2.218
• Education & Training	RM2.715
• Technical Services	RM4.282
• Contract/Research Grants/ Consultancies	RM1.092
• Investment Dividends	RM0.126
Total	**RM10.433**

1. Supply of product

- Secondary Standards Dosimentry Laboratories (SSDL)
- Prevulcanised Natural Rubber Latex (RVNRL) using Gamma Ray
- Supply of Radioisotopes

2. Education and Training

The Training Center has organized numerous national and international learning programs which include allied programs/smart alliances, training of field experts, and international participants under the Malaysian Technical Cooperation Program (MTCP) as well as hosting the Postgraduate Educational Course (PGEC) in Radiation Safety funded by the IAEA.

Total number of training products	Total number of courses	Total number of participants
32	116	2515

3. Technical Services

Nuklear Malaysia has successfully provided 7837 training, technical and consultancy services to 2454 companies from various sectors which include manufacturing, semiconductor, oil and gas, medicine, agriculture, telecommunications, universities and government agencies. At the same time, more than 5000 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).

2019 Selected R&D

1 NMR151 and NMR152 rice variety

As a world class research institution, it is the aim of the Agency that all research outputs can potentially be exploited and commercialised.

Nuklear Malaysia has successfully developed new rice varieties namely NMR151 and NMR152, which are able to withstand extreme weather changes in Malaysia. The results of this research can help framers increase their income by reducing operating costs of planting rice seeds between five to ten percent and increasing the harvest yield by 55%. A decade worth of research has produced several new, high value-added rice varieties such as NMR 152 and NMR 151 that was successfully registered under the New Plant Variety Protection Act 2004.

2 Commercialisation of volvariella volvacea

Volvariella Volvacea is a hybrid mushroom developed by Nuklear Malaysia. These hybrid seeds were developed using tissue culture. The cultivation technique is based on the principle Plant, Wait and Harvest which is a unique innovation for this crop. The cultivation technique is based on the principle Plant, Wait and Harvest which is a unique innovation for this crop.

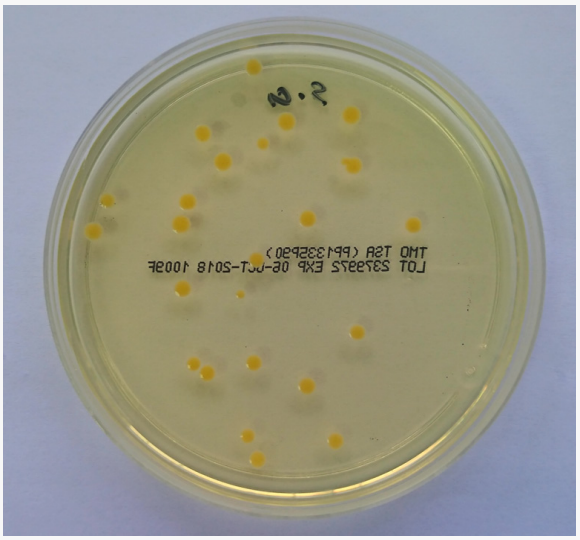
3 Production of **Samarium-153**

The therapeutic radiopharmaceutical Samarium-153 Ethylenediamine Tetramethylene Phosphonate (Sm-153 EDTMP) was produced in-house to be supplied to the National Cancer Institute (IKN) as a palliative treatment for cancer patients. Samarium-153 is produced by RTP through neutron activation of Samarium-152 trioxide and has a half-life of 46.3 hours. Samarium-153 emits beta particles to reduce pain caused by cancer. Emission of gamma rays, on the other hand, allows patient imaging using a gamma camera. This radioisotope can help improve the quality of life of chronic (terminal) cancer patients.

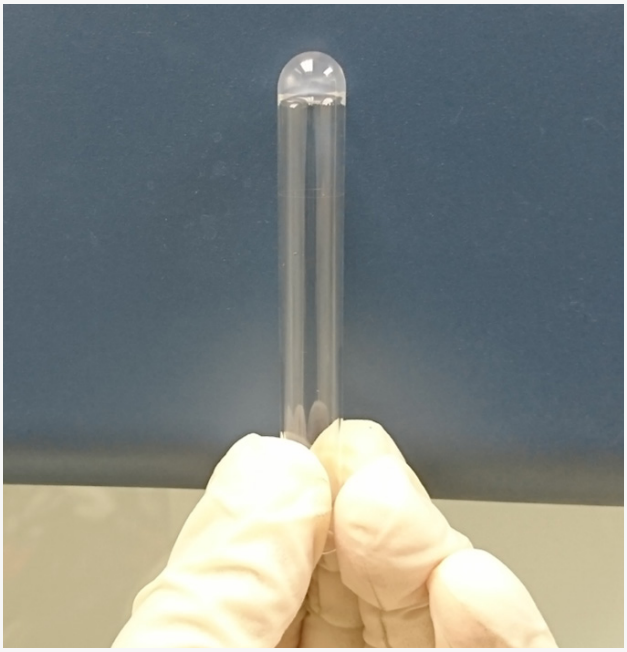
Nuclear Malaysia's expertise in producing **Samarium-153** Ethylenediamine Tetramethylene Phosphonate (Sm-153 EDTMP) in-house to be supplied for the National Cancer Institute as palliative treatment for the cancer patient.

4 **Microbiology Testing** Services

The Microbiology Quality Control Laboratory provides microbial testing on medical products and environmental samples. Using the gel clot method, product samples are tested for sterility, bioburden (bacterial and fungal) and bacterial endotoxin, while environmental samples are tested using the settle plate or press plate method. Microbiological tests are generally conducted to ensure that the products meet certain standards.



The most commonly used references are the British Pharmacopeia (BP) and United States Pharmacopeia (USP). Since obtaining the Good Manufacturing Practice (GMP) licence for the production of Tc-99m generator, the Microbiology Laboratory has become a reference lab for microbial testing involving radiopharmaceutical products. This is reflected in the increase in samples received from facilities with a cyclotron such as the National Cancer Institute, Beacon Hospital and Biomolecular Industries.



Nuklear Malaysia offers **mikrobiologi test** services for radiopharmaseutical productc produced by cyclotron facility at National Cancer Institute and private hospitals,

5 Launch of *GoGrow BioNPK Biobaja*

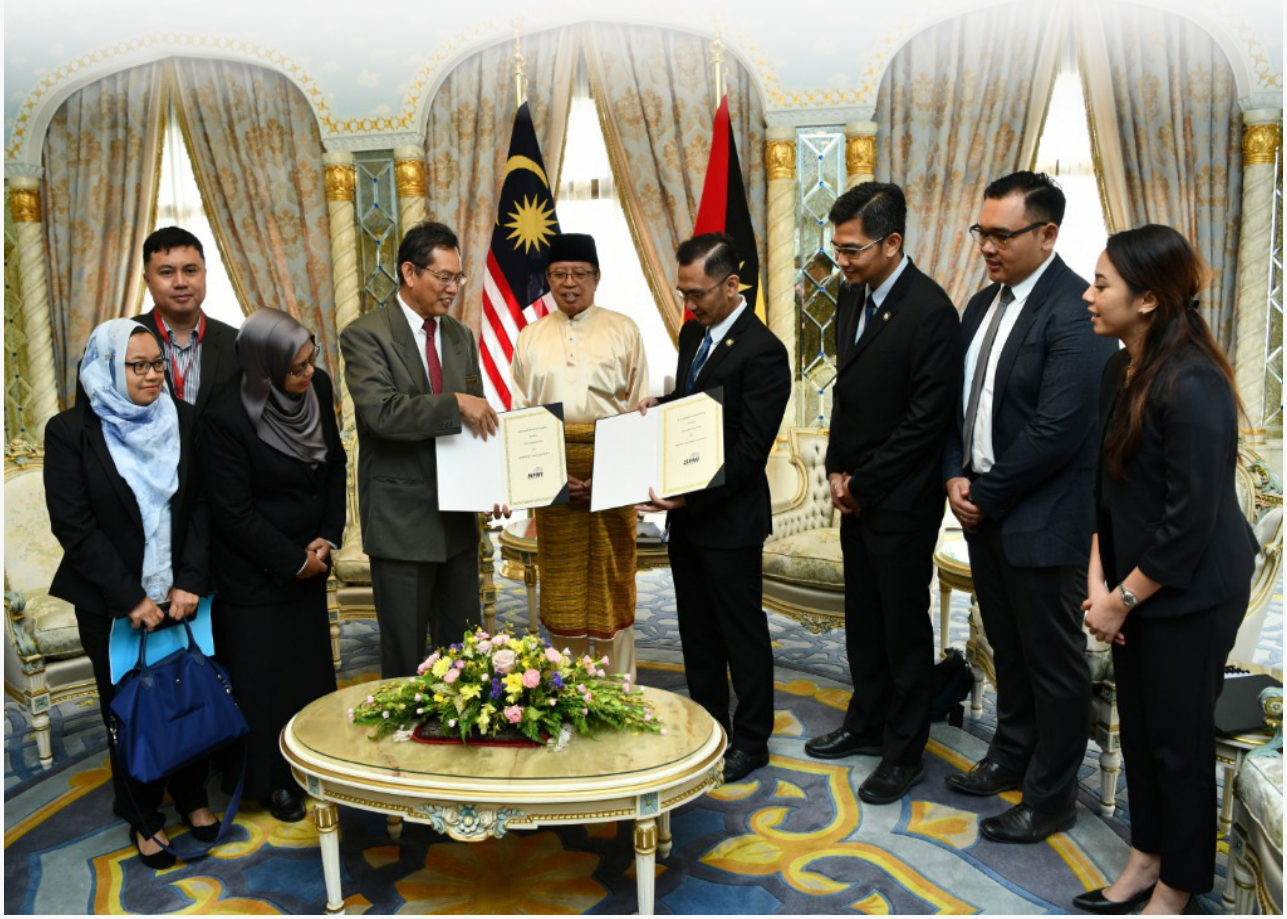
GoGrow BioNPK Biobaja Launching by The Sectretary General, Ministry of Energy, Science, Environment & Climate Change (MESTECC), **Datuk Seri Dr. Mohd Azhar Bin Haji Yahaya** on Nuklear Malaysia Innovation Day 2019

Cooperation with State Governments

Nuklear Malaysia has formed partnerships with the state governments of Sarawak, Selangor and Sabah.

Sarawak

Director General of Nuklear Malaysia, YBrs. Dr. Mohd Abd Wahab bin Yusof with the Sarawak Multimedia Authority (SMA) paid a courtesy call to the Office of the Chief Minister of Sarawak, YAB Datuk Patinggi Dr. Abang Haji Abdul Rahman Zohari Bin Tun Datuk Abang Haji Openg at Wisma Bapa Malaysia, Kuching Sarawak on June 14, 2019. The Chief Minister witnessed the exchange of Memorandum of Understanding between SMA and Nuclear Malaysia for the telecommunication radio frequency monitoring project in Sarawak. The exchange was held at Wisma Bapa Malaysia while the document signing was held at SMA Kuching.



Selangor

Director General of Nuklear Malaysia, YBrs. Dr. Mohd Abd Wahab bin Yusof with Deputy Director General of Technology Research & Development Program, YBrs. Dr. Zulkifli Bin Mohamed Hashim and Director of the Division of Agrotechnology & Biosciences (BAB), YBrs. Dr. Abdul Rahim Bin Harun and Nuklear Malaysia Officer made a courtesy call on the Chairman of the Committee on Infrastructure & Public Facilities, Modernization of Agriculture and Agro-based Industry, YB. Mr. Ir Izham bin Hashim on July 1, 2019 at the Selangor State Secretary's Office. The visit was to introduce Nuklear Malaysia's expertise in the field of agrotechnology and bioscience.

Sabah

A formal meeting was held between the Director General of Nuklear Malaysia, YBrs. Dr. Mohd Abd Wahab bin Yusof with Sabah Deputy Chief Minister and Sabah Minister of Trade and Industry, YB Datuk Seri Panglima Wilfred Madius Tangau at Wisma Kewangan, Kota Kinabalu, Sabah on November 22, 2019. The purpose of this visit was to discuss the collaboration between Nuklear Malaysia and Sabah's Department of Agriculture on the NMR151 and NMR152 rice cultivation project.

Researcher-Industry Scientific Exchange (RISE) Programme

The RISE program is an initiative by MESTECC to establish closer collaboration between researchers in public research institutions and the industry. The target groups for this program are companies registered in Malaysia, local researchers, government-linked companies and companies limited by t guarantee. This program is a platform for research officers to provide their expertise to the industry and thus far 37 research officers involving 14 companies have participated.

Researcher-Industry Scientific Exchange (RISE) Programme

14
Companies

37
Research Officers

MAIN PLANTS, FACILITIES AND SERVICE CENTRES

Main Plants and Facilities

1. SINAGAMA

Achievement Data 2019

SINAGAMA operates under the ISO 9001:2015 system

Gamma irradiation was performed on 84,374.77kg of herbs, 1,146,790.63kg of foodstuff, as well as 195,641.72kg and 1,094.82m3 of non-medical and medical products respectively.

Activity

Gamma irradiation for the decontamination of food and herbal products and sterilization of medical and pharmaceutical device

2. GGH

Achievement Data 2019

Collaborated with IAEA in R&D, as well as nuclear science application training especially in the field of plant mutation breeding using chronic gamma radiation. Gamma Green House has been recognized as an IAEA Collaborating Centre (ICC) from 2019 – 2023.

Activity

A total of four fellows and two IAEA scientific visitors underwent training in mutation breeding techniques at Gamma Green House.

3. ALURTRON

Achievement Data 2019

ALURTRON operates under the ISO 9001: 2015 system.

High voltage was generated for 1112.4 hours with a radiation duration of 833.7 hours.

R&D

Collaborated with UPM and a food manufacturing company in the preliminary study of low temperature decontamination of surimi food products.

4. LENDT

Leading Edge Non-Destructive Testing Technology

Achievement Data 2019

Recognition as an IAEA Collaborating Center for Advanced Non-Destructive Testing (2019 - 2023).

Activity

1. Consultation service ISO17020.
2. IAEA/RCA Training Course on Radiographic Testing RT–D Level 2 for Personnel Certified to Radiographic Testing RT-F Level 2 .
3. *Projek* RCA RAS1022 Strengthening Regional Capacity in Non-Destructive Testing and Examination using Nuclear and Related Technique for Safer, Reliable, More Efficient and Sustainable Industries Including Civil Engineering (2019 – 2022).

R&D

Quantitative Evaluation of Multi-scale Defects via Gradient-field Transient Eddy Current Testing with Uniform Field Excitation (National Natural Science Foundation of China - NSFC).

5. RAS

RadioChemistry & Environmental Laboratory

Achievement Data 2019

1. Certificate/Analysis report issued: 3,283.
2. The number of samples received for analysis: 6,469.
3. RAS customer satisfaction survey: 85.6%.
4. Accreditation of MS ISO / IEC 17025: 2017 on March 4, 2020.

Activity

Provide services measuring radioactivity levels in foodstuff, drinking water and environmental samples.

R&D

1. Level, Trends and Effects of Natural and Anthropogenic Radionuclides in the Malaysian Marine Environment (K41017-RC22192:IAEA CRP).
2. Assessment of Toxic element in Coastal Sediments Around Perai Industrial Area, Penang using Natural Radioisotopes (K41016-RC20884:IAEA CRP).
3. Enhancing Regional Capabilities for Marine Radioactivity Monitoring and Assessment of the Potential Effect of Radioactive Releases from Nuclear Facilities in Asia-Pacific Marine Ecosystems (IAEA/RCA/RAS/7/028).
4. Assessing and Improving Soil and Water Quality to Minimize Land Degradation and and Enhance Crop Productivity using Nuclear Techniques (IAEA/RCA RAS 5084).

6. Isotope Production facilities

Achievement Data 2019

1. Assembly of 330 units of Ir-192 for industrial radiographic use.
2. Performed 6 production runs of Sm-153 (6 x 150mCi). This products is ready-to-use by patients.
3. Successfully obtained GMP certification for the I-131 capsule production facility.

Activity

1. Assembly is carried out on a monthly basis throughout 2019. This is a project collaboration with Edaran Prestasi Sdn. Bhd.
2. The facility was audited in March 2019 by NPRA. Corrective actions are currently being taken based on the audit findings. This is a project collaboration with Radiopharma Sdn. Bhd.

R&D

Production of Sm-153 depends on consumer demand. Project collaboration with the National Cancer Institute (NCI).

7. Biological Dosimetry Laboratory

Achievement Data 2019

Analysing samples from an investigation of a radiological accident in Malaysia.

Activity

1. National laboratory that performs chromosome aberration tests on radiation workers in Malaysia.
2. Assisting the Ministry of Health (MOH) Malaysia in preparing the Radiological and Nuclear Emergency Action Plan for all hospitals and health clinics in Selangor. This plan is subject to 'Focus Area' # 19 of the International Health Regulation (IHR) for the Malaysia Joint External Evaluation (JEE) 2019 Program by the World Health Organization (WHO).

R&D

1. Chromosome Aberration in Interventional Radiology Staff Occupationally Exposed To Low Dose Ionizing Radiation - NMRR-18-230-40243 (IIR).

8. RN-42-CTBTO

Achievement Data 2019

Performed three preventive maintenance (PM) in March, June and September 2019.

Activity

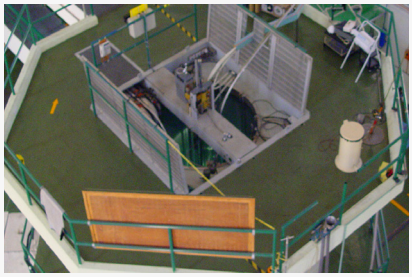
Perfomed routine as well as annual maintenance with specialists appointed by CTBTO to replace detectors, bearings of air sampling equipment (Snow White Air Sampler), and data loggers for the air sampler.

R&D

1. Analysed the annual profile data for Be-7 radionuclide at RN42 station.
2. Knowledge Book (KM) Radionuclide Monitoring Station (RN42) Tanah Rata, Cameron Highlands as the part of the Comprehensive Nuclear-Test-Ban Teaty : Malaysia's Experiences.

9. RTP

PUSPATI
Triga Reactor



Achievement Data 2019

RTP operations were conducted safely for 625 hours in 2019. A total of 2910 samples were irradiated using an average power of 587.34kW.

Activity

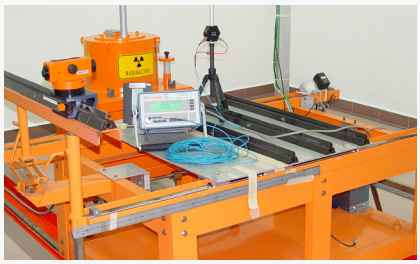
Irradiation activities were carried out using facilities inside and outside of the fuel core.

R&D

1. Irradiation of swiftlet nests, rice and honey samples for research projects related to food tracking and authenticity (NAA).
2. Production of samarium-153 and bromine-82 for R&D use in medicine and industry.
3. Use of neutron beam irradiation facility for material and forensic characterization.

10. SSDL

Standard Sekunder Dosimetry Laboratory



Achievement Data 2019

A total of 3501 calibration certificates were issued and 3600 units of survey meter/dosimeter calibrated. and In addition 196034 units of OSL badges, 16634 units of TLD Badges, 11425 units of TLD rings / chips and 18312 units of high dose dosimeter were issued.

Activity

1. SSDL calibration laboratory conducts calibration of protection level and therapeutic level calibration involving the use of gamma rays, x-rays, beta, neutrons and contaminants (Alpha & beta particles). IEC 17025: 2017 accreditation.
2. Conducted a total of five internal trainings and courses respectively, 23 briefings/discussions, and four internal presentations that also involved external trainees undergoing training at SSDL.
3. Two IAEA Fellows, three PGEC students and two local IPT students have carried out projects and underwent training at SSDL.

R&D

1. OSLD QC Tool Development Project.

2. Exports of irradiated fruits to the US market.

3. Promoting Food Irradiation by Electron Beam and X Ray Technology to Enhance Food Safety, Security and Trade.

11. Medical Physic Laboratory

Achievement Data 2019

1. Quality Control Test (QC)
   - Certificates/reports/stickers issued - 118
   - Number of QC tools - 118 tools

2. Diagnostic Calibration
   - Cerificates/Reports issued - 385
   - Number of test equipment calibrated - 315

3. Radiation Protection
   - Certificates/reports issued - 139
   - Number of LET Test conducted- 138 rooms/sample

4. Nuclear Medical Calibration
   - Certificates/reports issued - 58
   - Number of QC tools - 58

Activity

1. Quality Control (QC)
2. Diagnostic Calibration
3. Radiation Protection
4. Nuclear Medical Calibration

R&D

1. Characterizing the Role of Hypoxia on Radioresistance Mechanism in MDA-MB-231 Breast Cancer Cells Exposed to X-radiation.
2. Determination the Effect of Octreotide as in Human Breast Cancer Therapy in Vitro and in Vvo.
3. Radiation Protection and Safety for Staff in Fluoroscopy: Connection of Heel Effect and Scattered Radiation Profile.
4. Establishment of the Dosimetric Characteristics of Ge-doped Optical Fibre for Use in the High Energy Electron Beams Audit Service for Radiotherapy Centres in Malaysia.
5. Development of Lead Equivalent Thickness Test Procedures in Diagnostic Radiology Using Mobile X-ray Apparatus.
6. Developing Quality Control (QC) Procedures for Computed Radiography (CR) & Direct Radiography (DR) Systems (Extended Scope of Testing for H License Requirements.
7. Establishment of Correction Factor for Nanodot Optically Stimulated Luminescent Dosimeter (OSLD) at Low Energy X-ray and Mammography X-ray Beam Qualities.
8. Determination of Homogeneity Coefficient for Standard Radiation Qualities RQR, RQA and RQT.
9. The Potential of Using Clay Based Radiation Shielding Materials (CBRSM) for X-ray and Gamma rays shielding facilities.

12. MTEG
Materials Technology Group

Achievement Data 2019

Analyzed 500 samples for 85 customers and provided seven expert consultations

Activity

1. Carried out R&D and pre-commercialization activities for NuRust and aluminum alloys for corrosion protection

2. Provided analytical and consulting services to internal and external customers

R&D

1. Harnessing Nuclear Science and Technology for Preservation and Conservation of Cultural Heritage (RAS 1021
2. Radiation Processing of Electrocatalysts for The Enhancement of Catalytic Performance in Renewable Energy Devices (CRP23130)
3. Establishment of National Forensic Library (NFL) and Laboratory Procedure for Detection and Analysis of Gamma Emitting Radiation from Industrial Sealed Radioactive Source (Cesium-137, Cobalt-60 and Am-241) (J02013)

13. CoNE
Centre of Excellence in Nuclear

Achievement Data 2019

A total of 116 courses were held with 2515 participants.

Activity

1. Offered technical training programs in the field of nuclear and related technologies to the industry, public and private sector.
2. A total of 20 courses were conducted under the associated training projects with partner companies.
3. Successfully conducted the 16th PGEC course with 30 local and international participants from 14 countries.
4. Organized scientific attachment programs for 4 international trainees.

14. WasTeC

Radioactive Waste Management Facility

Achievement Data 2019

1. Radioactive waste disposal services were provided to 56 customers consisting of 54 external and two internal customers.

2. The total amount of radioactive material received for disposal were 180 units of sealed radioisotope, 72.48 L of liquid waste and 118.30 kg of solid waste/ A total of 180 units of sealed radioisotope, 72.48 L of liquid waste and 118.30 kg of solid waste were received for disposal.

Activity

1. A total of 56 services were provided by WasTeC, of which 87.5% were successfully implemented within 14 working days.
2. Customers applying for radioactive waste disposal must first obtain permission and approval from the Atomic Energy Licensing Board (AELB) before sending their waste to WasTeC, Nuclear Malaysia.
3. After WasTeC receives the approved application, details of the disposal will be recorded in the National Radioactive Waste Inventory.

R&D

1. Projection and forecast study of radioactive waste inventory for the construction of a permanent National Radioactive Waste Repository.
2. Reviewed upgrading the Low Level Effluent Treatment Plant (LLETP) to improve its effluent treatment capacity
3. Feasibility study for treating thorium effluent using Flocculation-Coagulation process at LLETP.
4. Reviewed upgrading the security and radiation protection control for the interim storage facility and sealed radioactive source area at WasTec

Service Centre

1. ALURTRON

Service Features

Provides electron beam irradiation services for R&D and to commercial users. The facility has two electron beam machines with a high 3.0 MeV (EPS-3000) and low 200 KeV (Curetron) energy. The plant has been certified with a Quality Management System ISO 9001: 2000 since 2003. The center provides electron beam irradiation services to treat finished products and is equipped with an operating system to treat products such as tubes, wires and cables.

Location

BLOCK 43, DENGKIL COMPLEX

2. ACA

Analytical Chemistry Application

Service Features

Provide analytical services to quantitatively and qualitatively identify elements in environmental samples such as water, air, soil, sediment, minerals, flora, fauna and others using nuclear and non-nuclear techniques. . The Lab has expertise in NAA (Neutron Activation Analysis), ICPMS (Inductive Coupled Plasma Mass Spectrometry), ICPMS NAA (Gamma Spectrometry), AAS (Atomic Absorption Spectroscopy, CHNS (Carbon, Hydrogen, Nitrogen, Sulphur Analyzer), and IC (Ion Chromatography).

Location

BLOCK 20, BANGI COMPLEX

3. BRI

Radiosotope Production Laboratory

Service Features

Responsible for the production and manufacture of radioisotopes, radiopharmaceuticals and radiopharmaceutical kits and their distribution across Malaysia for hospitals and other industrial users.

Location

BLOCK 20, BANGI COMPLEX

4. BIOTEST/BIODOSE

Biology Test Laboratory

Service Features

Provide specialist service in microbiological testing for radiopharmaceutical products and medical devices. Advisory/consultancy service on testing are also provided to customers. The biodose laboratory conducts chromosome aberration testing using the dysentric technique. AELB requires employees suspected of having exposure in excess of the annual dose to undergo this test to assess absorbed dose.

Location

BLOCK 24, BANGI COMPLEX

5. KFK

Health Physic Group

Service Features

Provide expert services to industries in the field of radiation safety and health, environmental and industrial radiological monitoring, leakage testing, decontamination, and radiation safety equipment leasing.

Location

BLOCK 19/17, BANGI COMPLEX

6. KMS

Radiation Metrology Group

Service Features

Provide specialist services in as a Secondary Standard Laboratory in diagnostic radiology and nuclear medicine not only in Malaysia but also in the Asian region. Services provided include calibration of testing and monitoring equipment for ionizing radiation used in the field of industrial and diagnostic radiology. The laboratory also offers standards for calibrating nuclear medicine equipment such as dose calibrators, scintillation counters, radioisotope intake counters, well counters and, foot and hand monitors. This laboratory MS ISO / IEC 17025: 2005 accreditation.

Location

BLOCK 32, BANGI COMPLEX

7. NDT

Non-Destructive Technology Centre

Service Features

The NDT Centre provides testing and training services in non-destructive techniques (NDT). This method is used to detect or measure defects of a material or system without damaging the material or system being tested. This technique plays an important role in manufacturing technology, quality control and plant lifespan determination. It is widely used in the manufacturing, petrochemical, and energy industries, as well as in transportation and civil engineering.

Location

BLOCK 29/59, BANGI COMPLEX

8. PAT

Plant Assessment Technology Centre

Service Features

The PAT Service Centre offers measurement and testing services for pipes, tanks, distillation columns and other components used in the oil, gas, and petrochemical industries as well as for water treatment and power plants. This nuclear measurement technique uses nuclear gauges (gamma and neutron) as well as radiotracers to determine pipe leakages, mechanical damage, level of process material or material deposition in tanks. The tracer technique can determine flow rates of materials in pipes as well as material residence time in tanks. In addition, PAT provides computerized tomography scanning services (CT Scan) using gamma and X-rays to produce cross-sectional images of materials and components. Computational Fluid Dynamics (CFD) Simulation Service is also provided to predict the performance of industrial processes.

Location

BLOCK 29/60, BANGI COMPLEX

9.MTEC

Materials Technology Group

Service Features

This Service Centre provides specialist services in the characterization of materials in the laboratory and the field. Basic and applied research is conducted in the field of ceramics, metals, rust, nanomaterials, radiation shielding, radiation damage, electronic materials, nuclear instrumentation and simulation as well as modelling material behaviour.

Location

BLOCK 34, BANGI COMPLEX

10.E-TAG

Environmental Tracer Application Group

Service Features

The Isotope Ratio Mass Spectrometer (IRMS) laboratory is able to measure lightweight stable isotopes of oxygen (18O / 16O) and hydrogen (2H / 1H) for water samples from various sources and to measure almost all major light stable isotopes such as hydrogen, carbon, nitrogen, oxygen and sulphur.

Location

BLOCK 29, BANGI COMPLEX

11.RAS

Radiochemistry and Environment Laboratory

Service Features

This laboratory offers analytical services for determining alpha, beta and gamma emitting radionuclidic content in various sample matrices such as soil, sediment, water, food, fauna and flora. This national laboratory, recognized by the Ministry of Health Malaysia (MOH), conducts radioactive contamination testing in imported food. It provides gross alpha/ beta content analysis in mineral water and bottled drinking water to meet the licensing requirements under the MOH Food Act 1983 before being sold to the public. Apart from that, this laboratory also has the ability to test the efficiency of water filtration system using the radioisotope Sr-90 and Ra-226 as tracers.

The RAS laboratory has its own management and quality assurance system where it has received MS ISO/IEC 17025: 2005 accreditation from the Department of Standards Malaysia since December 2005 for analysing gamma emitting radionuclides. For alpha and beta emitting radionuclides, the RAS laboratory is involved in inter-comparison studies with other laboratories organized by the International Atomic Energy Agency (IAEA) and other competent authorities.

Location

BLOCK 23, BANGI COMPLEX

12.TAB

Agro-Biotech Technology Group

Service Features

This service centre applies nuclear technology in the field of agrotechnology and biosciences by providing among others irradiation services, detection of irradiated foods, production of biodegradable products, as well as consultancy services on tissue culture and bioreactors.

Location

BLOCK 44, DENGKIL COMPLEX

13.SINAGAMA

Gamma Irradiation Plant

Service Features

SINAGAMA is a commercial irradiation facility that offers the following services and research activities:

- Sterilization of medical products and materials for packaging,
- Decontamination of food products, pharmaceuticals, herbs and animal feeds,
- Elimination of pests in food commodities,
- Treatment of quarantined items that is suspected to contain elements that may cause plant disease in this country,
- Tissue and bone sterilization for use by the National Tissue Bank and hospitals,
- Sterilization of agricultural waste materials for alternative uses such as bio fertilizer substrates, mushroom substrates and animal feed.

The plant, which uses cobalt-60 gamma source, is certified ISO 9001: 2008 for quality management, and ISO 13485: 2003 for quality standard. As such, irradiation in SINAGAMA is in accordance with international guidelines. The plant is also registered with the Ministry of Health Malaysia as a Food Irradiation Premise. In 2004, this irradiation plant was upgraded to JS 10000 (IR-219), which can irradiate a variety of products that require different doses at one time

Location

BLOCK 42, DENGKIL COMPLEX

14.RAYMINTEX

Radiation Prevulcanization of Natural Rubber Latex

Servicve Features

RAYMINTEX is a pilot plant that carries out vulcanization of natural latex using gamma rays. The plant was commissioned in March 1996. It is capable of producing 6000 tonnes of vulcanized natural latex using gamma rays a year, if loaded with a radioactive cobalt-60 source of up to 1MCi. The finished product can be supplied to the latex dipped products manufacturing industry for the purpose of promotion, commercialization and technology transfer.

Location

BLOCK 47, DENGKIL COMPLEX

15.WASTEC

Waste Technology Development Centre

Service Features

The national radioactive waste treatment center at Nuclear Malaysia was established in 1985 after the enactment of the Atomic Energy Licensing Act 1984. The main purpose of its establishment is to protect workers, the general public and the environment from the hazards of ionizing radiation through effective and integrated radioactive waste management. The radioactive waste management services offered, meet the requirements set by the Atomic Energy Licensing Act 1984. The center is equipped with various facilities for radioactive waste management services and consultations related to radioactive waste management.

Location

BLOCK 30, BANGI COMPLEX

16.NIR

Non-Ionizing Radiation Laboratory

Service Features

Services provided include non-ionizing radiation safety assessments from telecommunication transmitter structures (Radio Frequencies), high voltage cables (low frequency) and from various sources in manufacturing, broadcasting, consumer and health sectors. In addition, the NIR Group collaborates with several companies in radio frequency (RF) security assessments and to give talks on NIR safety.

Location

BLOCK 13, BANGI COMPLEX

17.SSDL

Secondary Standard Dosimetry Laboratory

Service Features

SSDL has been appointed by the National Metrology Institute of Malaysia (NMIM) a 'designated institute' to serve as the national radiation reference center.

The Lab performs calibration of radiation measurement equipment used in radiation safety/ protection, radiotherapy and diagnostic radiology. It is also a personal and area dosimetry provider to 70% of users in Malaysia and Brunei Darussalam. The types of dosimeters used are OSLD and TLD.

Additionally, SSDL provides calibration services and supply of high-dose Fricke and Ceric Cerous dosimeter to the radiation processing industry in Malaysia and radiation milling dose mapping services.

The Secondary Standard Dosimetry Laboratory (SSDL) meets the requirements of Act 304 (Atomic Energy Licensing Act 1984 and Act 675 (National Measurement Systems Act 2007).

SSDL has been a member of the 'International Atomic Energy Agency (IAEA) / World Health Organization (WHO) Network of Secondary Standard Dosimetry Laboratories' since 1981 and is a member of the Asia Pacific Metrology Program (APMP) since 2005.

Location

BLOCK 19/32, BANGI COMPLEX

18. PDC

Plant and Prototype Development Centre

Service Features

This service center is a reference point for the development of radiation / nuclear facilities. Among the services offered:

- Prototype development.
- Development of pilot plant, pilot facility and pilot system.
- Mechanical engineering design and engineering drawing services.
- Metal, plastic and glass fabrication services.
- Mechanical engineering consultation.
- Installation, testing & commissioning of special components, prototypes, systems and facilities.
- Radiation equipment removal service (X-rays and gamma).

Location

BLOCK 19/32, BANGI COMPLEX

19. PIA

Automation and Instrumentation Centre

Service Features

Provide preventive maintenance services and repair of nuclear and scientific equipment, as well as perform calibration for nuclear equipment such as X-Ray machines and so on. Involved directly in conducting leak tests and providing radiation consultancy service.

Location

BLOCK 37, BANGI COMPLEX

20. CoNE

Centre of Nuclear Excellence

The centre implements training programs related to nuclear and related technologies to enhance required skills, promotes greater safety awareness and creates an efficient workforce in playing a greater role in the national development agenda. It offers programs in the following sectors:

- Safety and radiation health
- Environmental safety and health
- Medical X-rays
- Non-Destructive Testing (NDT)
- Instrumentation and engineering
- Technology management

They are more than 100 training products with as many as 2500 participants/trainees per year.

Location

BLOCK 57, DENGKIL COMPLEX

21. MTS

Radiation Technology Laboratory

Service Features

Laboratory for testing and processing polymeric materials. The center has sophisticated processing and testing equipment. The laboratory is staffed with experts who are skilled in equipment use and data analysis.

Location

BLOCK 42, DENGKIL COMPLEX

Certifications and Accreditations

Nuklear Malaysia has long practiced the 'quality culture', especially when it comes to improving its service quality. The first International Standard Organization (ISO) certification in Nuklear Malaysia was obtained in 1991 for the Quality Management System at SINAGAMA.

Other accreditations followed which include ISO 9001, ISO 13485, ISO 27001, ISO 22301, ISO / IEC 17025 and ISO / IEC 17020. To date, Nuklear Malaysia has obtained and maintained 12 ISO certifications and accreditation for the various service centres in Nuklear Malaysia. Recently, the Non-ionizing Radiation Group from the Radiation Safety and Health Division (BKS) successfully obtained ISO / IEC 17020: 2012 accreditation.

Nuklear Malaysia is one of the earliest government agencies to receive the ISO 22301:2012 accreditation for Business Continuity Management System (BCMS)

Year 2019
12 Certifications and Accreditations

1.	ISO 9001:2015	SINAGAMA
2.	ISO 13485: 2016	SINAGAMA
3.	ISO 9001:2015	ALURTRON
4.	ISO 9001:2015	RAYMINTEX
5.	ISO 9001:2015	Technology Development Centre (WasTeC)
6.	ISO 9001:2015	Centre of Nuclear Excellence (CONE)
7.	ISO/IEC 17025:2017	Radiochemistry and Environment Laboratory (RAS)
8.	ISO/IEC 17025:2017	Secondary Standard Dosimetry Laboratory (SSDL)
9.	ISO/IEC 17025:2017	Medical Physic Laboratory (KFP)
10.	ISO/IEC 27001:2013	IT Centre
11.	ISO 22301:2012	Nuklear Malaysia
12.	ISO/IEC 17020: 2012	Non-Ionizing Radiation Group

Ion Radiation with **Plasma Focus Devices**

Plasma focus is a pulsating plasma accelerator that uses high electric currents to heat and compress gas to reach high temperatures (10 million Kelvin), density and pressure (thousands of atm). Under such extreme conditions, the gas will emit ultraviolet light, X-rays, electrons and ion beams. If the gas used is deuterium, the compressed plasma will trigger a nuclear fusion process and will produce neutrons, but when argon gas is used, X-rays will be produced. This indicates the devices' versatility and suitability for use in radiography, material modification, nanotechnology and other applications. This device does not require high cost to build and maintain. It is easy to operate because of its simplicity, small size and portability

An ionizing irradiation facility with a plasma focus device for irradiation of samples for material science study has been successfully established, based on the design and fabrication developed at Nuclear Malaysia. This success enables the upgrade of the existing electron accelerators from 140keV to 250keV for surface treatment applications, and education and training in the field of particle physics and electron accelerators.

An ionizing irradiation facility with a **plasma focus device** for irradiation of samples for material science study has been successfully developed at Nuclear Malaysia.

HEAVY DENSITY HOTCELL

A Mobile Hot cell (MHC) is a mobile facility used for nuclear material handling activities that ensures the safety of the personnel involves in the handling of any radioactive materials. It is a radioactive shielded facility with controlled air containment to prevent exposure and contamination of radioactive substances. To ensure that no personnel are put at risk,, the facility is equipped with remote manipulators for handling and shielded windows for viewing and monitoring.

The first Heavy Density Hotcell in Malaysia was developed by experts from Nuklear Malaysia using the allocation from MESTECC's Thorium Flagship at a cost of RM2.02 million. This facility is capable of handling unsealed radioactive materials/source with activity up to 7400 GBq Cobalt -60.

Some of the features of the Heavy Density Hotcell include:

1.	Dimensions: 4.4 meters (L) x 3.9 meters (W) x 3.825 meters (H)
2.	Semi-permanent alpha-gamma shielding
3.	Walls: High density concrete with a thickness of 1 meter with interlocking design
4.	Door: 200mm thick lead and Boronated HDPE 50mm thick
5	5Window: Zinc Bromide solution, $ZnBr^2$ transparent nuclear optical grade
6.	Mechanical remote control system
7.	Inspection of spent fuel
8.	Fuel fabrication
9.	Post-irradiation examination

The first **Heavy Density Hotcell** in Malaysia
was developed by experts from **Nuklear Malaysia**

TRIGA PUSPATI REACTOR

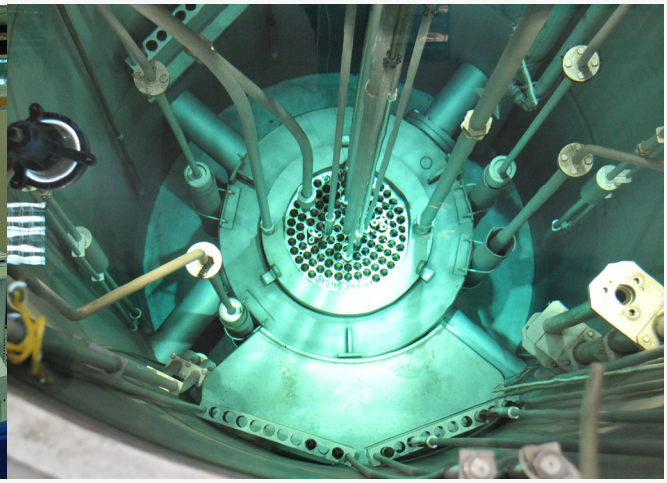
In 2019, various activities were carried out at the PUSPATI Triga Reactor (RTP), such as research and development, sample irradiation, human capacity building, facility maintenance and licensing.

The RTP was safely operated and has successfully produced 300GBq of Samarium-153 radioisotope for medical use. In addition, 3000 environmental samples which include minerals, soil sediments, and bird's nests were analysed using neutron activation.

As a result of research conducted at RTP and expertise available, the nuclear fuel grid arrangement and Fuel Transfer Cask (FTC) was successfully designed to safely transfer spent nuclear fuel from the RTP core to the spent nuclear fuel pool. In addition, design of the nuclear spent fuel pool that was developed by the Reactor Technology Center was based on their capability and experience operating a nuclear research reactor for 38 years. The design has taken into account the safety aspects of nuclear fuel as well as the radiological impact to the environment and the public.

Reactor maintenance is done twice a year to meet the requirements for licensing issued by AELB. In 2019, annual maintenance was performed on 20 January - 24 February and 3 - 14 July.

As a major facility at Nuklear Malaysia, RTP regularly receives trainees and visitors. A total of 400 IPTA/IPTS students have been trained in reactor technology. In addition, 5121 visitors from various government agencies, private companies, universities, as well as course participants and international visitors visited this facility in 2019.



Nuclear fuel grid design and **Fuel Transfer Cask (FTC)** to lift and move the nuclear-spent fuel from RTP core to spent fuel pool is an invention from nuclear Malaysia's researcher

The **Reaktor TRIGA PUSPATI** has successfully produced **300GBq** of **Samarium-153** radioisotope for medical use

Nuclear Spent Fuel Pool Storage

The safety design for nuclear spent fuel pool stirage was developed by Reactor Technology Centre based on their capabiloty and experienced in managing nuclear recearch reactor for **38 years**

ACHIEVEMENTS IN INNOVATION & RECOGNITION OF EXPERTISE

In realizing the potential of science and technology, Nuklear Malaysia leverages existing skills and expertise to disseminate research findings nationally and internationally. In this respect, Nuklear Malaysia has won 12 awards at national and international level innovation competitions:

1. Malaysia Technology Expo (MTE 2019)

No.	Participants	Project Title	Medal
1.	1. Dr. Ng Yen 2. Wan Hamirul Bahrin bin Wan Kamal 3. Manisah binti Saedon 4. Kong Khei Chong	Innovative Methods for Rapid Production of Gallium-68 Radiopharmaceuticals for Cancer Imaging	**GOLD**
2.	1. Azuhar bin Ripin 2. Mohd Khalid bin Matori 3. Harziera binti Halid	Smart Radiation Shielding Materials (Mullite-Barite Ceramics (MBC) Derived from Malaysian Kaolin	**SILVER**
3.	1. Khaironie binti Mohamed Takip 2. Wilfred @ Sylvester Paulus 3. Dr. Roshasnorlyza binti Hazan 4. Jacqueline Kones 5. Norhazirah binti Azhar 6. Nur Aqilah binti Sapiee	TRINAF: Gardening Aids from Mineral (Xenotime) Digestion Process	**BRONZE**
4.	1. Azhani binti Mohd Razali 2. Dr. Nazrul Hizam bin Yusoff 3. Roslan bin Yahya 4. Lahasen @ Norman Shah bin Dahing 5. Engku Mohd Fahmi bin Engku Chik 6. Airwan Affandi bin Mahmood 7. Nurliyana binti Abdullah 8. Mahadi bin Mustapha	Flex-Si: An Innovative Scanner for Industrial Pipe Inspection	**BRONZE**

2. International Invention, Innovation & Technology Exhibition (ITEX 2019)

No.	Participants	Project Title	Medal
1.	Dr. Zainon binti Othman	Geographical Origin of Malaysian Agroproducts using Isotopic and Elemental FingerprintT	**SILVER**
2.	Dr. Mazleha binti Maskin	COMPASS-M: Development of Probabilistic Safety Assessment for Plant Safety and Reliability	**GOLD**
3.	Dr. Noraishah binti Othman	LOW-COST CORE FLOOD RIG: Radiotracer Technology (LCCF-RT)	**SILVER**
4.	Dr. Julia binti Abdul Karim	TRIMON – An Integration of Deterministic-Monte Carlo Code for TRIGA Core Management	**SILVER**

3. Ekspo Penyelidikan, Pembangunan dan Inovasi Negeri Selangor 2019

No.	Participants	Project Title	Achievements
1.	Dr. Mek Zah binti Salleh	Development and the potential application of palm acrylate	5th place Life science cluster Industry Category
2.	Dr. Norasalwa binti Zakaria	Underwater Gamma Scanner for In-Pool Fuel Characterization	8th place Machines & Equipment Clusters Industry Category
3.	Dr. Ng Yen	Advanced Kit-based Production Methods for Preparation of Radiopharmaceuticals Used in Cancer Imaging and Therapy	Certificate of participation
4.	En. Mohd Faizal bin Abd Rahman	RIVERPROTEC : Mangrove Forest Ecosystem Preservation Via Advance Biocomposite Product Development	1st place received R&D grant of RM 50,000.00 Life Science cluster Industry category
5.	Dr. Shaiful Azuar bin Mohamad	Nuclear Technology in Agriculture	3rd place Life science cluster Industry category

4. UPNM: Defence, Security and Sustainability Exhibition (DSS 2019)

No.	Participants	Project Title	Medal
1.	1. Dr. Amy Hamijah binti Ab Hamid 2. Siti Hawa binti Mat Zain	*Sistem Simulasi Tindak Balas Insiden Radiologikal Malaysia*	**EMAS**
2.	1. Muhammad Hazim bin Muhammad Sayuti 2. Siti Salwa binti Mohammad Shirajuddin	Development of Economic Source via Reinforcement of Riverbank using Riverprotec	**EMAS**
3.	1. Mohd Hamzah bin Harun 2. Khairul Azhar bin Abdul Halim	Radiation Curing Materials for Bullet Proof Vest Application	**GANGSA**
4.	1. Azhani binti Mohd Rozali 2. Dr. Nazrul Hizam bin Yusoff 3. Mohamad Rabaie bin Shari 4. Nurliyana binti Abdullah	'Flexi-Si' dan Computed Tomography for Safety Inspection	**GANGSA**
5.	1. Faisal Izwan bin Abdul Rashid 2. Muhammed Zulfakar bin Zolkaffly	Malaysia's Experience in implementing the Comprehensive Nuclear-Test-Ban Treaty (CTBT) in supporting global effort to curb proliferation of nuclear weapons and advancing nuclear disarmament	***MERIT***

MBOT Recognition

Malaysia Board of Technologists (MBOT) is a professional body responsible for recognizing Professional Technologists and Certified Technicians. This initiative is a strategy to elevate the technical field through recognition of technologists and technicians as professionals in line with the recommendations of the Tenth Malaysia Plan (RMK-10).

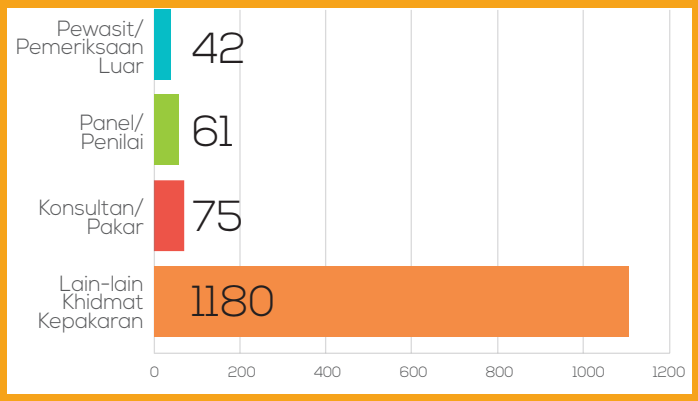
12 Staff
Professional Technologist (PT)

19 Staff
Graduate Technologist (GT)

Expert Services

A total of 1358 nuclear technology-related expert service involving 212 Research Officers has been rendered. Among the services provided are as advisers/radiation consultants, panellists/ assessors, external auditors/examiners and others.

212
Research Officers has been rendered as nuclear technology-related expert



Industrial Training

A total of **176 students** from **23** public and private institutions of higher learning have undergone industrial training and **37** postgraduate students have conducted research at Nuklear Malaysia.

Research Conducted by Study Programme

19
Bachelors

5
Masters

8
PhD

MESTECC Apprenticeship Programme 2019

Mentoring programs are one of the initiatives to provide professional guidance, support and assistance by mentors (trained, skilled and ethical) for the personal development of mentees (officers in need of guidance). This program is initiated with the aim of enhancing the competence of officers in performing their duties in accordance with the Public Service Circular No. 18 of 2005: Application of Psychology in Public Sector Human Resource Management.

Mentoring is an in-service training program that uses the concept of sharing tacit knowledge, skills and experiences between old and new employees/senior and junior staff. The objectives of the mentoring program implemented by MESTECC are to:

- guide officers in improving their careers and psychosocial performance;
- mprove their professional, cultural, personal and social skills;
- building good character among members of the organization;
- cultivate first-class and high performance work culture in the organization;
- inculcate continuous learning habits, and
- enhancing the image and reputation of officers and the organization.

The Best Mentor and Mentee Award 2018-2019 was conferred to the Senior Director of Management Program, Dr. Chantara Thevy Ratnam and Research Officer Grade Q44, Mrs. Nor Azilah Fatimah binti Othman respectively. While, the Deputy Director General, PP&T Program, Dr. Abdul Muin bin Abdul Rahman, was named as the best mentor at the Ministry level. The selection of the award winners was evaluated by officials from the Public Service Department (JPA) during presentation by officers at the MESTECC Best Mentor and Mentee Selection Workshop on 20 June 2019, MESTECC Assembly Hall.

The Best Mentor
MESTECC 2019 Apprenticeship Programme 2019

Dr Abdul Muin bin Abdul Rahman
Deputy Director General
Research and Technology Development Programme,
Malaysian Nuclear Agency

INTERNATIONAL ACHIEVEMENT

Nuklear Malaysia is always committed to support MESTECC's 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 as the International Atomic Energy Agency (IAEA) and Forum for Nuclear Cooperation in Asia (FNCA). Based on its expertise and infrastructure, Nuklear Malaysia has always been the host of choice for organizing meetings, workshops and training courses involving international participants. Since 2011, Nuklear Malaysia has been entrusted by the IAEA to organize the Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources (PGEC). This course is organized annually to build capacity in radiation protection and safety which involves participation of trainees from countries in the region. In addition, Nuklear Malaysia has also received IAEA recognition as IAEA Collaborating Centers (ICC) in Radiation Processing of Polymers, Waste Polymers and Biocomposites, Advanced Non-Destructive Testing and Plant Mutation Breeding Using Chronic Gamma Irradiation. The ICC serves as the IAEA's strategic partner in implementing its cooperation program to drive research, development and training in nuclear science and technology for peaceful purposes.

IAEA

1) Involvement and implementation of the Cooperation Project

Involvement / Organization / Recognition	Details	Activities
National Projects	No. of Project: 6	• Participation in fellowship courses and scientific visits
Regional Projects – Non-Agreements	No. of Project: 21	• Acceptance of expert missions and equipment
Regional Project - RCA	No. of Project: 14	• Participation in courses and meetings at the Asia Pacific regional level
Inter-Regional Projects	No. of Project: 7	• Participation in inter-regional courses and meetings
Coordinated Research Projects (CRP)	No. of Project : 18	• Participation in meetings

2) Organization / Participation in International Activities

Participation in International Activities (Main):

1. 41st Meeting of National RCA Representatives, 26-29 Mac 2019, Colombo, Sri Lanka
2. 48th RCA General Conference Meeting, 13 September 2019, Vienna, Austria
3. 6th Meeting of the Working Group on RCA MTS Coordination, 29 Julai- 1 Ogos 2019, Seoul, Korea
4. 63rd IAEA General Conference, 16-20 September 2019

Organization of International Activites:

1. First Project Coordination Meeting for IAEA Regional Project RAS1023: Developing and Upscaling of Radiation Grafted Materials for Water Treatment, Putrajaya, 18-22 Februari 2019
2. IAEA/RCA Regional Workshop on Implementations of Quality Management Systems, Pulau Pinang, 29 April hingga 3 Mei 2019
3. Regional Workshop On Disseminating Technologies Packages On Improved Varieties As Well As Nutrient And Water Saving Technologies Kuantan, Pahang, 29 April hingga 3 Mei 2019
4. IAEA/RCA Regional Training Course on RT-D Level 2 for Personnel Already Certified to RT-F Level 2, Bangi, Selangor, 10 hingga 21 Jun 2019

1. Regional Workshop On Disseminating Technologies Packages On Improved Varieties As Well As Nutrient And Water Saving Technologies Kuantan, Pahang, 29 April - 3 May 2019
2. IAEA/RCA Regional Training Course on RT-D Level 2 for Personnel Already Certified to RT-F Level 2, Bangi, Selangor, 10 - 21 June 2019
3. Regional Training Course for Teachers to Introduce Nuclear Sciences in Secondary Schools through Innovative Approaches, Kuala Lumpur, 1-12 July 2019
4. 16th Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources (PGEC16), 17 June – 13 December 2019, Selangor
5. Interregional Training Course on Advanced Methodologies for Orphan Source Search and Recovery, Bangi, 1-5 July 2019

Fellowship and Scientific Visits

1. Nineteen (19) trainees from countries including Sri Lanka, Nepal, Nicaragua, Uganda and Mali participated in the fellowship program under the supervision of Nuklear Malaysia research officers

2) International Recognition

1. IAEA Collaborating Centre (ICC)	Nuklear Malaysia received recognition as an ICC on 16 September 2020 in the field of: 1. Gamma Green House Facility 2. Advance Non-Destructive Testing Facility 3. Radiation Processing of Polymers Facility

FNCA

1) Project Involvement

No. of Project : 7

2) Organisation/participation in International Activities

Participation in International Activities:
1. 20th FNCA Coordinators Meeting 6 Mac 2019, Tokyo, Japan
2. 20th FNCA Senior Officer Meeting (SOM), 19 Julai 2019, Tokyo, Japan
3. 20th FNCA Ministerial Level Meeting, 6 Disember 2019, Tokyo, Japan

Organization of International Activities:
1. FNCA Mutation Breeding Workshop, Kuala Lumpur, 2 hingga 6 September 2019

CTBT

1) Participation in Project/Activities

1. National Data Centre Preparedness Exercise 2019

2) Participation in International Activities

1. 52nd CTBTO Working Group B, 25 March - 5 April 2019, Austria
2. 53rd CTBTO Working Group B, 26 August - 6 Sept 2019, Austria
3. CTBTO Infrasound Technology Workshop 2019, 10 – 14 November 2019, Jordan
4. Technical Training for Radionuclide Station Operators with ORTEC Equipment, 5-7 November 2019, USA

Regional Training Course for Teachers to Introduce Nuclear Science in Secondary Schools through Innovative Approach

Developments in the world of education has allowed the merging of technologies. To take advantage of this opportunity, the International Atomic Energy Agency (IAEA) in collaboration with Nuklear Malaysia held a Regional Training Course Workshop for Teachers to Introduce 'Nuclear Knowledge to Secondary Schools through Innovative Approach' from 1 to 12 July 2019. The 2-week course is targeted at secondary school science teachers with the aim of training them in nuclear science and innovative teaching methods.

This special program was created specifically to accommodate the ever-changing paradigm in the teaching of nuclear science among teachers. In addition, it has also provided a platform for teachers to share best practices in formulating nuclear science teaching strategies to their students. The IAEA is targeting 1 million students from countries in the region to benefit from this initiative by 2021.

NUKLEAR MALAYSIA AIDS IN CRISIS

Nuclear Technology Application for Environmental Sustainability

Nuklear Malaysia helps Department of Environmental (DOE) to identify and characterize contaminants in the form of solids, liquids and gases as well as detecting "fingerprints" of waste from selected factories related to the pollution case at the Pasir Gudang industrial area. Data given helps DOE to identify pollution source.

Development of Predictive Tools and Integrated Monitoring Protocols Using "Isotope Fingerprinting"

and Geophysical Techniques in Evaluating Hydrogeological Characteristics In Natural Risk Sites for Landslides

The integrated isotope and geophysical methods developed helped to detect and monitor the cause of building fractures and soil movement at SMK Batu 6, Bentong, Pahang. The results of geophysical techniques showed different hydrological systems, while isotopic techniques exhibited no relationship between groundwater and tap water. Thus, it was concluded that the deposition of soil in the school is not caused by leakage of water pipes but from the action of groundwater with contribution from rainwater or natural groundwater.

The Search for Pahang Royalty Lost Tombs

The request to find old tombs of the Pahang royalty in Teluk Cempedak, Kuantan, Pahang was made by the office of His Majesty the Sultan of Pahang on 18 June 2019 to Nuklear Malaysia through the Ministry of Defense Malaysia (MINDEF). Using Nuklear Malaysia's expertise in the field of geophysics, the Groundbreaker Radar (GPR) was deployed to find the tombs. Nuklear Malaysia has developed this expertise since 2003. This device is able to detect objects that are as deep as five meters underground accurately without perturbing the area. The results of the search found 33 tombs in good order.

Nuclear Technology Application for Determine of the Inscribed Stone's Provenance

A study was conducted to determine the origin of a inscribe stone in Terengganu using Neutron-Induced Prompt Gamma-Ray Techniques (Neutron-Induced Prompt Gamma-Ray Techniques). The advantages of this technique are that it can be done in-situ, employs contactless measurements and is safe. A study of the elemental composition of the stone revealed that it is made up of "dolerite" rock that originates around Hulu Sungai Lawit and Panchor, Kenyir Dam, Terengganu.

Measurement of Fine and Coarse Particles Elemental Determination in Airborne Dust

The content determination of fine particles (PM2.5), coarse particles (PM2.5-10) and components in airborne dust at the National Museum, Kuala Lumpur and Lukut Museum, Negeri Sembilan. This study aims to assist the Museums to produce standards/guidelines related to the control of airborne dust for the preservation of museum artefacts.

Detection of Underground Pipe Leaking District Cooling System TNB Bangsar

Locating underground leaks from the district cooling system owned by Tenaga Nasional Berhad (TNB) in Bangsar, Kuala Lumpur using radiotracer technology (RT). With the aid of this technique, problems which could not be solved prior to the use of conventional methods can now be solved.

HUMANISING NUCLEAR TECHNOLOGY

Nuklear Malaysia engages in promotional activities and disseminates information to continually raise public awareness of nuclear S&T. This activity is part of the Science, Technology and Innovation Cultivation Program (STI) via the National Innovation Movement Program (GIN). In addition, Nuklear Malaysia also receives international visitors from various agencies and educational institutions. Activities performed include:

National Science Week

Nuklear Malaysia has been appointed by MESTECC to lead the National Science Week (MSN) 2019 at the state level in Negeri Sembilan. Throughout the event, numerous public outreach activities and scientific exhibitions took place. In addition, science fairs/exhibits were also organised at the invitation of schools throughout Malaysia.

One of the initiative to organize National Science Week was to bring together interactive activities in science, technology, engineering and mathematics (STEM) under one roof at the Mini Science Technology & Discovery Centre, AEON Mall Nilai, Negeri Sembilan.

This programme took place from 1 to 7 August and was officiated by the Negeri Sembilan Chief Minister, YAB Dato' Seri Haji Aminuddin bin Harun.

ESTECC Education in Schools

Nuklear Malaysia is taking part in the ESTECC Education in Schools Program. The programme uses existing modules for secondary schools and develops special modules for primary schools. Completion of the program has provided exposure and stimulate student interest in science, technology, engineering and mathematics (STEM). It offers a unique opportunity for students to take inspiration from activities conducted through the sharing of research, knowledge and experience to cultivate their interest in choosing the science field as a career in the future. Approximately 51,836 students participated in various activities such as exhibits, workshops, lectures, tours, etc. benefitted from that programme. This sharing of knowledge also allows science teachers to learn about the latest scientific developments.

Nuclear BFF

This programme for students with disabilities (OKU). The learning module was developed and implemented by experts from Nuklear Malaysia. A total of 842 OKU students from 16 schools in Negeri Sembilan and Pahang participated in this activity.

Nuklear Malaysia Visitors

Nuklear Malaysia received around 19,040 visitors from various groups, including students from institutions of higher learning (national and international) as well as 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.

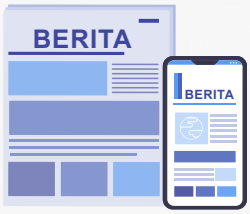
A visit to Nuklear Malaysia not only gives visitors the opportunity to interact directly with research officers, but also to familiarize themselves the facilities and products of nuclear technology innovation.

NUKLEAR MALAYSIA @ MEDIA

Nuklear Malaysia achievements on social media and printed media :

Media Coverage

44
Newspaper Coverage



8
Radio Broadcasting

19
TV Broadcasting

556
Facebook & Instagramme Uploading

KARISMA

Nurul Husna Mahmud
nurul_husna@hmetro.com.my

'JODOH' BERSAMA TENAGA ATOM

Dr Siti Aiasah kendali fasiliti, teknologi nuklear selama 20 tahun

Mendengar saja radiasi atau nuklear, pada kebanyakan orang kedua-duanya cukup menggerunkan, namun bagi Presiden Women In Nuclear Malaysia (WiN) Dr Siti Aiasah Hashim itu adalah dunianya.

Keterujaan beliau untuk mengenali dunia radiasi sudah terbit sejak zaman sekolah lagi dan mengakui ia bermula dengan perdebatan bersama rakan sekelasnya ketika itu.

Bekas pelajar cemerlang Sekolah Tun Fatimah Johor itu berkata, tidak sangka 'jodohnya' bersama tenaga atom itu cukup kuat menerusi pertemuan kembali dengan senior yang ketika itu berkhidmat bersama Agensi Nuklear Malaysia.

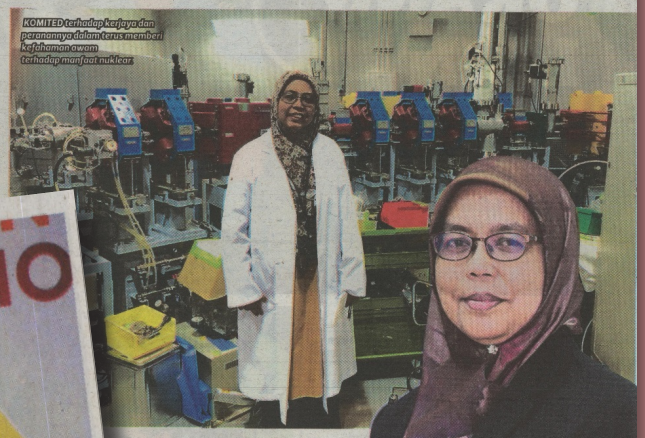
"Sebenarnya ad-

berhampiran dengan kediaman memudahkan menguruskan urusan harian.

"Tidak lama kemudian sekitar tahun 1992, waktu itu Malaysia baru saja menerima hadiah berupa sebuah mesin alur elektron melalui kerjasama dengan Japan International Cooperation Agency (JICA). Itu adalah titik permulaan penggunaan teknologi penyinaran alur electron bertenaga tinggi.

"Jadi ketika itu Agensi Nuklear Malaysia memang mencari jurutera dan saya cuba nasib sehinggalah diterima kerana tiada calon lelaki datang ketika itu.

"Dulu, peluang untuk perempuan terutama dalam bidang kejuruteraan agak terhad. Wanita perlu bergelut dengan persepsi masyarakat bahawa industri berat bukanlah lapangan wajar untuk kami.



KOMITED terhadap kerjaya dan peranannya dalam terus memberi kefahaman awam terhadap manfaat nuklear

"Saya juga mempunyai hubungan baik dengan jurutera dan penyelidik dari negara terbabit dalam bidang akselerator seperti Jepun, Russia, Australia dan banyak lagi.

"Satu lagi pengalaman menarik ketika mula berkhidmat sebagai jurutera fasiliti, saya ketika itu baru sebulan

anak dan perlu

Abang Johari, flanked by Abd Wahab (left) and Zulkifli, launches the Radiation Protection Conferenc

Renewable energ the way forwar for M'sia — Ab

Rintos Mail

KUCHING: Malaysia has to relook its energy policy if the country is to achieve a 'Clean Malaysia' status, says Chief Minister Datuk Patinggi Abang Johari Tun Openg.

He said the country cannot be too dependent on fossil fuels, which are fast depleting and have great impact on the environment, adding he believed renewable energy was the way forward due to its minimal impact on the environment and carbon emission.

"That is why in Sarawak, we are giving strong emphasis on renewable energy, having built our dams to produce hydro power. Currently, we have three fully-operational hydroelectric dams, which are Batang Ai, Bakun and Murum while the Baleh Dam is coming up.

"These four dams have the potential to generate a tota of about 22,000 megawat of electricity," he said at t opening of Radiation Protect Conference and Workshop, yesterday.

He said aside from gener electric power, water from

Nuklear Malaysia kaji 5G akhir tahun ini

Kuala Lumpur: Agensi Nuklear Malaysia (Nuklear Malaysia) akan menjalankan kajian terperinci dan penilaian keselamatan terhadap penggunaan teknologi mudah alih generasi kelima atau 5G selewat-lewatnya akhir tahun ini.

Ketua Pengarah Nuklear Malaysia Dr Mohd Abd Wahab Yusof berkata, penilaian dan kajian itu akan dijalankan bersama dengan Kementerian Kesihatan (KKM) serta pihak berkaitan.

Katanya, penggunaan teknologi 5G secara umumnya memberi banyak manfaat kepada masyarakat namun tidak boleh menolak kebimbangan orang ramai terhadap isu kesela-

matan dan kesihatan.

"Ketika ini, kajian terperinci berkaitan penggunaan 5G belum dilakukan dengan meluas di negara luar kerana ia adalah teknologi yang baharu saja diperkenalkan.

"Justeru, kita akan melakukan kajian terperinci dan penilaian keselamatan' bagi memastikan masyarakat di negara mendapat maklumat yang sahih sekali gus dapat menerima teknologi terbaru itu dengan lebih terbuka," katanya.

Beliau berkata media selepas merasmikan Persidangan Antarabangsa Sinaran Tidak Mengion (ICNIR 2019) anjuran Persatuan Pelindungan Sinaran Malaysia (MARPA) di ibu negara, semalam.

Penggunaan teknologi 5G beri banyak manfaat kepada masyarakat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WELFARE, SPORTS AND RECREATIONAL

Annual Shooting Exercise

Nuklear Malaysia Closed Run Race

National Day Archery Competition

Nuklear Malaysia Dragon Boat Team

Nuklear Malaysia Sports and Welfare and Club Dinner

Aerobics and Gotong Royong in conjuction with World Environmental Health Day

Royal Belum Expedition

Anak Angkat Ramadan: Jom Beli Baju Raya

Hike For Health Gunung Datuk Rembau

Glam Raya Nuklear Malaysia