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MEDICAL PHYSICS BULLETIN

MINISTRY OF HEALTH MALAYSIA (MOH)

Medical Physics Bulletin 2/2024
Ministry of Health Malaysia

Portfolio Buletin dan Jaringan Media
Technical Committee of National Medical Physicist
Ministry of Health Malaysia

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Medical Physics Bulletin Task Force 2023-2025

Welcome Message

Lead Editor

Ts. Dr. Prema Devi Chellayah

I am pleased to introduce the second issue of the Ministry of Health's Medical Physics Bulletin. The Medical Physics Bulletin Task Force at the Ministry of Health Malaysia has put in considerable effort to bring this publication to life. While every medical physicist is busy with their individual responsibilities, they have still generously contributed to the creation and distribution of this bulletin, whether within hospitals, State Health Departments, or the Ministry's Radiation Surveillance. Through this publication, we hope that the shared knowledge can serve as a valuable reference for medical physicists, both within the Ministry of Health and the broader medical community.

This bulletin was designed to foster interaction, updates, collaboration, networking, and communication. I want to thank everyone who contributed to making this a reality, no matter the form of their support. In closing, I urge all medical physicists, interns, colleagues, and educators to continue strengthening intra-agency cooperation, which will help raise awareness about the medical physics profession and its essential role in healthcare.

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"Have no fear of perfection;
you'll never reach it."
Marie Curie

Introductory Message

Head
Medical Physicist Profession
Ministry of Health Malaysia

Mr. Zainudin bin Yasak @ Yusof

To begin, I would like to extend my deepest appreciation and thanks to all the medical physicists within the Malaysia Ministry of Health (MOH) for entrusting me with the mandate and responsibility to lead the Medical Physics Profession for the 2024–2025 term. Congratulations to the appointed members of the MOH Medical Physics Technical Committee 2024–2026 term, whose dedication and exemplary cooperation have ensured the success of our planned initiatives. Your hard work has earned the trust of the ministry's top management, driving the current progress and future direction of the medical physics profession. This bulletin serves as an excellent platform for showcasing activities related to the roles and responsibilities of medical physicists, aiming to broaden public understanding of this career path, which also supports the mission and vision of the Ministry of Health Malaysia.

Furthermore, the bulletin offers a space for medical physicists to share valuable ideas and research insights, fostering enhanced professionalism in medical physics both nationally and internationally. Today, we are proud to see many of our officers advancing their studies to the PhD level. These individuals are crucial assets to the profession, contributing through science- and technology-based research toward a more advanced and high-quality healthcare system.

I want to take this opportunity to express my deepest gratitude to the Director General of Health, Deputy Director General of Health (Research & Technical Support), Deputy General of Health (Medical), Deputy Director General of Health (Public Health), Director of Medical Radiation Surveillance Division, Director of Allied Health Division, Directors of State Health Department, Directors of hospitals, Heads of Medical Specialty, and all other esteemed individuals for their invaluable support and guidance. Your leadership and dedication have made a significant impact, and I am truly grateful for the opportunity to work alongside such accomplished professionals.

Lastly, let us leverage modern technology—whether through this bulletin or social media platforms like the Web, Facebook, TikTok, and Instagram—to share recommendations, perspectives, or initiatives that help to grow the career and direction of the physics profession, increasing its recognition and relevance. Together, let us safeguard the welfare of our professional members, move forward collectively, and elevate our profession to new levels of excellence and credibility. Remaining united is the foundation of any organization's success.

Message from Regulator

Director
Medical Radiation Surveillance Division
Ministry of Health Malaysia

Dr. Zunaide bin Kayun @ Hj. Farni

Bismillahirrahmanirrahim,
Assalamualaikum Warahmatullahi Wabarakatuh,

I would like to begin by congratulating the Medical Physics Bulletin committee for their outstanding effort in producing this second volume. Your efforts continue to strengthen the voice and visibility of medical physicists in healthcare.

Medical physicists play an integral role in ensuring the safe and effective use of radiation in medicine, in alignment with the regulatory requirements set by the Medical Radiation Surveillance Division according to Atomic Energy Licensing Act 1984 (Act 304) for medical purposes and its subsidiary regulations. This adherence to safety standards not only protects patients, healthcare workers and the public but also advances the quality of care across radiology, nuclear medicine, and radiotherapy.

The implementation of Quality Assurance Programs (QAP) across radiology, nuclear medicine, and radiotherapy has been a significant achievement. Soon, we will introduce QAP for dental radiology, further enhancing our efforts to uphold quality and safety in all aspects of medical radiation. Additionally, the upcoming certification program for Radiation Protection Officers (RPOs) in medicine marks a new chapter in strengthening radiation safety and radiological security in healthcare. This initiative will provide a robust framework to ensure comprehensive protection for patients and healthcare workers alike.

While safety is paramount, we must also recognize the importance of cultivating a culture of security alongside safety. A strong foundation in both safety and security culture is crucial for sustainable progress in radiation practices, ensuring that our systems are resilient, reliable, and prepared for future challenges.

On a personal note, as I approach my retirement in January 2025, I reflect with gratitude on the incredible journey we have shared. It has been an honour to witness the unwavering dedication of medical physicists who continuously excel and advance the field. As I bid farewell, I urge all of you to continue pushing the boundaries of innovation, collaboration, and excellence. Your contributions are vital to the future of healthcare, and I am confident that the medical physics profession in Malaysia will continue to thrive and achieve new heights.

Finally, I wish the best of luck to all Medical Physicists at the Ministry of Health Malaysia.

Medical Physics
Messages from Clinical Representatives

Mr. Mohd Hizwan bin Mohd Yahya, Chief Medical Physicist, Department of Nuclear Medicine, Hospital Pulau Pinang

Nuclear medicine is a medical specialty that uses radioactive substances called radiopharmaceuticals, to diagnose and treat a variety of diseases. Radiopharmaceuticals are introduced into the patient's body by swallowing, injection, or inhalation. These substances are then attracted to specific organs, bones, or tissues. As the radioactive substance travels through the body, it emits radiation which is then detected by a camera.

Nuclear medicine, in a sense, is radiology done inside out because it creates images from radiation emitted from within the body rather than radiation generated by external sources, such as X-rays. It is unique because it images organ function, rather than just the anatomy. A poorly functioning organ will emit a different signal than a healthy organ. This allows us to not only monitor cancer but also indicate the activity of many organs including the heart, lungs, kidneys, and bones. Although nuclear medicine is primarily used for diagnosis, it can be used to treat disease as well. For example, for the treatment of brain tumours or for pain relief from certain types of bone cancers. Some people might be worried when they hear the word radioactive, but nuclear medicine procedures are among the safest imaging exams available; the amount of radiation received from nuclear medicine is comparable to that of many diagnostic X-ray and CT procedures. And because nuclear medicine procedures can pinpoint molecular activity within the body, they have the potential to identify disease its earliest stages, often long before other tests are able to reveal abnormalities.

Mr. Mohd Amin bin Yaakob, Chief Medical Physicist, Department of Radiotherapy and Oncology, Hospital Kuala Lumpur

Radiotherapy and oncology services in Malaysia started in 1950 at the wooden building (now known as Wisma Kayu) in Kuala Lumpur General Hospital. The facilities have 3 (three) kilovolt energy capacity X-ray machines. The services were operated by 2 (two) radiotherapy specialists from Singapore, supported by 2 (two) radiotherapy radiographers, 1 (one) nurse, 1 (one) attendant, and 1 (one) secretary, who functions as a receptionist.

The Institute of Radiotherapy, Oncology, and Nuclear Medicine was established in 1968. The new building housed the Radiotherapy and Oncology Department and the Nuclear Medicine Department. The radiotherapy and oncology services in the new building are equipped with 5 (five) therapy machines, 1 (one) simulator, 1 (one) CT scan, and 1 (one) general X-ray, as well as one operating theatre (OT) for brachytherapy.The facility has 6 (six) wards with a 180-bed capacity for inpatients. The services also extended to outpatient clinics, labs, patient record offices, and pharmacy satellites. The services are operated by 4 (four) oncologist specialists, 4 (four) therapy radiographers, and 1 (one) physicist and assisted by 76 nurses and 70 attendants.

The building has gone through Phase II upgrading from 1987 to 1995, as well as services and equipment used. Back then, in 1986, the radiation equipment used was Dermopan, 50 kV ; Rotating Muller X-ray 250 kV ; and Telecasium 0.66 MeV. Over the time, the equipment was upgraded accordingly as the technology improved. Since then, the services have been improved with relevant simulator technology, namely conventional simulator (1985-2001), digital simulator (2001-2019), computed tomography simulator (2006-2023), and computed tomography simulator (2020 tills now). Radiotherapy and oncology services in HKL improved further with the acquisition of linear accelerator machines in 2012 and 2014.

Medical Physics Messages from Clinical Representatives

Ms. Siti Normasitah binti Masduki, Chief Medical Physicist, Radiology Department, Hospital Sultan Idris Shah

Radiology is a vital field in modern medicine, encompassing two main branches: diagnostic radiology and interventional radiology. Both play crucial roles in patient care, leveraging advanced imaging techniques to diagnose and treat various medical conditions. Diagnostic radiology focuses on using imaging technologies to identify diseases and conditions within the body.

This includes techniques such as: X-rays: commonly used for evaluating bone fractures and detec pneumonia. Computed Tomography scan (CT scan): provides cross-sectional images of the body, aiding in the diagnosis of tumors, internal injuries, and other conditions. Magnetic Resonance Imaging (MRI): uses a strong magnetic field and radio waves to produce detailed images of soft tissues, making it particularly useful for brain, cardiac, spinal cord, and joint imaging. Ultrasound: employs sound waves to create images, commonly used in obstetrics, as well as for examining abdominal organs. Radiologists will analyze these images to provide accurate diagnoses, guiding treatment decisions and monitoring disease progression.

Interventional radiology (IR) is a subspecialty that utilizes imaging guidance to perform minimally invasive procedures for both diagnosis and treatment. This includes biopsies that obtain tissue samples using imaging techniques to guide the needle to the target area. Angioplasty and Stenting: treating narrowed or blocked blood vessels to improve blood flow. Embolization: blocking blood flow to a specific area, often used to treat tumors or control bleeding. Drainage procedures: placing catheters to drain fluid collections, such as abscesses or cysts. Interventional radiology is characterized by its focus on reducing patient recovery time, minimizing complications, and offering alternatives to traditional surgery. Both diagnostics and IR are essential components of contemporary healthcare. Diagnostic radiology provides critical information for accurate diagnoses, while IR offers innovative treatment options that enhance patient outcomes. Together, these disciplines not only improve patient care but also advance the field of medicine through ongoing research and technological innovation.

THE JOURNEY begins...

" I did not **think**;
I **experimented** - Wilhelm Roentgen "

Perjalanan dan Pengalaman Sebagai Seorang Pegawai Sains (Fizik) di Kementerian Kesihatan Malaysia

Ts. Nik Mohamed Hazmi bin Hj. Nik Hussain, Mantan Pegawai Sains (Fizik),
Jabatan Perubatan Nuklear, Hospital Kuala Lumpur

Pada 2.2.1991 saya telah melaporkan diri di Hospital Besar Kuala Lumpur (HBKL). Saya telah ditempatkan di bawah seliaan Encik Wong Jin Tin, Ketua Unit Fizik, Jabatan Radioterapi, Onkologi dan Perubatan Nuklear, HBKL.

Lebih kurang 6 bulan selepas itu, saya telah dipindahkan bagi mengetuai Unit Fizik, Jabatan Perubatan Nuklear bagi membantu Dr. Mat Rifin Bin Jusoh. Ketua Jabatan di Unit Perubatan Nuklear.

Semasa di Unit Perubatan Nuklear, saya telah diberi tanggung jawab menjalankan tugas-tugas pengurusan membantu Ketua Jabatan, tugas Pegawai Perlindungan Sinaran dan juga tugas memastikan kualiti peralatan di dalam keadaan baik selaras dengan pewartaan Akta Lembaga Perlesenan Tenaga Atom (Akta 304).

Pada 29 Mac 1993 – 23 Julai 1993, saya telah ditawarkan mengikuti kursus anjuran Badan Bebas Tenaga Atom Antarabangsa di Royal Prince Alfred Hospital dan University of Sydney, Australia selama 4 bulan. Sekembalinya dari sana, saya telah diberi peluang menandatangani kontrak projek *Certification of Quality and Preventive Maintenance of instruments in Nuclear Medicine Centres* in Malaysia dengan pihak IAEA selama 4 tahun.

Pada 25 Mei 2009, saya telah dicalonkan oleh En. Wong Jin Tin dan telah dilantik sebagai Ketua profession Pegawai Sains (Fizik) KKM buat kali pertama. Dalam menerajui profession ini, saya dapati, dua isu utama yang perlu diatas untuk membolehkan profession berkembang iaitu isu organisasi dan perjawatan yang tidak mencukupi. Maka pada tahun 1994, saya bersama-sama rakan sejawat telah menulis pelbagai kertas kerja bagi menangani kedua-dua isu berkaitan.

Usaha kami membuahkan hasil apabila profession telah mendapat pertambahan jawatan baharu dan juga jawatan naik pangkat. Namun begitu, bagi isu organisasi, saya gagal untuk mewujudkan Jabatan Fizik Perubatan kerana tidak dipersetujui oleh Ketua Perkhidmatan Perubatan Nuklear pada masa tersebut. Pada 2011, saya telah dipindahkan ke Bahagian Sains Kesihatan Bersekutu (BSKB), KKM. Kami telah berjaya mewujudkan Akta profession Kesihatan Bersekutu 2016 (Akta 774) yang menjadi punca kuasa untuk kelayakan pengamal.

Mantan Ketua Perkhidmatan Perubatan Nuklear berkenaan, selepas beliau bersara dan berkhidmat dengan hospital swasta, beliau telah datang berjumpa saya dan menyatakan beliau memohon maaf di atas tindakan beliau sebelum ini dan beliau menyatakan bahawa beliau sepatutnya menyokong cadangan saya tersebut kerana ianya telahpun dipraktik dengan jayanya di hospital-hospital swasta.

Kerjaya sebagai Pegawai Sains (Fizik)amat menyeronokkan sekiranya kita diberi peluang dan ruang untuk mengatur aktiviti sendiri berdasarkan kehendak kedua-dua Akta profession Kesihatan Bersekutu 2016 (Akta 774) dan juga Akta Perlesenan Tenaga Atom (Akta 304). Banyak perubahan yang dapat kita lakukan agar kita seganding dan setanding dengan perkembangan di peringkat antarabangsa.

Pesanan saya, teruskan mencuba dalam membangunkan menegahkan idea baru demi untuk mewujudkan kejayaan. Dunia akan bertambah maju apabila adanya semangat mencuba dan terus mencuba tanpa henti. Biarlah semangat yang membara tersebut mati hanya apabila nyawa terkeluar dari badan. Rentaslah segala halangan dengan tenang dan doa akan kita hidup di dunia tetapi kita sejalan dengan wadah kita, akhirat tempat dituju.

Often when you think you're at the end of something,
you're at the beginning of something else.

Fred Rogers

2024 Shared Mission
Technical Committee of Medical Physicist Profession
Ministry of Health Malaysia

Technical Committee Meeting 1/2024,
UTC, Kuala Terengganu on February 13th - 14th, 2024

Head of profession met up
Deputy Director General (Medical) to
discuss issues regarding profession
in hospital on February 23rd, 2024

Sesi Dialog
Timbalan Ketua Pengarah Kesihatan
(Penyelidikan & Sokongan Teknikal) bersama
Profesion Pegawai Sains (Fizik) ,
Bahagian Kawalselia Radiasi Perubatan,
Kementerian Kesihatan Malaysia, 11 Mac 2024

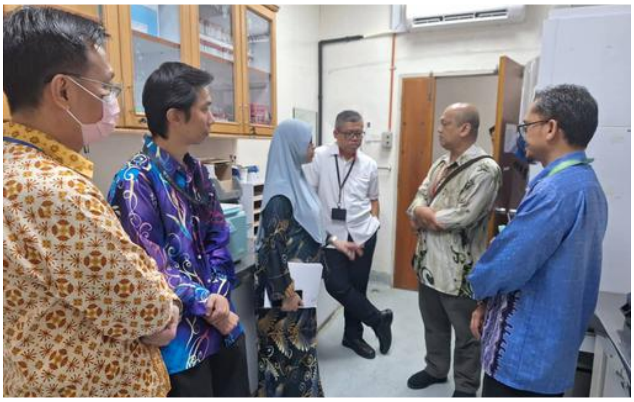
Medical Physicist Profession's
Strategic Plan Meeting, March 1st, 2024
SUK Office, Shah Alam

Bengkel Pemantapan Pegawai Sains (Fizik),
Cameron Highlands, 2-5 Mei 2024.
During this workshop, we prepared 4 proposal
papers to elevate profession's services.

Director of MRSD meeting with
YB Minister of Health and
Deputy Director General of Health
(Research & Technical Support) on June
10th, 2024

2024 Shared Mission
Technical Committee of Medical Physicist Profession
Ministry of Health Malaysia

Mesyuarat Penyediaan Kertas Kerja Perjawatan Pegawai Sains (Fizik) Radiologi, KKM, 11 Julai 2024, Universiti Putra Malaysia



On August 1st, 2024, the MOH Finance Department visited Hospital Pulau Pinang (HPP) to view the Individual Monitoring Services (IMS) Lab in order to discuss additional funding allocation for phases 4 and 5. Therefore, the budgets for phases one, two, and three have already been authorized. They paid *Unit Perlindungan Sinaran* (not existed yet) HPP an unexpected visit. Thank you Finance Department. Our hard work paid off.

Lawatan Penanda Aras MS ISO/IEC 17025, Agensi Nuklear Malaysia, 16 Ogos 2024

Head of Profession, Deputy Head of Profession & Director of Medical Radiation Surveillance Division meeting with Deputy Director General of Health (Research & Technical Support), Head of Medical Specialties (Radiology, Nuclear Medicine & Radiotherapy), representative from Allied Health Division, Medical Development Division and Finance Division. This meeting was initiated by Deputy Director General (Research & Technical Support), aimed to have the mutual understanding with all parties regarding 4 proposal papers submitted by the profession. All meeting members agreed with the proposal papers. July 26th, 2024
Deputy DG of Health (Research & Technical Support) Meeting Room,
Ministry of Health

Lawatan Penanda Aras MS ISO/IEC 17025, Makmal Kesihatan Awam Kebangsaan, 15 Ogos 2024

2024 Shared Mission
Technical Committee of Medical Physicist Profession
Ministry of Health Malaysia

Meeting with Ms. Wong from *Jabatan Standard Malaysia (JSM),* on August 16th 2024. The meeting was held to have a better understanding with all the process and documentation needed for Accreditation MS ISO/ IEC 17025 2017

On August 28th, 2024, the profession's Technical Committee had a meeting with the 3 Heads of Specialty, Radiology, Nuclear Medicine and Radiotherapy & Oncology. The aim was to get the approval from them on the proposed administration structure including function chart of U*nit Perlindungan Sinaran* which will be run at hospital. All 3 of them had agreed on the proposal. It was a historical moment for the profession.

Majlis Kick-off Clinically Qualified Medical Physicist (CQMP) Training, *19 Ogos 2024, Hospital Kuala Lumpur*

September 26th, 2024, *Mesyuarat Penyediaan Dokumen* Quality Manual *dan* Standard Operating Procedures *IMS ISO/IEC 17025 2017,* Klana Beach Resort, Port Dickson. This meeting was held within short period of time to fullfill the registration with *Jabatan Standard Malaysia* for the accreditation to be kick-start. We proposed the budgetary to Deputy Director General (Research & Technical Support) and with great pleasure we secured the financial support. Thank you YBhg. Datuk Dr. Nor Fariza for your endless support.

NEWS Letter

"The **bad news** is **time flies**,
The **good news** is **you** are the **pilot** -
Michael Altshuler"

Bonds Beyond Medical Physics

Ms. Tuan Solawati binti Tuan Muda, Chief Medical Physicist,
Nuclear Medicine Department, Institut Kanser Negara.

At the beautiful western coast of Malaysia, Avillion Admiral Cove Hotel, Port Dickson, the Society of Medical Physicist in Ministry of Health Malaysia, known as PERFEKS, was abuzz with excitement and nostalgia on 27-28th January 2024. They were organizing a team-building event that would also serve as a farewell for their esteemed head of medical physicists cum President of PERFEKS, Ts. Nik Mohamed Hazmi bin Hj. Nik Hussain, who was going to retire after 33 years of service as a MOH medical physicist. The day promised a mix of building a team spirit, camaraderie, and heartfelt goodbyes. This was the first team building that brought all the MOH medical physicists together for a shared mission. The event kicked off early on a Saturday morning at a picturesque retreat just outside the city. The sun shone brightly, and the sound of laughter filled the air as teams arrived, clad in vibrant T-shirts emblazoned with the PERFEKS logo. Ts. Nik Mohamed Hazmi, known for his innovative mind and compassionate leadership, was the heartbeat of the organization. He made significant contributions to the development and enhancement of the profession in numerous ways, especially in nuclear medicine. He also established PERFEKS in 2011. The organizing committee, a diverse group of dedicated professionals, had planned a series of activities to strengthen their bonds while celebrating his contributions.

About 50 MOH medical physicists from across Malaysia participated in the team-building event. They were divided into teams, with each member coming from different workplace. Teams were given group activities and challenges to test their knowledge and teamwork. They had a lot of fun with extra bonding with each other. After the team-building activities ended, they gathered in a beautifully decorated hall for the farewell dinner to celebrate Ts. Nik Mohamed Hazmi. The night was named as *"Malam Tautan Kasih, Sanjungan Budi,"* embracing the theme of nostalgia. About 100 medical physicists from all over Malaysia gathered together to bid farewell to Ts. Nik Mohamed Hazmi. Everyone was adorned in impressive traditional outfits that aligned with the theme. All the medical physicists approaching retirement were also invited as special guests, including Dr. Zunaide and Mrs. Mahzom. Unfortunately, Dr. Bidi was unable to attend due to personal reasons. Ts. Nik Mohamed Hazmi’s family also attended the ceremony. As they savored the delightful cuisine, the atmosphere brimmed with warmth and laughter. Finally, it was time for Ts. Nik Mohamed Hazmi's farewell speech. He stood before others, his eyes glistening with tears. "You have all been more than just colleagues; you are family. I may be leaving, but the impact we've made together will resonate in everything we do in the future," he said, his voice unwavering. The group erupted in applause, their appreciation echoing in the night. As the event unfolded, everyone took turns showcasing their talents. Laughter and applause filled the room as participants delivered captivating presentations—some sang heartfelt songs, while others recited poignant poems and traditional pantun. Each performance brought a unique flavor to the gathering, weaving a rich tapestry of creativity and camaraderie. The atmosphere buzzed with excitement when everyone made the tribute to Ts. Nik Mohamed Hazmi.

When the event drew to a close, Ts. Nik Mohamed Hazmi received a bundle of souvenirs and special gifts from PERFEKS and other colleagues representing their workplace. PERFEKS presented him with cash and a custom-made rehal, elegantly engraved with his name. With the stars twinkling above, the night concluded with a promise to stay connected, no matter where their paths led. As they parted ways, the team knew that while they were bidding farewell to a remarkable leader, they were also celebrating the enduring spirit of collaboration that Ts. Nik Mohamed Hazmi had instilled in them. In that moment, they weren’t just a team of medical physicists; they were a family, united by their passion for healing and the memories they had created together. Thank you to PERFEKS for organizing this wonderful event, to the organizing committee for making it comes true, and last but not least to all participants who had contributed to the unforgettable moments for Ts. Nik Mohamed Hazmi. Goodbye, Ts. Nik Mohamed Hazmi!

Bonds Beyond Medical Physics

Ms. Tuan Solawati binti Tuan Muda, Chief Medical Physicist,
Nuclear Medicine Department, Institut Kanser Negara.

Workshop on Quality Control of Single Positron Emission Computed Tomography (SPECT) 1.0

Mr. Fakhrur Razi bin Kufian, Medical Physicist,
Nuclear Medicine Department, Institut Kanser Negara

Medical Physicist of Nuclear Medicine Department, Institut Kanser Negara (IKN), in collaboration with Society of Medical Physicist in Ministry of Health Malaysia (PERFEKS), had organized Workshop on Quality Control of Single Positron Emission Computed Tomography (SPECT) 1.0. It was held from March 6th to 8th, 2024. The event was attended by 10 nuclear medicine medical physicists from both the government and private healthcare sectors.

The workshop aimed to enhance the participant's technical proficiency and competence in maintaining the quality control of SPECT equipment, a crucial imaging technology used for diagnosing various medical conditions. Ensuring the accuracy and reliability of this equipment is vital for delivering high-quality patient care in nuclear medicine. During the program, participants received comprehensive training on performing quality control tests, preparing phantoms, and conducting image quality analysis. Additionally, radiation safety and improvise techniques were also being discussed for a better and more efficient work process at their respective institutions. The workshop combined lectures, hands-on practical sessions, and group discussions for a well-rounded learning experience.

The event also promoted collaboration between sectors, with 4 participants from government healthcare facilities and 6 from private facilities, encouraging valuable knowledge sharing across different institutions to enhance best practices in the field. This workshop represents a significant step in keeping NM medical physicists updated with the latest skills and knowledge. The program hopefully can contribute to improving the precision and safety of SPECT imaging, which will result in better patient outcomes and support the continued growth of NM in Ministry of Health Malaysia.

The successful collaboration between IKN and PERFEKS paves the way for future initiatives aimed at further enhancing the quality and safety of medical physic services in healthcare. It was a successful event when all the participants gave very positive feedback and went home with more skills and knowledge to practice on.

The Recognition Ceremony of The Irradiating Apparatus Testers for Medical Physicist Northern Zone

Ms. Rosdiana binti Wahab, Medical Physicist,
Medical Radiation Surveillance Branch, Penang State Health Department

On August 12th, 2024, at Auditorium 1, Complex Eureka, USM, was the day of the Irradiating Apparatus Testers Recognition Ceremony for Medical Physicist in Northern Zone 2024. The Medical Radiation Surveillance Branch (MRSB), Penang State Health Department (PSHD) organized this event. Mr. Zainuddin Bin Yasak@Yusof, Senior Principal Assistant Director of the MRSB made an introduction speech. He defines medical physicist in the medical area as a medical physicist who uses the physic notion in medicine during his speech.

He also highlighted that a medical physicist's primary responsibility is to ensure that all irradiation equipment has passed quality control (QC) testing, which is done every two years for intraoral and annually for general radiography. This is carried out in accordance with the Atomic Energy Licensing Act 1984 (Act 304). The purpose of the QC test is to verify that the irradiating equipment satisfies the safety and performance standards outlined in the Atomic Energy Licensing Act 1984 (Act 304).

To become a recognised QC tester, MOH medical physicist must successfully complete the assessment conducted by the Medical Radiation Surveillance Division (MRSD). The training and assessment sessions went for three days. MRSB, PSHD had arranged the inaugural session, which took place on March 11th and 12th, 2023, at Health Clinic Tasek Gelugur, Penang. The second review, which was conducted by the Perak State Health Department, had been scheduled on May 25th, 2023, at Health Clinic Simpang, Perak. Then, Kedah State Health Department hosted the third session on October 19, 2023, at Health Clinic Padang Mat Sirat, Kedah.

The Penang State Health Director, YBrs. Dato' Dr. Fazilah binti Shaik Allaudin, was then gave the introductory remarks and launched the program. All the participants were medical physicists from Penang, Kedah, Perak, and Perlis who work in the Radiology Department and Health State Department. During this event, they received a certificate of recognition from YBrs. Dato'. Director of MRSD, Ministry of Health Malaysia, Dr. Zunaide bin Kayun @ Hj Farni and the Deputy Health Director (Public Health), Dr. Haji Alias bin Haji Abdul Aziz were also attended this event.

Now, all the participants are already being recognised to carry out intraoral, mobile, and general radiography QC testing. All this while, the QC test is performed by the approved medical physics Class H consultant. A QC test for intraoral machines costs approximately RM800 each, whereas tests for general radiography and mobile radiography cost roughly around RM1500 each. So by allowing the QC test to be carried out by the recognised MOH medical physicist, some government budget can be save.

In the future, we hope that all medical physicists working in Malaysia's Radiology Department and Health State Department will be recognized as irradiating apparatus tester and be qualified to conduct full Quality Control (QC) tests for intraoral, mobile, and general radiography replacing the medical physics Class H consultants.

Institut Kanser Negara (IKN) Medical Physics Team Won Silver Medal at National Nuclear Innovation 2024

Dr. Mohd Aminudin bin Said, Senior Medical Physicist,
Nuclear Medicine Department, Institut Kanser Negara

We are thrilled to announce that the medical physicist's team from Nuclear Medicine (NM) Department, Institut Kanser Negara (IKN) has won the Silver Medal for our innovative GammaSens Phantom at the prestigous National Nuclear Innovation Award 2024, held by Nuclear Malaysia (NM) from August 27th to 28th, 2024. This annual event brought together nuclear researchers, developers, and scientists from across the country. A total of 50 innovative projects were presented by various entities, including NM, research institutes, and government and private universities. We take great pride in representing the Ministry of Health Malaysia and are delighted to have secured the Silver Award (2nd place) among so many participants.

The GammaSens Phantom was developed by our skilled team, Dr. Mohamad Aminudin and Mr. Fakhrur Razi with the continuous support from the NM medical physicist’s team. The phantom is a major advancement in gamma camera sensitivity testing, significantly reducing acquisition time and improving efficiency. This achievement highlights the team’s commitment to excellence in nuclear medical physics and their dedication to healthcare innovation. Winning the Silver Award at this prestigious event is a testament to our exceptional contributions to the field of nuclear medicine, and it reinforces the institute's position as a leader in innovative nuclear medicine technology. We also aimed to motivate all the MOH medical physicists to continue researching and developing new ideas to enhance and streamline their day-to-day work processes. This innovation also secured Bronze Award at International Materials Technology Challenge.

Last but not least, we would like to take this opportunity to extend our heartfelt gratitude to Dr. Nor Salita binti Ali, Head of the NM Department and Dr. Mohd Anis bin Haron @ Harun, Director of IKN for their continuos support in bringing this innovation to life. Support and leadership from the top management are crucial to encourage every employee to enhance their creativity and work quality. Once again, congratulations to the IKN medical physics team on this outstanding accomplishment!

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NUKLEAR MALAYSIA

ANUGERAH INOVASI NUKLEAR KEBANGSAAN 2024

SIJIL PEMENANG

PINGAT PERAK
SILVER MEDAL
dianugerahkan kepada

GammaSens Phantom

Mohamad Aminudin Bin Said, Tuan Solawati Binti Tuan Muda,
Fakhrur Razi Bin Kufian, Mohd Zulfadhli Bin Zaini

DR. ROSLI BIN DARMAWAN
Ketua Pengarah
Agensi Nuklear Malaysia

HARI INOVASI NUKLEAR MALAYSIA 2024

BRONZE

THIS CERTIFICATE OF AWARD IS PRESENTED TO
DR. MOHAMAD AMINUDIN BIN SAID, FAKHRUR RAZI BIN KUFIAN,
TUAN SOLAWATI TUAN MUDA, RABI'ATUL ADAWIYAH BINTI MAT SALLEH,
MUHAMMAD ZULFADHLI BIN ZAINI, UMMI HABIBAH BINTI IBARHIM,
JANNATUL AKMA BINTI RAMLAN, HAFIZAH BINTI BAZAL AHMAD
for the invention/innovation of

GAMMASENS PHANTOM

at the
INTERNATIONAL MATERIALS TECHNOLOGY CHALLENGE (IMTC 9.0)

10th DECEMBER 2024
PUTRA HALL 2, FOURTEENTH COLLEGE, UPM

Organized by:
The Malaysian Solid State Science and Technology Society (MASS)
Department of Physics, Faculty of Science, Universiti Putra Malaysia

PROF. DR. ABDUL HALIM SHAARI, FASc
PRESIDENT
THE MALAYSIAN SOLID STATE SCIENCE
AND TECHNOLOGY SOCIETY (MASS)

Taklimat Penggunaan Aplikasi "DOSE RATE"

Ms. Tuan Solawati binti Tuan Muda, Chief Medical Physicist,
Nuclear Medicine Department, Institut Kanser Negara

The Android version of the Dose Rate App was developed by Dr. Janatul Madinah binti Wahabi (Dr. Jan) at the request of the Chief Medical Physicist of Nuclear Medicine, Institut Kanser Negara (IKN). It was primarily designed for time calculations when handling radioactive substances, particularly in nuclear and radiological emergencies. Mrs. Dhalisa binti Hussin from the Nuclear Medicine Department also assisted Dr. Jan with the physics formulas.

Before the Android version was developed, we relied on an Excel format to perform the calculations, which, although functional, was quite cumbersome and prone to human error. The process involved manually entering data into predefined cells, making it time-consuming and less efficient, especially during emergencies where quick and accurate calculations were essential. Additionally, the Excel format lacked the portability and user-friendly interface that the Android app now provides, making it less suitable for on-the-go use in critical situations. The transition to the Android version significantly improved the speed, accuracy, and convenience of performing these calculations.

Together, we secured the 1st Runner-Up position in the oral presentation at the International Seminar on Medical Physics 2024, presented by Dr. Jan. With this accomplishment, we are confident that the newly developed Dose Rate App is a reliable tool. Subsequently, we collaborated with *Portfolio Perkembangan Teknologi*, Technical Committee of Medical Physicist Profession, Ministry of Health Malaysia -Mr. Mohd. Amir bin Abdul Wahab and Mr. Mohd Fairoz bin Mohd Yusoff- to organize the launching event for this application. The event was conducted in both physical and online formats on September 30th, 2024 at Seminar Room, Nuclear Medicine Department, IKN. To enhance the event's value, we invited Mr. Bazli bin Sapiin, Deputy Director of the Medical Radiation Surveillance Division at the Ministry of Health Malaysia, to provide a refresher on "Back to Basics : Radiation Quantities and Its Application in Medical Physics". His presentation was engaging, and the participants expressed their gratitude for his excellent lecture. Mrs. Haizana binti Hairuman, Chief Medical Physicist of Nuclear Medicine, Hospital Kuala Lumpur, then continued to energize the event with a sharing session on the topic "Handling of Radioactive Patient Transferred to Emergency Department : HKL Experience".

Dr. Noorzaini Rose binti Mohd Zain, Radiology Head of Specialty, Dr. Nor Salita binti Ali, Head of Nuclear Medicine Department, IKN, and Dr. Shafirin bin Ab. Sani, Oncologist from Radiotherapy & Oncology Department, IKN were also attended this event together with more than 30 medical physicists (physical and online). At the event, Dr. Jan explained the detail of Dose Rate App and how to download it into everyone smart phone. Everyone was very interested and successfully downloaded it. The event concluded successfully with the launching gimmick of the Dose Rate App by Mr. Bazli, followed by a photo session. We were glad to have had this opportunity to share something valuable for the medical physics profession. We hope this will inspire all medical physicists to generate new ideas and embrace advancements in technology.

The logo of Dose Rate Android version

Taklimat Penggunaan Aplikasi "DOSE RATE"

Ms. Tuan Solawati binti Tuan Muda, Chief Medical Physicist,
Nuclear Medicine Department, Institut Kanser Negara

Certificate of Award

This is to certify that

JANATUL MADINAH WAHABI

has been awarded the 1st Runner Up for Best Oral Presentation for the presentation entitled:

Dose Rate App: Development of Temporal Assessment Tool for Radiation Workers During Nuclear and Radiological Emergency (NRE)

at the

13th INTERNATIONAL SEMINAR ON MEDICAL PHYSICS

held on

29th - 30th April 2024

at

Universiti Putra Malaysia

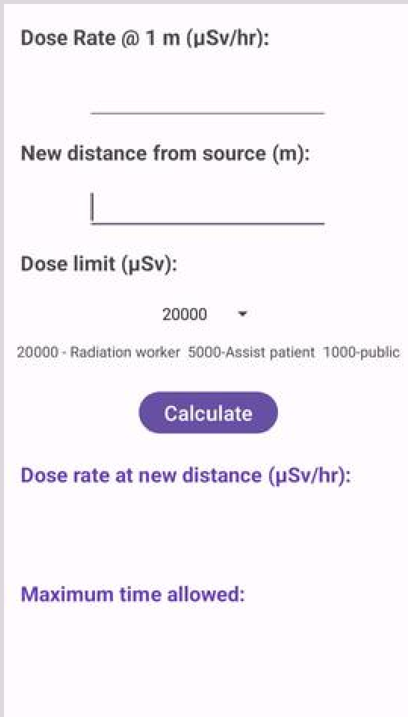
organised by

Malaysian Association of Medical Physics

Associate Professor Dr. Noramaliza Mohd Noor
President of Malaysian Association of Medical Physics

BKRP/CME/24/153: 4.25 hr (DR)
BKRP/CME/24/154: 4.75 hr (NM)
BKRP/CME/24/155: 6.25 hr (RT)

The Android version can be downloaded using this bar code.



Dose Rate App user interface

IOMP School on Intensity-Modulated Radiation Therapy (IMRT) Institut Kanser Negara (IKN)

Ms. Norhafizah binti Zolpakar, Senior Medical Physicist,
Radiotherapy & Oncology Department, Institut Kanser Negara

The IOMP School on Intensity-Modulated Radiation Therapy (IMRT) took place from October 5th to 8th, 2024, at the Institut Kanser Negara (IKN) in Putrajaya, Malaysia. This significant event was organized through a collaboration between the International Organization for Medical Physics (IOMP), the National Cancer Institute (IKN), and the Asia-Oceania Federation of Organizations for Medical Physics (AFOMP). The primary focus of the school was to provide specialized training in IMRT treatment planning techniques and patient-specific quality assurance (QA), with a particular emphasis on addressing common cancers in the region, including prostate, breast, head and neck, brain, and lung cancers.

IMRT is an advanced radiation therapy technique that allows for precise targeting of tumors while minimizing damage to surrounding healthy tissues. It achieves this by modulating the intensity of radiation beams, delivering varying levels of radiation to different areas of the tumor based on its size, shape, and location. This precision makes IMRT particularly beneficial in treating complex and irregularly shaped tumors, especially those located near vital organs. By reducing radiation exposure to healthy tissues, IMRT helps minimize side effects and improve treatment outcomes for patients. The program featured a combination of lectures and hands-on IMRT treatment planning, allowing participants to gain both theoretical and practical knowledge. Participants from various countries, including Malaysia, Indonesia, the Philippines, Mexico, Saudi Arabia, and Iran, took part in this immersive learning experience, which aimed to enhance their capabilities in cancer treatment using IMRT techniques.

Distinguished panel of speakers contributed significantly to the success of the event. Professor Eva Bezak, Vice-President of the International Organization for Medical Physics (IOMP), shared her expertise on radiation physics. Professor Dr. Arun Chougule, Dean and Chief Academic Officer at the SwasthyaKalyan Group in Jaipur, India, offered valuable insights into the radiobiology of cancer. Ms. Lisa Cunningham, a lecturer at the University of South Australia, shared her academic and clinical experience on treatment planning, while Yong Jie See, Chief Medical Physicist at Sunway Medical Centre in Malaysia, provided clinical experiences on patient care and setup during IMRT treatment. Additionally, Mr. Rahmatfadli bin Marzuki, Chief Medical Physicist at the National Cancr Institute, and Dr. Janatul Madinah Wahabi, Medical Physicist at IKN, shared essential knowledge on the theory and practical aspects of patient-specific quality assurance in IMRT.

The organizing committee, comprising medical physicists from the Radiotherapy and Oncology Department at IKN, expressed their gratitude and happiness in being able to organize this event. They warmly welcomed all participants from different countries and emphasized the importance of international collaboration in advancing cancer treatment techniques. The event was made possible with the generous support of several organizations. Varian (a Siemens Healthineers Company) provided the treatment planning software used during the course, enabling participants to engage in practical, real-time IMRT planning. Transmedic, a key provider of medical technologies, supplied the quality assurance tools used in the hands-on sessions, ensuring a comprehensive learning experience.

The IOMP School on IMRT in Putrajaya was a great success, offering participants valuable training in IMRT that will improve cancer treatment outcomes in their respective countries. This event fostered a spirit of collaboration, skill development, and innovation that will undoubtedly contribute to the continued advancement of cancer care across the region and beyond.

IOMP School On Intensity-Modulated Radiation Therapy (IMRT) National Cancer Institute (IKN)

Ms.Norhafizah binti Zolpakar, Senior Medical Physicist,
Radiotherapy & Oncology Department, Institut Kanser Negara

IAEA/RCA RAS6109 Regional Workshop on The Status and Roles & Responsibilities of Medical Physicists in Diagnostic and Interventional Radiology

Ms. Siti Normasitah Masduki, IAEA/RCA RAS6109 National Project Coordinator,
Chief Medical Physicist, Radiology Department, Hospital Sultan Idris Shah
Ms. Siti Norsyafiqah Mohd Mustafa, IAEA/RCA RAS6109 Alternate National Project Coordinator,
Medical Physicist, Radiology Department, Institut Kanser Negara,
Ms. Suratey Sulaiman, Technical Committee of MOH Medical Physicist Profession (Radiology),
Medical Physicist, Radiology Department, Hospital Selayang

This scientific meeting is the first workshop for IAEA/RCA RAS6109 organized by the International Atomic Energy Agency (IAEA) in collaboration with Government of Malaysia through the Institut Kanser Negara, Technical Committee of the Medical Physicist (Radiology) Profession and Malaysia Nuclear Agency. This workshop was held on October 15th to 18th, 2024, at Zenith Hotel Putrajaya and been officiated by Dr. Norzaini Rose Mohd Zain, Head of Clinical Radiology Expertise, Ministry of Health Malaysia.

We are grateful for the opportunity to be the host for this event. The project was one of the activities under the RCA-AP project RAS6109; Improving the Quality and Safety of Diagnostic and Interventional Radiology Services to Benefit Health Care by Enhancing the Status, Knowledge and Skills of Medical Physicists.

The purpose of this workshop is to develop a survey profiling the Diagnostic Radiology Medical Physicist (DRMP) profession in the RCA region and to review the regional status of medical physicists and workforce needs, in line with relevant IAEA standards and guidelines such as IAEA GSR Part 3 and IAEA HHS No. 25. There are 15 Asian countries involved in this meeting were China, Thailand, Malaysia, Myanmar, Philippines, Cambodia, India, Nepal, Indonesia, Japan, Pakistan, Papua New Guinea, Singapore, Sri Lanka, and Vietnam. A total of 10 participants from Malaysia were involved, namely from Hospital Sultan Idris Shah Serdang, Institut Kanser Negara, Hospital Sungai Buloh, Hospital Selayang, Hospital Kuala Lumpur, Hospital Ampang, Hospital Sultanah Aminah, Universiti Putra Malaysia, Hospital Putrajaya and also Medical Radiation Surveillance Division, Ministry of Health, Malaysia.

This workshop was led by the Lead Country Coordinator, Mr. Ioannis Delakis from Queensland Health Brisbane, Australia, Technical Officer, Dr. Olivera Ciraj-Bjelac from the Division of Human Health, Department of Nuclear Sciences and Applications, IAEA, and the IAEA expert from Australia, Mrs. Zoe Brady from Alfred Health Melbourne. Program was filled with various activities, particularly lectures from IAEA experts, sharing experiences from other countries regarding their efforts in implementing the IAEA workforce model, participant's presentations from each country and group practical sessions on the development of the survey information about the medical physicist in diagnostic and interventional radiology to be used in the IAEA workforce model.

In summary, this program emphasizes the significance aspect that; i)Distinguish and explain the key roles and responsibilities of a qualified Clinical Medical Physicist in Diagnostic and Interventional Radiology, in accordance with IAEA standards and guidelines; ii) Understand challenges through discussions and experiences from previous similar efforts in RCA and other areas; iii) Identify questions to be included in the RAS6109 project survey and recognize the meaning of collecting quality data to meet the survey objectives; iv) Demonstrate an understanding of the IAEA workforce model principles for the medical physics radiology profession; v) Apply the IAEA workforce model to regional medical physics radiology workforce needs. Hopefully, medical physicists in the radiology department will benefit from this program and spark the advancement of the profession as well as the delivery of health services.

IAEA/RCA RAS6109 Regional Workshop on The Status and Roles & Responsibilities of Medical Physicists in Diagnostic and Interventional Radiology

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Ms. Suratey binti Sulaiman, Technical Committee of MOH Medical Physicist Profession (Radiology), Medical Physicist, Radiology Department, Hospital Selayang

Kursus Kesedaran Akreditasi MS ISO/IEC 17025 bagi Makmal Individual Monitoring Services (IMS)

Ms. Noor Diana binti Dolmat, Senior Medical Physicist,
Nuclear Medicine Department, Hospital Kuala Lumpur

Kursus Kesedaran Akreditasi MS ISO/IEC 17025 bagi Makmal Individual Monitoring Services (IMS) was held on October 30th. 2024, at the Putrajaya International Convention Centre (PICC). This course aimed to raise awareness of standard MS ISO/IEC 17025 requirements. This course intended to enhance understanding of the standard MS ISO/IEC 17025 criteria. This standard will be utilized in the accreditation process of Individual Monitoring Services (IMS) laboratory. HKL was the first hospital to develop the IMS lab, starting in 2016. Then followed by Hospital Pulau Pinang in 2020, and Institut Kanser Negara in 2022. All 3 IMS was located in Nuclear Medicine (NM) Department since the developer group was NM medicial physicist. The service was initiated for inter department and research activities. After 8 years of experienced, we are now confident in offering IMS services to users of personal dosimeters from the Ministry of Health Malaysia (MOH). To achieve this goal, the laboratory needs approval from the Medical Radiation Surveillance Division (MRSD), MOH. One of MRSD's condition for approval is the IMS lab should be accredited by *Jabatan Standard Malaysia* (JSM). The objective of obtaining accreditation is to ensure the IMS lab report accurate, trustworthy, and globally acknowledged.

In relation to that, the profession's Technical Committee had begun efforts to secure funding needed to meet this requirement. The effort was rewarded when Datuk Dr. Nor Fariza binti Ngah, Deputy Director General of Health (Research & Technical Support), consented to assist with the budget. The funds were allocated for registering the accreditation procedure with JSM, as well as for trainings and meetings. The most crucial part in this accreditation is the preparation of documentation. There were many documents that needed to be prepared. Since the budget arrived in August, the committee must exert considerable effort to complete everything before December. By the grace of Allah, the committee reached its conclusion. We achieve success in the JSM registration and all the paperwork. The documentation was completed and delivered to JSM within 3 days during the document preparation meeting held in Port Dickson on September 26th to 28th, 2024. Certainly with the assistance of the draft document previously created by Mrs. Haizana, Chief Medical Physicist of NM, HKL.

Then, the process followed by trainings. Training is the most important tools when dealing with accreditation. We must provide training to all parties involved as the element of competency assessment. As for that, the awareness course is the starter. This course was successfully held by third party organiser at PICC. They invited JSM representative, Mrs. Siti Rohaya binti Omar to deliver their awareness on their work process. For technical part, Mr. John Konsoh Sangau, from Nuclear Malaysia, delivered the talk. He is one of the experienced auditor who is very well versed with the technical part of IMS lab under SAMM standard. We were very glad to have Dr. Siti Zarina binti Amir Hasan, Head of Specialty Nuclear Medicine and Dr. Ros Suzanna binti Ahmad Bustamam, Head of Specialty Radiotherapy & Oncology, together attending this course for a better understanding of Standard MS ISO/IEC 17025.

Kursus Kesedaran Akreditasi MS ISO/IEC 17025 bagi Makmal Individual Monitoring Services (IMS)

Ms. Noor Diana binti Dolmat, Senior Medical Physicist,
Nuclear Medicine Department, Hospital Kuala Lumpur

Majlis Peluncuran ke Arah Pelaksanaan Akreditasi ISO/IES 17025 bagi Makmal Individual Monitoring Services (IMS) *Kementerian Kesihatan Malaysia*

Ms. Haizana binti Hairuman, Chief Medical Physicist,
Nuclear Medicine Department, Hospital Kuala Lumpur

The Launching Ceremony was organized by Radiation Protection Committee of Hospital Kuala Lumpur (HKL) and led by Mr. Mohd Amin Bin Yaakob as Radiation Protection Officer for HKL. The event was held on November 22nd, 2024. The ceremony was officiated by YBhg. Datuk Dr. Nor Fariza binti Ngah, the Deputy Director-General of Health (Research & Technical Support) from the Ministry of Health Malaysia (MOH) at Auditorium Perdana Hospital Tunku Azizah (HTA).

The primary objective of this program is to reduce the dependency on outsourcing service providers for the dosimetry analysis of radiation workers, which now can be carried out directly by the MOH. HKL as the headquarters of the IMS Laboratory MOH, has successfully implemented the IMS system for all radiation workers in the Nuclear Medicine Department at HKL. Furthermore, other IMS laboratory branches, such as the Penang Hospital and the Institut Kanser Negara, have also taken steps to enhance and strengthen this service.

In order to further strengthen the operations and independence of these MOH laboratories, they are now ready to achieve accreditation of MS ISO/IEC 17025 laboratory from the Department of Standards Malaysia. This accreditation will not only be valid within Malaysia but also internationally, ensuring that the laboratory's analysis results are recognized globally.

This success has had a significant and positive impact on the development and progression of the MOH's Medical Physics profession, elevating the profession at both the national and international levels.

Majlis Peluncuran ke Arah Pelaksanaan Akreditasi ISO/IES 17025 bagi Makmal Individual Monitoring Services (IMS) *Kementerian Kesihatan Malaysia*

Ms. Haizana binti Hairuman, Chief Medical Physicist,
Nuclear Medicine Department, Hospital Kuala Lumpur

The successful event were also attended by Director of MRSD, Director of BSKB, Deputy Director HKL, Deputy Director HTA, Head of Services Nuclear Medicine, representatives from Director of MOH Divisions, State Health Department, and invited hospitals.

From right : Dr. Siti Zarina, Head of Services Nuclear Medicine; YBhg. Dato' Dr. Harikrishna, Director HKL; YBhg. Datuk Dr. Nor Fariza, Deputy Director General of Health; Dr. Hjh. Shahrum, Deputy Director HKL; Dr. Azlihanis, Deputy Director Medical Development Division; Dr. Shamsul, Director HTA; Mrs. Mages, Director Allied Health Division; and Mr. Zainudin, Head of Profession Medical Physicist MOH

Head of profession with the organizer and all the MOH medical physicists who came to support this event. Thank you very much.

A Commitment to Radiation Safety (Clinical Audit): Enhancing Compliance in the Nuclear Medicine Department, Hospital Pulau Pinang

Dr. Fatin Nadhirah binti A Halim, Medical Physicist,
Nuclear Medicine Department, Hospital Pulau Pinang

In the esteemed environment of Hospital Pulau Pinang, the Department of Nuclear Medicine plays a pivotal role in the diagnosis and treatment of patients requiring advanced medical care. Within this critical setting, the use of personnel dosimeters—devices designed to measure exposure to ionizing radiation—serves as a fundamental component of worker safety. However, an internal audit revealed a concerning compliance rate, with only 52% of radiation workers consistently wearing their dosimeters.

Recognizing the gravity of this situation, Mr. Mohd Hizwan, the radiation protection supervisor of the department, convened a meeting with his team. "Our responsibility extends beyond patient care; we must prioritize our own safety as well. Compliance with wearing dosimeters is essential," he stated, emphasizing the importance of this practice. Despite the acknowledgment of this duty, it was clear that further efforts were needed to turn awareness into consistent action.

In response to the audit findings, the medical physicist team developed a comprehensive strategy to improve compliance rates. They launched a "Radiation Awareness Week," aimed at educating staff on the significance of radiation safety. The week was filled with a variety of engaging activities, including workshops, video presentations, and informative posters displayed throughout the department. A quiz was organized to encourage participation, and incentives were offered to those who actively engaged with the material.

The Medical Physics Group achieved first place in the hospital-level Clinical Audit Competition, demonstrating exceptional skill, dedication, and professionalism in their approach.

As the week progressed, a noticeable shift occurred within the department. Staff members began to actively discuss the importance of wearing dosimeters, and enthusiasm grew as colleagues participated in quizzes and workshops. The program successfully educated participants while fostering a strong sense of community focused on radiation safety.

However, some employees continued to neglect the use of their dosimeters. A gentle reminder memo was issued to all staff to emphasize the importance of compliance. It was understood that fostering a culture of safety required continuous communication and encouragement. Yet, when reminders proved ineffective, a more serious warning memo was sent to emphasize the potential consequences of non-compliance.

The initial efforts yielded measurable results; after the first re-audit, compliance increased to 58%. Although this improvement was encouraging, the medical physicist team remained committed to achieving even higher standards. The team rallied once again, reinvigorating their commitment to the initiative and reinforcing their educational efforts

By the second audit, a compliance rate of 95% was achieved—an immense accomplishment for the department. This outcome was a testament to the collective dedication of the team, reflecting a significant cultural shift toward accountability and safety.

The team observed that the initiative had gone beyond simply wearing dosimeters; it had fostered a culture of vigilance and responsibility. The commitment to safety became a shared value, creating an environment where every radiation worker felt empowered to take charge of their own safety and that of their peers.

In summary, the efforts undertaken by the Department of Nuclear Medicine, Hopital Pulau Pinang demonstrate a successful approach to enhancing compliance with personnel dosimeter usage. Through education, communication, and a shared commitment to safety, the department not only improved compliance rates but also established a culture of care and accountability that will serve as a model for future initiatives in radiation safety.

ADD YOUR Knowledges

Ego = 1/Knowledge

- Albert Einstein

Introduction of Knowledge Management (KM) Concept in Medical Regulation: A Strategic Imperative

Mr. Syarul Iman bin Saufi, Principal Assistant Director,
Medical Radiation Surveillance Division, Ministry of Health

Introduction

In today's rapidly evolving nuclear landscape, effective knowledge management (KM) is crucial for ensuring operational safety, compliance with international standards, and sustained excellence in nuclear regulation. The recent discussions at the National Workshop on the Development of a Nuclear Safety Knowledge Management Programme held by the IAEA underscored the necessity for regulatory bodies like Medical Radiation Surveillance Division (MRSD) to formalize KM processes that are both sustainable and adaptable.

Developing a Comprehensive KM Program

A KM program begins with structured policies and frameworks. As per recommendations by the International Atomic Energy Agency (IAEA) and in compliance with ISO 9001:2015 (Clause 7.1.6), regulatory bodies must ensure that systems are in place to capture, organize, and store knowledge effectively. This structured development phase is critical in building a foundation that supports continual learning and adaptation in the face of industry challenges.

Preserving Knowledge for Future Generations

One of the core objectives of a nuclear knowledge management program is to preserve knowledge, particularly in anticipation of an aging workforce and the retirement of experienced personnel. The IAEA emphasizes the importance of systems that capture critical operational, regulatory, and safety information from senior experts. Documenting this knowledge through interviews, databases, and comprehensive reports ensures that future generations of regulators inherit the insights needed to maintain high safety standards.

Maintaining Knowledge Continuity in a Rapidly Changing Environment

Maintaining an updated and relevant knowledge base is not just about storing information but also about adapting to new technological and regulatory developments. Nuclear regulatory bodies must continuously refine their practices, ensuring that stored knowledge reflects current best practices and emerging threats. This is crucial, particularly in preparation for audits like the IAEA Integrated Regulatory Review Service (IRRS), which assess the regulatory body's readiness to manage nuclear safety challenges effectively.

Summary

For MRSD, MOH, embracing a structured, sustainable KM program is more than just a compliance requirement. It is a strategic priority that will help the organization maintain its role as a leader in nuclear safety and security for medical purposes and regulation. By focusing on the development, preservation, and maintenance of knowledge, regulatory bodies can ensure that they remain resilient and responsive to both current and future challenges in the nuclear industry especially in medicine.

Medical Physics Laser Applications in Medicine: Transforming Modern Healthcare

Ts. Dr. Prema Devi Chellayah, Senior Medical Physicist,
Nuclear Medicine Department, Hospital Pulau Pinang

Lasers have become invaluable in modern medicine, offering precision, safety, and versatility in a range of diagnostic and therapeutic applications. The term "laser" stands for Light Amplification by Stimulated Emission of Radiation, and this focused light technology enables practitioners to target specific tissues with remarkable accuracy. Here's a look at some key areas where lasers are revolutionizing healthcare.

1. Surgical Procedures

Lasers are widely used in minimally invasive surgeries, including eye surgeries (like LASIK for vision correction), tumor removal, and skin treatments. Laser surgery often causes less pain, reduces bleeding, and speeds up recovery times, as it can precisely cut or vaporize tissues without affecting surrounding areas. This precision is particularly valuable in delicate areas, such as the eyes and brain.

2. Dermatology and Cosmetic Treatments

In dermatology, lasers are used for skin resurfacing, removing scars, wrinkles, tattoos, and unwanted hair. Fractional lasers target the skin's deeper layers, stimulating collagen production and improving skin texture. These treatments have become popular for their effectiveness and ability to rejuvenate the skin with minimal downtime.

3. Oncology

Laser therapy plays an essential role in treating certain types of cancer. In photodynamic therapy (PDT), a laser activates a photosensitizing drug that specifically targets cancer cells, causing them to break down. This treatment is used for specific cancers, such as skin and lung cancer, and offers a less invasive alternative to traditional methods.

4. Dentistry

Dentists are increasingly using lasers to treat gum disease, remove tooth decay, and even whiten teeth. Laser dentistry reduces discomfort and the need for anesthesia, making dental visits less daunting for patients. Additionally, it can sterilize areas and minimize damage to healthy tissue.

5. Ophthalmology

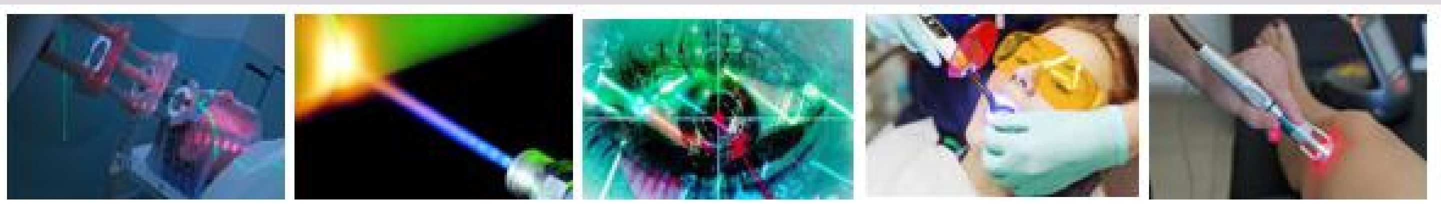
Ophthalmology was one of the first fields to adopt laser technology. In addition to LASIK, lasers treat glaucoma, retinal detachments, and diabetic retinopathy. The focused light can selectively target damaged tissues in the eye, preserving vision and helping prevent further deterioration.

6. Pain Management and Physical Therapy

Low-level laser therapy (LLLT), or "cold laser therapy," is used to reduce pain and inflammation in musculoskeletal conditions. It works by promoting cellular repair, reducing swelling, and increasing circulation. This non-invasive treatment has been helpful in managing chronic pain and promoting healing. Medical physicists should play a significant role in advancing laser applications in the Ministry of Health of Malaysia. This represents a valuable and challenging opportunity to enhance medical care in the country. Time to see the future !

7. Future Potential

Advances in laser technology continue to expand its applications in medicine. Researchers are exploring even more precise and powerful lasers to treat complex conditions with minimal side effects, promising a future where laser therapies become even safer and more widely available.



Patient-Specific Quality Assurance (PSQA) in Radiotherapy

Ms. Norhafizah binti Zolpakar, Senior Medical Physicist,
Radiotherapy & Oncology Department, Institut Kanser Negara

In radiotherapy, precision is essential to effectively treat cancer while protecting surrounding healthy tissues. Advanced techniques like Intensity-Modulated Radiation Therapy (IMRT) and Volumetric Modulated Arc Therapy (VMAT) are used to achieve this goal by delivering highly targeted radiation. To ensure these treatments are safe and accurate, Patient-Specific Quality Assurance (PSQA) is performed before treatment start. At the Radiotherapy and Oncology Department, Institut Kanser Negara (IKN), physicists play a key role in this process, ensuring that treatment plans are accurate, feasible, and deliverable.

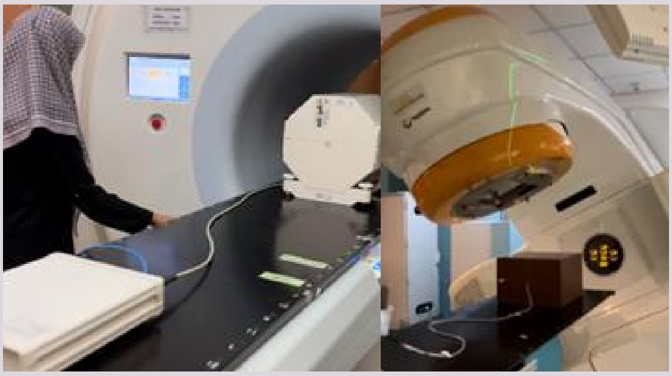
IMRT is a sophisticated form of radiation therapy that divides the radiation beam into small, adjustable segments called "beamlets." This allows for precise control of the beam intensity, enabling high doses to be directed at the tumor while minimizing exposure to healthy tissues. Similarly, VMAT further enhances precision by delivering radiation in a continuous arc as the treatment machine rotates around the patient. During this rotation, the intensity and shape of the radiation beam are continuously adjusted, offering advantages in treatment speed, flexibility, and accuracy.

IMRT/VMAT technique require detailed planning and rigorous verification. Physicists in the radiotherapy department are responsible for developing and validating these plans. They collaborate with oncologists to create treatment plans that maximize the dose to the tumor while minimizing the risk to nearby healthy tissues. Before any treatment is delivered, these plans undergo thorough Quality Assurance (QA) checks to ensure safety and accuracy.

The QA process includes verifying the radiation dose will be delivered as planned and ensuring that the treatment machine can execute the plan precisely. At IKN, IMRT plans are validated using a combination of two-dimensional (2D) and three-dimensional (3D) evaluations.

For 2D evaluations, tools like the IBA ionization chamber and a virtual water phantom are used. The ionization chamber measures radiation doses at various points, while the virtual water phantom simulates how human tissue responds to radiation. This ensures the dose distribution within a single plane matches the treatment plan, with a standard passing rate of 3%.

For 3D evaluations, the Octavious 4D phantom is used. This advanced system measures radiation doses at all angles during treatment delivery, ensuring accuracy across the entire tumor volume. The gamma analysis method compares the measured dose to the planned dose, with passing criteria of a 3% dose difference and a 3 mm spatial deviation. These standards confirm both dosimetric and spatial accuracy.



To minimize disruptions to daily operations, PSQA is typically conducted during the lunch hour. During this time, QA teams test and verify treatment plans scheduled for the next day, resolving any issues before treatments begin. This efficient workflow ensures that every patient's treatment is thoroughly checked without affecting the department's routine. This rigorous QA process, led by skilled physicists, guarantees accurate radiation delivery to tumors while protecting healthy tissues, ultimately improving patient outcomes.

Enhancing Medical Physics Services in Malaysia through Acts and Regulations

Mr. Syarul Iman bin Saufi, Principal Assistant Director,
Medical Radiation Surveillance Division, Ministry of Health

Medical physics plays a crucial role in modern healthcare, particularly in areas involving diagnostic imaging, radiation therapy, and nuclear medicine. As Malaysia continues to develop its healthcare system, enhancing medical physics services is essential to ensure the safety, efficacy, and quality of radiation-based medical treatments. Acts and regulations are key tools for advancing medical physics services by setting standards for radiation protection, ensuring the proper use of radiation technologies, and safeguarding public health and worker safety. This article explores how legislative frameworks and regulatory policies can enhance medical physics services in Malaysia, ultimately contributing to better healthcare outcomes.

The Importance of Medical Physics Services

Medical physics services are vital in the application of ionizing and non-ionizing radiation for diagnosis and treatment. Medical physicists work closely with healthcare providers to ensure that radiation doses used in procedures are safe for both patients and medical staff. In radiation therapy, they are responsible for accurate treatment planning and delivery, ensuring that cancer patients receive optimal radiation doses to target tumors while minimizing exposure to healthy tissues. In diagnostic imaging, medical physicists help optimize the use of technologies like X-rays, CT scans, and MRIs to produce high-quality images with the lowest possible radiation dose.

Given the inherent risks of radiation exposure, it is essential that medical physics services operate under strict guidelines and regulations. Acts and regulations ensure that healthcare facilities maintain proper safety standards, that medical personnel are adequately trained, and that radiation doses remain within safe limits for patients and healthcare workers.

The Role of Acts and Regulations in Medical Physics

Acts and regulations provide a legal framework that governs the use of radiation in healthcare settings. In Malaysia, Act 304—the Atomic Energy Licensing Act 1984—is a key piece of legislation that regulates the use of ionizing radiation in medicine, industry, and research. This Act mandates the licensing of all radiation sources, equipment, and facilities, as well as the registration of radiation workers, including medical physicists. By enforcing these licensing requirements, Act 304 ensures that radiation sources are handled only by qualified personnel and that safety protocols are adhered to in medical settings.

Additionally, guidelines and codes of practice developed under Act 304 outline safety standards for the design and operation of radiation facilities. These documents specify the minimum qualifications for medical physicists, required safety equipment, and procedures for radiation protection. By ensuring compliance with these standards, Malaysia can enhance the quality of its medical physics services, reduce the risks associated with radiation exposure, and improve patient safety.

The development of regulations specific to medical physics is also essential for advancing the profession. For instance, regulations could formalize the certification and accreditation processes for medical physicists, ensuring that professionals meet rigorous standards of competence. These regulations could also establish continuing education requirements to keep medical physicists updated on technological advancements and best practices in radiation safety.

Enhancing Quality Assurance through Regulatory Oversight

One of the key areas where acts and regulations can enhance medical physics services is in Quality Assurance Programs (QAPs). In radiation therapy and diagnostic imaging, quality assurance involves regular calibration of equipment, verification of treatment plans, and monitoring of radiation doses. Acts like Act 304 can mandate the implementation of QAPs in all healthcare facilities that use radiation, ensuring that equipment is functioning correctly and that procedures are safe and effective.

For example, in radiation therapy, regulations can require that every facility undergoes regular audits by certified medical physicists to assess the accuracy of treatment planning systems and the performance of radiation delivery machines. Similarly, in diagnostic imaging, regular quality checks on X-ray and CT machines can be mandated to ensure that image quality is high and radiation doses are as low as reasonably achievable.

Enhancing Medical Physics Services in Malaysia through Acts and Regulations

Mr. Syarul Iman bin Saufi, Principal Assistant Director,
Medical Radiation Surveillance Division, Ministry of Health

By enforcing strict quality assurance measures through regulatory oversight, the government can help improve the overall standard of medical physics services in Malaysia, ensuring that patients receive the highest quality care while minimizing risks.

Safeguarding Radiation Workers through Legal Protections

In addition to protecting patients, acts and regulations also play a critical role in safeguarding radiation workers. Medical physicists and other healthcare workers who handle radiation are at risk of occupational exposure, which can lead to serious health consequences if not properly managed. Acts like Act 304 include provisions for the monitoring of radiation doses received by workers, ensuring that exposure levels do not exceed safe limits.

Regulations can further enhance worker safety by requiring that radiation workers, including medical physicists, undergo regular training on radiation protection and safety protocols. This training ensures that workers are aware of the risks associated with radiation exposure and are equipped with the knowledge and skills to minimize those risks. Additionally, by mandating the use of personal protective equipment and radiation monitoring devices, regulations can reduce the likelihood of harmful radiation exposure in the workplace.

Strengthening Inter-agency Collaboration and Research

Effective regulation of medical physics services requires collaboration between various agencies and stakeholders. In Malaysia, the Atomic Energy Licensing Board plays a central role in regulating radiation safety, working closely with the Ministry of Health (e.g., the Medical Radiation Surveillance Division, MRSD) and other relevant bodies (such as the Department of Atomic Energy, MOSTI). Strengthening inter-agency collaboration can help ensure that regulations are consistently enforced and that healthcare facilities comply with safety standards.

Moreover, acts and regulations can encourage research and development in medical physics by providing funding and support for studies on radiation safety, new treatment techniques, and the development of advanced radiation technologies. By fostering a culture of research and innovation, Malaysia can stay at the forefront of medical physics, continuously improving its healthcare services and enhancing patient outcomes.

Summary

Acts and regulations are essential for enhancing medical physics services in Malaysia. Through the enforcement of safety standards, licensing requirements, and quality assurance measures, legislation like Act 304 plays a critical role in safeguarding both patients and radiation workers. By strengthening the regulatory framework, encouraging inter-agency collaboration, and fostering research and education, Malaysia can ensure that its medical physics services continue to advance in line with global best practices. In doing so, the country will not only improve the quality and safety of radiation-based medical treatments but also contribute to better overall healthcare outcomes for its population.

Shielding and Lead Equivalent Test (LET) for X-Ray Facility

Ms. Nurul Ain binti Abdullah, Medical Physicist,
Ms. Dhalisa binti Hussin, Chief Medical Physicist,
Radiology Department, Hospital Sultanah Aminah

X-ray is an ionizing radiation which potentially leads to unnecessary radiation exposure when the design of the X-ray room is not sufficient enough for radiation protection. Therefore, a well-designed X-ray imaging facility shall consider from a radiation perspective view with the aim of minimal radiation exposure. This aim can be achieved by reducing time spent working with the radioactive source, using suitable shielding and far distance from the radioactive source. The most practical way in this context is to design the room structural design with proper shielding material, the room and equipment layout shall consider the appropriate distance between machine, patient and staff that reflects comfortable and ergonomic.

In Malaysia, the structural shielding and layout of X-ray imaging facilities shall comply with Malaysian Standard, MS 2228:2009 and MS 838:2018. The layout of the X-ray room shall obtain approval prior to installation by the Medical Radiation Surveillance Division (MRSD), Ministry of Health (MOH) Malaysia.
To verify the integrity of the shielding, Lead Equivalence Test (LET) to be conducted prior to facility services operations. The objective of this test is to ensure the thickness of the lead affording the same attenuation as the material.

There are several types of shielding material such as lead sheet, concrete, barium plaster, various types of bricks, gypsum wallboard, lead glass, lead acrylic and other hybrid or materials with high atomic number. Lead and concrete are the most common materials used for X-ray shielding due to its chemical properties of high atomic number and high density contributing to effective radiation protection. Barium plaster also known as gypsum plaster incorporating barytes aggregates, as a final coat applied on X ray room.
MOH has set the guidelines on minimum requirement for X-ray room and related facility & lead equivalent thickness as referred to Table 1.

Type of Irradiating Apparatus	Minimum dimension of X-ray room	Shielding thickness of walls and doors	Dimension & thickness of lead for walls (back of Bucky Chest)	Dimension of lead glass (min thickness of 2mm Pb eq)	Dimension & thickness of lead for floor (if on upper floor)
General Radiography (control room inside with examination table)	3.0m x 5.0m	2.0mm Pb eq.	1.2m x 1.2m x 2.0mm Pb eq	35cm x 30 cm	1.2m x 2.5m x 2.0mm Pb eq.
General Radiography (control room outside from examination table)	2.5m x 4.0m	2.0mm Pb eq.	1.2m x 1.2m x 2.0mm Pb eq	35cm x 30 cm	1.2m x 2.5m x 2.0mm Pb eq.
X-ray OPG /CBCT	2.5m x 3.5m	1.5mm Pb eq.	n/a	n/a	n/a
Fluoroscopy (with radiographic tube)	6.0m x 4.0m	2.0mm Pb eq.	1.2m x 1.2m x 2.0mm Pb eq	100cm x 50 cm	1.2m x 2.5m x 2.0mm Pb eq.
Fluoroscopy (without radiographic tube)	6.0m x 4.0m	2.0mm Pb eq.	n/a	100cm x 50 cm	n/a

Table 1: Minimum requirement for X-ray room and related facility & lead equivalent thickness (MOH, 2021)

Figure 1: Lead sheet installed to a door frame of an X-ray room

LET and shielding test applies to every single compartment in the X-ray room such as several main entrance patient doors, staff doors, doors to changing rooms or to a patient toilet. Doors and walls should be of solid construction with the lead bonded on both sides by wood or a suitable alternate protective material and comply with the requirements as in Table 1. Doors may also include lead glass windows for certain modalities. The shielding in the window, window frame, door frame and door must be effectively uninterrupted and sufficiently overlapped to avoid any radiation leakage. Figure 1 shows example of installed lead sheet to a door frame of an X-ray room.

Shielding and Lead Equivalent Test (LET) for X-Ray Facility

Ms. Nurul Ain binti Abdullah, Medical Physicist,
Ms. Dhalisa binti Hussin, Chief Medical Physicist,
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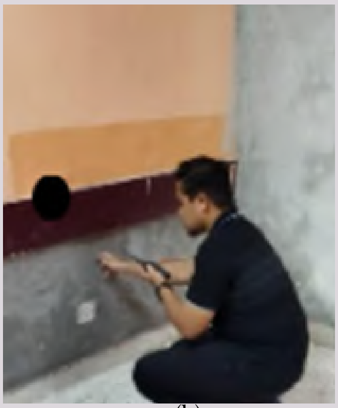
According to the Application Guidelines for The Registration of Ionizing Radiation Facilities for Radiology Services issued by MOH (2021), LET report shall be submitted to MRSD, especially for a new X-ray room or renovated existing X-ray room and potentially affected the existing shielding integrity (Figure 2 (a)(b)). The LET must be performed by a qualified Consultant Medical Physicist (Class H) or Medical Physicist approved by MOH as Figure 4(a)(b).

For a shielding test report, it may be a compilation of shielding calculation and shielding verification either or. As for shielding calculation, you need to consider the estimation of patients per week, estimation type of case per week, the emission parameters like kV, mA etc. Meanwhile, shielding verification shall be performed whenever a physicist needs to verify the LET report, to do radiation self-check on the possibility of radiation leakage by time or any other facility upgrading reason.

3(a)



3(b)

Figure 3(a): The set up between radioactive source and survey meter with variance of measure distance which equal to room and wall thickness of the room 3(b) LET measurement for placement of new barium plaster wall by a qualified consultant medical physicist

To perform LET, as referred to Figure 3(a), it requires test tools such as radioactive source or X-ray machine, survey meter, lead sheets, measuring tape, adjustable source holder with container and personal protective equipment (PPE). Americium-241 is commonly used as the radioactive source for the LET.

Secondly, the thickness of every single door, window and wall needs to be taken into account and recorded in the forms in Table2.

All transmission exposure values through the tested materials (wall, door, etc.) were recorded. For technical comparison data evaluation, we need to create a reference data sheet, exactly positioned in Figure 3(a) to assess the lead equivalent thickness. The results are properly analyzed to ensure all the tested materials (wall, door, etc.) meet the requirements set by MOH to ensure safety of all concern. The data tabulation is as shown in Table 2.

Point	Measurement reading				Reference reading of 2mm Pb	Exceed 2mm Pb equivalent reading? (Yes / No)
	1	2	3	Average		

Table 2 : A sample of data tabulation to analyse the Pb equivalent reading

In conclusion, the shielding integrity of X-ray facilities play crucial consideration to ensure everyone dealing with ionizing radiation is safe and complies with Atomic Energy Licensing Act 1984 (Act 304) for medical purpose. This is also in line with the requirement of National Council on Radiation Protection (NCRP) Report No. 147 (NCRP, 2005).

4(a)

4(b)

Figure 4(a)(b) LET conducted in Hospital Sultanah Aminah Johor Bahru by Medical Physicists MOH

Performance Assessment of Thyroid Counter using Gamma Emitting Radionuclides Caesium (Cs-137) and Europium (Eu-152)

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In the radiation protection program, it is recommended that radiation workers do routine medical check-ups to ensure the dose received by radiation workers is not more than 20 mSv per year. Every licensee is responsible for obeying the rules by the regulatory authority from time to time to protect occupational safety and health and the public from ionizing radiation.

Dose assessment received by radiation workers is important to deduce if the dose received during occupational exposure may be causing cancer. One of the ways to get the dose directly is using the thyroid counter. A thyroid counter is used to access the doses received by radiation workers, especially in the neck area where the thyroid gland is. A thyroid counter that is optimal and can give accurate readings is essential to ease the radiation worker's anxiety about the amount of dose received.

This research was conducted to monitor background radiation levels for accurate internal dose assessment and to evaluate the reliability and performance of the thyroid counter system for thyroid dose monitoring among radiation workers. The tested thyroid counter is located at *Agensi Nuklear Malaysia*, Kajang. Equipment maintenance management is essential to ensure the machine operates according to the manufacturer's specifications and guarantee the safety of radiation workers and operators.

This performance evaluation includes (i) Background radiation monitoring in two different conditions, (ii) Quality control testing using Cs-137 and Eu-152 radioactive sources, (iii) Chi-square test, and (iv) Assessment of Minimum Detectable Activity (MDA) level. The performance evaluation of this thyroid counter complied with the tolerance range of factory settings and was safe to use in obtaining dose readings received by radiation workers.

The findings of this study found that: (i) There is no significant difference in background radiation readings in two different conditions; (ii) Quality control tests are within the production specification range (± 5%); (iii) The chisquare test is in the production specification range between the values of 4.1 to 14.7; (iv) The MDA value proves the ability of the thyroid counter to detect radionuclide activity at a low activity with a longer time.

The Role of Licensing Officers in Ensuring Radiological Safety: Essential Skills and Competencies for Effective Assessment

Mr. Syarul Iman bin Saufi, Principal Assistant Director,
Medical Radiation Surveillance Division, Ministry of Health

The Medical Radiation Surveillance Division, under Malaysia's Ministry of Health, plays a crucial role in ensuring the safe and effective use of ionizing radiation across healthcare facilities. Licensing officers in this division hold significant responsibilities in regulating and monitoring radiation practices in diagnostic and therapeutic settings. These roles require a high level of expertise, adherence to national and international standards, and a keen understanding of the complex skills and competencies needed to conduct thorough radiological assessments. This article explores the responsibilities of a licensing officer and the essential skills and competencies necessary to maintain safety and compliance within Malaysia's radiological facilities.

Licensing Responsibilities for Medical Radiation

Licensing officers serve as the front line in ensuring radiation safety in healthcare. Their core duties encompass evaluating license applications, ensuring facilities comply with safety standards, and conducting on-site assessments. The regulatory process involves reviewing radiological plans, assessing equipment, and confirming that facilities meet all requirements for the safe use of radiation. Licensing officers act as stewards of public health by guaranteeing that radiation exposure limits for patients, healthcare workers, and the environment align with international standards.

The role includes implementing regulations from global frameworks, such as the International Atomic Energy Agency (IAEA) and the World Health Organization (WHO), which set out key guidelines for radiological safety. These standards include the IAEA's Basic Safety Standards (BSS), which govern the use of radiation sources, dose limits, and safety protocols for handling and administering radiation in healthcare settings. Additionally, licensing officers collaborate with stakeholders to ensure that practices align with both regulatory standards and evolving technologies.

Essential Skills and Competencies for Licensing Officers in Radiological Assessment

The role of a licensing officer requires a specialized set of skills and competencies that enable effective assessments and compliance with regulatory frameworks. These skills are crucial in evaluating radiological facilities and ensuring that safety measures are robust and comprehensive. Below are the essential skills that licensing officers must develop:

1) Technical Expertise in Radiation Physics and Medical Physics

- Understanding Radiation Interactions: Licensing officers need a thorough understanding of radiation physics, including how ionizing radiation interacts with different materials and affects human tissue. This knowledge is fundamental for assessing equipment safety and its application in clinical settings.
- Familiarity with Various Modalities: Knowledge of diverse radiation modalities, such as X-rays, CT scans, linear accelerators, brachytherapy, and PET imaging, enables officers to evaluate the unique characteristics and requirements of each device, enhancing overall safety assessments.

2) Regulatory Knowledge of Standards and Guidelines

- National and International Regulations: A key responsibility is ensuring that facilities comply with safety standards, such as those outlined by the IAEA and WHO. Licensing officers need to stay current with updates to guidelines, such as BSS and GSR Part 3, to assess regulatory compliance accurately.
- Interpretation of Safety Standards: Understanding these standards aids officers in translating regulatory requirements into actionable safety measures, helping facilities implement effective radiation protection measures.

3) Proficiency in Risk Assessment and Hazard Identification

- Assessing Risks and Hazards: Risk assessment skills enable officers to identify hazards in facilities, from inadequate shielding to potential equipment malfunctions. This ensures that potential risks are mitigated before licensing approval is granted.
- Pre-emptive Hazard Identification: By proactively addressing these risks, licensing officers contribute to a safer environment for patients and healthcare workers, reducing the likelihood of radiation exposure incidents.

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4) Skills in Dosimetry and Dose Optimization

- Radiation Dose Monitoring: Proficiency in dosimetry is essential for evaluating radiation doses administered to patients and healthcare staff. Licensing officers need to ensure that dosimetry practices comply with safety limits and are effectively optimized for each modality.
- Dose Optimization Techniques: Ensuring that facilities implement dose optimization techniques helps minimize radiation exposure while achieving desired clinical outcomes, protecting both patients and personnel.

5) Competency in Facility Design and Shielding Evaluation

- Assessing Facility Layout: Licensing officers evaluate the design and layout of radiological facilities, including room setup and equipment positioning, to minimize unnecessary exposure.
- Understanding Shielding Requirements: Knowledge of shielding materials and placement requirements allows officers to verify that all structural elements, from walls to windows, provide adequate radiation protection based on facility needs and dose calculations.

6) Analytical Skills for Evaluating Safety Protocols

- Protocol Review and Quality Control: Strong analytical skills enable licensing officers to assess safety protocols for emergency procedures, PPE usage, and quality control of equipment, ensuring comprehensive risk management.
- Quality Control (QC) Measures: QC is an essential aspect of equipment safety. Licensing officers should evaluate and confirm that facilities have robust QC protocols for regular equipment calibration and testing.

7) Communication and Documentation

- Effective Communication: Licensing officers need to clearly communicate assessment findings, recommendations, and regulatory requirements to healthcare facility administrators and staff.
- Detailed Documentation: Accurate documentation of assessments, findings, and recommendations is essential for maintaining a transparent and traceable regulatory process. This record-keeping provides a clear account of compliance efforts and any required follow-up actions.

8) Commitment to Continuous Professional Development

- Adapting to Technological Advances: Given the rapid development in radiological technologies, licensing officers must stay updated with the latest advancements and best practices to enhance assessment accuracy.
- Ongoing Training and Certification: Engaging in continuous education programs, attending workshops, and maintaining certifications allows licensing officers to remain proficient in the most recent standards and practices in radiological safety.

Supporting a Culture of Safety through Licensing and Assessment

The role of licensing officers is vital to fostering a culture of safety and accountability in the use of ionizing radiation within healthcare. By combining regulatory knowledge with technical expertise and strong analytical skills, licensing officers help mitigate the risks associated with radiation exposure. The licensing and monitoring process ensures that radiological practices in Malaysia adhere to international standards, providing confidence to patients, healthcare providers, and regulatory bodies alike.

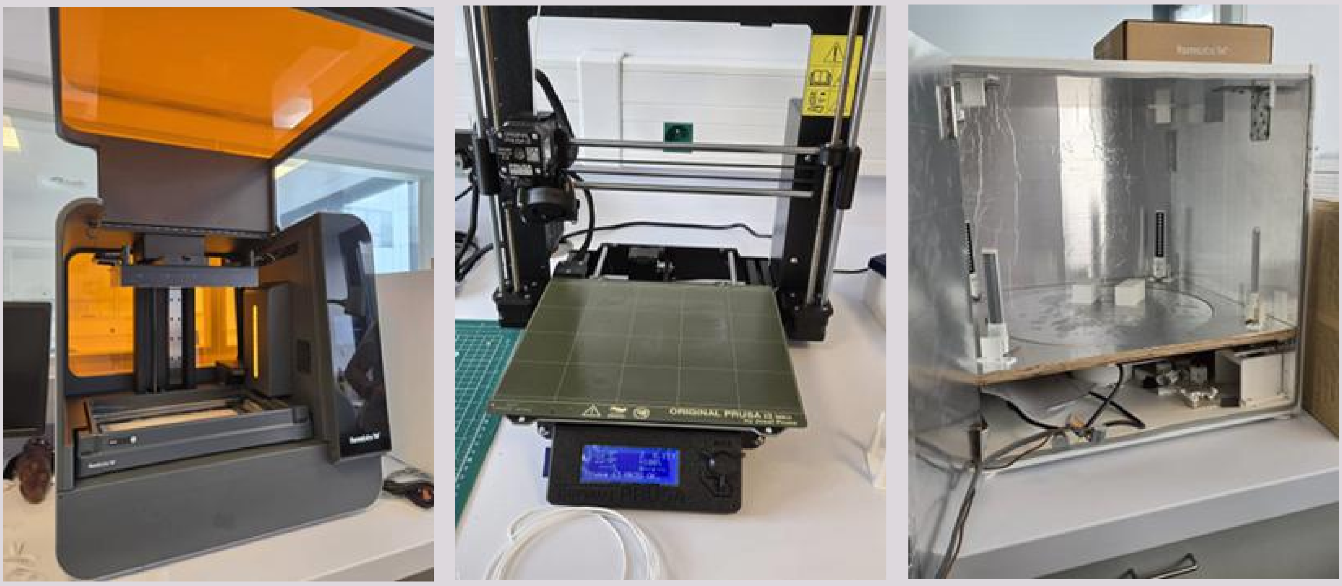
In this capacity, licensing officers act not only as regulators but also as advocates for safe and effective radiation practices. By continuously developing their skills and competencies, they contribute to the ongoing improvement of Malaysia's healthcare standards and support the nation's commitment to protecting public health through safe radiological practices. Ultimately, the dual focus on licensing responsibilities and the essential skills required in radiological assessment ensures that Malaysian healthcare facilities maintain the highest standards in radiation safety, aligning with global benchmarks for health and safety in medical radiation use.

The Magic of Physical Sciences: A Look at Medical Physics Lab- 3D Printer Evaluation

Ts. Dr. Prema Devi Chellayah, Senior Medical Physicist,
Department of Nuclear Medicine, Hospital Pulau Pinang

3D printing, also known as additive manufacturing, is a process that creates three-dimensional objects by layering materials based on a digital design. It works by taking a computer-generated 3D model and converting it into thin, successive layers that are printed one on top of another. This technology can use a variety of materials, including plastics, metals, and even biological materials, depending on the application. 3D printing is used in various fields, including manufacturing, healthcare, architecture, and education, to produce prototypes, customized products, and complex structures that would be difficult or impossible to create with traditional methods.

The design of phantoms for quality control and radiopharmaceutical chemistry optimization for nuclear medicine applications are made possible by 3D printers. For instance, the thyroid, salivary glands, and liver implant to measure the amount absorbed. 3D printing has the potential to significantly improve patient care by enabling customized cancer treatments as well as customized radiopharmaceutical chemistry research. In addition to that, this 3D printing can help to improve patient care from other department such in surgical, breast implant support, in dental, facial bone support for any kind of facial bone cancers as how have been practiced in Hospital University De Brussels.



a) b) c)

Figure 1: a) Resin and b) PLE -Shows 3D printer c) Oven with UV light

3D printing has increasingly found applications in nuclear medicine, radiology, and radiotherapy, enhancing both diagnostic and therapeutic capabilities. Here's a brief overview of its usage in these fields:

1. Nuclear Medicine:
Phantom Creation: 3D printing is used to create anatomical phantoms (models) for training and calibration of imaging equipment like PET or SPECT scanners. These phantoms help in testing and quality assurance without the need for human subjects.
Customized Radiopharmaceutical Delivery: 3D-printed scaffolds or structures can be used to deliver radiopharmaceuticals in a more controlled and targeted manner, improving the precision of treatments.

The Science of Artificial Intelligence: A Look at Medical Physics Lab- 3D Printer Evaluation

Ts. Dr. Prema Devi Chellayah, Senior Medical Physicist,
Department of Nuclear Medicine, Hospital Pulau Pinang

Figure 2: Example of the products from 3D printer for the patient clinical support a) mandible support for the mandible bone cancer patient b) Breast anatomical model for education purpose

2. Radiology:

- Patient-Specific Models: 3D printing creates detailed, patient-specific anatomical models from imaging data (CT, MRI), helping doctors visualize complex structures. These models assist in planning and performing more accurate diagnoses and surgical interventions.
- Pre-Surgical Planning: Surgeons can practice procedures on 3D-printed models of patients' organs or tumors, allowing for better preparation and reducing risks during surgery.

3. Radiotherapy:

- Bespoke Immobilization Devices: Custom 3D-printed devices are used to ensure patients remain in the correct position during radiotherapy, ensuring accurate targeting of tumors while minimizing exposure to surrounding healthy tissue.
- Brachytherapy: In brachytherapy, where radioactive sources are placed directly inside or near the tumor, 3D printing is used to create personalized applicators that fit the patient’s anatomy, improving precision in treatment delivery.
- Treatment Planning and Simulation: 3D-printed models help in simulating radiation treatment plans and visualizing tumor areas to ensure proper beam angles and dosages.

4. Prosthetics and Implants:

- Custom Prosthetics: 3D printing allows for the creation of patient-specific prosthetic limbs and joints, improving comfort and functionality. This is particularly useful for patients with unique needs or anatomical variations.
- Orthopedic Implants: 3D-printed implants, such as hip or knee replacements, can be custom-designed to match the patient’s anatomy perfectly, enhancing fit and reducing the risk of complications.
- Dental Implants and Crowns: Dentists use 3D printing for creating precise dental implants, crowns, bridges, and dentures, reducing the time needed for fittings and improving the quality of the final product.

5. Surgical Instruments and Tools:

- Customized Surgical Tools: Surgeons can design and print specialized tools tailored to specific surgeries or individual patient needs. This reduces the time spent on surgery and enhances precision. Training Models: 3D-printed models are used for surgical training and simulations, enabling healthcare professionals to practice procedures before performing them on patients.

6.Tissue Engineering and Bioprinting:

- Bioprinting Tissues and Organs: Though still in the research phase, 3D printing is being explored for printing human tissues and organs using bioinks (living cells). This could eventually lead to the creation of transplantable organs, reducing the need for organ donors.
- Regenerative Medicine: 3D printing is used to create scaffolds for tissue regeneration, providing a structure for cells to grow and form new tissues, particularly for burn victims or patients with damaged organs.

The Physical Science of 3D Printer: A Look at Medical Physics Lab- 3D Printer Evaluation

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7.Implantable Devices:
Custom Implants for Complex Conditions: For certain medical conditions, like cranial defects or complex fractures, 3D printing allows for the creation of implants that match the patient's anatomy perfectly, leading to better outcomes and faster recovery times.

6. Personalized Medication:
3D-Printed Pills: Researchers are developing 3D-printed pharmaceuticals, where pills can be customized to release medications in specific ways or dosages, tailored to individual patient needs. This includes combining different drugs into a single pill.

7. Assistive Devices:
Custom Orthotics: 3D printing is used to create customized orthotic devices, such as insoles or braces, that are specifically designed for the individual patient's anatomy, improving comfort and functionality.
Hearing Aids: 3D printing is used to create personalized hearing aids that fit the unique shape of an individual's ear, enhancing comfort and sound quality.

8. Education and Research:
Anatomical Models for Teaching: 3D printing provides medical students and professionals with realistic, tangible models for learning and training. These models help in understanding complex anatomy and diseases without the need for cadavers.
Research Models: 3D printing enables the creation of models for research purposes, allowing scientists to study disease progression or experiment with drug testing on simulated tissues.

9. Surgical Implants and Biomaterials:
Metal and Biocompatible Implants: 3D printing is used to create customized metal implants, such as those made from titanium, which are biocompatible and durable for joint replacements and bone repairs.
Biodegradable Implants: Researchers are also working on biodegradable 3D-printed implants, which naturally dissolve in the body, reducing the need for follow-up surgeries to remove them.
In summary, 3D printing in medicine is a game-changer, providing highly personalized, precise, and efficient solutions that improve patient outcomes, reduce costs, and open up new possibilities in healthcare.

Conclusion
3D printing has emerged as a transformative tool in the medical field, enabling advancements in patient care, surgical planning, and medical innovation. Its ability to create highly personalized solutions has revolutionized prosthetics, implants, and surgical tools, improving patient outcomes and reducing recovery times. Furthermore, the technology has accelerated the development of custom anatomical models, aiding in preoperative planning and enhancing medical education.

The use of biocompatible materials and ongoing research into 3D bioprinting of tissues and organs hold the promise of addressing the challenges of organ shortages and regenerative medicine. However, challenges such as cost, regulatory approvals, and the need for standardization must be addressed to fully integrate 3D printing into mainstream medical practices.
Overall, 3D printing stands as a pivotal innovation in modern medicine, bridging the gap between technology and personalized healthcare while paving the way for groundbreaking future applications.

Incident of Cremation of Patient with Radioactive Seed Implant with Less Than 1 year Implantation in Pulau Pinang

Ms. Rosdiana binti Wahab, Principal Assistant Director,
Medical Radiation Surveillance Branch, Penang State Health Department

Recently, Medical Radiation Surveillance Branch (MRSB), Penang State Health Department (PSHD), received email notification on 30 September 2024 from Penang Adventist Hospital staff about a patient with seed implant has come to Penang Adventist Hospital on 22 August 2024. Radiation dose was monitored by Penang Adventist Hospital Staff to the patient. The dose measured was 0.28 μSv per hour at 1 meter distant from the patient. A permanent implant is a radiation hazard if the ambient dose equivalent is more than **25 μSv per hour at 1 meter from the body**. The patient had **59 seeds implant** for liver metastasis with unknown radioactive source. The activity of radioactive sources is 0.7 mCi. The radioactive seed implantation was done on 22 August 2024 at Modern Hospital Guangzhou. We were not informed when was the patient discharge from the hospital. After the discharge, the patient was sent to Charis Hospice (cancer patient care under NGO).

On 16 November 2024, our medical physicist from MRSB, Ms. Habibah received notification from Charis Hospis at 9.40 am about the death of this patient with the seed implant on that day. The body will be cremated on 18 November 2024 at 3.00 pm at Mount Erskine Crematorium. The family member of the patient decided to cremate the body of the cadavers because the cost for burial is very expensive and cannot be afford by family members. On 19 November 2024, four of our medical physicist with one physicist from Hospital Pulau Pinang have go to the crematorium centre to do dose monitoring for the cadavers after cremation.

During the dose measuring and monitoring process, we take a few precaution to avoid contamination with radioactive source. We were wearing personal protective equipment (PPE) – gown, mask and rubber gloves – during handling and hands washing afterwards. We also advise the cremationist to wear PPE gown, mask and rubber glove during collection of body remaining into a basin. The remaining bone will be destroyed to the ashes and will be transferred to metal urn for storage. The family members will bring the ashes to Kek Loksi Temple, Air Itam for storage.

Mr. Irwan, a medical physicist from MRSB advices the family members of the patient through phone call to adhere to radiation safety measures such as reduce time being near the ashes and take a minimum distant of 1 meter from the ashes if possible. The pregnant woman should not stand near the ashes of the patients with radioactive seed implant.

In this case in Penang, we have made a measurement of radiation dose to ashes and bone of patient after cremation (collected bone and ashes). Dose measured at close distance approximately **20** centimeter is **81 μSv/hr**. Measured dose at **1** meter distance (**0.25μSv/hr**) compared to background dose 0.22 μSv/hr. We concluded that dose of radiation is very low and safe at 1 meter distant.

For comparison, there is one case in United State, a patient died in July 2000, only five days after the I-125 prostate implant. The estimated activity in the body was **9.8 mCi**. With the permission of NRC, the body was cremated with the seeds inside the body. A radiation survey was performed on the cremated remains, and an exposure rate of 2 mR/h or about **19.9 μSv/hr** was measured in contact with the plastic bag containing the cremated remains. The radiation level dropped to background level when the plastic bag was placed in a metal urn. The measured dose is very depending on the initial dose in patient body. Usually, the doserate will drop significantly after the process of cremation.

In conclusion, if the body is to be cremated less than one year from the date of the radiation seed implantation, some precautions are needed in handling the cremated remains. **The use of proper PPE during management of body remaining after cremation is very important to avoid radiation contamination especially from airborne**. Although the Malaysian Guidelines For Management Of Brachytherapy For Prostate Cancer Using Permanently Implanted Radioactive Sources stated that patient dead with radioactive seed implant management should be burial, it is not possible in most cases. Most of the patient's family members choose to cremate the body of the patient because of economy factors. It is important for medical physicist to be informed about the cremation of patient with radioactive seed implant so that the medical physicist can explain the precautions to cremationist and family members and at the same time perform a radiation monitoring immediately after cremation.

Incident of Cremation of Patient with Radioactive Seed Implant with Less Than 1 Year Implantation in Pulau Pinang

Ms. Rosdiana binti Wahab, Principal Assistant Director,
Medical Radiation Surveillance Branch, Penang State Health Department

STUDENTS Insight

Every **expert** was once a **beginner**.
Embrace the journey - Robin Sharma

5th Penang Radiation Protection Day 2024 From Internship Student Perspective

Ms. Anis Fikriyah binti Mulyadi, USM Internship Student,
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On June 27, 2024, the significant event, "5th Penang Radiation Protection Day 2024," took place at Auditorium A, Komtar. This event was organized by the Penang State Level Radiation Protection Programme Committee, with support from Hospital Pulau Pinang. All radiation workers in both private and government sectors were invited to participate.

The objective of the event is to provide exposure to all radiation workers under the Atomic Energy Licencing Act 1984 (Act 304) and the latest regulations. The organiser also aims to provide knowledge to the participants on radiological emergency preparedness and standard operating procedures when handling accidents related to radiation and to encourage good work practises among radiation workers.

The event began with a greeting speech by the *Ketua Penolong Pengarah Kanan*, *Cawangan Kawalselia Radiasi Perubatan (CKRP).* Then the event proceeded with the first talk delivered by En. Nurshahrul Aman Bin Johari from Bahagian Kawalselia Radiasi Perubatan (BKRP), KKM, focusing on radiation protection awareness. The second talk, titled "Radiological Emergency Preparedness and Response," was presented by Tuan Nuzaihan Bin Abu Hassan, a representative from Jabatan Bomba & Penyelamat (HAZMAT).

After the talk by HAZMAT, participants enjoyed a breakfast. During this time, they visited vendor booths set up by Canon Medical, Fujifilm, Oral7, and Delta Medisains. These booths featured the latest innovations in medical imaging and medical protection. After that, there was a video presentation by Penang State Medical Physicists showcased their role in radiation protection and their workplace. This segment highlighted the crucial contributions of medical physicists to ensuring safety and efficiency in medical imaging and treatment.

Following the conclusion of the video presentation, participants were treated to an insightful talk delivered by Dr. Nurul Nadiah Binti Zulkifli, a specialist specializing in Nuclear Medicine at Hospital Pulau Pinang. Her presentation, entitled "Optimization of Paeds Protocol in Nuclear Medicine," delved into the critical area of improving pediatric protocols within the field of nuclear medicine. Dr. Zulkifli's expertise shone through as she presented strategies aimed at enhancing both the safety and efficacy of these procedures for young patients.

Dr. Nursakinah Binti Suardi, a senior lecturer from the School of Physics at Universiti Sains Malaysia, Pulau Pinang, gave a talk titled "Radiation Hazards and Effects of Ionizing Radiation on Humans." Her presentation addressed the potential risks associated with ionizing radiation and its impact on human health.

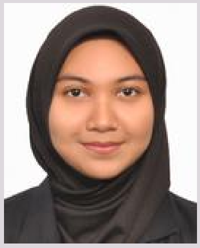
Figure 1: Guest speaker, Dr Nursakinah Suardi, Senior Lecturer, USM

Right after that, there was Canon Medical's vendor talk showcasing their newest CT scan machine, emphasizing its superior high-resolution imaging, innovative low radiation dose technology, broad applications in oncology, cardiology, neurology, and emergency medicine, easy-to-use interface, patient comfort enhancements, cost-effectiveness and impressive return on investment, extensive customer support and maintenance services, and ended with a Q&A session to address audience queries.

Following the morning sessions, the event paused for a lunch break. In addition to enjoying the meal, this period was also allocated for participants to perform their prayers.. The break provided a much-needed respite, enabling everyone to recharge and prepare for the remainder of the day's activities.

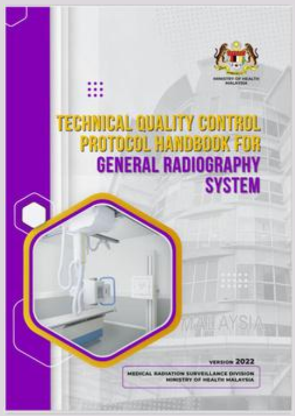
The Penang State Level Radiation Protection Day celebration officially began with an inauguration by YBrs Dr. Fazilah Binti Shaik Allaudin, Pengarah Kesihatan Negeri Pulau Pinang. This ceremony marked the formal start of the celebration, highlighting the importance of radiation protection and the commitment of the Penang State Health Department to ensuring the safety and well-being of all radiation workers.

Ministry of Health Malaysia Clinic Visit with Medical Physicist for Cross Check Quality Control



Ms. Umie Eliatusyifa binti Badrol, USM Internship Student,
Nuclear Medicine Department, Hospital Pulau Pinang

Quality control (QC) in general X-ray imaging is an essential practice aimed at ensuring that radiographic procedures are safe, reliable, and effective. This involves regular testing and maintenance of X-ray equipment to guarantee that it operates within specified parameters, producing high-quality images with minimal radiation exposure to patients and staff. The fundamental components of QC in general X-ray imaging can be broadly categorized into equipment performance testing, image quality assessment, radiation dose monitoring, and regular calibration and maintenance. Basically, in Quality Control in general X-ray will refer to the technical quality control protocol handbook. With this technical QC protocol handbook, it can be a guidance for medical physicists, radiographers, and other healthcare professionals to ensure the optimum performance of the diagnostic medical imaging equipment as well as associated facilities in their respective medical center.



Technical quality control protocol handbook

Quality control in X-ray imaging systems is a critical process to ensure the safety, accuracy, and efficiency of radiographic procedures. This involves a comprehensive evaluation of ten key parameters, each addressing different aspects of the X-ray system's performance and safety.

First, the Unit Assembly Evaluation is conducted to ensure that all interlocks, indicators, and mechanical support devices for the X-ray system and its associated receptor or bucky assembly are functioning properly and safely. This evaluation is crucial because any malfunction in these components can lead to significant safety hazards and operational inefficiencies. X-ray Generator Performance test ensures the accuracy of the kilovoltage (kV) settings, exposure timer, repeatability of radiation output, and output linearity.

The X-ray Beam Limitation test ensures the alignment and positioning of the X-ray beam includes checking the X-ray beam field alignment, beam perpendicularity, X-ray beam field centering, and collimation light field illumination. Proper alignment and positioning are essential to ensure that the X-ray beam is accurately targeted, minimizing unnecessary radiation exposure to the patient and optimizing image quality. Beam perpendicularity ensures that the X-ray beam is correctly aligned with the imaging receptor, preventing distortion or artifacts in the image.

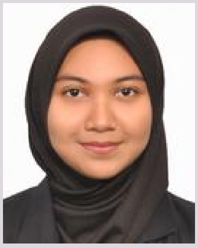
Beam Quality (Half Value Layer) assessment is conducted to evaluate the X-ray beam quality. The half value layer (HVL) is a measure of the beam's penetration capability, indicating the thickness of a specified material (usually aluminum) that reduces the X-ray beam intensity by half. This test helps in assessing the beam’s energy spectrum and ensures that the X-ray system is producing a beam of adequate quality for diagnostic purposes.

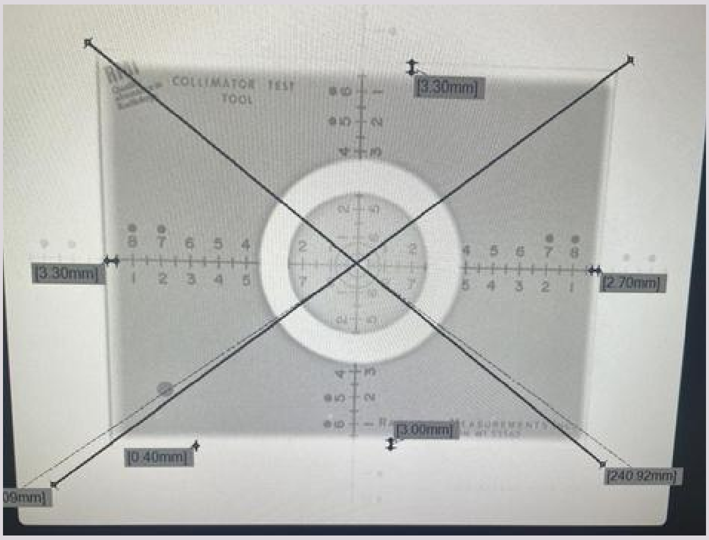
Image Quality evaluation focuses on assessing the resolution and contrast of the images produced by the X-ray system. High-resolution images with good contrast are essential for accurate diagnosis. This test typically involves the use of phantoms, which are objects that simulate human tissues, to evaluate the system’s ability to produce clear and detailed images.

The Automatic Exposure Control (AEC) test assesses the performance of the AEC system, which is designed to automatically adjust the exposure parameters to maintain consistent image optical density regardless of patient thickness or changes in image modes. The AEC system is critical for optimizing radiation dose and ensuring consistent image quality. This test includes assessing the system’s response to changes in optical density function control (density control function), ensuring that the AEC system can adapt to different imaging conditions.

Ministry of Health Malaysia Clinic Visit With Medical Physicist For Cross Check Quality Control

Ms. Umie Eliatusyifa binti Badrol, USM Internship Student,
Department Nuclear Medicine, Hospital Pulau Pinang





Focal Spot Size measurement is conducted to determine the size of the focal spot of the X-ray tube. The focal spot size affects the spatial resolution of the images; a smaller focal spot size generally provides better image detail. However, it is essential to balance focal spot size with the heat load capacity of the X-ray tube to prevent overheating and damage.

The Kerma Area Product (KAP) calibration performed annually, verifies the KAP reading displayed on the X-ray system console panel. The KAP value represents the total radiation dose multiplied by the area irradiated and is used to assess the patient's overall radiation exposure. Ensuring that the KAP readings are within tolerance levels when compared with a reference dose area product is crucial for accurate dose measurement and patient safety.

Leakage Radiation testing also conducted annually, aims to identify any areas of radiation leakage through the X-ray tube housing. This test is essential for ensuring that the radiation is contained within the intended path and does not expose operators or patients to unintended radiation. Measuring leakage radiation helps in maintaining a safe environment in the X-ray room.

Finally, scattered radiation testing performed annually, checks the radiation safety level in the surrounding area of the X-ray room. This test is vital for protecting healthcare personnel and patients from exposure to scattered radiation, which can occur as X-rays interact with various objects and materials in the room. Ensuring low levels of scattered radiation helps in maintaining compliance with safety standards and regulations.

In summary, quality control in X-ray imaging systems involves a rigorous and systematic evaluation of various parameters to ensure safety, accuracy, and efficiency. Each of these ten parameters plays a crucial role in maintaining the overall performance of the X-ray system and protecting patients and healthcare personnel from unnecessary radiation exposure.

Area Contamination Monitoring at Nuclear Medicine Department

Ms. Nurbaity binti Mohamad Shariff, USM Internship Student,
Department of Nuclear Medicine Department, Hospital Pulau Pinang

Nuclear medicine departments routinely handle radioactive materials, necessitating rigorous safety protocols to protect personnel and the environment. A critical component of these protocols is area monitoring, which involves detecting and quantifying radioactive contamination on surfaces. Wipe tests are essential tools for this process.

Adherence to regulatory standards is a fundamental responsibility of nuclear medicine departments. Area monitoring wipe tests play a crucial role in demonstrating compliance with regulations set forth by regulatory bodies such as the Medical Radiation Surveillance Division (MRSD), Ministry of Health (MOH) Malaysia as well as in the United States Nuclear Regulatory Commission (NRC) as per recommended by the International Atomic Energy Agency (IAEA). Regular area monitoring wipe tests are integral to a comprehensive quality assurance program in nuclear medicine. By tracking contamination levels over time, facilities can identify trends, evaluate the effectiveness of control measures, and implement necessary improvements.

The first step in conducting an area monitoring wipe test in a nuclear medicine department is to prepare appropriately. This involves donning the necessary personal protective equipment (PPE) such as gloves, lab coats, and possibly face masks to protect oneself from potential radioactive contamination. All the required materials for the test need to be gathered. These materials typically include wipes (which can be filter paper or cloth designed for this purpose), sample vials to store the collected wipes, a scintillation counter or gamma counter for measuring radioactivity, decontamination supplies in case of high contamination, and a detailed map of the area to ensure comprehensive coverage of the testing area. For Nuclear Medicine Department in Hospital Pulau Pinang, a gamma counter is used for measuring radioactivity.

Next, the areas that need to be tested are identified and prioritized. High-risk areas should be prioritized as they are more likely to be contaminated. These include work surfaces where radioactive materials are handled, floors where spills may occur, equipment used in the procedures, and waste disposal areas. Here, in our department, we cover 19 areas, including specific areas in hot labs, dispensing rooms, and injection rooms. Figure 1 shows the samples collected in respective vials for 19 different areas. The 19 areas covered are as in Figure 2. Mapping out these areas in advance and marking them for testing helps in maintaining a structured and thorough testing process.

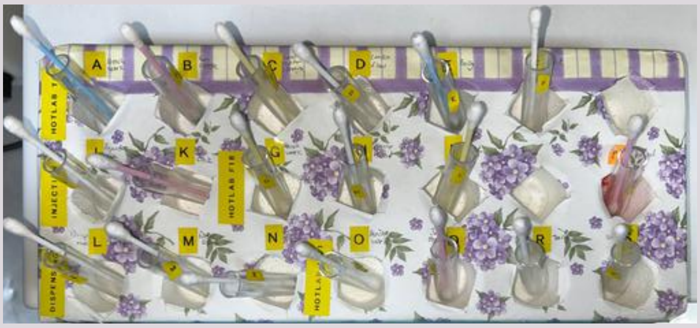


Figure 1

Technetium 99-m Hotlab	Iodine-131 Hotlab	Fluorine-18 Hotlab
A = Bench Work	L = Dispensing Area	G = Bench Work
B = Generator Storage	M = Near Dose Calibrator	H = Fume Hood
C = Lead Carrier Storage	N = Floor	I = Sink
D = Laminar Flow	O = Bench Work	
E = Trolly	P = Fume Hood	
F = Sink	Q = Iodine Storage	
J = Injection Site	R = Trolly	
K = Sink	S = Sink	

Figure: 2

To perform the wipe test, take a clean cotton bud and press it firmly onto the surface to be tested. Use a consistent, standardized method for wiping to ensure that results from different areas can be compared reliably. Typically, a 10x10 cm area is wiped. The wipe should then be placed in a labelled vial to keep the samples organized and to maintain a clear record of which sample corresponds to which area.

After collecting the samples, the next step is to analyse them using a gamma counter, which will measure the radioactivity present on the wipes. This involves placing each wipe into the counter and recording the counts per minute (CPM) detected. These readings provide a quantitative measure of the contamination levels at each sample point. In our department, MCA (Multichannel analyser) is used to analyse the samples.

The results from the analysis need to be interpreted by comparing the measured radioactivity values against acceptable contamination limits, which are typically set by regulatory authorities. Areas that exceed these limits are identified as contaminated and require immediate attention. It is essential to identify and understand the potential sources of contamination to prevent future occurrences.

For areas identified as contaminated, decontamination procedures must be carried out. After decontamination, the areas should be re-tested to ensure that the contamination has been effectively removed and that the area is now safe.

Radiation Protection Equipment (RPE) Integrity Checks

Ms. Nurulhaziqah Syahirah binti Mohd Yunus, USM Internship Student,
Department of Nuclear Medicine, Hospital Pulau Pinang

The International Atomic Energy Agency (IAEA) sets global standards for radiation protection to safeguard human health and the environment from the harmful effects of ionizing radiation. The key principles of IAEA radiation protection are Justification, Optimization, and Limitation. These principles guide practices in various fields, including medical imaging, nuclear medicine, industrial radiography, and nuclear power generation.

Justification

Any practice involving radiation exposure must be carefully justified by weighing the potential benefits against the associated risks, considering factors such as the severity of the condition, diagnostic accuracy, alternative methods, and potential harm. This includes any activity that exposes people or the environment to ionizing radiation including medical imaging (X-rays, CT scans), nuclear medicine, industrial radiography, and nuclear power generation.

Optimization

The principle of Optimization involves keeping radiation exposure "As Low as Reasonably Achievable" (ALARA). This requires implementing practical measures to reduce exposure without compromising the intended outcome. Key strategies under ALARA include minimizing the time spent near radiation sources, increasing the distance from these sources, and using protective barriers such as lead shielding. These measures are crucial in both medical settings and industries like nuclear power and research.

Limitation

Radiation exposure limits are essential to protect human health by preventing deterministic effects and reducing the probability of stochastic effects. Deterministic effects, such as skin burns or radiation sickness, occur above a certain dose threshold and are severe health issues. Stochastic effects, including cancer and genetic disorders, can occur randomly with increasing exposure but do not have a direct link to dose severity. Setting and adhering to exposure limits helps prevent both immediate and long-term health risks.

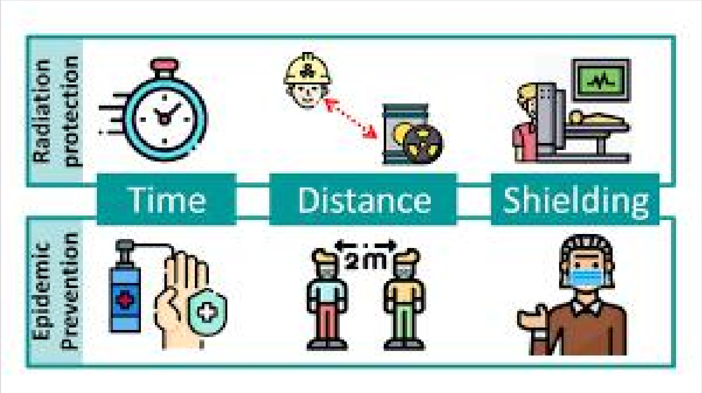


Figure 1: Time, distance, shielding (TDS)

Radiation Protection Equipment (RPE)

Radiation Protection Equipment (RPE) is essential for safeguarding individuals from the harmful effects of ionizing radiation. These specialized garments and accessories, such as lead aprons, thyroid collars, gloves, and eye protection, act as barriers between the personnel and radiation sources. By strategically shielding the body's most important areas, RPE significantly reduces radiation exposure, making it indispensable in industries like healthcare, nuclear power, and research where exposure risks are prevalent.

RPE Integrity Checks

To ensure ongoing protection and safety, annual RPE Integrity Checks are essential. These inspections evaluate the condition of the equipment, identifying any damage, defects, or reduction in protective capabilities. By regularly assessing the RPE's performance, organizations can replace or repair faulty equipment promptly, safeguarding the health and well-being of their personnel. The annual RPE Integrity Checks has two important inspections which are physical and radiographic.

Figure 2: Radiation Protection Equipment (RPE)

Internship Experiencs

Ms. Nurulhaziqah Syahirah binti Mohd Yunus, USM Internship Student,
Department of Nuclear Medicine, Hospital Pulau Pinang

During my internship in May 2024, I had the valuable opportunity to participate in Radiation Protection Equipment (RPE) integrity checks within the Radiology department. Working alongside experienced physicists in the PET-CT room, I was able to observe and assist with the entire process. The procedure began with the physical inspection of the RPE. I watched as the physicists carefully laid out the equipment on the patient table, examining both the inner and outer surfaces for any visible defects, damage, or signs of wear that could compromise its protective capabilities. This hands-on experience highlighted the importance of thoroughness in maintaining safety standards.

Following the physical inspection, I assisted in the radiographic inspection using a CT scan. This advanced imaging technique is favored for its speed and ability to provide detailed images, allowing multiple RPEs to be inspected simultaneously. Through the CT scan, we were able to identify any hidden defects that were not visible during the physical inspection. The precision of the CT scan ensured that even the smallest breaks in the lead lining were detected and recorded. The final step was categorizing the RPE as either pass or fail based on the inspection results. To pass, there could be no breaks in the lead lining near critical organs. Any RPE that did not meet this standard was marked for replacement to ensure the highest level of protection for the personnel.

This experience was incredibly educational, providing me with a deeper understanding of the procedures involved in maintaining radiation safety and the critical role that detailed inspections play in protecting healthcare professionals and patients alike.

Figures show the lead gown tests in the PET-CT room.

A visit to the Radiotherapy and Nuclear Medicine Department at Penang Adventist Hospital

Mr. Adja Muhamad Fikry bin Dhany, USM Internship Student,
Department Of Nuclear Medicine, Hospital Pulau Pinang

On August 2, 2024, a visit to the Radiotherapy and Nuclear Medicine Department at Penang Adventist Hospital was conducted. The group included four physicists and five internship students from Hospital Pulau Pinang. The aim of the visit was to learn and gain more knowledge about the radiotherapy and nuclear medicine department's role in patient diagnosis and therapy.

Figure 1: Medical physicists and internship students from Hospital Pulau Pinang together with Penang Adventist Hospital staff.

What is Radiotherapy?

Radiotherapy is a cancer treatment modality that employs high-energy radiation to eradicate or inhibit the growth of malignant cells. This therapeutic approach can be administered externally through the application of focused radiation beams or internally by implanting radioactive sources within or adjacent to the tumor. Radiotherapy is indicated for various treatment goals, including curative intent, prevention of recurrence, tumor reduction, and palliation of symptoms associated with advanced disease. While effective in targeting cancer cells, radiotherapy may induce temporary side effects such as fatigue, skin reactions, nausea, and alopecia within the irradiated area.

What is Nuclear Medicine?

Nuclear medicine is a medical specialty that utilizes radioactive substances, known as radiopharmaceuticals, to diagnose and treat diseases. These radiopharmaceuticals are introduced into the body, where they accumulate in specific organs or tissues. Advanced imaging techniques, such as PET and SPECT scans, detect the radiation emitted by the radiopharmaceutical, providing detailed information about the function and structure of organs. Beyond diagnosis, nuclear medicine also offers therapeutic applications, using radioactive substances to target and destroy cancer cells or regulate overactive tissues.

Radiotherapy in Penang Adventist Hospital

In the radiotherapy department, a specialized medical imaging device called a CT simulator (Toshiba Aquilion LB model) is employed as a crucial preliminary step before creating a treatment plan. This equipment generates detailed, three-dimensional images of the patient's internal anatomy. These images serve as a foundational map, allowing healthcare professionals to precisely locate the tumor, surrounding healthy tissues, and critical organs. By carefully analyzing these images, the radiation oncologist can meticulously design a tailored radiation treatment plan that maximizes the destruction of cancer cells while minimizing harm to healthy tissues.

Once the radiation oncologist has carefully analyzed the patient's CT scan images, they develop a customized treatment plan using specialized software called Monaco, provided by Elekta. This treatment plan outlines the precise radiation dose, angles, and schedule required to target the tumor while protecting healthy tissues.

To deliver the radiation treatment as planned, a sophisticated machine called a Linear Accelerator (LINAC) is used. The Elekta Versa HD LINAC is a cutting-edge device that generates high-energy X-rays or electron beams to destroy cancer cells. The specific treatment parameters, such as radiation dose and number of sessions, are determined based on the patient's individual needs and the treatment plan created using the Monaco software.

Figure 2: LINAC machine.

A visit to the Radiotherapy and Nuclear Medicine Department at Penang Adventist Hospital

Mr. Adja Muhamad Fikry bin Dhany, USM Internship Student,
Department Of Nuclear Medicine, Hospital Pulau Pinang

Nuclear Medicine in Penang Adventist Hospital

The Nuclear Medicine department at Penang Adventist Hospital offers advanced imaging technologies known as PET/CT and SPECT/CT. These machines provide detailed images of the body to aid in diagnosing and monitoring various medical conditions.

PET/CT combines positron emission tomography (PET) and computed tomography (CT). PET measures the metabolic activity of cells, indicating how organs and tissues are functioning. CT provides detailed anatomical images. Together, they offer comprehensive information about both the structure and function of the body.

Figure 3: PET/CT machine.

SPECT/CT combines single-photon emission computed tomography (SPECT) and CT. Similar to PET, SPECT measures organ function, but it uses a different type of radioactive tracer. CT again provides the anatomical context. While SPECT/CT is valuable for certain conditions, PET/CT generally offers higher image quality and more precise information.

Radiopharmaceuticals are specialized medications containing a small amount of radioactive material. They are designed to accumulate in areas of heightened cellular activity, such as tumors. Once injected into the body, the radiopharmaceutical releases either positrons (in PET scans) or gamma rays (in SPECT scans). These emissions are detected by the respective scanner to create images that visualize and measure the function of organs and tissues.

For instance, F-18 FDG is commonly employed for PET/CT scans, while I-131 is used in SPECT/CT. These substances are handled with meticulous care due to their radioactive properties. Upon delivery, radiopharmaceuticals are received by pharmacists in a specialized area known as a "hot lab". Here, they are prepared for administration to patients.

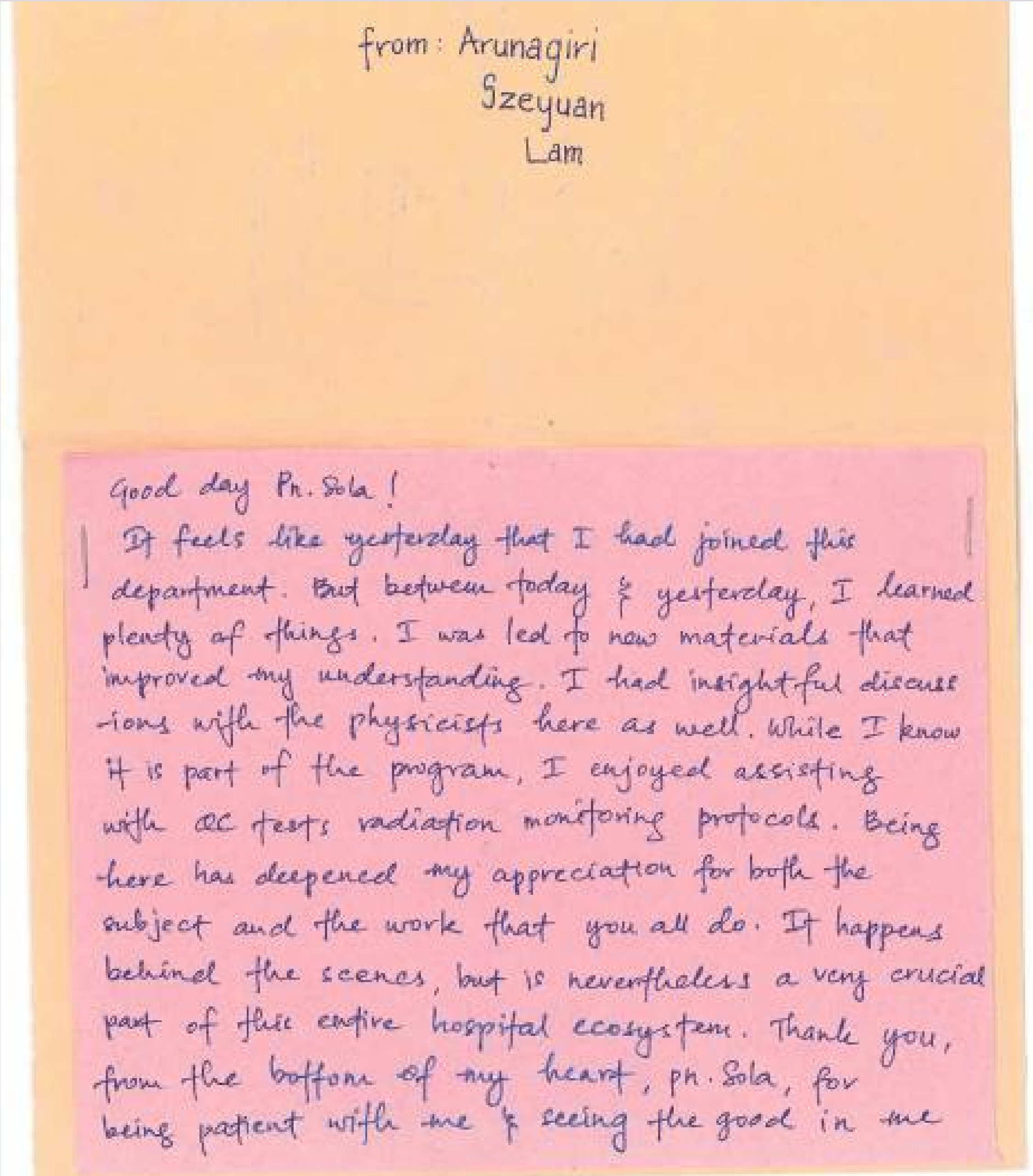
Given the radioactive nature of these medications, patients who have received them require isolation from public spaces to protect others from radiation exposure. Patients receiving high doses of I-131 require specialized care as the half-life is long (8 days). Due to the persistent radiation emitted by the patient, they are typically admitted to a dedicated radioiodine ward. This ward is equipped with specific shielding to protect healthcare workers and the environment from radiation exposure.

The ward's facilities, including the toilet, are designed to manage radioactive waste. Waste from patients undergoing I-131 therapy is channeled into a decay tank, where it is stored until the radiation levels significantly decrease. Only then is the waste transferred to the general waste disposal system. Patients are discharged from the hospital once their radiation levels have dropped to a safe point, allowing them to return home without posing a risk to others.

Figure 4: Decay Tank.

The visit to the Radiotherapy and Nuclear Medicine departments proved to be an invaluable experience, particularly for the students. It offered a unique opportunity to gain a deeper understanding of the intricacies involved in these specialized fields of medicine. Witnessing firsthand the advanced technologies and dedicated professionals at work was truly inspiring.

We extend our sincere gratitude to the physicists at Hospital Pulau Pinang and the staff at the Radiotherapy and Nuclear Medicine Department of Penang Adventist Hospital for their time, expertise, and warm hospitality in providing us with this enriching experience. This visit has undoubtedly broadened our understanding of the vital role these departments play in patient care and medical advancement.



from: Arunagiri
Szeyuan
Lam

Good day Ph. Sola!

It feels like yesterday that I had joined this department. But between today & yesterday, I learned plenty of things. I was led to new materials that improved my understanding. I had insightful discussions with the physicists here as well. While I know it is part of the program, I enjoyed assisting with QC tests radiation monitoring protocols. Being here has deepened my appreciation for both the subject and the work that you all do. It happens behind the scenes, but is nevertheless a very crucial part of this entire hospital ecosystem. Thank you, from the bottom of my heart, Ph. Sola, for being patient with me & seeing the good in me

You are most welcome...

RESEARCH
Development

" **Research** is what I'm doing
when I **don't know** what I'm doing -
Wernher von Braun "

Third International Regulator's Conference on Nuclear Security

Organized by AMSSNuR IAEA Ministry of Health, Malaysia

RADIATION IN MEDICINE: REGULATORY IMPROVISATION

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INTRODUCTION

Taiping Hospital was among the earliest medical institution in East Asia implementing X-ray technology on February 1897 which after a year Wilhelm Conrad Roentgen discovered X-ray. To regulate the utilization of ionizing radiation in Malaysia, Radioactive Substance Act, 1968 was enacted before been replaced with Atomic Energy Licensing Act 1984 (Act 304) in April 1984. Under this Act, the Ministry of Health Malaysia regulates the use of ionizing radiation for medical purposes while Department of Atomic Energy Licensing Board for non-medical purposes

OBJECTIVE

The study aims to identify the proposed improvements to enhance the existing legislation in order to control for safe usage of ionizing radiation sources.

MATERIALS AND METHODS

The system was assessed through observations and systematic literatures review by using literature search such as IAEA Publication, PubMed Central and Attorney General Chambers Malaysia with search strings; legal framework and regulatory infrastructure.

RESULTS

No.	Literature search	Improvisation
1.	Attorney General Chambers Malaysia i. Criminal Procedure Code [Act 593] a. Powers to investigate	**1. Power to investigate** The Investigation Officer (IO) shall be given full authorization to investigate, request for witnesses attendance and accessible to any information sources.
	b. Examination of witnesses	**2. Examination of witnesses** The IO shall has commission to examine the witnesses regarding the case through orally and written statement.
	ii. Atomic Energy Licensing Act 1984 [Act 304] a. Offence	**3. Doctrine of Ultra Vires** To revise the prosecution authority of any committed offence within legal authority.
	iii. Allied Health Professions 2016 [Act 774] a. Sanction required for prosecution	**4. Sanction to prosecute in court** Public Prosecutor shall provide written sanction with regards to the prosecution of any committed offence.
2.	PubMed Central Lessons Learned from the Fukushima Nuclear Accident for Improving Safety and Security of U.S. Nuclear Plants (Nuclear and Radiation Studies Board)	**5. No restriction on independent technical judgements** Judgements or decisions of regulatory body which inclusive technical judgements shall be free from any undue influences from political or economic conditions and government interference
3.	IAEA Publication i. IAEA Safety Standards - Legal and Regulatory Framework for Safety	**6. More transparency in communications** The regulatory body shall have closer engagement with the public and other interested parties and ability to consult on the potential risks associated with radiation facilities and activities together with regulatory body processes and decisions.
	ii. Radiation Safety Standards: Functions and Processes of the Regulatory Body for Safety	**7. Ensuring regulatory resources readiness** Regulatory body effectiveness on documentation system shall be assessed through multiple methods such as management overview, internal audits and quality indicators.
	iii. The Ionising Radiation (Medical Exposure) Regulations 2017 by Care Quality Commission (England)	**8. Enact a specific regulation for medical** The regulations aim shall include to ensure patients are fully protected from any risk due to ionising radiation exposure

DISCUSSION

Towards effective enforcement, several provisions such as power to investigate, examination of witnesses and sanction to prosecute in court need to be included.
To improvise current nuclear safety and security culture, recognition for some legal measures is needed likes ensuring regulatory resources readiness, more transparency in communications and no restriction on independent technical judgements.
Hence it's important to enact a specific regulation for medical, dental and veterinary in order to control the usage of ionizing radiation in medicine extensively.

CONCLUSION

In conclusion, an effective national regulatory infrastructure must have a comprehensive legislative drafting, a transparent regulatory body that has an authority to conduct enforcement activities independently and compliance to radiation protection provisions.

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ANUGERAH INOVASI NUKLEAR KEBANGSAAN
NATIONAL NUCLEAR INNOVATION AWARD

GammaSens Phantom

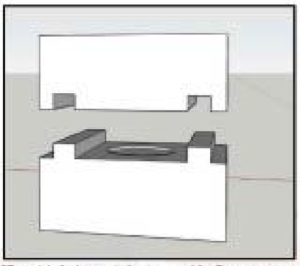
Dr. Mohamad Aminuddin Said | Fakhrur Razi Kuffian | Zulfadhli Zaini | Tuan Solawati Tuan Muda

N.U.R NUKLEAR UNTUK RAKYAT

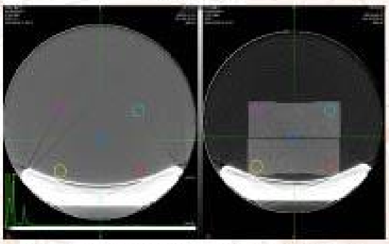
GammaSens Overview

- Gamma cameras are vital in nuclear medicine for capturing images of radioactive tracer distribution in patients. These images are important in diagnosing and monitoring conditions like cancer, heart disease, and neurological disorders.
- The camera's sensitivity, or its ability to detect gamma photons, is crucial for image quality and diagnostic accuracy.

Purpose



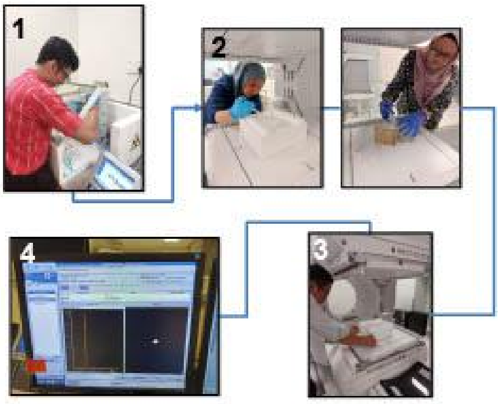
3D model of a two-part phantom used for Gamma camera sensitivity tests



(Left) CT Hounsfield with blank scan, (Right) CT Hounsfield with GammaSens Phantom

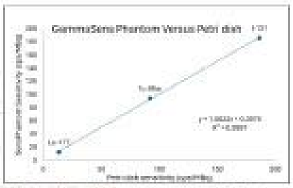
- The purpose of the GammaSense test is to evaluate the gamma camera's sensitivity to gamma photons emitted from radiotracers, ensuring high-quality diagnostic images and accurate diagnostic information.
- By conducting simultaneous assessments, the acquisition time can be reduced by half, enhancing the efficiency of the testing process.

Method of Testing



1. Preparing and measuring the radioactive source.
2. Assembling the phantom with the radioactive source.
3. Placing the phantom in the Gamma camera for scanning.
4. Analyzing the sensitivity test results using the Gamma camera's software

Results & Analysis



Comparison of Gamma Camera Sensitivity Tests using Different Radionuclides: Petri Dish versus GammaSens Phantom

ROI	GammaSens Phantom (HU)	Air (HU)	Different (%)
ROI 1	-984	-996	-1.16
ROI 2	-983	-995	-1.24
ROI 3	-981	-992	-1.14
ROI 4	-982	-993	-1.10
ROI 5	-985	-996	-1.03

HU Comparison between for GammaSens Phantom and Air

Discussion & Conclusion

- GammaSens HUs are consistently similar with air
- Data demonstrates phantom's replicating accuracy for air in CT image
- The phantom has potential as a valuable tool for gamma camera sensitivity testing

Poster design | Arunagiri Szeyuan Lam

HARI INOVASI NUKLEAR MALAYSIA 2024

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24th AOCMP 22nd SEACOMP PENANG, MALAYSIA | 10 - 13 OCTOBER 2024

Kementerian Kesihatan Malaysia INSTITUT KANSER NEGARA

PATIENT EFFECTIVE DOSE REVIEW FOR LUNG CANCER SCREENING AT INSTITUT KANSER NEGARA: A FIVE-YEAR RETROSPECTIVE STUDY

TS. SITI NORSYAFIQAH MOHD MUSTAFA, NUR HAFIZAH ZAKARIA, DATIN DR ZUHANIS ABDUL HAMID, SOLEHAH ISMAIL

INTRODUCTION

Lung cancer remains a leading cause of cancer-related mortality globally, necessitating effective screening programs for early detection and improved survival rates.

OBJECTIVE

This study reviews the effective radiation dose received by patients undergoing lung cancer screening at Institut Kanser Negara over a five-year period (2019-2023).

METHODOLOGY

Data from 40 patients (mean age 53.3 years, average BMI 26.7 kg/m²) were analyzed, and the effective dose, calculated using the Dose Length Product (DLP) multiplied by the CF (0.014)

AFFILIATIONS

Radiology Department, Institut Kanser Negara, Putrajaya, MALAYSIA

RESULTS/FINDINGS

The average effective dose was 1.82 mSv. Although higher BMI is theoretically expected to result in higher doses, the majority of patients, regardless of BMI, had doses scattered around the range of 1.4 to 2.2 mSv.

EFFECTIVE DOSE VS BODY MASS INDEX

ANALYSIS

This outcome can be attributed to the use of a preset protocol that standardizes dose delivery. Additionally, no significant difference in dose was observed between male and female patients.

RECOMMENDATIONS

Screening programs should adjust scanning parameters based on patient size to reduce unnecessary radiation exposure, especially for those with lower BMI.

CONCLUSION

This study provides a benchmark for future screening programs and highlights the need for tailored approaches based on patient demographics to enhance screening outcomes.

REFERENCE:

ABTRACT ID : 307

EARLY DETECTION, saves **lives**

24th AOCMP 22nd SEACOMP
PENANG, MALAYSIA | 10 - 13 OCTOBER 2024
AOCMP2024-182

Quality Assurance of Treatment Planning System: An Institutional Experience of AAA and Collapse Cone Dose Calculation Algorithm Commissioning based on TRS-430

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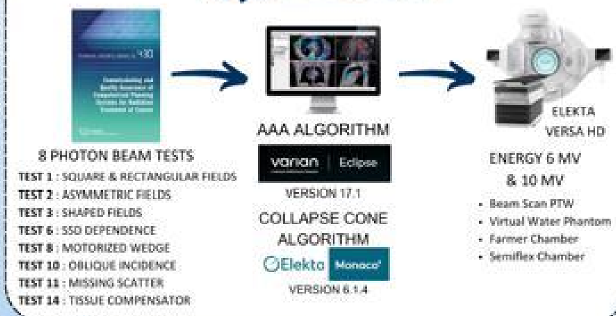
INTRODUCTION

- Modern TPSs use a variety of dose calculation algorithms, each requiring different data, commissioning processes, and QA checks.
- Every algorithm has its limitations, which can sometimes lead to the risk of misinterpreting calculation results. In the past, the absence of thorough TPS QA procedures has caused serious accidents.
- Therefore, QA in the radiotherapy treatment planning process is essential to ensure accuracy and prevent treatment errors.
- This study evaluates the dose calculation accuracy of two common dose calculation algorithms used in two commercial treatment planning systems (Eclipse's Anisotropic Analytical Algorithm (AAA) and Monaco's Collapsed Cone (CC)) for photon beam commissioning and quality assurance following the TRS-430 guideline.

METHODS



RESULTS

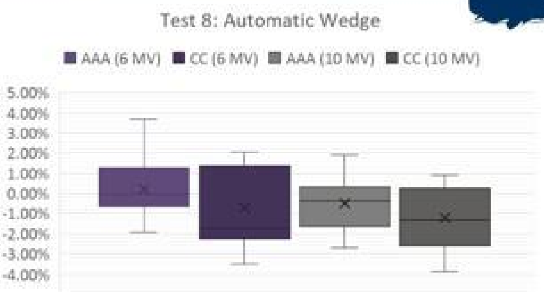


Figure 1: Percentage deviation distribution in photon test 8 for the AAA and CC dose calculation algorithm compared to the measured dose for energy 6 and 10 MV.

	AAA			CC		
6 MV	min	max	mean	min	max	mean
Test 1a	-0.57%	3.07%	1.11%	-0.74%	1.31%	0.41%
Test 1b	1.54%	2.68%	1.94%	0.59%	1.56%	1.12%
Test 2	-0.65%	0.54%	0.04%	-0.22%	0.26%	0.00%
Test 3	-0.89%	1.07%	-0.07%	-0.94%	0.46%	-0.09%
Test 6	0.43%	0.67%	0.56%	-0.74%	-0.08%	-0.39%
Test 8	-1.94%	3.68%	0.22%	-3.50%	2.06%	-0.63%
Test 10	-0.48%	1.18%	0.42%	-0.42%	1.24%	0.27%
Test 11	0.75%	3.89%	2.24%	-0.63%	2.11%	0.48%
Test 14	0.20%	0.73%	0.52%	-0.86%	-0.31%	-0.59%

Table 1: Percentage deviation for the AAA and CC dose calculation algorithm compared to the measured dose for energy 6 MV.

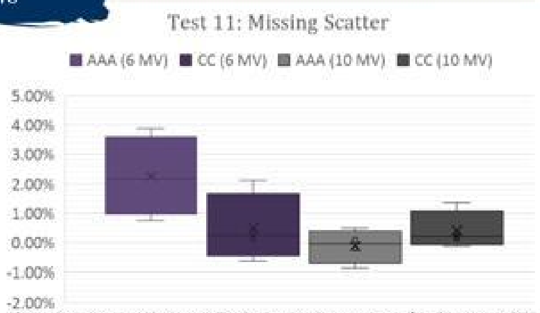


Figure 2: Percentage deviation distribution in photon test 11 for the AAA and CC dose calculation algorithm compared to the measured dose for energy 6 and 10 MV.

	AAA			CC		
10 MV	min	max	mean	min	max	mean
Test 1a	-1.78%	1.62%	-0.02%	-1.19%	1.64%	0.72%
Test 1b	0.67%	1.44%	0.91%	0.82%	1.78%	1.34%
Test 2	-0.68%	0.35%	-0.04%	-0.28%	0.63%	0.17%
Test 3	-1.45%	0.71%	-0.67%	-0.44%	0.74%	0.09%
Test 6	0.24%	0.47%	0.33%	0.10%	0.41%	0.18%
Test 8	-2.70%	1.90%	-0.49%	-3.84%	0.91%	-1.20%
Test 10	-0.84%	0.86%	0.06%	-0.10%	1.95%	0.64%
Test 11	-0.87%	0.49%	-0.12%	-0.12%	1.34%	0.41%
Test 14	0.41%	0.53%	0.49%	-0.03%	0.13%	0.07%

Table 2: Percentage deviation for the AAA and CC dose calculation algorithm compared to the measured dose for energy 10 MV.

DISCUSSIONS

- Test 1 (square field), CC predicts a better agreement for smallest and largest field size compared to AAA, as AAA normally overestimated the dose for small field compared to CC.
- Test 8 (motorized wedge), both algorithms show a same trend for both energies but AAA has lower agreement compared to CC due to heterogeneity.
- Test 11 (missing scatter), AAA are less accurate compared to CC in predicting the dose change when part of the beam misses the phantom due to beam modelling at the field edge where the representation of dose fall-off and scatter contributions may be suboptimal.

CONCLUSION

- AAA algorithm is more accurate but within certain conditions and shows good agreement for 10 MV energy while the CC algorithm shows good agreement for both energies.
- Therefore, there are no concerns about using these algorithms in 3D treatment planning clinically for these specific energies.

ACKNOWLEDGEMENTS

The authors would like to thank Mister Mohd Najib Salihi, Miss Mira Syamimi and Miss Sukainah Suhana from ABEX Medical System Sdn Bhd for their assistance related to this study. The authors also acknowledge support from the Department of Radiotherapy and Oncology, Hospital Sultan Ismail, Johor Bahru as well as from the Ministry of Health Malaysia. We are also most grateful to Dr Jong Wei Loong for the beam modelling. This research did not receive any specific grant from funding agencies in the public, commercial, or non-profit sectors.

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COMPARATIVE ANALYSIS OF QUANTITATIVE IMAGE QUALITY METRICS BETWEEN DIFFERENT TYPES OF HYBRID ITERATIVE RECONSTRUCTION IN CTPA PROTOCOLS

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1 INTRODUCTION

Computed Tomography Pulmonary Angiography (CTPA) is a well-known technique for the detection of pulmonary embolism (PE). PE is caused by a blockage of blood flow in the arterial system of the lungs that a primary cause of cardiovascular death. Despite radiation exposure concerns, diagnostic performance became essential for enhancing the sensitivity and specificity of examination outcomes. Evaluations based on noise texture, edge enhancement and sharpness have demonstrated to be promising indications for clinical imaging performance in the frequency domain. Limited research was conducted for the frequency domain evaluation, more so on a specific CT examination.

Figure 1. Example of the CTPA examination image of the Pulmonary Embolism patient.

2 OBJECTIVE

The purpose of this study is to evaluate selected quantitative image quality metrics (frequency domain) with the changes of Hybrid Iterative Reconstruction (HIR) for CTPA protocols.

3 METHOD

An image quality phantom (CATPHAN 600) was scanned with a Philips Brilliance 128 slices USA CT and GE Revolution Frontier 256 slices USA CT using local CTPA protocol. Both exposures were set to 2.9 mGy. Images were reconstructed with alteration of iDose and ASIR level for Philips and GE scanners respectively. Several quantitative image quality metrics such as contrast to noise ratio (CNR), target transfer function (TTF), noise power spectrum (NPS) and detectability index (d') were then measured accordingly by using imQuest software (version 7.1, Duke University, USA).

Figure 2. A Catphan 600 – (The Phantom Laboratory, Greenwich, NY) used for image quality assessment

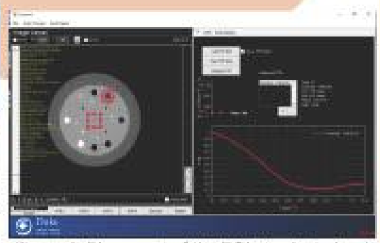
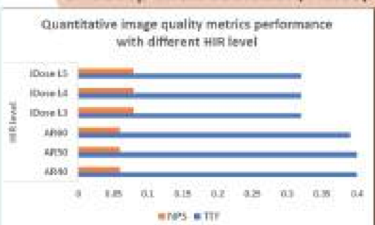


Figure 3. Placement of the ROI at selected rod insert for the CNR,TTF, NPS and detectability index calculation

4 RESULT & DISCUSSION

For all reconstructed images, ASIR outperformed iDose in terms of CNR, TTF, and d' performance. The slightly higher NPS peak frequency for iDose rather than ASIR indicates that iDose has good noise texture performance across all HIR levels. In terms of raising the amount of HIR, different HIR types showed a varied trend in image quality indicator performance.

The significant reduction in noise caused by the level of HIR improves CNR performance. When compared to iDose, d' values that combine the texture of noise (NPS) and spatial resolution (TTF) features of the images with a predetermined function perform better for ASIR. CT scanners have varied inherent parameters (focus size, detector pixel size), and the protocols' settings are slightly different. These changes can affect spatial resolution, noise, and consequently d' values.



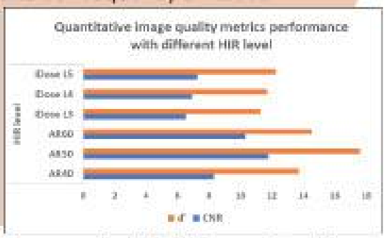


Table 1 & 2. Quantitative image quality performance for both CT Scanner brand for alteration of HIR levels.

5 CONCLUSION

This study discovered a fascinating finding in the evaluation of selected quantitative image quality indicators (frequency domain) with changes in Hybrid Iterative Reconstruction (HIR) for CTPA protocols.

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The authors wish the gratitude to the support from radiology staffs from Hospital Kuala Lumpur.

24th AOCMP 22nd SEACOMP PENANG, MALAYSIA | 10 - 13 OCTOBER 2024

24[Th] ASIA-OCEANIA CONGRESS OF MEDICAL PHYSICS (AOCMP) &
22[ND] SOUTHEAST ASIA CONGRESS OF MEDICAL PHYSICS (SEACOMP)

KEMENTERIAN KESIHATAN MALAYSIA
HOSPITAL KUALA LUMPUR

Case Study: A Comparison Of Different Technique In Evaluating of Iodine 131 (I-131) Absorbed Dose In Differentiated Thyroid Carcinoma (DTC) Patients

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3. Abex Medical Systems, Lion Industrial Park, Lot 2-6, Jalan SU 6A, Section 26, 40400 Shah Alam, Selangor, Malaysia

Introduction

Radionuclide iodine such as ^{131}I is commonly used in the treatment of differentiated thyroid cancer (DTC) due to the metabolic capacity simulating the behaviour of iodine in the thyroid hormone synthesis (TSH). Patient specific dosimetry is crucial in optimising treatment efficacy and minimizing harm to healthy tissue with the determination of maximum tolerated activity (MTA) and lesion dose per administered (LDpA). Organ-based and voxel-based dosimetry are two approaches used to calculate the absorbed dose. Organ based calculating the absorbed dose for entire organ while voxel-based give more refines and detail approach by calculation at a voxel level.

Since CT dose to the patient are concern, this study is intended to justify whether a single CT is sufficient in determining the absorbed dose. Reference from PET-Edge could be utilized to determine the suitable thresholds for more accurate quantification of radionuclide distribution within organs and tumors

Objective

To evaluates three different techniques in analysing the agreement of LDpA using different value of threshold, single CT and multiple CT approach and evaluate the absorbed dose between organ-based and voxel-based methods.

Materials and methods

Patients are administered with 2-5 mCi of I-131 Sodium Iodine (NaI-131) and underwent a series of Whole Body Scan (WBS) using Intevo Bold SPECT-CT. WBS was performed at five (5) time points of 1, 4, 24, 48 and 120 hours post-administration of I-131 additionally with Computed Tomography (CT) were performed at each time points from the head to mid-thigh.

Lesions were contoured using a threshold method based on SUV maximum (SUV_{max}) auto-contouring with HERMES at 40% and 50% comparing with single CT and multiple CT were performed at all time points. Additionally, manually drawn contours were utilized. The threshold percentages were applied to the iso-contour VOI at 24-hr or 48-hr mark and then replicated across all subsequent time points.

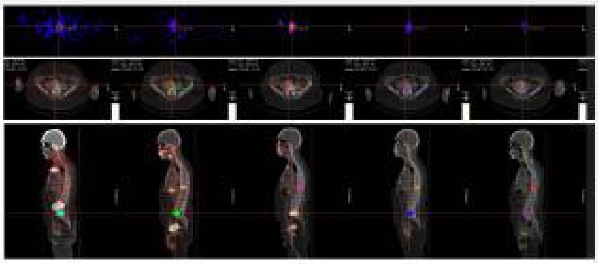


Figure 1. Image Segmentation and Quantitation for 40 % threshold

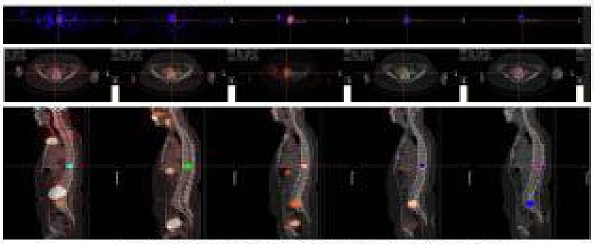
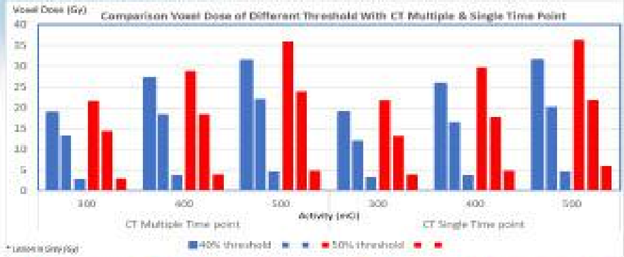


Figure 2. Image Segmentation and Quantitation for 50 % threshold

Conclusion

Lesion response depends on SUV_{max} and volume, which are critical parameters. The hand drawn and threshold methods at 40% and 50% showed no significant different with with $R^2 > 0.9$. The voxel dose for multiple CT and single CT method was not significantly different by p value = 0.263. There is a massive difference between organ-based and voxel-based method for both 40% and 50% threshold, 109 % and 130 % respectively.

Results



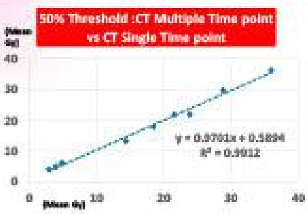


Table 1: Comparison Voxel Dose of Hand Drawn versus 40% and 50 % Threshold

Activity (mCi)	300	400	500	300	400	500	300	400	500
Lesion	L1	L1	L1	L2	L2	L2	L3	L3	L3
Hand Drawn	15.79	21.05	26.32	13.99	18.65	23.3	2.73	3.61	4.51
40 % Threshold	18.85	27.01	31.4	13.24	18.42	22.06	2.78	3.69	4.6
50 % Threshold	21.58	28.83	35.96	14.35	18.47	23.89	2.94	3.89	4.86

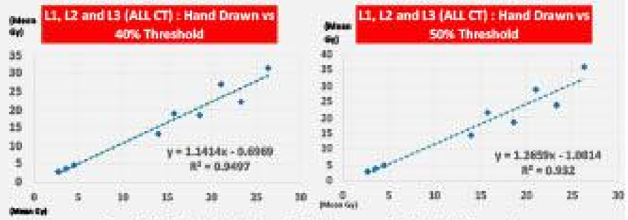


Figure 3: Relationship between Hand Drawn and Threshold Approach

Figure 4: Organ Dose and Voxel Dose at Different Threshold and Different Predicted Activity

Discussion

- Estimated cumulative effective dose for CT exposure (130kV,70mAs) for 5 time points are 40.5 mSv per patient. As CT radiation exposure is concern, single CT approach is sufficient for attenuation correction at selected time point. However, a low dose CT protocol can be performed at others time point as misregistration becomes more prominent.
- R^2 for hand drawn between 40% and 50% threshold are 0.9497 and 0.932 respectively. This study showed 50% threshold is more accurate to the lesion uptake. The use of threshold method in image quantitation and segmentation is time saving, efficient and accurate compared to hand drawn.
- Voxel-based dosimetry calculates radiation doses at very detailed level, resulting in smaller values than organ-based dosimetry, which averages doses across entire organs. Due to that organ based is not the best predictor of tumour response and normal tissue toxicity.

ICHLERA-11

UNIVERSITI PUTRA MALAYSIA

Novel Fabricated Germanium-doped Optical Fibres as High Absorbed dose Measurement Detector for Mapping Gamma-ray Cesium-137

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SUNWAY UNIVERSITY A CLASS ABOVE

SARAWAK GENARAL HOSPITAL

A. Introduction

TA-GvH Disease in Blood Transfusion

- **Measurement of radiation dose is crucial** for assessing biological harm [1].
- Dose mapping method **ensures radiation dose remains within predetermined limits** set by authorities up to 50Gy [2].

B. Objective

This study explores the feasibility of novel fabricated Ge-doped optical fibre dosimeters as a radiation **dose mapper** for quality assurance (QA).

C. Methodology

- **2.3mol% Ge-doped Optical Fibres** Cylindrical (CF) and flat (FF) types of fabricated optical fibres used (Figure 1), **calibrated within high dose range of 5 to 50Gy** using Cobalt-60 machine at the SSDL, Nuclear Malaysia Agency.
- Dose mapping conducted in Cesium-137 source blood irradiator at the Pathology Department, HSAAS.
- For irradiation, location for mapping was used the GS300 Dose Mapping Report from Best Theratronics as a standard to generating the grid (Figure 2)-100 locations.
- Blood-equivalent phantom to gamma radiation of 25 Gy used, the results were compare of thermoluminescence signals with EBT-XD film.

Figure 1. CF and FF 2.3 mol% Ge-doped optical fibres.

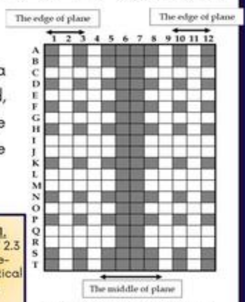

Figure 2: Locations on the grid.

E. Analysis

The thermoluminescence (TL) signals emitted by the fibers were subsequently measured using a Harshaw™ 3500 TLD reader [3].

F. Conclusion

Ge-doped Optical Fiber Dosimetry: **Accurate Monitoring of High Radiation Exposure**

- High sensitivity, cost-effectiveness, and reusability.
- Offers comprehensive dose mapping for **precise radiation field evaluation.**
- Offers an **alternative passive dosimeter** to conventional blood dosimetry, EBT film.

D. Results

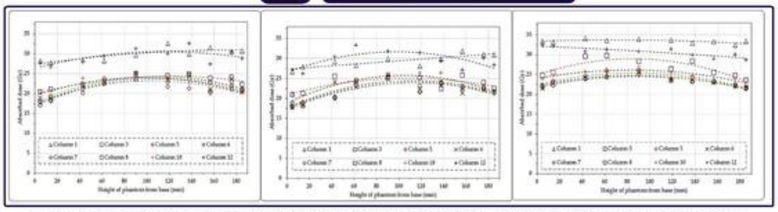

Figure 3: The graph shows isodose curves by location in the columns (1 to 12) between the optical fibres CF, FF and EBT-XD film.

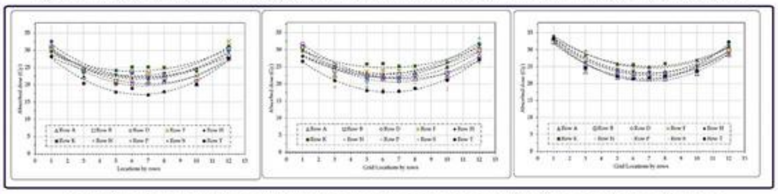

Figure 4: Horizontal view, the graph show isodose curves by location in the row (A to T) between the three dosimeters.

Optical Fibers and EBT-XD Film Comparison

- Vertical : the central region at **the midpoint of the phantom base** – high level of absorbed dose (Figure 3 - dome-shaped isodose curves).
- Horizontal : **the edges of planes** demonstrate the greatest radiation dose level (Figure 4 - inverted dome-shaped isodose curves).
- Dose Mapping in Blood Irradiator (turnover canister) show **larger dose distribution along plane edges** (Figure 5) [3],[4].
- The dose mapping revealed **no significant difference** (*p* =.654 and .073, 95% CL) in the mean absorbed dose of optical fibres throughout the edge and the middle of the plane when compared to EBT-XD film, as analysed by the one-way analysis of variance (ANOVA) test.
- **Mean error of 4% for both fibres CF and FF and EBT-XD film error of 3.4%,** indicating good agreement with nominal 25Gy dose value.

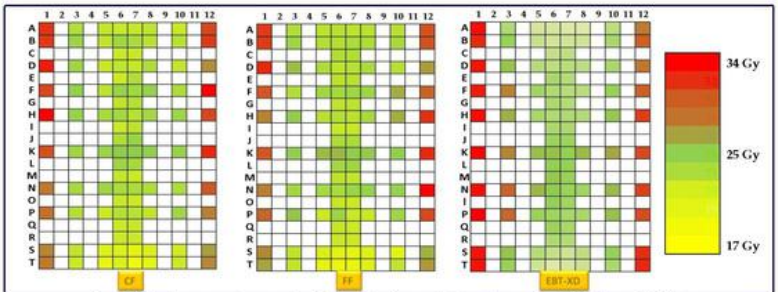

Figure 5: The dose mapping generates 2-dimensional images in the colour gradient of the dose distribution.

Acknowledgement: Staff of the Secondary Standard Dosimetry Laboratories (SSDL), Malaysian Nuclear Agency; Department of Radiology and Pathology, Faculty of Medicine and Health Sciences, UPM for their valuable assistance in this study. **Ethical Approval** : JKEUPM-2023-367 (JKEUPM, HSAAS UPM)

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IAEA-CN-295-49-POS

Disposal of Cobalt-60 (Co-60) Teletherapy System in Malaysia's Medical Institution: Involvement of Stakeholders in Ensuring the Safety and Security of Radioactive Sources

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IAEA

KEMENTERIAN KESIHATAN MALAYSIA

Introduction

The Cobalt-60 (Co-60) teletherapy machine was invented by University of Saskatchewan medical physicist; Harald E. Johns in 1951 in Saskatoon, Canada. Commonly applied for external beam radiotherapy procedure, this machine uses Co-60 with high specific activity that emits high-energy gamma rays to kill cancer cells. Based on the IAEA Code of Conduct on the Safety and Security of Radioactive Source, Co-60 assigned to Category 1, corresponding to security Level A and IAEA Nuclear Security Series. Once Cobalt-60 decays and the teletherapy are no longer functional, the unwanted teletherapy units and sources need to be properly disposed to prevent any radiological theft or accidents. In Malaysia, Queen Elizabeth Hospital II are the first medical institution that implementing the disposal process of Co-60 teletherapy system with full collaboration with all national stakeholders.

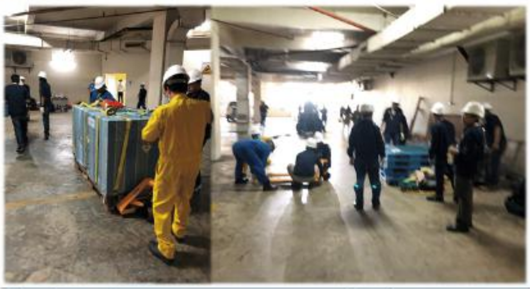
Objectives

1. Strengthen collaboration among national stakeholders by leveraging existing capabilities to facilitate disposal process
2. Enhancing safety and security of radioactive sources throughout the disposal process.

Results

No.	Process Category	Details
1.	Before disposal	❑ A **special task force committee** are established to coordinate and identify the role of each government agency involved during this disposal activities to ensure the process are executed more efficiently, cost effectively, and align with current government policies as well as international practices. ❑ Advance approval are required to ensure the disposal process are complied with all requirements under **Atomic Energy Licensing Act 1984 (Act 304)** and others legislation in force.

No.	Process Category	Details
2.	During disposal	❑ Disposal process consist of **decommissioning** of teletherapy unit and source, **packaging** and **transportation**. ❑ During the disposal works all process involved must adhere with established **Radiation Safety Measures**. ❑ This inclusive **time, distance** and **shielding** to ensure the safety of all workers involved in the disposal process.



No.	Process Category	Details
3.	After disposal	❑ Submit device disposal documents to Ministry of Health Malaysia (MOH) in order to in line with existing disposal procedures. ❑ All disposal process information are requires to be updated inside government asset disposal records and MOH RADIA (Licensing and Monitoring) system.

Discussion

1. The establishment of a **special task force committee** is very critical to develop SOPs for Co-60 waste disposal.
2. Identify **the functions and roles** of each department and government agency involved to enhance the end to end process efficiency and to prevent overlapping work scope
3. The disposal process must complies with all safety and security requirements as well as on the enforced legal policy which including to ensure the costs involved are **in line with the national austerity policy**.

Conclusion

In conclusion, the disposal process of Co-60 teletherapy machine at Queen Elizabeth Hospital II has successfully executed with the cooperation of all stakeholders and Co-60 radioactive waste was well disposed at National Radioactive Waste Management Center, Malaysia.

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International Conference on the Safety and Security of Radioactive Sources: Accomplishments and Future Endeavours (CN-295)
Vienna, Austria; 20-24 June 2022

TOWARDS ESTABLISHING NDRL IN ADULT PLAIN RADIOGRAPHY: A PRELIMINARY RESULTS

24th AOCMP 22nd SEACOMP PENANG, MALAYSIA | 10 - 13 OCTOBER 2024

Session ID: PSTR - DR – 35 ; Abstract ID: 220

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1 INTRODUCTION

Diagnostic Reference Level (DRL) defines as a level used in medical imaging to indicate whether, in routine conditions, the dose to patient in a specified radiological procedure for medical imaging is unusually high or unusually low for that procedure[1]. DRL is also a form of investigation level used as a tool to aid optimisation of protection in the medical exposure of patients for diagnostic and interventional procedures[2]. A DRL is a level set for a standard procedure for the groups of 'standard patients' and not for individual exposure. Hence, it is important to establish an updated national DRL (NDRL) values.

2 PURPOSE

This study aims to propose a new NDRL values in adult plain radiography towards promoting dose optimisation in general radiography examinations.

3 METHOD

STEP 1: Identified routinely performed diagnostic examination and DRL quantities

STEP 2: Determined sampling size, select healthcare facilities and conduct data collection

STEP 3: Analysed data and determined median value for dosimetric quantities of each healthcare facilities

STEP 4: NDRL are derived from the third quartile of the median values

Figure 1: Steps in Setting a NDRL in Malaysia

4 RESULT & DISCUSSION

A total of 21,320 cases were collected for this study using general radiography system. This can be divided into 10,163 cases collected in entrance-surface air kerma ($K_{a,e}$) in unit mGy and 11,157 cases in air kerma-area product (P_{KA}) in unit mGy.cm², for both adult male and female patients. Most common cases are the posteroanterior (PA) chest radiograph with total 2,364 case collected in $K_{a,e}$ and 1,735 cases in P_{KA}. This is due to all hospitals and general practitioner (GP) clinics equipped with general X-ray system are allowed to perform chest PA examination.

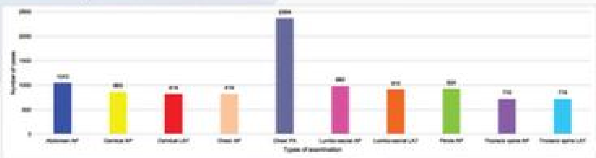

Figure 2: Total Number of Cases Based on Types of Examination Collected in $K_{a,e}$

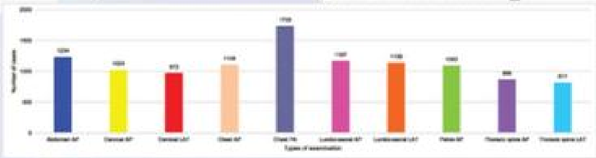

Figure 3: Total Number of Cases Based on Types of Examination Collected in P_{KA}

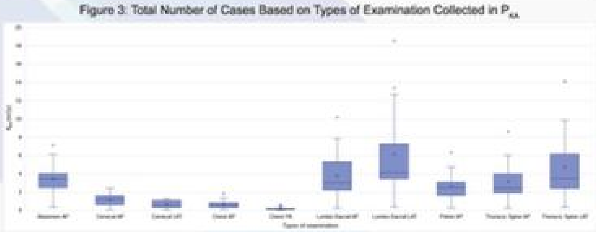

Figure 4: Box-Plot Showing $K_{a,e}$ Values for Various Types of Examination in General Radiography

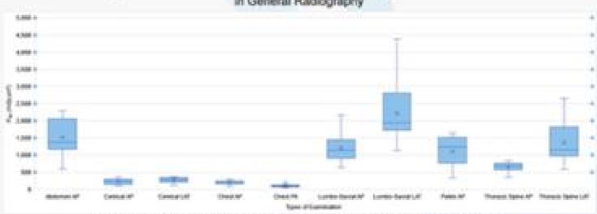

Figure 5: Box-Plot Showing P_{KA} Values For Various Types Of Examination In General Radiography

Preliminary NDRL

The preliminary data to propose NDRL are derived from the third quartile of the distribution of median values obtained from each healthcare facilities.

Table 1: Preliminary NDRL for Adult in General Radiography

Types of Examination	DRL	
	$K_{a,e}$ (mGy)	P_{KA} (mGy.cm²)
Chest PA	0.2	120
Chest AP	0.8	250
Abdomen AP	4.1	2060
Pelvis AP	3.1	2040
Cervical AP	1.6	300
Cervical LAT	1.1	350
Lumbo-sacral AP	5.4	1500
Lumbo-sacral LAT	7.3	2800
Thoracic spine AP	4.0	760
Thoracic spine LAT	6.2	1800

The lowest preliminary NDRL value for general radiography systems is chest PA with $K_{a,e}$ value of 0.2 mGy and P_{KA} value of 120 mGy.cm². This is because the X-ray must pass through less dense tissues. In contrast, the highest preliminary NDRL value is the lateral view of lumbo-sacral with $K_{a,e}$ value of 7.3 mGy and P_{KA} value of 2800 mGy.cm². This higher value results from the high exposure settings used in area of the greatest X-ray attenuation, including the pelvic bones.

Preliminary NDRL Data Comparison with Other Countries

The preliminary NDRL were compared to previous Malaysian DRL (2013) value and with other countries.

Table 2: Comparison of $K_{a,e}$ and P_{KA} with Published International DRL for General Radiography

Types of Examination	$K_{a,e}$ (mGy)					P_{KA} (mGy.cm²)				
	This Study	NDRL 2013[3]	Thailand 2023[4]	Indonesia 2021[5]	Japan 2020[6]	This Study	NDRL 2013[3]	Thailand 2023[4]	Ireland 2023[7]	UK 2022[8]
Chest PA	0.2	0.9	0.4	0.4	0.3 (> 100kV) 0.4 (< 100kV)	120	NA	219	120	100
Chest AP	0.8	NA	NA	0.4	NA	250	NA	NA	130	150
Lumbo-sacral AP	5.4	7.5	3.4	2.0	3.5	1500	NA	2014	1600	1500
Lumbo-sacral LAT	7.3	13.5	9.18	4.4	9.0	2800	NA	3046	2240	2500

The $K_{a,e}$ values in this study were significantly decreased compared to the previous 2013 DRL. This suggest improvements in clinical protocol and better equipment which is leading to better optimization of radiology services. The comparison also illustrate the propose preliminary NDRL for Malaysia are closely aligned with other internationally recognized DRL values.

5 CONCLUSION

Overall, the preliminary NDRL values in this study significantly lower than the Malaysian DRL established in 2013 and comparable with other countries, indicates good practices in radiology services. Therefore, these proposed DRL are recommended for future to optimise radiation in clinical practices in Malaysia.

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7 ACKNOWLEDGEMENT

1- We extend our sincere gratitude to the healthcare facilities that generously contributed their data for this study. We also wish to acknowledge the dedicated committee responsible for verifying and analysing the data.
2- This study has received approval from Medical Research & Ethics Committee (MREC), Ministry of Health (MOH) Malaysia under reference number NMRR ID – 22-00639-M3J and supported by National Institute of Health, MOH research grant .

24th AOCMP 22nd SEACOMP PENANG, MALAYSIA | 10 - 12 OCTOBER 2024

ESTABLISHMENT OF NATIONAL DRL IN PAEDIATRIC RADIOGRAPHY: A NOVEL EXPERIENCE

Session ID: PSTR - DR – 42 ; Abstract ID: 302

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1. INTRODUCTION

Diagnostic Reference Level (DRL) are an important tools used in medical imaging to ensure that radiation doses are kept within safe limits. For pediatric patients, who are more sensitive to radiation than adults, DRL are especially critical. They help guide healthcare providers in choosing appropriate imaging techniques and settings to minimize radiation exposure while still obtaining high-quality diagnostic images. By adhering to DRL, healthcare professionals can enhance patient safety and ensure that the benefits of diagnostic imaging outweigh the risks.

2. PURPOSE

This study aims to propose specific national DRL (NDRL) value for paediatric and neonate patients in radiography.

3. METHODOLOGY

Data collected between 2022 to 2023 from fixed and mobile X-ray units, were analysed to establish the NDRL.

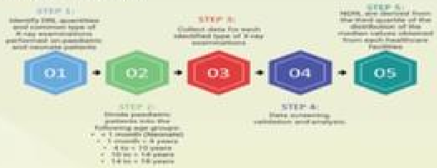

Figure 1: Steps in setting a NDRL for paediatric patients in Malaysia

4. RESULT & DISCUSSION

The dosimetric data for general radiography were expressed in entrance-surface air kerma ($K_{a,e}$) in unit mGy and air kerma-area product (P_{KA}) in unit mGy.cm².

Total number of cases collected for this survey for examination using general radiography system is 5,873 cases. This can be divided into 2,237 cases collected in $K_{a,e}$ and 3,636 cases in P_{KA}, both for male and female paediatric patients. The total number of cases collected from paediatric patients, ranging in age from 1 month to 18 years old is 2,077 for $K_{a,e}$ and 2,588 for P_{KA}. Meanwhile, the total number of cases collected for neonate patients is 160 for $K_{a,e}$ and 1,048 for P_{KA}.

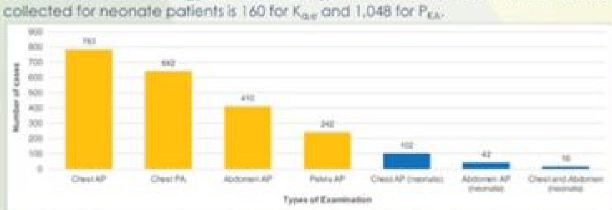

Figure 2 : Total number of cases based on types of examination in $K_{a,e}$ for paediatric patients

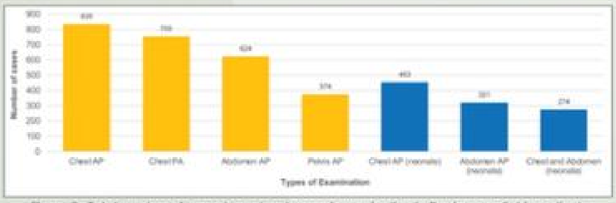

Figure 3 : Total number of cases based on types of examination in P_{KA} for paediatric patients

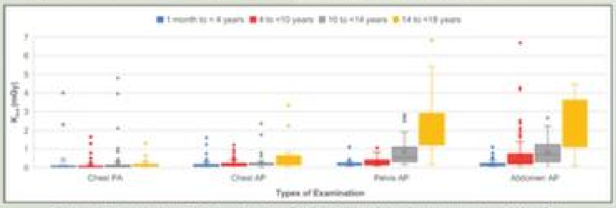

Figure 4 : Box-plot showing $K_{a,e}$ for paediatric patients in various types of examination

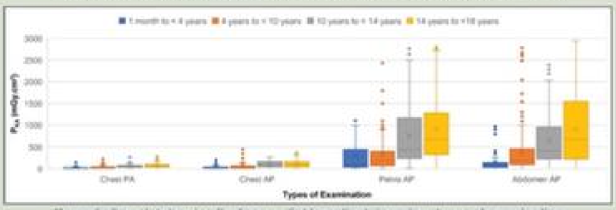

Figure 5 : Box-plot showing P_{KA} for paediatric patients in various types of examination

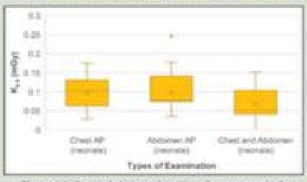

Figure 6: Box-plot showing $K_{a,e}$ for neonate in various types of examination

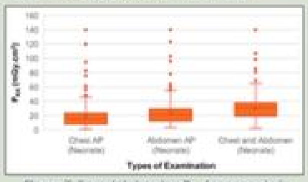

Figure 7: Box-plot showing P_{KA} for neonate in various types of examination

The preliminary data to propose NDRL are derived from the third quartile of the distribution of median values obtained from each healthcare facilities.

Table 1: Proposed paediatric NDRL for general radiography systems

Types of Examination	Age Group	DRL	
		$K_{a,e}$ (mGy)	P_{KA} (mGy.cm²)
Chest AP	1 month to < 4 years	0.17	45
	4 to < 10 years	0.23	70
	10 to < 14 years	0.24	175
	14 to < 18 years	0.64	170
Chest PA	1 month to < 4 years	0.10	30
	4 to < 10 years	0.08	30
	10 to < 14 years	0.15	85
	14 to < 18 years	0.19	100
Abdomen AP	1 month to < 4 years	0.23	105
	4 to < 10 years	0.70	395
	10 to < 14 years	1.20	960
	14 to < 18 years	3.60	1550
Pelvis AP	1 month to < 4 years	0.25	450
	4 to < 10 years	0.40	405
	10 to < 14 years	1.10	1165
	14 to < 18 years	2.90	1290

Table 2: Proposed neonates NDRL for general radiography systems

Types of Examination	DRL	
	$K_{a,e}$ (mGy)	P_{KA} (mGy.cm²)
Chest AP	0.13	30
Abdomen AP	0.14	25
Chest and abdomen	0.10	40

Preliminary NDRL Data Comparison with Other Countries

Preliminary NDRL data were compared with other countries.

Table 3: Comparison of $K_{a,e}$ and P_{KA} with published international DRL for general radiography

Types of Examination	Age Group	$K_{a,e}$ (mGy)		P_{KA} (mGy.cm²)		
		NDRL 2024	EUCLIDE 2018	NDRL 2024	EUCLIDE 2018[3]	Ireland 2023 (HIQA)[4]
Chest and abdomen	Neonate	0.10	NA	40	NA	NA
Chest AP	Neonate	0.13	NA	30	15 (<5 kg)	9 (<5 kg)
	1 month to < 4 years	0.17	0.06 (5 to < 15 kg)	45	22 (5 to < 15 kg)	17 (5 to < 15 kg)
	4 to < 10 years	0.23	0.08 (15 to < 30 kg)	70	30 (15 to < 30 kg)	22 (15 to < 30 kg)
	10 to < 14 years	0.24	0.11 (30 to < 50 kg)	175	70 (30 to < 50 kg)	50 (30 to < 50 kg)
	14 to < 18 years	0.64	NA	170	87 (50 to < 80 kg)	70 (50 to 80 kg)
Chest PA	1 month to < 4 years	0.10	0.06 (5 to < 15 kg)	30	22 (5 to < 15 kg)	17 (5 to < 15 kg)
	4 to < 10 years	0.08	0.08 (15 to < 30 kg)	30	30 (15 to < 30 kg)	22 (15 to < 30 kg)
	10 to < 14 years	0.15	0.11 (30 to < 50 kg)	85	70 (30 to < 50 kg)	50 (30 to < 50 kg)
	14 to < 18 years	0.19	NA	100	87 (50 to < 80 kg)	70 (50 to 80 kg)
Abdomen AP	Neonate	0.14	NA	25	45 (<5 kg)	13 (<5 kg)
	1 month to < 4 years	0.23	0.06 (5 to < 15 kg)	105	150 (5 to < 15 kg)	63 (5 to < 15 kg)
	4 to < 10 years	0.70	0.08 (15 to < 30 kg)	395	250 (15 to < 30 kg)	100 (15 to < 30 kg)
	10 to < 14 years	1.20	0.11 (30 to < 50 kg)	960	475 (30 to < 50 kg)	286 (30 to < 50 kg)
	14 to < 18 years	3.60	NA	1550	700 (50 to < 80 kg)	437 (50 to 80 kg)
Pelvis AP	1 month to < 4 years	0.25	NA	450	NA	39 (5 to < 15 kg)
	4 to < 10 years	0.40	0.40 (15 to < 30 kg)	405	180 (15 to < 30 kg)	111 (15 to < 30 kg)
	10 to < 14 years	1.10	0.73 (30 to < 50 kg)	1165	310 (30 to < 50 kg)	412 (30 to <50 kg)
	14 to < 18 years	2.90	NA	1290	NA	800 (50 to 80 kg)

This study is the first Malaysia novel experience in developing NDRL for paediatric patients. Therefore, the comparison of this data with other international published data were performed with caution. Age band were used as age is the only available measure in most healthcare facilities. Thus, age grouping for paediatric DRL are approximate equivalent to weight.

5. CONCLUSION

DRL are essential for ensuring radiation doses used in medical imaging are kept within safe limits, especially for paediatrics. Based on our experience, establishing specific DRL for paediatric patients is crucial to protect this vulnerable group.

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4. Health Information and Quality Authority. (2023). Diagnostic reference levels, guidance on the establishment, use and review of diagnostic reference levels for medical exposure to ionising radiation.

7. ACKNOWLEDGEMENT

1. We extend our sincere gratitude to the healthcare facilities that generously contributed their data for this study. We also wish to acknowledge the dedicated committee responsible for verifying and analysing the data.
2. This study has received approval from Medical Research & Ethics Committee (MREC), Ministry of Health (MOH) Malaysia under reference number NMRR ID - 23-00639-MXU and supported by National Institute of Health (NIH), MOH research grant.

NATIONAL STUDY OF PATIENT DOSIMETRY FOR HEAD AND CARDIAC ANGIOGRAPHIC PROCEDURE

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INTRODUCTION

Rapid increasing number and complexity of interventional radiology procedure raising concerns regarding radiation exposure to patients. Head and cardiac angiographic procedure reported contribute to the highest IR radiation dose, thus raising the need for patient dose monitoring.

OBJECTIVE

This study aims to establish national benchmarks on radiation dose data through national diagnostic reference level (NDRL) from patients undergoing head and cardiac angiographic procedures in Malaysia.

METHODOLOGY

1. Identified routinely performed types of examination for head and cardiac & DRL quantities. — $K_{a,r}$ (mGy), P_{KA} (Gy.cm^2)
2. Determined sampling size & healthcare facilities. Data was collected from 2022 - 2023. — 28
3. Analyze data and determine median value for each dosimetric quantity for each healthcare facilities. — $\bar{x} = \frac{\Sigma x}{n}$
4. Derived NDRL from the third quartile of the distribution of the median values obtained from each healthcare facilities.

RESULTS AND DISCUSSION

1. DEMOGRAPHIC DATA

Total Case **1901**

579 — 1322 — 1396 — 505

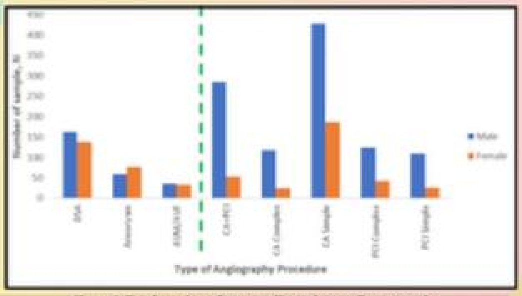

Figure 1: Total number of cases collected according to gender

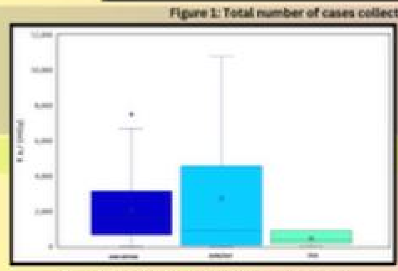

Figure 2: Box plot of $K_{a,r}$ values for head examination

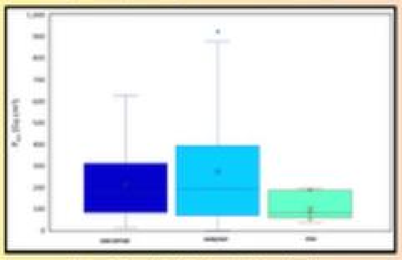

Figure 3: Box plot of P_{KA} for head examination

The highest value is from AVM/AVF examination with $K_{a,r}$ value is 4,700 mGy and P_{KA} value is 390 Gy.cm^2. The highest proposed NDRL value were from AVM/AVF examination due to long exposure time, complexity of the cases and most of the examination done by using bi-lateral examination.

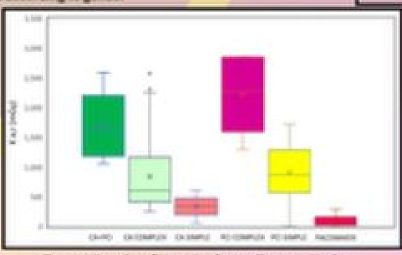

Figure 4: Box plot of $K_{a,r}$ value for cardiac examination

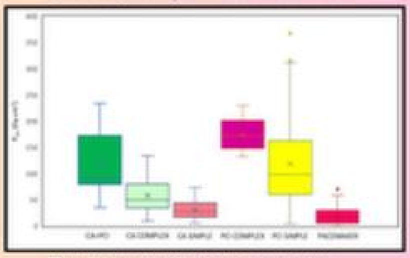

Figure 5: Box plot of P_{KA} for cardiac examination

Meanwhile, value for cardiac examination is higher in PCI complex examination with $K_{a,r}$ value is 2,800 mGy and P_{KA} value is 200 Gy.cm^2. In CA+PCI examination, it may involve single vessel intervention which takes shorter fluoroscopy time as compared to PCI complex examination that may involve triple vessels.

2. RESULTS OF THE SURVEY

Two types of dosimetry data were used in this study which are patient entrance reference point $K_{a,r}$ (mGy) and air kerma-area product P_{KA} (Gy.cm^2) for both head and cardiac examination were expressed in Table 1.

Table 1: $K_{a,r}$ and P_{KA} value for head and cardiac examination

Types of Examination	Proposed NDRL	
	$K_{a,r}$ (mGy)	P_{KA} (Gy.cm^2)
Head		
Cerebral Embolisation – Aneurysm	3,200	310
Cerebral Embolisation - AVM/AVF	4,700	390
Cerebral Digital Subtraction Angiography (DSA)	940	190
Cardiac		
Coronal Angiography (CA) + Percutaneous Intervention (PCI)	2,200	170
Coronal Angiography (CA) – Complex	1,200	80
Coronal Angiography (CA) – Simple	480	44
Percutaneous Intervention (PCI) - Complex	2,800	200
Percutaneous Intervention (PCI) – Simple	1,300	160

3. CONCLUSION

This study represents a significant step forward in ensuring the safe and effective use of radiation in Malaysia. The awareness of patient dose in interventional radiology and application of optimisation principle should be enhance among healthcare professionals. Thus, examination for appropriate patient follow up is recommended to established in all Malaysia healthcare facilities

4. ACKNOWLEDGEMENT

1. We extend our sincere gratitude to the healthcare facilities that generously contributed their data for this study. We also convey our acknowledgement to the dedicated committee responsible for verifying and analyzing the data.
2. This study has received approval from Medical Research & Ethics Committee (MREC), Ministry of Health (MOH) Malaysia under reference number NMRR ID – 22-00639-M3J and supported by National Institute of Health (NIH), MOH research grant.
3. We also would like to express our gratitude to Dr. Zulkifli Zaki bin Abdul Ghani for his invaluable guidance and support throughout this project

5. REFERENCES

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HOSPITAL PULAU PINANG

Phantom Evaluation of SPECT Quantification In Multi-Vendor SPECT/CT Systems

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INTRODUCTION

The utilisation of quantitative single-photon emission computed tomography (SPECT) imaging in targeted radionuclide therapy using Iodine-131 (I-131) exhibits significant promise for personalized treatment. However, its accuracy depends on many factors. The study incorporated two modern SPECT/CT systems, namely the Discovery™ NM/CT 870 DR by GE Healthcare and the Symbia Intevo™ Boldby Siemens Healthineers.

OBJECTIVE

To evaluate the recovery coefficients (RC) in multi-vendor of various SPECT/CT systems in the department by using I-131 as the radioactive tracer.

METHODOLOGY

A NEMA IEC Body Phantom without lung insert was scanned in both modalities to assess the accuracy of these SPECT/CT system.

a) Phantom Scan

All six fillable spherical diameters of 10 mm, 13 mm, 17 mm, 22 mm, 28 mm and 37 mm were filled with I-131 to a concentration of about 9:1 (sphere to background) ratio.

Figure 1: Unfilled NEMA IEC Phantom without lung insert

Table 1: Phantom scan parameter for SIEMENS SPECT and GE SPECT

PARAMETER	SIEMENS	GE
No. of views	60	60
Direction	CW	CW
Type of detector	Step and Shoot	Step and Shoot
motion	25 s	25 s
Lower window	15%	10%
Upper window	15%	10%
Detector Collimator	HE	HEGP

CW clockwise, *HE* High Energy, *HEGP* High Energy General Purpose

b) Image Reconstruction

Both SPECT/CT models are flood-corrected, attenuation-corrected, scatter-corrected, and decay-corrected. The reconstructed quantitative data for both modalities were sent to MIM software for analysis.

Table 2: SIEMENS SPECT and GE SPECT use clinical reconstruction parameters

PARAMETER	SIEMENS	GE
Reconstruction Method	OSCGM	OSEM
Iteration	6	4
Subsets	4	10
Post- Filter	Gaussion, 20 mm	None
Window SC	TEW, ± 15% keV	DEW, ± 10% keV
Processing	xQuant	GE Xeleris 5.0

OSCGM Ordered Subset Conjugate Gradient Minimization, *TEW* Triple Energy Window, *OSEM* Ordered Subset Expectation Maximization, *DEW* Dual Energy Window

c) VOI Analysis

Volumes of interest (VOI) for the spheres were obtained by manually segmenting the sphere according to the known sphere volume using MIM software. The recovery coefficients (RCmean and RCmax) in all spheres were calculated by dividing the measured activity concentration with the actual activity concentration.

$$\text{Recovery Coefficient, } (RC) = \frac{\textit{VOI activity concentration}}{\textit{actual activity concentration}}$$

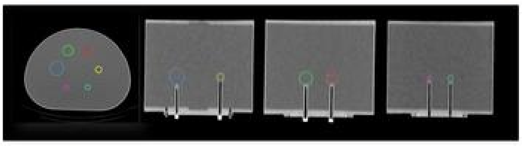

Figure 2: CT scan of a standard NEMA IEC Phantom fillable sphere. The spheres were filled with radioisotope I-131. The ratio of sphere-to-background activity concentration was 9:1

RESULT AND DISCUSSION

The observed pattern reveals a negative relationship between sphere volume and RC. The range of variation for RC_{mean} was 7.5% (0.58 ml) ~ 42.6% (2.56 ml), whereas for RC_{max} was 37.9% (0.58 ml) ~ 86.5% (5.51 ml).

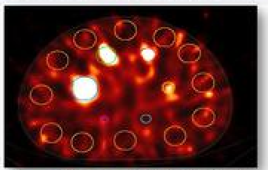

Figure 3: Image of NEMA IEC Body Phantom reconstructed with OSEM algorithm by GE Healthcare.

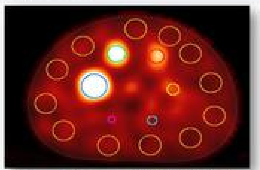

Figure 4: Image of NEMA IEC Body Phantom reconstructed with OSCGM algorithm by Siemens.

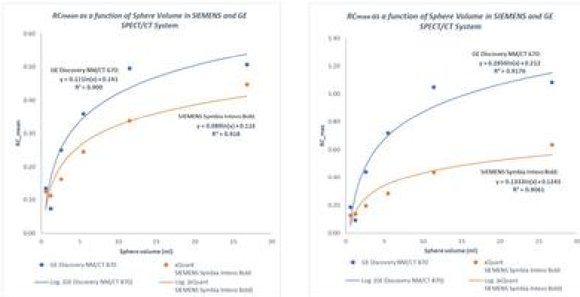

Figure 5: Recovery coefficient as a function of sphere volume in both SPECT/CT system.

- The RC_{mean} and RC_{max} decrease as sphere volume decrease in both SPECT/CT system.
- This is due to the spatial resolution of emission tomographic imaging system that can lead to a significant underestimation or overestimation of the apparent activity concentration in a reconstructed image.
- Resulting from the "spill-out" or "spill-in" effect of the sphere to the background.
- In performing dosimetry, the dosage of tiny lesions is likely to be underestimated. In this case, the interpolation of the RC value with the known sphere volume will be utilised to estimate the activity concentration accurately. The graph above can potentially be used as the "gold standard" to practise I-131 dosimetry. The RC value can be applied by multiplying with the activity concentration of the corresponding volume to produce precise dose estimation for I-131 therapy.

CONCLUSION

It is feasible to achieve precise SPECT quantification for I-131 in a setting involving multiple vendors. Nevertheless, it is crucial to ensure a high level of concordance among vendors in order to conduct dosimetry studies involving multiple vendors by considering RC of various SPECT/CT systems in the department.

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The Future of Medical Physicist

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The future of medical physics is being shaped by advances in artificial intelligence (AI), 3D digital printing, and laser technologies. These innovations promise to revolutionize diagnostics, treatment planning, and patient care. Here's a brief discussion of each:

1. Artificial Intelligence (AI) in Medical Physics

AI is increasingly integrated into medical physics, especially in areas like imaging, radiation therapy, and dosimetry. Machine learning algorithms can analyze large volumes of medical data, enabling faster and more accurate diagnosis. In radiation therapy, AI can assist in treatment planning by optimizing radiation dose distribution, personalizing therapy to individual patients, and minimizing side effects. Additionally, AI-powered imaging techniques (e.g., in MRI, CT, and PET scans) enhance the accuracy of early diagnosis and prediction of disease progression, improving overall outcomes.

2. 3D Digital Printing in Medicine

3D printing is transforming medical physics by enabling the creation of patient-specific anatomical models. These models, made from various materials (including bio-compatible ones), can be used for preoperative planning, simulation, and even creating custom prosthetics or implants. In radiation therapy, 3D-printed phantoms are used for quality assurance and dosimetric testing. Furthermore, bioprinting—printing tissues or organs from living cells—holds the potential to revolutionize organ transplantation and regenerative medicine in the future.

3. Laser Applications in Medicine

Lasers have broad applications in medical physics, especially in diagnostics and treatment. For example, laser imaging techniques such as Optical Coherence Tomography (OCT) provide non-invasive ways to visualize tissues in high resolution, useful in ophthalmology and dermatology. Laser-based therapies are widely used in treating tumors (e.g., laser ablation), eye conditions (e.g., LASIK), and dental procedures. Additionally, lasers can be employed in radiation therapy (e.g., proton or heavy ion therapy) to target tumors more precisely, minimizing damage to surrounding healthy tissues.

Synergy Between These Technologies

The integration of AI, 3D printing, and laser technology can create a more personalized, efficient, and effective medical environment. AI can help optimize 3D-printed implants or prosthetics, while laser applications in medical treatments could be fine-tuned using AI algorithms to enhance precision. The overall result will be better patient outcomes, faster recovery times, and more accessible treatments.

Conclusion

Together, these technologies represent a transformative shift in medical physics, promising to enhance diagnostic capabilities, improve treatment accuracy, and reduce costs and recovery times. However, their full potential will depend on continued research, interdisciplinary collaboration, and ethical considerations in their implementation.

We have to expand in Malaysia!!!

Closing

Thank you!

We want to thank and express our gratitude to everyone who has been contributing to this bulletin. Every drop in the ocean counts, and we will never forget those who contributes in sailing through difficulties deserve a portion of this reward.

By *Portfolio Buletin dan Jaringan Media*,
Technical Committee of Medical Physicist Profession ,
Ministry of Health Malaysia

" **Health** is the greatest of human **blessings**. - Hippocrates "

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