

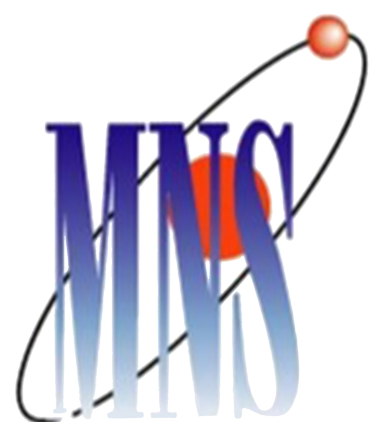
• INTERNATIONAL •

NUCLEAR SCIENCE, TECHNOLOGY & ENGINEERING CONFERENCE

{ 2023 }

UNITEN | OCT 10-12

ORGANIZED BY:



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iNUSTEC2023 PROGRAMME BOOK

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A MESSAGE FROM VICE-CHANCELLOR, UNIVERSITI TENAGA NASIONAL (UNITEN)



UNITEN is honored to host the International Nuclear Science, Technology, and Engineering Conference 2023 (iNUSTEC2023) and the Nuclear Youth Competition (NYC). With the theme “Nuclear Science and Technology for Sustainable Development Goals”, iNuSTEC2023 is the thirteenth in a series of conferences hosted by the Malaysian Nuclear Society (MNS) since 2010 through collaboration with research institutes and local universities.

Don't we feel like time has passed by so quickly? And with it, came along significant and some were unthinkable changes to our lives. According to Our World in Data statistics, in 2022, each of us consumed on average 3.5 times more energy compared to 40 years ago.

In the year 2050, Malaysia is expected to consume almost twice the amount of electricity in 2022 (320 TWh vs. 180 TWh). This means that on a daily basis in 2050, Malaysia is expected to consume close to 0.9 TWh of electricity per day.

About 50 million electric vehicles are expected to be on the road in 2050. Every day, about 0.6 TWh of electricity is needed to charge these cars. That is an additional two-thirds of the expected daily electricity consumption per person in 2050.

Malaysia has identified the pathways for Responsible Transition 2050 in the National Energy Transition Roadmap (NETR) to tackle the energy trilemma of affordability, security, and sustainability. These pathways include having 0% coal share and 70% renewable energy share of installed capacity in 2050.

70% of renewable energy share is about 57 GW of solar PV, which will take a total land size that is slightly smaller than Melaka state. The same amount of power can be generated by nuclear power on a total land size that is 10 times smaller. That is not even considering the intermittency of power generation with solar PV.

At UNITEN, we believe that research and knowledge in nuclear power can play a huge role in supporting the Low Carbon Nation Aspiration and the Responsible Transition, especially in providing affordable, clean and safe energy supply to the Rakyat. Institute of Nuclear Energy (INE) at UNITEN was established in May this year to further empower and accelerate the existing research and educational efforts done at UNITEN since 2010.

At the university level, UNITEN has established the National Energy Centre (NEC) to support the national energy transition efforts. NEC will serve as a hub for research institutes, industrial and international linkages, and government agencies to form collaborations with experts from local and foreign universities, energy agencies, and stakeholders.

UNITEN envisions that NEC will play a significant role in providing technological solutions for Malaysia's energy transition which will be beneficial to Malaysia, as well as the surrounding region. NEC will also play the role of capacity building for the country's future workforce that will lead Malaysia towards net-zero in 2050. I extend my warmest invitation to every participant attending this conference, to be a part of this concerted nationwide effort in championing sustainability through involvement with the NEC.

I would like to remind participants, that you are among the very small percentage of Malaysia's population, who are experts in the nuclear field. Thank you so much for your contributions to keeping the knowledge related to nuclear science and engineering alive, despite how hard or negative it can get in the industry.

Congratulations to the organizing committee for hosting this iNuSTEC2023 together with the Nuclear Youth Competition (NYC2023). My deepest appreciation goes to our keynote speakers, technical co-sponsors, and all supporters for their contribution to ensuring the success of this conference. To the presenters and participants, thank you for your participation and I wish the conference all success.

PROFESSOR IR. DR. NOOR AZUAN ABU OSMAN
Vice-Chancellor
Universiti Tenaga Nasional

MESSAGE FROM PRESIDENT, MALAYSIAN NUCLEAR SOCIETY (MNS)



On behalf of the Malaysian Nuclear Society (MNS), I am pleased to welcome all presenters and participants to the International Nuclear Science, Technology, and Engineering Conference 2023 (iNuSTEC2023). MNS is indeed honoured to co-organize this conference with Universiti Tenaga Nasional Institute of Nuclear Energy, and with organizations such as Nuklear Malaysia, UTM, UiTM, UKM, UNITEN, UM, USIM, and UTHM, with the support from American Nuclear Society (ANS) and Malaysian Welding and Joining Society (MWJS). This brought to the front MNS's aspiration to become more professional in nature. With the affiliation of Kelab Sains Nuklear (KESAN), the Nuclear Engineering Student Society (NESS), the Institute of Nuclear Engineers (INE MNS), MNS

has moved towards greater strength in Nuclear Science, Engineering, and Technology. MNS members shall strive to make it better and stronger in the future.

In conjunction with this conference, MNS is also honored to organize Nuclear Youth Competition 2023 (NYC2023) to help bring the young nuclear talents from the Z-generation into the mainstream of nuclear development, issues and to highlight the importance of youth factor in the development of the nuclear sector in Malaysia.

This conference, participated by experienced and young researchers, will discuss and debate the latest developments in all areas of nuclear technology applications for friendly purposes at the international level. This would spur and catalyse further research and development leading to the sustainability and improvement of the quality of life without compromising the quality of the environment in Malaysia and in the world.

MNS is a unique non-governmental organization incorporated under the Malaysian Society Act, formed and headed by individuals who are aligned with the good usage of nuclear science and technology. Its memberships are opened to those interested in such causes. We are actively involved in promoting the advancement, information, understanding, and popularization of nuclear to the public in Malaysia. This conference is a way of realizing such an objective. This conference also served as a public acceptance program hosted by MNS together with institutions of higher learning and research institutes, with the aim of introducing the good use of nuclear science and technology to the public at large. On top of that MNS also published twice a year on a regular basis the Journal of Nuclear and Related Technologies (JNRT) and Buletin Nuklear Malaysia (BNM) for researchers to share their research findings with the community. We also publish the iNuSTEC proceedings with WoS publishers on a yearly basis.

I wish to express my heartfelt thanks to all speakers for your willingness to share your experience with the rest of the participants for the advancement of the nuclear field. The contribution comes not only from the Malaysian scientific community but also from distinguished guest speakers of iNuSTEC2023.

We are honored to have distinguished international and national experts in the fields of nuclear, science, and engineering from supporting universities serving as International Advisory and National Advisory Panels for iNuSTEC2023. We are indeed pleased to have the Organizing Committees of iNuSTEC2023 and the Secretariats working with along to ensure the success of iNuSTEC2023.

We must also thank the UNITEN for hosting iNuSTEC2023, NYC2023, and, all the personnel involved for their unwavering efforts to make this event a reality. I wish to also record my appreciation and thanks to all sponsors for their generous support. May all these efforts bring benefits to all of us and I wish everyone a successful conference.

Nuclear Science and Technology for Sustainable Development Goals

Thank you.

DR ABDUL AZIZ BIN MOHAMED
PRESIDENT, MALAYSIAN NUCLEAR SOCIETY (MNS)

DASAR TEKNOLOGI NUKLEAR NEGARA 2030 (DTNN 2030)

A Summary by the Malaysian Nuclear Society (MNS)



Dasar Teknologi Nuklear Negara 2030 (DTNN2030) was formulated to drive national development in nuclear technology and to create a sustainable and conducive nuclear technology ecosystem. DTNN2030 provides the direction and strategic priorities of national nuclear technology development in Malaysia. DTNN is the first such policy in Malaysia and part of the national agenda to increase Malaysia's global

competitiveness. DTNN was officially launched by the Minister of Science, Technology and Innovation on 20 September 2023 by the Minister of Science, Technology and Innovation YB Chang Lih Kang.

With a vision as a leading nation in peaceful uses of nuclear science and technology towards achieving global sustainable development, DTNN's framework's three key foundations are:

- Legislation, Regulation and Standards (3S – Safety, Security and Safeguards)
- Communication, Education, and Public Awareness (CEPA)
- Future Preparedness

On top of these foundations, lay four strategic thrusts as follows:

- ST1: Strengthening Governance and Collaborative Platforms
- ST2: Energising Industries and Enhancing Competitiveness
- ST3: Developing High-skilled and Adaptive Talent through Multi-disciplinary Approach
- ST4: Advancing Research and Innovation for Value Creation

With six focus sectors i.e. (i) medicine and health care; (ii) food and agriculture; (iii) device and equipment manufacturing; (iv) environmental and natural resource management; (v) industrial applications; as well as (vi) nuclear safety and security, the implementation of DTNN involves 18 Strategies, 46 Policy Measures, 19 Flagship Programme and 46 Sectoral Initiatives to be implemented in the next decade.

With the implementation of DTNN, it is targeted that the country achieves its nuclear technology investment value of RM2.4 billion by 2030.

iNUSTEC2023 & NYC2023

Program Overview

	Tuesday 10 Oct 2023	Wednesday 11 Oct 2023	Thursday 12 Oct 2023
8:30 am - 9:00 am	Registration		
9:01 am - 10:00 am	Opening & Nuclear Dialogue	Plenary 3	Plenary 6
10:01 am - 11:00 am		Symposium 2	Final NYC
11:01 am - 12 noon	Nuclear Now (private screening)	Plenary 4	
12:01 pm - 1:00 pm		Symposium 3	Closing
1:01 pm - 2:00 pm	Lunch	Lunch	Lunch
2:01 pm - 3:00 pm	Plenary 1	Plenary 5	
3:01 pm - 4:00 pm	Plenary 2	Symposium 4	
4:01 pm - 5:00 pm	Symposium 1	Symposium 5	


Venues @ UNITEN Putrajaya Campus:

- Administration Building Theatre (Main event)
- Administration Building BA-3-063 (Remote work area for iNUSTEC2023)
- Administration Building BA-4-027 & BA-4-030 (Nuclear Youth Competition)

**INTERNATIONAL NUCLEAR SCIENCE, TECHNOLOGY AND ENGINEERING
CONFERENCE (iNuSTEC2023) & NUCLEAR YOUTH COMPETITION (NYC2023)**

DAY 1: TUESDAY, 10 October 2023

Morning Session

08:00 – 09:00	Registration
09:00 – 09:05	Opening Ceremony Negaraku and prayer recital
09:05 – 09:15	Welcoming Address <i>Dr. Abdul Aziz bin Mohamed</i> <i>President of Malaysia Nuclear Society</i>
09:15 – 09:30	iNUSTEC2023 and NYC2023 Launch <i>Prof. Ir. Dr. Noor Azuan bin Abu Osman</i> <i>Vice Chancellor UNITEN</i>
09:30 – 09:45	Break
09:45 – 10:45	Nuclear Dialogue Is Nuclear Power Necessary? <i>Mr. Piarapakaran Subramaniam (AWER)</i> <i>Ir. Dr. Ahmad Nizar bin Harun (The eCEOs)</i> <i>Raja Dato' (Dr.) Abdul Aziz bin Raja Adnan (AELB)</i>
10:45 – 11:00	Break
11.00 – 13.00	Nuclear Now (private screening) 
13:00 – 14:00	Networking lunch, poster & exhibition visits

DAY 1: TUESDAY, 10 October 2023
Afternoon Session

Plenary 1: The Changing World <i>Ts. Dr. Hassan bin Mohamed (UNITEN Institute of Nuclear Energy)</i>		
K01	14:00 – 15:00	The Roles of SMR and Fusion Power towards Achieving NetZero-2050 <i>Prof. (Adj.) Ir. Ts. Dr. Shamsul Amri bin Sulaiman</i> <i>Tenaga Nasional Berhad</i>
Plenary 2: The Future of Nuclear Education <i>Assoc. Prof. Dr. Irman bin Abdul Rahman (UKM)</i>		
K02	15:00 – 15:30	Splitting Atoms, Artificial Intelligence and the NEC <i>Prof. Emeritus Dato' Dr. Halimah binti Badioze Zaman</i> <i>UNITEN National Energy Center</i>
K03	15:30 – 16:00	INSTA: IAEA's Nuclear Science & Technology Educational Initiatives <i>Ms. Marina binti Mishar (*virtual)</i> <i>International Atomic Energy Agency</i>
Symposium 1 <i>(Separate NYC kick-off @ BA-4-027, BA-4-030)</i>		
P01	16:00 – 16:15	Depth Dose Measurement by using Al ₂ O ₃ OSL Dosimeters in High Energy Photons in the Presence of Air Cavity and Density Inhomogeneities <i>Mohd Fahmi Mohd Yusof, Amirah Sauki, Nur Ateqah Suzaini, Arifah Nazirah Abdullah, Ahmad Bazlie Abdul Kadir, Norriza Mohd Isa</i>
P02	16:15 – 16:30	Study the Dynamic Aperture of a Compact Hadron Driver for Cancer Therapy <i>K.W. Leo, K. Takayama, T. Adachi, T. Kawakubo, and T. Dixit</i>
P03	16:30 – 16:45	An Efficient Approach for Benchmarking High-Reynolds Number Axial Flow-Induced Vibration for Nuclear Applications <i>Anas Muhamad Pauzi (*virtual)</i>
P04	16:45 – 17:00	Boron Neutron Capture Therapy Implementation at Research Reactor: Physical and Biological Aspects <i>Norfarizan Mohd Said, Faridah Mohamad Idris and Julia Abdul Karim</i>
<i>End of Day 1</i>		

DAY 2: WEDNESDAY, 11 October 2023
Morning Session

Plenary 3: Pioneering the Future <i>Ts. Dr. Leo Kwee Wah (Malaysia Nuclear Agency)</i>		
K04	09:00 – 09:30	Overview of J-PARC: Japan Proton Accelerator Research Complex <i>Prof. Dr. Takashi Kobayashi (*virtual)</i> <i>Japan Proton Accelerator Research Complex (J-PARC)</i>
K05	09:30 – 10:00	From the Desk of ACP100 Chief Designer: Progress of CNNC SMR Projects <i>Dr. Song Danrong (*virtual)</i> <i>China National Nuclear Corporation (CNNC)</i>
Symposium 2 <i>(Separate NYC Sharing Session @ BA-4-027, BA-4-030)</i>		
P05	10:00 – 10:15	Single-Layer Compton Camera Based on High-Z Hybrid Pixel Detectors <i>Lombigit, Maneuski</i>
P06	10:15 – 10:30	Design and Integration of a Radiation Detector Module for Robot Operating System (ROS) <i>Nur Aira Abd Rahman, Khairul Salleh Mohamed Sahari, etc.</i>
P07	10:30 – 10:45	Subsurface Utility detection using Electromagnetic Locator <i>Amer Hazreq Haron, Tengku Sarah Tengku Amran, etc.</i>
P08	10:45 – 11:00	Preliminary Results of the Autonomous Radiation Mapping in MNA <i>Nabilah Ramli, Nur Aira Abd Rahman, etc.</i>
Plenary 4: Innovative Nuclear Reactor Designs <i>Dr. Mohd Syukri bin Yahya (UNITEN Institute of Nuclear Energy)</i>		
K06	11:00 – 11:30	A Made-by-Malaysian Low-Pressure Water Reactor <i>Dr. Azrudi bin Mustapha Al-Edrus</i> <i>Clean Energy Xpeditons (CENERGY)</i>
K07	11:30 – 12:00	Climate Change, Global Decarbonization, and SMR Development <i>Prof. Dr. Yonghee Kim (*virtual)</i> <i>Korea Advanced Institute of Science and Technology (KAIST)</i>
Symposium 3 <i>(Separate NYC Sharing Session @ @ BA-4-027, BA-4-030)</i>		
P09	12:00 – 12:15	Lagrangian and Eulerian Approach to Predict Movement of Radionuclides in Selected Potential Sites in Malaysia during Monsoon Period <i>L.H Muhammad, M.K.A Karim</i>

P10	12:15 – 12:30	Wakefield Excitation in Solid Density Plasma <i>F. T. T. Houng, S. Y. Hoh, and J. F. Ong</i>
P11	12:30 – 12:45	Prove of Concept for High Voltage Supply in Radiation Detection <i>Nor Arymaswati Abdullah, Maslina Mohd. Ibrahim, Noor Farhana Husna A.Aziz, Nabilah Ramli, Muhd. Izzuan Mohd. Ghazali</i>
P12	12:45 – 13:00	Probabilistic Approach of Solving Burnup Problems <i>Kabiru Alhaji Bala, Muhammad Rabie Omar</i>
13:00 – 14:00		Networking lunch, poster & exhibition visits

DAY 2: WEDNESDAY, 11 October 2023
Afternoon Session

Plenary 5: MNS Special Invitation <i>Prof. (Adj.) Dr. Faridah binti Mohammad Idris (MNS)</i>		
K08	14:00 – 14:30	Hybrid Pixel Detectors for Scientific Applications <i>Dr. Dima Maneuski</i> <i>University of Glasgow</i>
K09	14:30 – 15:00	Mandates for Sustainable SMRs <i>Prof. Dr. Il Soon Hwang (*virtual)</i> <i>MicroURANUS Corp.</i>
Symposium 4 <i>(Separate NYC Discourse @ @ BA-4-027, BA-4-030)</i>		
P13	15:00 - 15:15	Technology Foresight: Capturing the Benefits from Nuclear Science Technology and Innovation in a Malaysian Ecosystem <i>Fairuz Suzana Mohd Chachuli, Azlinda Aziz and Faridah Mohd Idris</i>
P14	15:15 – 15:30	Probing Fillers in the Polymer Blend Composite: A New Approach <i>Hafizal Yazid</i>
P15	15:30 – 15:45	Radiation-Assisted Synthesis Polyaniline-Based Nanocomposite <i>U. Z. Mohd Azmi, N. A. Yusof, K. N. Mohamed, etc</i>
P16	15:45 – 16:00	Study the Nicotine Exposure towards Human Blood <i>Amirah Natasha Ashmahady, Siti Amira Othman</i>

Symposium 5 <i>(Separate NYC Discourse @ @ BA-4-027, BA-4-030)</i>		
P17	16:00 – 16:15	Optimization of Oil Recovery using Heated Low Salinity Water (LSW) in the Horizontal Sand Pack Column During Water-Flooding for Oil Recovery Application <i>Noraishah Othman, Akram Mujaddid Bin Abdul Halim, Muhammad Firdaus Hakimi bin Mohd Zulkarnain</i>
P18	16:15 – 16:30	A Study on Beryllium-7 Concentration at MYP42 During Northeast Monsoon Seasons in Malaysia. <i>Mohd Fauzi Haris^{1,3}, Norita Md. Norwawi¹, Mohd Hafez Mohd Isa², Muhammad Rawi Mohamed Zin³, Muhammed Zulfakar Zolkaffly³, Azlai Ta'at</i>
P19	16:30 – 16:45	Underground Utility Inspection using Ground Penetrating Radar <i>Tengku Sarah binti Tengku Amran, Mohamad Ridzuan Ahmad, etc.</i>
End of Day 2		

DAY 3: THURSDAY, 12 October 2023

Morning Session

Plenary 6: Navigating the Nexus of NORM and Rare Earth <i>Dr. Eli Syafiqah binti Azaman (UNITEN Institute of Nuclear Energy)</i>		
K10	09:00 – 09:30	The Rare Earth Industry in Malaysia <i>Mr. Hacib Benaissa</i> <i>Lynas Malaysia</i>
K11	09:30 – 10:00	Overview of NORM Management in Mining and Mineral Processing <i>Ts. Razali Harun</i> <i>Malaysia Nuclear Society</i>
10:00 – 12:00		NUCLEAR YOUTH COMPETITION (NYC2023) Final <i>Ms. Madihah binti Mujaini</i> <i>UNITEN Institute of Nuclear Energy</i>
12:00 – 13:00		Closing & Farewell Lunch <i>Dr. Abdul Aziz bin Mohamed (MNS)</i>

NUCLEAR YOUTH COMPETITION (NYC) 2023

BA-4-027 & BA-4-030, Tuesday, 10 October 2023

08:00	Registration
09:00	Opening & Nuclear Dialogue
10:00	
11:00	Nuclear Now (private screening)
12:00	
13:00	Lunch
14:00	Plenary 1
15:00	Plenary 2
16:00	NYC Kick-off: Ice-breaking Session & Briefing
17:00	End of Day 1

Wednesday, 11 October 2023

09:00	Plenary 3
10:00	NYC Sharing Session 1
11:00	Plenary 4
12:00	NYC Sharing Session 2
13:00	Lunch
14:00	Plenary 5
15:00	NYC Discourse Session
16:00	
17:00	End of Day 2

Thursday, 12 October 2023

09:00	Plenary 6
10:00	NYC Final
11:00	
12:00	Closing
13:00	End of Day 3

Note:

- Participants are to be divided into the following groups:
 - Sustainable Development Goals (SDG)*
 - Nuclear Security and its Challenges*
 - Nuclear Safety and Radiation Protection*
 - Tackling Climate Change with Nuclear Power*
 - Non-Destructive Test (NDT) Applications*
- Group oral presentations are limited to 5 minutes and 5 slide pages.
- For inquiry, please contact Ms. Madihah Mujaini (madihah@uniten.edu.my)

POSTER SESSION

No.	Title and Authors
PP1	A Simple Method of Evaluating Absorbed Dose in Electron Beam Accelerator (EPS-3000) <i>Shalina Sheik Muhamad</i>
PP2	Characterisation of Sealed Radioactive Source for Nuclear Forensic <i>Zalina Laili, Hishamudin Husin, Ahmad Ahmad Hasnulhadi Che Kamaruddin, Muhamad Azfar Azman, Wilfred Sylvester Paulus and Nadira Kamarudin</i>
PP3	Attenuation Coefficient for Wood Sections At 59.6keV And 356keV <i>Susan Sipaun, Mohd Fakhrul Hidayat Bin Anuar, Hearie Bin Hassan</i>
PP4	An Overview of X-ray Micro Computed Tomography Application in the Malaysian Nuclear Agency <i>Roslan Yahya, Mohd Fitri Abdul Rahman, Lahasen @ Normanshah Dahing, Nazrul Hizam Yusoff, Maziah Jamaludin and Hearie Hassan</i>
PP5	Density Profile Comparison of Different Build-Ups using Gamma Transmission <i>Mohd Fitri Abdul Rahman, Hanafi Ithnin, Nurul Huda Azahar, Lahasen @ Norman Shah Dahing, Hearie Hasan & Nurliyana Abdullah</i>
PP6	Design of Exposure Room for Industrial Radiography Using PHITS <i>Asyraf Arif Abu Bakar, Sharmila Sivam, Mark Dennis Usang</i>
PP7	Initial Findings of Autonomous Radiation Mapping Robot Field Test <i>MIM Ghazali, Nur Aira Abd Rahman, N Ramli, L Lombigit, NA Abdullah, AHC Kamaruddin, SC Soh, NFH Aziz, SM Sarowi</i>
PP8	Changes in crystallinity and crystallite size of sago palm (<i>Metroxylon sago spp.</i>) residue during cellulose extraction <i>N. Yacob, M.R. Yusof, A.Z. Mohamed and K.H. Badri</i>
PP9	Dose Verifications in Several Organs in Abdominal Computed Tomography (CT) Scan by Using Al₂O₃ OSL Dosimeters <i>Mohd Fahmi Mohd Yusof, Amirah Sauki, Nur Ateqah Suzaini, Arifah Nazirah Abdullah, Ahmad Bazlie Abdul Kadir, Norriza Mohd Isa</i>
PP10	Analysis Of Uranium And Thorium In Radioactive Wastewater Samples In Accordance With American Public Health Association (Apha) 3125 Method <i>Munirah Abdul Zali, Azian Hashim, Shakirah Abd Shukor, Siti Aminah Omar, Zalina Laili</i>

PP11	Evaluation of Elemental Pollution in Soil Samples from Klang Industrial Area <i>Md Suhaimi Elias, Muhammad Azfar Azman, Jeremy Andy Dominic Daung, Azian Hashim, Siti Aminah, Nazaratul Ashifa Abdullah Salim, and Shakirah Shukor</i>
PP12	Soil Moisture Measurement Using Cosmic Ray Neutron Sensor <i>Muhammad Aiman Mohd Yunus, Mohd Idzat Idris, Shyful Azizi Abdul rahman, Mohamad Syafiq Mohd Amin</i>
PP13	Gamma Irradiation Of Newcastle Disease Virus Towards Development Of Inactivated Nd Vaccine <i>Zainah Adam, Nurmaziah Mohammad Shafie, Abang Abdul Rahim Ossen, Rosniza Razali, Daryl Jesus Arapoc, Mohd Rizal Md Chulan, Cik Rohaida Che Hak, Pheik-Sheen Cheow and Suet Lin Chia</i>
PP14	Lessons Learned In Borehole Disposal Facility For Disused Sealed Radioactive Sources (Dsrs) Construction <i>Nazran Harun, Mohd Zaidi Ibrahim, Kang Wee Siang, Azmi Ibrahim & Nurul Syazwani Yahaya</i>
PP15	Natural Weathering Effects On The Morphological and Physicochemical Properties of Radiation Curable Coatings in tropical Climate <i>Rida Tajau, Mohd Sofian Alias, Mohd Hamzah Harun, Nurul Huda Mudri, Farah Fadzahah Hilmi, Sharilla Muhammad Faisal, Rosley Che Ismail, Abdul Muizz Mohd Sani, Cik Rohaida Che Hak, Wilfred Sylvester Paulus, Jong Bor Chyan, Pauline Liew Woan Ying</i>
PP16	Study The Depth Dose Profile of The Low Energy Electron Accelerator <i>Leo Kwee Wah, M. Mokhtar, M. Azhar, R.M. Chulan, S.A. Hashim, M. N. Shafeek, H. Baijan, R.M. Sabri</i>
PP17	The Potential Of NAA And ICP-MS For Determining Soil Dispersibility In Relation To Landslide Incidents <i>Azlan Shah Nerwan Shah @ Nintin, Munirah Abd Zali, & Nor Shahidah Mohd Nazer, Azian Hashim, Nurul Ashikin Rusdi & Ahmad Hambali Ismail</i>
PP18	Utilizing CTBT Data for Initial Information for Environmental Radiological Monitoring and to Understand Transportation behaviour of Anthropogenic Radionuclides: A Preliminary Study for Malaysia <i>B. Baharuddin1, A.I.A. Bakar, Y.M Wo1, N.F. Yusof, N.A.M Jaffary and M.S.M. Sanusi, A.H.C. Kamaruddin, A.S.Z.M Halmi and J.S. Johan</i>

LIST OF EXHIBITORS/ SPONSORS

Exhibitors:

- E1. RELTECH LAB SDN BHD**
- E2. UNIVERSITI TENAGA NASIONAL**
- E3. MALAYSIAN NUCLEAR AGENCY**
- E4. MALAYSIAN NUCLEAR SOCIETY**

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We are passionate

about what we do

Since its founding in 2007, The eCEOs Sdn. Bhd. (eCEOs) has become a leading project management consulting and solution provider, headquartered in Kuala Lumpur, Malaysia.

We are dedicated to promoting a low-carbon economy and advocate for the use of nuclear power as a clean and sustainable energy source. Our expert teams excel in project management, ensuring the smooth execution of our initiatives.

In our specialized Nuclear Division, we offer tailored project management services for the nuclear power, combining technical expertise, industry knowledge, and advanced methodologies to ensure project success, with a strong focus on safety, efficiency, and environmental sustainability.

III

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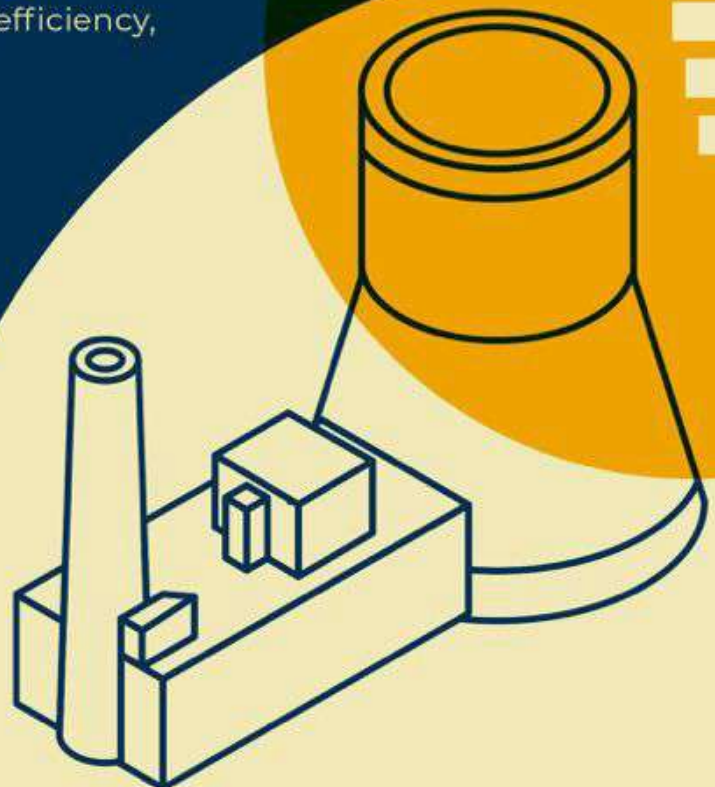
to discuss how we can support your nuclear project management needs.



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ABSTRACTS FOR ORAL

P01

Depth Dose measurement by Using Al₂O₃ OSL Dosimeters in High Energy Photons in the Presence of Air Cavity and Density Inhomogeneities

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ABSTRACT

Air cavities and tissue density inhomogeneity significantly affects the distribution of radiation doses, potentially resulting in adverse consequences such as cancer recurrence. This research aims to assess the accuracy of Al₂O₃ optically stimulated luminescence (OSL) dosimeters in measuring doses within varying thicknesses of air cavities (3, 5, and 8 cm) and tissue inhomogeneities of low and high density simulated by the lung and bone phantoms. An expanded polystyrene (EPS) was employed in homogeneous solid water® phantoms to simulate the air cavity. The percentage depth-dose (PDD) curves at 6 MV photon were obtained in both presence of air cavity and density inhomogeneities and compared to that in the EBT3 radiochromic film dosimeters and treatment planning system (TPS). The results indicated that the presence of an air cavity and tissue inhomogeneities affected the depth dose measured in OSL dosimeters, EBT3 films and TPS. OSLD and TPS showed good agreement at the center of the cavity, which is within $\pm 5\%$ but could not estimate scattered radiation to the distal and proximal surfaces of the air cavity. The obtained p-values showed no significant differences of dose measured in OSL dosimeters compared to those in EBT3 films and TPS. The Kruskal Wallis test and Mann-Whitney showed no significant difference between OSL dosimeters, EBT3 film and TPS in the measurement of depth doses in the presence of density inhomogeneities. The overall results indicated the suitability of OSL dosimeters as indirect dosimeters for the measurements of depth dose in the presence of air cavity and tissue density inhomogeneities.

Keywords: OSL dosimeters, high energy photons, air cavity, density inhomogeneity

Area of research: Radiotherapy

P02

Study The Dynamic Aperture Of A Compact Hadron Driver For Cancer Therapy

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ABSTRACT.

A design of a compact hadron driver for future cancer therapies based on the induction synchrotron concept is given. In order to realize a slow extraction technique in a fast cycling synchrotron, which allows the energy sweep beam scanning, the zero momentum-dispersion $D(s)$ region and high flat $D(s)$ region are necessary. The present design meets both requirements. The lattice has the two-fold symmetry with a circumference of 52.8 m, 2 m-long dispersion-free straight section, and 3 m-long large flat dispersion straight section. Assuming a 1.5 T bending magnet, the ring can deliver heavy ions of 200 MeV/au at 10 Hz. Details of the lattice parameters and dynamic aperture approach and method are studied are discussed.

P03

An Efficient Approach for Benchmarking High-Reynolds Number Axial Flow-Induced Vibration for Nuclear Applications

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Abstract – *Fretting wear at the spacer grid in fuel assemblies, due to flow-induced vibration (FIV), is one of the main causes of fuel failures in Light Water Reactors (LWRs). Therefore, accurately predicting FIV is crucial for mitigating this issue, and a computationally efficient simulation method is necessary. In this regard, the Unsteady Reynolds-Averaged Navier-Stokes (URANS) approach is applied as a promising and efficient simulation method for FIV prediction. While previous studies have primarily relied on Large Eddy Simulation (LES) for the fluid domain, URANS provides an attractive alternative due to its lower computational demands, especially for strong 2-way Fluid-Structure Interaction (FSI) coupling. This paper aims to explore efficient approaches for benchmarking axial FIV for nuclear applications by examining the self-exciting axial FIV over a cantilevered rod and comparing it with experimental measurements at the University of Manchester (UoM) using different URANS models and divergence schemes for the convection term in the fluid momentum equations. In both variations of the URANS model closure, the eddy viscosity model (EVM) k -SST model and the Reynolds Stresses Model (RSM) Launder, Reece, and Rodi (LRR) model, accurately predicted the mean RMS amplitude and frequency of vibration for flow with annulus Reynolds number between 16,400 and 61,730.*

Keywords: Flow-Induced Vibration (FIV), Fluid-Structure Interaction (FSI), Nuclear Fuel

P04

Boron Neutron Capture Therapy Implementation At Research Reactor: Physical And Biological Aspects.

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ABSTRACT

Boron Neutron Capture Therapy (BNCT) is a promising cancer treatment modality that utilizes thermal neutrons to induce tumor cell death in less toxic environment. Research reactor is one of the reliable neutron sources for BNCT implementation. The use of research reactors has allowed researchers to optimize treatment parameters and develop more effective neutron capture agents. This review will focus on the physical and biological aspects of BNCT implementation at research reactor. The aim is to propose TRIGA PUSPATI Reactor as a neutron source for BNCT procedure

P05

Single-Layer Compton Camera Based on High-Z Hybrid Pixel Detectors

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ABSTRACT.

The Compton camera is a novel γ -camera paradigm that relies upon the kinematics of Compton scattering for image reconstruction. A Conventional Compton camera uses two layers of sensors - the Absorber and the Scatterer. This work reports the proof of concept of a single-layer Compton camera (SLCC) where simultaneous Compton pairs events are registered in a single High-Z semiconductor sensor. The Hybrid pixel detector (HPD) is 1 mm thick, 256×256 square pixels with $55 \mu\text{m}$ pixel pitch CdTe sensor bonded to a Timepix3 readout ASIC. The superior spectroscopic imaging and fast timing capabilities of the Timepix3 readout ASIC coupled with a microscopic and highly pixelated CdTe enable simultaneous event detection of multi-energies occurring at multiple positions. The concept was exemplified by measuring the 122 KeV γ -ray emitted from a ^{57}Co radioisotope source at two positions. Data were captured in the Timepix3 data-driven mode with the KATHERINE readout system via Gigabyte Ethernet data transfer. A bespoke Compton kinematics criterion algorithm implemented in Python 3 IDE was used for data analysis and Compton's image reconstruction. Numerous events (5.2 million) were captured for 30-minute acquisitions. However, due to the thin nature of CdTe, fewer events ($\approx 0.01\%$) met the Compton kinematics criteria. Nevertheless, the algorithm accurately pinpointed the radioisotope's location, demonstrating proof of concept of the SLCC system

P06

Design and Integration of a Radiation Detector Module for Robot Operating System (ROS)

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ABSTRACT

In this paper, we present a radiation detector module that can be seamlessly integrated with Robot Operating System (ROS) to enable robots to perform radiation measurements in hazardous environments. The module is designed with a detector PCB and connectors that are compatible with an Arduino shield. The Arduino firmware is programmed with a counter-timer algorithm and publishes data to the ROS environment, allowing for easy visualization of the data in a 2D occupancy map. Our experimental results demonstrate the module's effectiveness in inspecting and reconstructing the robot's path during operations. This paper provides a valuable contribution to the field of robotics by enabling robots to perform radiation measurements safely and accurately in dangerous environments.

Keywords: radiation detector module, robot, ROS

P07

Subsurface Utility Detection Using Electromagnetic Locator

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ABSTRACT

An electromagnetic locator is a device that uses electromagnetic fields to locate underground utilities and other objects. It emits a low-frequency electromagnetic signal and detects the response from nearby metallic or conductive objects. The strength and direction of the reaction can be used to determine the location and depth of the thing. Electromagnetic locators are commonly used in construction, engineering, and utility industries to locate buried cables, pipes, and other infrastructure. This paper will discuss the overview of the electromagnetic locator, its working principle, and the ideal method to be used in different utility locating and mapping situations. The advantages of having this instrument and how its data can be correlated with other utility-locating devices to ensure a high level of accuracy when doing utility mapping will also be covered. Overall, this study will reflect the importance of doing Non-Destructive Testing for a safe operation and excellent time and cost optimization.

Keywords: *electromagnetic locator, pipe and cable locator, subsurface utility, detection*

P08

Preliminary Results of the Autonomous Radiation Mapping in Malaysian Nuclear Agency

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ABSTRACT

Autonomous radiation mapping refers to the use of autonomous robots to perform radiation mapping to measure and analyze the levels of radiation intensity of a target area. The primary purpose of the radiation mapping is to uncover the dose distribution across the target area and identify the presence of any hotspots. In this paper, the findings of the autonomous radiation mapping experiments at selected sites in Malaysian Nuclear Agency were presented. The experiments were conducted with radiation mapping robot developed in the previous project. The results consisting of radiation maps of the target areas will be presented and discussed.

Keywords: radiation mapping, mobile robot, ionizing radiation

P09

**Langragian And Eulerian Approach To Predict Movement Of Radionuclides In
Selected Potential Sites In Malaysia During Monsoon Period.**

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In computing the movement of particle through the fluid, there are three types of dispersion models that are used which are gaussian plume models, Lagrangian puff models and small-scale numerical models. Lagrangian particle dispersion models are increasingly used for nuclear applications. In this study, the usage of the Lagrangian model is implemented in HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory) which combine with the Eulerian model to predict movement of radionuclides from the simulated nuclear power plant accident in selected locations in Malaysia. These include nuclear risk studies at these area, emergency response systems, and source term analyses. The aim of this study is to compare the risk from the dispersion of ^{137}Cs from simulated NPP at Mersing, Mukah, Tasik Temenggor, Tasik Kenyir and Mengkuang Dam during Northeast monsoon and Southeast monsoon. The HYSPLIT model was setup based on the meteorological data during both monsoon period and be simulated for 5 days after the accident occur. On the first day after the simulation, the outcomes revealed that the ground deposition of ^{137}Cs is highest at at Mengkuang Dam ($1 \times 10^8 \text{ kBq/m}^2$) during Northeast monsoon and at Tasik Kenyir ($8 \times 10^7 \text{ kBq/m}^2$) during Southeast Monsoon. Meanwhile, for the lowest value of ground deposition of the same radionuclide during the first day of the accident is at Mersing ($4.3 \times 10^6 \text{ kBq/m}^2$) during Northeast monsoon and at Mukah ($8.3 \times 10^6 \text{ kBq/m}^2$) . After 5 days of the accident, it shows that the lowest ground deposition of ^{137}Cs is at Mukah (12 kBq/m^2) during Northeast monsoon and at Tasik Kenyir (100 kBq/m^2) during Southeast Monsoon. By the average movement of the radionuclides during 5 days after the nuclear incident, this study conclude that Mukah compute lowest risk among the dispersion of radionuclide as the activity of the radionuclide from the selected NPP is at lowest value for both northeast and southwest monsoon period. This study also aims to provide an evacuation path for each location as an emergency preparedness if the accident based on the graphical dispersion of the radionuclides during the 5 days after the Nuclear Power Plant accident occur.

Keyword: Hysplit; Langragian; Nuclear sitting; Atmospheric dispersion

P10

Wakefield Excitation In Solid Density Plasma

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ABSTRACT.

The wakefield excitation in the high-power laser irradiated nano-wire target exhibits high laser energy absorption compared to flat-target. In Extreme Light Infrastructure Nuclear Physics (ELI-NP), Romania, high-power lasers are entering a new realm of 10~PW peak power, capable of obtaining a focused intensity of 10^{23}Wcm^{-2} . Through particle-in-cell simulations, it has been observed that the irradiation of solid-density materials with such intense laser pulses leads to the generation of substantial wakefield excitations driven by particles, resulting in electron acceleration and the emission of photons. The investigation of wakefield excitation phenomena within solid plasma density is carried out. Furthermore, the potential implications of these findings for laser-driven nuclear physics applications will be explored

P11

Prove Of Concept For High Voltage Supply In Radiation Detection

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ABSTRACT

Most of ionizing radiation detectors are using high voltage to activate the detectors into operation mode. These radiation detectors, such as ionization chamber, proportional counter and Geiger-Mueller (GM) counters and scintillation detector etc, must adopt HV power supply system in the application process. Nevertheless, each type of radiation detector requires a specific HV value depending on the particular radiation detection method. Even within a specific detector type like the Geiger Mueller tube, different models consume varying HV values based on their specifications and optimal voltage requirements. The radiation detection device is a primary instrument extensively used in the Malaysian Nuclear Agency. Typically, when the device's HV component is damaged, the options are to either replace it or have it repaired by an external party. Hence, the objective of this project is to develop internally a versatile range of HV modules. These modules will not only cater to small detectors like GM tubes but also provide support for larger detectors such as HPGE or ion chambers. This initiative aims to not only save costs but also facilitate HV applications in other projects and foster in-house skill development.

P12

Probabilistic Approach Of Solving Burnup Problems

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ABSTRACT

This paper presents a new approach to solving burnup problems in a nuclear reaction by using a probabilistic method. Unlike traditional methods that rely on complex matrix exponential calculations, the proposed method traces the time evolution of nuclide concentrations through probability distributions. The method is implemented in a C++ program named CNUCTRAN and verified against the Chebyshev Rational Approximation Method (CRAM). Numerical results for various nuclear reactions demonstrate the accuracy and efficiency of the probabilistic method, making it a promising alternative for simulating realistic nuclear reaction scenarios.

P13

**Technology Foresight: Capturing The Benefits From Nuclear Science Technology
And Innovation In A Malaysian Ecosystem**

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ABSTRACT

Nuclear technology history started in Malaysia with the establishment of the Malaysian Nuclear Agency (Nuclear Malaysia) in 1972. The agency was established to promote the peaceful applications of nuclear science and technology for national development. Since then, nuclear science and technology for peaceful purposes have effectively advanced in various sectors, including industry, healthcare, food and agriculture, natural resources, energy, and nuclear safety and security through research, development, commercialization and innovation (RDCI). Scientific advancements through RDCI activities contribute substantial impact on the advancement of nuclear technology. New demands placed on the public R&D infrastructure are also influencing government research priorities. Many governments believe that establishing a definite longer-term science and technology policy is essential in a time of escalating economic competitiveness. Therefore, in order to focus resources and achieve the greatest economic and social benefits, the most promising research fields and new technologies shall be determined using technology foresight. Technology foresight is a method used to evaluate the revolutionary influence of new emerging technologies on the economy and society over the coming years, given the sustainability of RDCI in nuclear technology in Malaysian Nuclear Agency. The goal of technology foresight is to identify the fields of strategic research and emerging technologies, with the involvement of scientists, industrialists, government officials, and other stakeholders. This study proposes a conceptual model framework of the technological foresight exercise and its implementation stages for in Malaysian Nuclear Agency. Through this foresight exercise, Malaysian Nuclear Agency is expected to close the gap between the adoption of the foresight recommendations and the subsequent use of nuclear technology in social and economic sectors, by working with relevant industries, communities, and government agencies to match products, technologies, and services.

Keywords: emerging technologies; nuclear technology; policy; strategic research; technology foresight

P14

Probing Fillers In The Polymer Blend Composite: A New Approach

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ABSTRACT

We have demonstrated the use of XRD and thermal measurements to diligently probe the location of nano-scaled Boron Carbide fillers. Herein, the XRD diffraction of Bragg and amorphous peaks was successfully fitted from the parameters determined by a deconvolution process using the Pearson VII function, and the fitting error was less than 4%wt}. Thermal measurement was achieved by measuring the thermal conductivity of the composite. 4%wt of filler loading was found as a threshold. Beyond this value, a significant increase in thermal conductivity was observed. There was no further decrease in HDPE crystallinity above the threshold, but rather a considerable increase. Below the threshold value, the addition of fillers disturbed the HDPE crystall arrangement, leading to a reduction of both HDPE crystallinity and thermal conductivity. The influence of ordered structure, intrinsic thermal conductivity, radius of gyration of fillers, and their interactions, elucidated the trend of the thermal conductivity

P15

Radiation-Assisted Synthesis Polyaniline-Based Nanocomposite

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ABSTRACT

Polyaniline (PANI) is a conductive polymer that has been widely used as a sensing layer in electrochemical sensor and biosensor applications. This is due to its ease of synthesis, low cost, low toxicity, biocompatibility, and environmental stability. With these useful advantages, PANI has been used as a material to incorporate with various kinds of nanomaterials to improve the properties. Various techniques such as chemical, electrochemical, interfacial, and irradiation treatment, have been used to synthesis PANI-based nanocomposites. This review highlights the current development of PANI-based nanocomposites, and its properties. The advantages of radiation-induced polymerization as synthesis method of PANI-based nanocomposites have been covered. The usage of PANI-based nanocomposite in sensor applications also has been summarized. Finally, the future outlook for the radiation-induced polymerization technique for the development of PANI-based sensing technology is outlined.

Keywords: Radiation-induced polymerization, Polyaniline-based nanocomposite, Sensor applications

P16

Study The Nicotine Exposure Towards Human Blood

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ABSTRACT

Smoking is known as one of the leading cause of premature death. It is also a major cause that leads to mortality and morbidity like cancer and cardiovascular diseases. Based from the previous research, the effects can be seen when blood was taken directly from a smoker when examined by using FTIR and AFM. In this research, it emphasize the findings from the previous research about the effects of nicotine exposure which was to prove does nicotine induce haemolysis, to investigate the effects of 3 different nicotine levels on blood and to study the structure of erythrocytes before and after the exposure. Blood sample was taken to be exposed to 3 different types of cigarette which were Winston Red, Winston Green and Winston Blue with different levels of nicotine in them. FTIR, AFM, UV-VIS and microscopic study using Meiji Microscope were used. The findings from the AFM and microscopic study indicate that smoking lead to changes on the blood like potholes on the surface, swelling of shapes, darkened the red blood cell membranes, rupturing of erythrocytes or haemolysis. While UV-VIS shows the presence of NADH and FAD in the plasma are twice in concentration than the control plasma. It proved that the average life span of red blood cell for smoker is less than the non-smoker's as the red blood cell is in their abnormal shapes.

Keywords: Nicotine; Cigarette; Erythrocyte; Effects

P17

Optimization Of Oil Recovery Using Heated Low Salinity Water (Lsw) In The Horizontal Sand Pack Column During Water-Flooding For Oil Recovery Application

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ABSTRACT

Water-flooding is a prevalent technique for secondary oil recovery that is capable to increase oil recovery by up to 45% overall. Due to its accessibility, affordability, and simplicity, water flooding is the most frequently used oil recovery technique. However, conventional water flooding which basically uses seawater is able to extract up to 45% oil. Thus, in this study, thermal recovery was introduced by raising the temperature of the low salinity water (LSW) to investigate the percentage of oil recovery during water flooding and 100ppm low salinity water was used for this purpose. The current study used a horizontal sand pack column to optimize the temperature of low salinity water and the injection of LSW was carried out throughout the column to displace the residual oil. The column was initially packed with sieved 125micrometer of sand for constant homogeneity. Initially, formation water which comprised with NaCl, CaCl₂ and MgSO₄ was introduced inside the column together with light oil and was aged overnight. TAPIS oil and kerosene oil, with viscosity of 0.001382 Pa.s (1.382cP) and 0.09583 Pa.s (95.83cP) were used as low velocity light-oil in this study. The injection rate was set to 1 mL/min, 2 mL/min, and 3 mL/min respectively whereas, the temperature of the LSW was heated at 50 °C, 70 °C, and 90 °C subsequently. Heated water was supplied continuously throughout the sand pack which was heated using water blanket to retain heat at 70°C (reservoir temperature). In conclusion, 3 mL/min and 70°C were identified as optimum parameters and the oil recovery experiment was proceeded with liquid radiotracer using Technecium-99m (Tc-99m) intervention and resulted with 73% of yield. Nevertheless, the radiotracer intervention only provides the Residence Time Distribution (RTD) models which describe the behavior of the sand pack during water flooding process.

Keywords: water-flooding, heated low salinity water (LSW), secondary oil recovery, thermal recovery, radiotracer, technetium-99m (Tc-99m)

P18

A Study on Beryllium-7 Concentration at MYP42 During Northeast Monsoon Seasons in Malaysia

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ABSTRACT

Detection of natural radionuclides in surface air provides a valuable opportunity for researchers to investigate the behavior of radionuclides on the environment and weather patterns. Researchers can gain insights into the factors that influence their distribution and dispersion in the atmosphere. Such information is crucial to enhance the understanding of how radionuclides interact with the environment and how they may contribute to weather phenomena, such as precipitation or atmospheric transport. This study aimed to assess the activity concentrations of Beryllium-7 (⁷Be), a cosmogenic radionuclide, in surface air and meteorological data in the region of Tanah Rata, Cameron Highlands, Malaysia. The study spanned from January 2011 to December 2021 and sought to determine the influence of atmospheric conditions and processes on airborne radioactivity levels during the Northeast Monsoon seasons. Through the analysis, this study is further aimed to identify the impact of monsoon season on changes in airborne radioactivity levels. By gaining insights into the behavior of radionuclides in different meteorological conditions, one can better understand the mechanisms that drive changes in airborne radioactivity levels and how these changes may be related to seasonal weather patterns. This increased knowledge may contribute to a deeper understanding of the monsoon season itself and aid in the development of more effective strategies for mitigating the potential impacts of the monsoon on human health and the environment.

Keywords: Radionuclide, Beryllium-7, the Northeast Monsoon, surface air

P19

Underground Utility Inspection Using Ground Penetrating Radar

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ABSTRACT

Ground Penetrating Radar (GPR) is a non-invasive geophysical method that uses high-frequency electromagnetic waves to detect and map subsurface features and objects. This technology has been widely used for underground utility inspection due to its ability to accurately locate buried utilities without excavation. In this paper, we present a study on the use of GPR for underground utility inspection. We first provide an overview of GPR technology, including its basic principles, equipment, and data interpretation methods. We then discuss the advantages and limitations of using GPR for underground utility inspection and compare it with other traditional methods. Finally, we discuss the challenges and future directions of using GPR for underground utility inspection, including the need for standardized procedures and protocols, improved equipment and data processing methods, and increased awareness and training of GPR operators. Overall, our study demonstrates that GPR is a valuable and effective tool for underground utility inspection and has the potential to significantly improve the efficiency and safety of utility locating and mapping operations.

Keywords: *ground penetrating radar, underground utility, inspection*

ABSTRACTS FOR POSTER

POSTER

PP1

A Simple Method Of Evaluating Absorbed Dose In Electron Beam Accelerator (EPS-3000)

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ABSTRACT

The absorbed dose received by an irradiated product depends on the following factors: the characteristics of the beam, which are electron energy, average beam current, scan width and scan uniformity; the conveyor speed; the product composition and density; the composition, density and thickness of material; and the distance of output window to the product. The significant parameters controlled by the operator are the characteristics of the beam and the conveyor speed. As this accelerator has been used for various applications in radiation processing, product surface doses must be set and utilized through operational qualification such as beam energy, beam current, scan width and conveyor speed. In this work, we describe a simple method for evaluating the absorbed-dose coefficient K. The qualification was carried out using Alanine dosimeters and the calculations were evaluated according to ISO/ASTM 51649 and ISO 11137-3. The relative uncertainty of the measurements is estimated to be 4.20-7.10 %.

PP2

Characterisation Of Sealed Radioactive Source For The Nuclear Forensic Purpose

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ABSTRACT

A study was conducted to characterise sealed radioactive sources for the purpose of nuclear forensic analysis. Three types of sealed radioactive sources (^{60}Co , ^{137}Cs and ^{241}Am) were characterised to determine their inherent signature. The sources were characterised in terms of their physical, macroscopic and radiological properties. The result showed that the studied sources can be distinguished by their physical, macroscopic and radiological characteristics. All the signatures identified in this study could be useful for the development of a National Nuclear Forensic Library (NNFL) in Malaysia.

Keywords: nuclear forensic analysis, sealed radioactive source, signature

PP3

Attenuation Coefficient For Wood Sections At 59.6keV And 356keV

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ABSTRACT

Gamma ray measurements were carried out on wood sections of agarwood and shade trees to obtain its attenuation coefficients. Diameter of the blocks of agarwood (*aquilaria malaccensis*) and shade tree (*khaya senegalensis*) were 24.0cm and 37.2cm respectively. The dry density of agarwood trunk was 0.398 gcm⁻³. For the shade tree, the densities were 0.515 gcm⁻³ (branch) and 0.485 gcm⁻³ (trunk). This paper describes the transmission measurement setup, which used a 0.5" x 0.5" thallium-activated sodium iodide detector, scaler ratemeter Ludlum model 2200 and 3.5GBq Am-241 and 0.05GBq Ba-133 for the attenuation measurements. It was found that the attenuation coefficient (μ/ρ) for dry shade wood section is between 0.108 and 0.114 cm²g⁻¹ at 356keV, and between 0.154 and 0.177 cm²g⁻¹ at 59.6keV. The attenuation coefficient for dry agarwood is between 0.034 and 0.110 cm²g⁻¹ at 356keV, and between 0.025 and 0.182 at 59.6keV.

Keywords: gamma ray, attenuation coefficient, agarwood, shade tree

Area of research: nuclear gauge, density measurement, densitometry

PP4

An Overview Of X-Ray Micro Computed Tomography Application In The Malaysian Nuclear Agency

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ABSTRACT

This technical paper provides an overview of the current applications of X-ray Micro Computed Tomography (XMT), with a specific focus on Skyscan 1172 XMT, in the Malaysian Nuclear Agency. XMT is a non-destructive imaging technique that has gained widespread use in scientific and industrial fields. The paper examines the fundamental principles and techniques of Skyscan 1172 XMT and explores its present applications in the Malaysian Nuclear Agency for material characterization and defect detection. Additionally, the paper discusses the advantages and limitations of XMT and outlines the challenges and opportunities for its use in Malaysia. Overall, this review aims to provide insights into the potential applications of XMT in Malaysia and to encourage further research and development in this field

PP5

Density Profile Comparison Of Different Build-Up Using Gamma Transmission

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ABSTRACT

The comparison of density profiles across various build-up materials assumes paramount importance within radiation-intensive domains. Nonetheless, discerning constituent materials within complex piping systems becomes an intricate endeavor, particularly when dealing with multiple specimens. This state-of-the-art pipe scanning technology fulfills the imperative of non-destructively assessing pipework and finds extensive utility across sectors encompassing oil and gas, manufacturing, and critical infrastructure. The present study is primarily dedicated to effectuating a comprehensive comparative analysis that juxtaposes empirical experimentation against computational modeling for the determination of density profiles. The inquiry underscores the commendable precision of the pipe scanning apparatus in identifying and characterizing anomalies within synthetically generated samples. The findings derived from this investigation carry substantive implications for industries heavily reliant on efficient pipe networks, thereby accentuating advancements in cutting-edge inspection methodologies. Notably, this research not only enhances the comprehension of radiation-matter interactions but also enriches the knowledge base driving informed choices in fields dependent on adept radiation shielding and meticulous dosimetry practices.

PP6

Design Of Exposure Room For Industrial Radiography Using PHITS

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ABSTRACT

Bunkers or exposure rooms are crucial structures designed to protect against the release of radioactive materials into the environment. Evaluating the effectiveness of exposure room design is essential for ensuring adequate protection. In this study, the Monte Carlo particle transport simulation code, PHITS (Particle and Heavy Ion Transport Code System) will be used, to evaluate exposure room design and its ability to mitigate radioactive releases. These investigate various aspects of bunker design, including the thickness of walls, and the materials used in construction. By assessing the walls, it can evaluate the effectiveness of different design configurations. This evaluation helps in optimizing exposure room to enhance protection against potential hazards. The results obtained through PHITS simulations shows decreasing in dose rate with 25 cm thickness wall using high-density concrete. This work will continue with different layout and materials for shielding. This will contribute to improved understanding and informed decision-making regarding exposure room.

Keywords: Exposure room, PHITS, dose rate, radiation, shielding, gamma
Area of research: Radiation shielding

PP7

Initial Findings of Autonomous Radiation Mapping Robot Field Test

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ABSTRACT

Radiation mapping using mobile robotic can minimize the risk of operator exposure to radiation while providing detailed radiation maps of targeted areas. Despite its potential advantages, the use of this technology is still limited and requires further investigation. In a previous study, an autonomous radiation mapping robot was designed and developed. This paper presents the initial findings on autonomous radiation mapping field test that focuses on the operation procedures and the challenges faced during the robot deployment. Temporary solutions implemented to overcome the challenges are also discussed. The results will provide insights for future researchers and operators working on mobile robotic technology for radiation mapping.

Keywords: mobile robot, radiation mapping, field test

PP8

Changes In Crystallinity And Crystallite Size Of Sago Palm (*Metroxylon Sago Spp.*) Residue During Cellulose Extraction

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ABSTRACT

Sago plam (*Metroxylon sago spp.*) is one of the major agricultural waste in Malaysia. A residue left behind after sago starch extraction is disposed by wash off into the nearby river. The reuse of this residue provides a solution to the problem of discarding the waste as well as expand the market of this plantation. In this study, cellulose has been extracted from *Metroxylon sago spp.* residue. The fibers were pretreated with 2% of aqueous sodium hydroxide (NaOH) solution and prior to bleaching with an acidified sodium chlorite (NaClO₂) and acetate buffer solution. The influence of NaOH and bleaching treatment on cellulose crystallinity of *Metroxylon sago spp.* residue (SW) has been investigated using thermogravimetry analyzer (TGA), chemical analysis and X-ray diffraction (XRD). From the XRD analysis the crystallite size and crystallinity index were calculated. The crystallinity index of SW increased significantly by 110% and slightly changed in crystallite size. The observed defibrillation on the treated SW surface proves the dissolution of the non-cellulosic components present in the fiber cell wall by NaOH and NaClO₂ treatments.

Keywords: Meroxylon sago spp., sago residue, crystallinity, crystallite size

PP9

Dose Verifications in Several Organs in Abdominal Computed Tomography (CT) Scan by Using Al₂O₃ OSL Dosimeters

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ABSTRACT

The study investigated the dose of several organs in the computed tomography (CT) scan by using Al₂O₃ optically stimulated luminescent (OSL) dosimeters. The organs of right and left kidney, right pancreas, spleen and liver in an anthropomorphic human phantom were investigated for the dose received during the scan. The OSL dosimeters are embedded into custom-made wax and replace onto two selected slices of human body phantom where the selected organs are located. The phantom was scanned with by using adult abdomen protocol. The percentage differences of OSL doses reading compared to the previous study data and the international dose reference level (DRL). The doses obtained from OSL nanodots exhibit a smaller percentage difference compared to doses obtained using XRQA film dosimeters. The results obtained from the OSL dosimeter consistently demonstrate a percentage difference within the DRL values. The doses measured in five organs were within the range of the national DRL values by the Ministry of Health of Malaysia (MOH). These findings suggest that our results can be utilized to verify the doses received by internal organs during computed tomography abdomen protocols. The overall results indicated the suitability of OSL dosimeters for the indirect dose verification in the CT scan.

Keywords: OSL dosimeters, CT scan, organ dose

Area of research: Diagnostic Radiology

PP10

Analysis Of Uranium And Thorium In Radioactive Wastewater Samples In Accordance With American Public Health Association (Apha) 3125 Method

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Abstract

The main issue with uranium and thorium in wastewater is their potential to contaminate the soil and water bodies. The unregulated wastewater release can affect the ecosystem and potentially harm aquatic life. Therefore, there is a need to establish the analysis of uranium and thorium using standard method to obtain better sensitivity and good reproducibility in the final report. In this study, the determination of uranium and thorium was employed using the American Public Health Association (APHA) method 3125 standard method. The quality control (QC) samples were prepared in the wastewater matrix and digested using hot block (APHA 3030E) and microwave digester (APHA 3030K). The quantification of uranium (^{238}U , ^{235}U , ^{234}U) and thorium (^{232}Th) in the QC samples was performed using standard mode Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). The method detection limit (MDL) obtained from hot block digestion for ^{238}U , ^{235}U , ^{234}U and ^{232}Th were 0.010, 0.009, 0.009 and 0.001 mg L⁻¹ respectively. Meanwhile, the MDL obtained from the microwave digester for ^{238}U , ^{235}U , ^{234}U and ^{232}Th were 0.001, 0.004, 0.003 and 0.0005 mg L⁻¹ respectively. The microwave digester technique gives better detection limit and reproducibility compared to that hot block digestion technique. This will enhance the detection of uranium and thorium in the wastewater samples towards better environmental monitoring programs at the national and global levels.

Keywords: uranium, thorium, ICP-MS, method detection limit, microwave digester, hot block digester

PP11

Evaluation of Elemental Pollution in Soil Samples from Klang Industrial Area

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ABSTRACT

The presence of elemental pollution in the soil at high concentrations can be uptake by vegetables and crops. Consumption of vegetables at high concentrations of elemental pollution could adversely affect human health. Studies of elemental pollution in the soil in the Klang industrial area were conducted to determine the concentration level in that area. Analysis of the content of elemental pollution in soil samples has used neutron activation analysis (NAA) techniques. The average concentration of major elements (Fe, Mg, Ti), heavy metals (As, Sb, Cr, Zn), uranium (U) and thorium (Th) in the soil of the Klang industrial area exceeded the average concentration in granitic igneous rocks. In comparison, the average concentration of rare earth elements (REEs) in soil samples in the study area is lower than in granitic igneous rocks (reference value). The elements of As, Zn and Cr showed a high concentration in the SL 11 area, where business activities, vehicle workshops and residential were located. The REEs show a high concentration in the SL 14 area compared to other sites. The geo-accumulation (Igeo) index was applied to identify the pollution status. The Igeo index for the elements of Mg and U can be categorised as unpolluted to moderately polluted. As and Sb can be categorised as unpolluted to moderately polluted, and as extremely polluted in the areas of SL 11 and SL 14. The element of Th can be categorised as unpolluted to moderately and strongly polluted. The Igeo index of REEs can be categorised as unpolluted in the soil of the Klang Industrial area.

Keywords: geo-accumulation index, soil, Klang, neutron activation analysis.

PP12

Soil Moisture Measurement Using Cosmic Ray Neutron Sensor

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ABSTRACT

Neutron cosmic rays are one of the important components of the background radiation found in the Earth's atmosphere. The interaction between cosmic rays and atmospheric molecules produces subatomic particles, including neutrons which have the potential to interact with the environment and affect agriculture water usage. At the global level, the problem of water deficiency and some parts of the world cause food security to be disturbed. To determine the water content of the soil in one area, there are 2 methods that can be practiced which are conventional methods such as using Time Domain Reflectometer (TDR) and Neutron Probe (NP). In addition, the second method is a modern method which is by using a modern method using the Cosmic Ray Neutron Sensor (CRNS) tool. Related nuclear techniques can help optimize the efficiency of water use. The Cosmic Ray Neutron Sensor (CRNS) is a new technology that functions as a detection of hydrogen in soil H₂O molecules. This helps meet the need for information related to soil moisture by calculating the number of neutrons in the Earth's atmosphere. This CRNS uses in-situ techniques (directly) with the ability to estimate the water content in the soil on a scale from ~1 to 10 hectares. The research has been done at the grazing field UPM Serdang and the pineapple field in Ulu Tiram, Johor. The relation between neutron cosmic rays and agriculture has been the subject of research interest because exposure to radiation can have direct or indirect effects on crops and agricultural land. A study of neutron cosmic ray exposure in agriculture can provide a better understanding of how plants respond to exposure to this radiation as well as whether there is any influence on growth, productivity, or the quality of agricultural produce.

PP13

Gamma Irradiation Of Newcastle Disease Virus Towards Development Of Inactivated Nd Vaccine

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ABSTRACT

Vaccine is a biological preparation that provides active acquired immunity to a particular infectious or malignant disease. Vaccines contain active components (antigen) that generate immune response to a specific disease. The antigen could be a small part of the disease-causing organism (spike protein), or the entire organism in a weakened or inactive form. There are several different types of vaccines such as inactivated, live-attenuated, messenger RNA (mRNA), subunit, recombinant, conjugated vaccine and etc. For inactivated vaccine, the common inactivation process is to use chemicals such as formaldehyde and beta-propiolactone. Chemicals inactivated vaccine is associated with safety issues such as allergic reaction and disease outbreak. In addition, chemicals inactivation can alter the antigenic protein of the virus causes loss of immunogenic property. Therefore, searching for the inactivation method that will produce a safe and effective vaccine needs to be continued. Instead of chemicals, gamma radiation can also be used for virus inactivation. The advantage of gamma rays is that they are able to penetrate the virus and destroy the nucleic acid (DNA) without damaging the protein structure of the viral antigen. This will preserve the immunogenic nature of the virus and thus be able to protect the recipient from disease infection. Various types of vaccines have been produced using nuclear technology such as malaria, influenza and salmonellosis. In Malaysia there is still no vaccine produced using gamma irradiation technique. Nuclear Malaysia has started research and development of inactivated vaccines using the gamma irradiation method. The virus model used for this project is Newcastle disease virus (NDV). Preliminary irradiation of Newcastle disease virus (NDV) was done to see the ability of gamma radiation from Cobalt-60 source at SINAGAMA facility to inactivate the virus. The NDV was irradiated at different dose of gamma radiation (0, 10, 20 and 50 kGy) and the irradiated virus was inoculated in 9-days embryonated chicken egg. The propagated irradiated NDV was harvested and subjected to hemagglutination assay (HA) and morphology analysis using FESEM method. The HA and FESEM results showed that gamma irradiation at dose of 10, 20 and 50 kGy were able to in-activate the NDV and preserve the core structure of the NDV. This preliminary study shows that gamma radiation is capable of inactivating NDV and can be applied for the production of inactivated NDV vaccine. This promising result can be used as a starting point in the research and development of inactive vaccines in Nuclear Malaysia.

Keywords: Inactivated vaccine; Newcastle disease virus; gamma radiation

PP14

Lessons Learned In Borehole Disposal Facility For Disused Sealed Radioactive Sources (DSRS) Construction

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ABSTRACT

Borehole Disposal Facility is part of Nuklear Malaysia's effort to ensure that its disposal activity is conducted in a manner that will protect and maintain environmental quality. The construction phase physically commenced from 30th May 2023 and expected to be completed on 8th September 2023. Site supervision on construction is a compulsory activity in compliance with requirements imposed by Department of Atomic Energy Malaysia (JTA) and International Atomic Energy Agency (IAEA). The construction activities comprising drilling, constructing and sealing of a disposal borehole for disused sealed radioactive sources (DSRS) in Malaysia in accordance with the specific requirements outlined by the IAEA and JTA, in the optimum time, in the most viable and safe manner to the satisfaction of all parties involved. Lesson learned and challenges during the construction regularly occurred and the issues are encountered on site. After construction phase completed, the disposal phase will take place starting with provisional and cold testing expert mission on the borehole disposal facility.

Keywords: Borehole, DSRS, construction

PP15

Natural Weathering Effects On The Morphological And Physicochemical Properties Of Radiation Curable Coatings In Tropical Climate

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ABSTRACT

Surface finishing materials produced from biomass resources, such as palm oil, have the potential to be among the top options among local industries since they offer functionality qualities equivalent to petrochemical-based coating products and are even more environmentally friendly. The natural weathering effects on palm oil-based film coatings, petrochemical-based film coatings, and TiO₂ organic-inorganic nanoparticle composite films on diverse substrate surfaces were studied for many days at varied angles of 0°, 45°, and 90°. The aim of the study is to investigate the chemical degradation of the coating, as well as the coatings resilience to ambient temperature and the influence of mould or fungus development in a tropical climate. The study's findings demonstrate that the chemical properties of coating materials exposed at a 90° angle resemble their original properties and gradually deteriorate after 30 days of exposure to natural weathering. The coating materials deteriorated the most at 0° and 45° angles, respectively, and indications of mould and fungus began to appear. Overall, the palm oil-based coatings degrade slower than the petroleum-based coatings in a tropical climate environment, and they can preserve their good performance even after more than a year at room temperature.

Keywords: EPOLA, EPOLA-OPV, POBUA, palm oil-based resin, radiation curable coatings

PP16

Study The Depth Dose Profile Of The Low Energy Electron Accelerator

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ABSTRACT

This paper describes depth dose measurement of Low Energy Electron Accelerator (LEEA). This locally designed LEEA with the former energy of 140 keV will be upgraded to 300 keV. As the setup, the electron beam is energized by the electric field with the high voltage power supply, scanning and passing through the titanium foil to irradiate the sample. As the results, depth dose profile by the energetic beam mapping results have been obtained by using B3 radiochromic film and FWT-60 nylon dosimeters.

PP17

THE POTENTIAL OF NAA AND ICP-MS FOR DETERMINING SOIL DISPERSIBILITY IN RELATION TO LANDSLIDE INCIDENTS

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ABSTRACT

Dispersive soils pose significant challenges due to their inherent tendency to rapidly respond to the presence of water, resulting in erosion and heightened susceptibility to landslides. The inclusion of sodium ions onto the surface of soil clay particles results in the attenuation of the electrochemical interactions between the dispersed soil, leading to the repulsion and subsequent migration of the clay particles away from one another. This study employed Neutron Activation Analysis (NAA) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) to assess the Sodium Adsorption Ratio (SAR) and Exchangeable Sodium Percentage (ESP) as indicators of soil dispersibility. The initial findings indicate that the SAR and ESP values were affected by factors such as soil texture, soil mineralogy, pH level, soil consistency, and swelling capacity. The findings demonstrate a significant correlation when compared to other physical methods. In conclusion, it is apparent that both NAA and ICP-MS method has the capability to be applied for the purpose of predicting soil dispersibility in landslide-prone regions of Malaysia.

Keywords: dispersive soil; ESP; landslide; SAR; sodium ions

PP18

Utilizing CTBT Data for Initial Information for Environmental Radiological Monitoring and to Understand Transportation behaviour of Anthropogenic Radionuclides: A Preliminary Study for Malaysia

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ABSTRACT

Many activities have put the Asia Pacific at risk of radiological contamination, since 1946 because it was used as a site for nuclear tests and last was in 2017 by the North Korea, and the region also encountered two major reactor accidents namely, the 1986 Chernobyl and the 2011 TEPCO Fukushima Nuclear Power accident. Due to the 2011 TEPCO Fukushima Nuclear Power accident there were releases of long lived medium or low volatility fission products from the NPP reactors, but the atmospheric release was dominated by volatile isotopes of iodine and caesium. These major events have released fission radionuclide to the environment and gives major concern to the international community, especially to the nearby countries, including Malaysia.

Understanding factors such as atmospheric and hydrological processes are significant for assessing the potential pathways and impacts of anthropogenic radionuclide transport, as well as for developing effective strategies for monitoring and mitigating their environmental and health consequences. This is because once radionuclides are released into the atmosphere or water bodies, natural processes such as wind patterns, precipitation, evaporation, and water currents can influence their transport over short or long distances. This study is part of the initiative for environmental radiological monitoring and understanding anthropogenic radionuclides transportation through information given by the CTBTO database. This study also an initiative to develop a comprehensive radiological monitoring database and mapping, specifically on anthropogenic radionuclides release from man-made activities such as nuclear reactor and nuclear weapon test to incorporate it with National Disaster Management Plan/Program. This due to abovementioned disastrous events and ambiguity in global current situation such as (i) increasing interest in nuclear power among neighbouring countries, (ii) conflict in international politic that motivate country to develop nuclear weapons and leading to the nuclear test such as by the DPRK, India and Pakistan; and (iii) nuclear power plant accident that beyond human control such as the 2011 TEPCO Fukushima Nuclear Power accident that caused by nature. Using ArcGIS and CTBTO data, this study aims to create a comprehensive mapping of anthropogenic radionuclide concentrations and examine their relationship with natural processes such as wind patterns, precipitation, evaporation, and water currents. Specifically, the focus will be on mapping the fallout of Americium-241 (²⁴¹Am), Cesium-137 (¹³⁷Cs), Strontium-90 (⁹⁰Sr), and Plutonium isotopes (²³⁹⁺²⁴⁰Pu) in the region encompassing Malaysia and the South China Sea. This digital mapping database will contribute to the global understanding of the distribution and concentration patterns of these radionuclides. Currently, the preliminary findings indicate the presence of Cesium-137 (¹³⁷Cs) as the detected anthropogenic radionuclide reaching Malaysia. The concentration mapping will be developed considering the influence of the Northwest Monsoon and Southwest Monsoon seasons.

Keyword: CTBTO, countermeasures and environmental responses, monitoring and mitigating nuclear disaster consequences.

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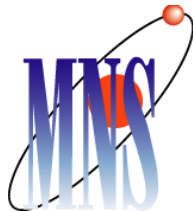
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Malaysian Nuclear Society (MNS)



About Us

The Malaysian Nuclear Society (MNS) is a non-governmental organization aiming at promoting the development and dissemination of information on nuclear science, engineering and technology; providing objective views/ advice on matters relating to nuclear science, technology and its applications. MNS is also a key player in promoting cooperation among members and other organizations of similar objectives.

It was formed as Nuclear Science Society (Persatuan Sains Nuklear Malaysia, PESAN) in 1989, operating in the state of Selangor and Wilayah Persekutuan (Kuala Lumpur), Malaysia.

With the expansion of its members to more than seven states in Malaysia in 1994, it was renamed the Malaysian Nuclear Society (MNS).

Currently, MNS enjoys the support of over 2000 members in the government, private, and corporate sectors (as corporate member) and maintains two international linkages with the American Nuclear Society (ANS), the Canadian Nuclear Society (CNS), European Nuclear Society (ENS), Korean Nuclear Society (KNS) and Atomic Energy Society of Japan (AESJ).



OBJECTIVES

Associating nuclear science and technology to the bombs is a common tendency and an almost automatic response when many are asked about nuclear. Very little is known about its other applications. MNS aims at correcting this perception through its objectives, viz:

- To promote the advancement and dissemination of nuclear science and technology and its applications;
- To provide objective views and advice on matters pertaining to nuclear applications ; and
- To promote cooperation among members and other bodies of similar objectives

➔ ACTIVITIES

- **Education and Awareness Program** - forum, discussion, seminar, conferences, and student outreach.
- **Publication of an Annual Magazine** - BuletinNuklear Malaysia ("Nuclear Bulletin of Malaysia")
- **Publication of Scientific Journal** - Journal SainsNuklear Malaysia (JSNM) or Nuclear Science Journal of Malaysia starting 1999 and from 2003 the journal is known as Journal of Nuclear and Related Technology (JNRT).
- **Award to Outstanding University Student** - At the Nuclear Science Department, UniversitiKebangsaan Malaysia (UKM), UniversitiInstitutTeknologi Malaysia and UniversitiTenagaNasional (UNITEN).
- **Collaboration with international nuclear societies** – American Nuclear society, Canadian Nuclear society, European Nuclear society, Korean Nuclear society, Japan Atomic Energy society, China Atomic Energy society, Asia-Oceania Neutron Scattering Association, Asia-Oceania Forum on Synchrotron Radiation Research, Thailand Nuclear society, Indonesian Nuclear society and Australian Nuclear Association.

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