



'Teknologi Nuklear Pemacu Wawasan Negara' 'Nuclear Technology Propels The Nation Vision'

# SAFETY, SECURITY, HEALTH, AND ENVIRONMENTAL MANAGEMENT SYSTEM FOR TRIGA PUSPATI RESEARCH REACTOR

IAEA "Technical Meeting on Integrated Management Systems for the Sustainable Safe Operation and
Effective Utilization of Research Reactors"

EVT2405016

Mito, Japan, 16 – 19 June 2025













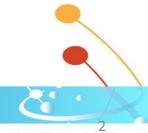
Agensi Nuklear Malaysia

### INTRODUCTION

Malaysian Nuclear Agency adopts a holistic, integrated approach to workplace safety and health, with particular attention to radiation safety and environmental protection.

This is achieved through the implementation of an Integrated Management System (IMS) that merges Occupational Safety and Health Management Systems (OSHMS), Quality Management Systems (QMS), Environmental Management Systems (EMS), and specialized programs such as radiation safety.

Nuklear Malaysia Occupational Health and Safety and Environmental Management System (SHE-MS) includes the Occupational Health and Safety Assessment Quality Management System (OHSAS) 18001 and the Environmental Management System (ISO 14000)



Effective Date: 0/01 Mac 2023

Nuklear Malaysia

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1. Legislative framework

2. Occupational Safety System

2. Summary





#### LEGISLATIVE FRAMEWORK

#### Occupational Safety and Health (Amendment) Act 2022 (Act A1648):

- This Act, which took effect on June 1, 2024, replaces the previous OSHA 1994 (Act 514) as the principal legislation governing workplace safety and health in Malaysia.
- Key features include:
  - Expanded coverage to all workplaces and industries.
  - Mandatory appointment of a safety coordinator for companies with five or more employees.
  - Increased penalties for non-compliance (up to RM500,000).
  - Emphasis on self-regulation and shared responsibility between employers and employees.
  - Mandates employers to provide a safe working environment, conduct risk assessments, ensure employee competency, and establish safety and health committees where required.



#### LEGISLATIVE FRAMEWORK

#### Atomic Energy Licensing Act 1984 (Act 304)

- Regulates all activities involving radioactive materials and radiation-emitting devices.
- Requires licensing, safety programs, and the appointment of a Radiation Protection Officer (RPO).
- Subsidiary regulations include:
  - Radiation Protection (Licensing) Regulations 1986
  - Radiation Protection (Transport) Regulations 1989
  - Atomic Energy Licensing (Basic Safety Radiation Protection) Regulations 2010 (P.U.(A) 46)
  - Atomic Energy Licensing (Radioactive Waste Management) Regulations 2011 (P.U.(A) 274)
- These regulations mandate safety culture, dose limits, ALARA principle, monitoring, emergency preparedness, and record-keeping



### **LEGISLATIVE FRAMEWORK**

## Environmental Quality Act 1974 (Act 127), as amended by the Environmental Quality (Amendment) Act 2024:

- The EQA is Malaysia's primary environmental legislation, addressing pollution control, waste management, and environmental protection.
- The 2024 amendment introduces stricter penalties (up to RM10 million), clarifies definitions, and enhances enforcement powers for the Department of Environment (DOE).
- Requires robust environmental management systems, especially for industrial waste and pollution control.



# MALAYSIAN NUCLEAR AGENCY OCCUPATIONAL SAFETY SYSTEM

Effective Date: 0/01 Mac 2023

## OCCUPATIONAL HEALTH AND SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEM (SHE-MS)

- Occupational Health and Safety Assessment Quality Management System (OHSAS) 18001
- Environmental Management System (ISO 14000).

Nuklear Malaysia

#### **SHE POLICY**







#### AGENSI NUKLEAR MALAYSIA

#### Dasar Keselamatan Pekerjaan, Kesihatan dan Alam Sekitar

Agensi Nuklear Malaysia bertanggungjawab menjalankan penyelidikan dan pembangunan (R&D) serta memberi khidmat teknikal dan latihan dalam bidang teknologi nuklear bagi pembangunan negara.

Adalah menjadi dasar Agensi Nuklear Malaysia untuk menyediakan persekitaran tempat kerja dan alam sekitar yang selamat dan sihat untuk semua pekerjanya dan perlindungan kepada orang lain yang terganggu keselamatan dan kesihatan akibat perlaksanaan aktiviti-aktivitinya.

Agensi Nuklear Malaysia yakin bahawa matlamat dasar ini dapat dicapai dengan melaksanakan sepenuhnya objektif-objektif dasar seperti berikut:

- Untuk mematuhi serta menilai pematuhannya secara berkala atas keperluan perundangan dan peraturan berkaitan dengan keselamatan pekerjaan, kesihatan dan alam sekitar:
- Untuk mematuhi keperluan perundangan dan peraturan berkaitan keselamatan nuklear dan sinaran, sekuriti serta kawalselia;
- Untuk meminimakan risiko serta kesan yang mungkin kepada pekerja dan individu terlibat yang boleh terjejas ekoran perlaksanaan aktiviti- aktivitinya;
- Untuk memantau secara berkala, menilai dan mewujudkan kaedah mengurangkan kesan terhadap alam sekitar;
- Untuk memastikan semua kakitangan berinfomasi serta mendapat arahan, latihan dan penyeliaan dalam menjalankan tugas masing-masing dengan selamat dan risiko yang minima:
- Untuk menyiasat semua kemalangan, penyakit, keracunan dan kejadian berbahaya serta mengambil langkah – langkah yang efektif bagi memastikan kejadian yang sama tidak berulang:
- Untuk menetap, menambahbaik dan memantapkan lagi sistem pengurusan keselamatan, kesihatan dan alam sekitar secara berterusan;
- Untuk menyediakan kemudahan kemudahan kebajikan bagi semua pekerja;
- Untuk memastikan semua kontraktor, pelawat, pembekal barangan dan perkhidmatan serta individu yang berkaitan mematuhi semua kehendak keselamatan, kesihatan dan alam sekitar Agensi Nuklear Malaysia; dan
- Untuk mengkaji semula dasar ini bila perlu.

(DR. ROSLLEIN DARMAWAN) Ketua Pengarah Agensi Nuklear Malaysia

06 SEPTEMBER 2023





#### MALAYSIAN NUCLEAR AGENCY

#### Occupational Safety, Health and Environmental Policy

Malaysian Nuclear Agency is entrusted with conducting research and development (R&D) as well as providing technical services and trainings in the areas of nuclear technology for national development

Malaysian Nuclear Agency's policy outlines its pledge to provide a safe and healthy workplace and environment for its employees as well as to protect the public whose safety and health might have been affected following the implementation of activities in Malaysian Nuclear Agency.

Malaysian Nuclear Agency believes the aims of this policy can be accomplished by fully implementing the policy objectives as follows:

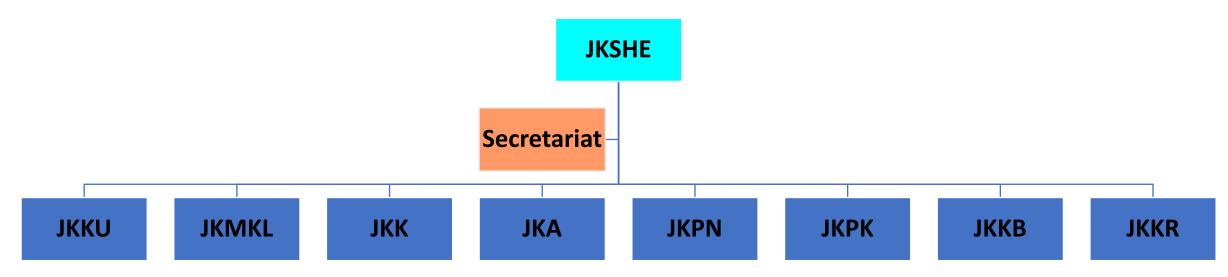
- To abide by, and assess its compliance periodically, as required by legislative obligation and regulations pertaining to occupational safety, health and environment;
- To comply with legal requirements and regulations concerning radiation, nuclear safety, security and safeguard;
- To minimise possible risk and effects on its employees and individuals whose safety and health might have been affected following the implementation of activities in Malaysian Nuclear Agency:
- To periodically monitor, assess and create methods of minimising effects on the environment.
- To ensure all employees are well-informed and that, instructions, trainings and supervision
  are accessible to them, hence warranting their duties to be conducted safely and at minimal
  risk?
- To examine all accidents, illnesses, intoxication and hazardous incidents as well as to take cautious approaches to prevent the recurrence of such events;
- To continuously rate, improve and strengthen the safety, health and environmental management system;
- To provide welfare facilities to all employees;
- To ensure all contractors, visitors, supply and service vendors as well as related individuals, comply with the safety, health and environmental requirements of Malaysian Nuclear Agency; and
- · To revise this policy when necessary.

(DR. ROSULEIN DARMAWAN)
Director General
Malaysian Nuclear Agency

06 SEPTEMBER 2023



#### SHE Management System (SHEMS) Committee Structure



#### Key Legend:

JKSHE: Safety, Health and Environmental Committee JKA: Subcommittee of Audit

[Jawatankuasa Keselamatan, Kesihatan dan Alam Sekitar] [Jawatankuasa Kecil Audit]

Secretariat: Secretariat KFK (Health Physics Group)/ BKS (Radiation Safety and Health Division) JKPN: Subcommittee of Nuclear Protection

[Sekretariat KFK (Kumpulan Fizik Kesihatan)/ BKS (Bahagian Keselamatan dan [Jawatankuasa Kecil Perlindungan Nuklear]

Kesihatan Sinaran)

JKPK: Subcommittee of Area Supervisor JKKU: Subcommittee of Main Facilities [Jawatankuasa Kecil Penyelia Kawasan]

[Jawatankuasa Kecil Kemudahan Utama]

Subcommittee of Biological Safety JKKB: JKMKL: Subcommittee of Laboratory and Field Work [Jawatankuasa Kecil Keselamatan Biologi]

[Jawatankuasa Kecil Makmal dan Kerja Lapangan]

Subcommittee of Reactor Facility JKKR: Subcommittee of Emergency JKK:

[Jawatankuasa Kecil Kemudahan Reaktor] [Jawatankuasa Kecil Kecemasan]

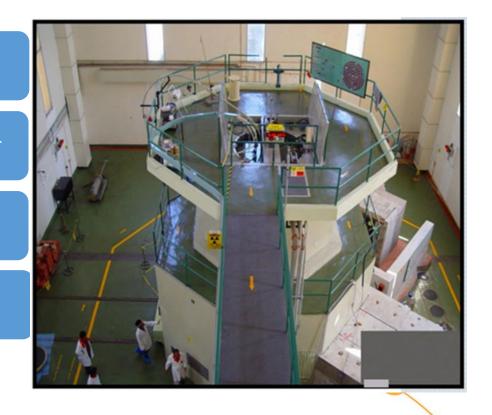
### **FACILITY**

1 MW PUSPATI TRIGA MARK II : Operational since 28 June 1982

Located in and operated : Malaysian Nuclear Agency, Bangi, Selangor

Project Agreement: INFCIRC/287 (22 September 1980)

Fuel: UZrH (19.9% enriched) & Control Rod: Boron Carbide



### REACTOR SAFETY PROGRAM







1. Nuklear Malaysia Safety, Health and Environment Committee (JKSHE)



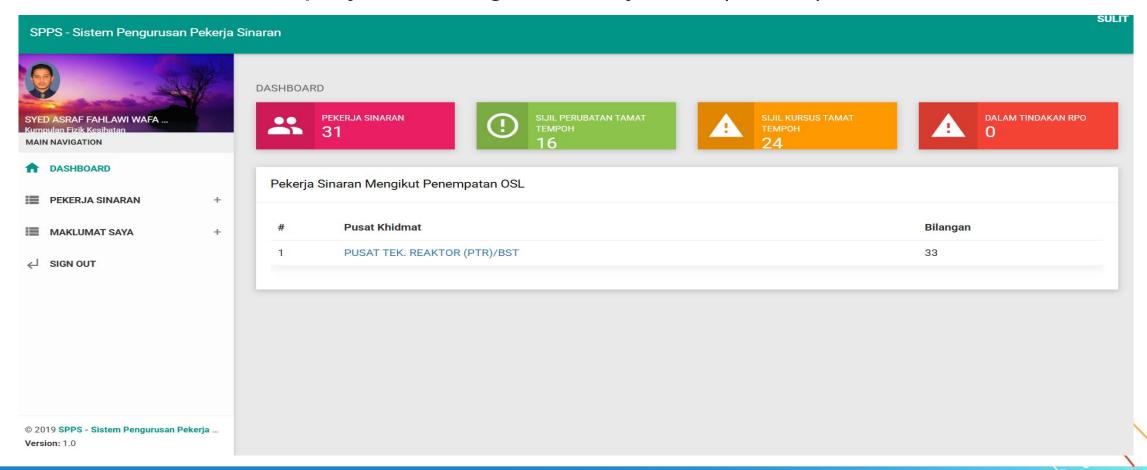


RADIATION CONTROL

- 1. RPO
- 2. Health Physic Group
- 3. Radiation Safety & Health Division

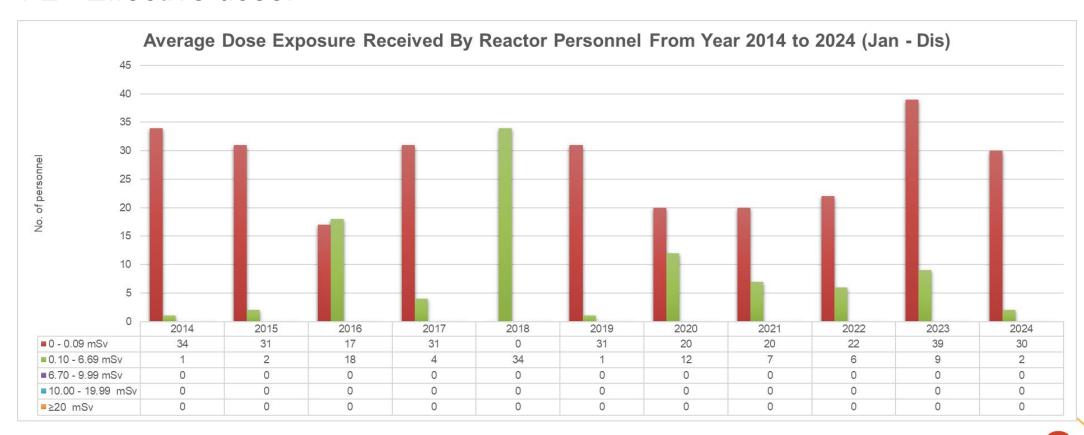


- 1. PERSONNEL MONITORING
  - 1.1 Radiation Employee Management System (SPPS)



#### PERSONNEL MONITORING

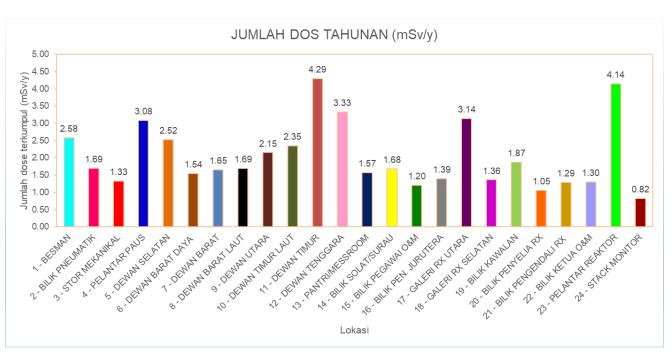
#### 1.2 Effective dose:-

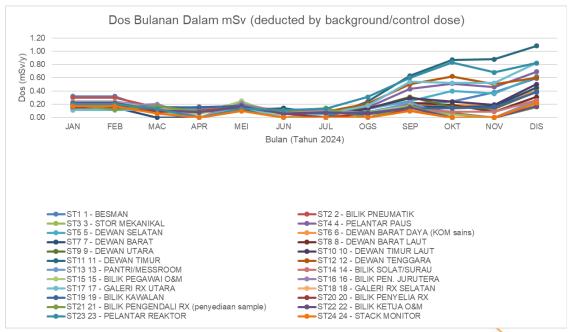


#### 2. AREA MONITORING

#### **External Radiation Levels**

Measurement of radiation level inside reactor building using OSLD.



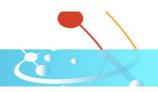


## 3. EFFLUENT MONITORING 3.1 PARTICULATE

 AMOUNT OF RADIOACTIVE EFFLUENT RELEASED TO THE ENVIRONMENT IN 2024

			Particulate		
Bulan	Kendalian (jam)	Tenaga Terbebas (kW jam)	Kepekatan Radioaktiviti Tertinggi (Bq/m³)	Purata Kepekatan Radioaktiviti (Bq/m³)	Jumlah Pelepasan Radioaktiviti (Bq)
Januari	24.67	0.143	2.84	1.91	1,645,309.71
Februari	27.02	8670.96	2.70	2.31	1,977,086.99
Mac	0	0	0	0	0
April	0	0	0	0	0
Mei	0	0	0	0	0
Jun	0	0	0	0	0
Julai	0	0	0	0	0
Ogos	27.1500	8663.36	0.65	0.65	217,573.57
September	46.27	12344.44	1.47	0.57	712,974.27
Oktober	88.73	49461.78	0.61	0.20	370,357.53
November	59.62	26012.91	0.65	0.22	222,422.58
Disember	93.12	41008.34	1.03	0.43	1,095,862.55
Nilai Tahunan	366.57	146161.93	9.94	0.52	6,241,587.20

Had penggera: 5,000.00 Bq/m<sup>3</sup>



## 3. EFFLUENT MONITORING 3.2 IODINE

 AMOUNT OF RADIOACTIVE EFFLUENT RELEASED TO THE ENVIRONMENT IN 2024

Bulan	Kendalian (jam)	Tenaga Terbebas (kW jam)	lodine		
			Kepekatan Radioaktiviti Tertinggi (Bq/m³)	Purata Kepekatan Radioaktiviti (Bq/m³)	Jumlah Pelepasan Radioaktiviti
Januari	24.67	0.143	4.1191	1.2965	869,842.66
Februari	27.02	8670.96	6.7472	1.1205	921,382.50
Mac	0	0	0	0	0
April	0	0	0	0	0
Mei	0	0	0	0	0
Jun	0	0	0	0	0
Julai	0	0	0	0	0
Ogos	27.1500	8663.36	159.00	74.03	217,573.57
September	46.27	12344.44	188.00	52.60	712,974.27
Oktober	88.73	49461.78	321.00	161.01	370,357.53
November	59.62	26012.91	189.00	147.19	222,422.58
Disember	93.12	41008.34	170.00	108.63	1,095,862.55
Nilai Tahunan	366.57	146161.93	1,029.86	45.44	6,241,587.20

Had penggera: 5,000.00 Bq/m<sup>3</sup>

## 3. EFFLUENT MONITORING3.3 NOBLE GASES

 AMOUNT OF RADIOACTIVE EFFLUENT RELEASED TO THE ENVIRONMENT IN 2024

			Noble Gases		
Bulan	Kendalian (jam)	Tenaga Terbebas (kW jam)	Kepekatan Radioaktiviti Tertinggi (Bq/m³)	Purata Kepekatan Radioaktiviti (Bq/m³)	Jumlah Pelepasan Radioaktiviti (Bq)
Januari	24.67	0.143	403,761.20	91,921.16	151,944.38
Februari	27.02	8670.96	160,111.74	85,014.99	71,096.52
Mac	0	0	0	0	0
April	0	0	0	0	0
Mei	0	0	0	0	0
Jun	0	0	0	0	0
Julai	0	0	0	0	0
Ogos	27.1500	8663.36	405,805.00	186,736.00	129,761.68
September	46.27	12344.44	449,702.00	147,917.11	666,195.92
Oktober	88.73	49461.78	827,829.00	389,312.71	666,195.92
November	59.62	26012.91	493,179.00	390,447.91	392,383.26
Disember	93.12	41008.34	488,258.00	307,622.33	979,940.56
Nilai Tahunan	366.57	146161.93	3,000,712.71	131,479.63	2,936,855.27

Had penggera: 5,000.00 Bq/m<sup>3</sup>



Noble Gas Kr-85, Kr-87, Kr-88, Xe-131, Xe-133, Xe-135

Halogens I-131, I-132, I-133, I-134, Br-82

Alkali metal Cs-134, Cs-137, Cs-138, Rb-88

Alkaline earth Ba-140, Sr-89

Noble Metal Pd-109, Tc-99, Te-125m, Fe-59, Rh-105, Sb-125, Ru-103, Te-127m, Te-129m, Mo-99,

Mn-54, Fe-59, Co-60

Actinides Am-241, Np/U-239

Refractory Zr-95, Nb-95

### 2. RADIOACTIVITY MONITORING OF REACTOR TANK WATER

- carried out throughout the year to detect the presence of fission products
- Analysis from the Analytical Chemistry Application Group (ACA) confirmed that no fission products were detected



#### 4. ENVIRONMENTAL MONITORING

 Carried out inside and outside Nuclear Malaysia with a radius of 25 km from Nuclear Malaysia



#### 4. ENVIRONMENTAL MONITORING

### 4.1 Radioactivity of Environmental Samples

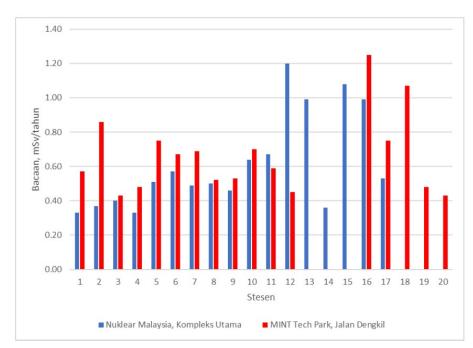
- ➤ Radionuclides Ra-226 & Ra-228 measured is the naturally occurring radionuclide found in the environment while radionuclides Cs-137 detected are caused from nuclear power plant accidents and past nuclear weapons testing activities.
- Overall, the average concentration of radionuclides measured is in range of radioactivity measured in previous years.

Jenis Pemantauan	Parameter yang akan dianalisis	Kaedah Pensampelan		
		Sampel diambil menggunakan skop tanah		
		dengan kedalaman 5 cm daripada permukaan		
Sampel Tanah	Analisis Makmal:	tanah.		
	<sup>228</sup> Ra, <sup>226</sup> Ra <sup>, 137</sup> Cs	Sampel diproses di makmal Alam Sekitar		
		KFK,BKS.		
		Sampel dianalisis di makmal RAS,BAS.		
		Sampel diambil menggunakan skop sedimen.		
Sampel	Analisis Makmal:	Sampel diproses di makmal Alam Sekitar		
Sedimen	<sup>228</sup> Ra, <sup>226</sup> Ra <sup>, 137</sup> Cs	KFK,BKS.		
		Sampel dianalisis di makmal RAS,BAS.		
		Sampel diambil menggunakan alat pemotong.		
Compol Flora	Analisis Makmal:	Sampel diproses di makmal Alam Sekitar KFK,		
Sampel Flora	<sup>228</sup> Ra, <sup>226</sup> Ra <sup>, 137</sup> Cs	BKS.		
		Sampel dianalisis di makmal RAS, BAS.		
Sampel Air	Analisis Makmal:	Sampel yang diambil dihantar terus ke makmal		
Samper Air	<sup>228</sup> Ra, <sup>226</sup> Ra <sup>, 137</sup> Cs	RAS, BAS untuk proses sampel dan analisis.		
Aras Sinaran	Dos Sinaran	Demonstration of the second constraints		
	Luaran:	Pemasangan OSLD di setiap stesen pemantauan		
Luaran	mSv/tahun	dan dianalisis di Makmal SSDL.		
Dos Berkesan	Dos Berkesan :	Pengiraan dos berkesan untuk orang awam pada		
(Orang Awam)	μSv/6 bulan	lokasi yang berbeza daripada reaktor.		

#### 4. ENVIRONMENTAL MONITORING

#### 4.2 External Radiation Levels

Measurement of radiation level outside the building using Optically Stimulated Luminescence Dosimeter, (OSLD).



Dose distribution at monitoring stations for the year 2024 in the Malaysian Nuclear Agency area

External Radiation Dose for Areas Outside the Malaysian Nuclear Agency

Stesen	Lokasi	Dos (mSv/tahun)
1	Bandar Baru Bangi	1.25
2	Kajang	1.63
3	Bandar Seri Putra	1.28
4	Bukit Mahkota	1.26
5	Sungai Buah	0.35
6	Semenyih	1.38
7	Bandar Salak Tinggi	0.69
8	Southville City 1.65	
	Min ± σ	1.19 ± 0.45



- Area radiation monitoring instrument (ARM) also known as a survey meter, acts to measure radiation level of the surrounding area where are they located.
- Located at several strategic places where the probability of radiation released is higher.

**Reactor Hall** 

**Control Room** 

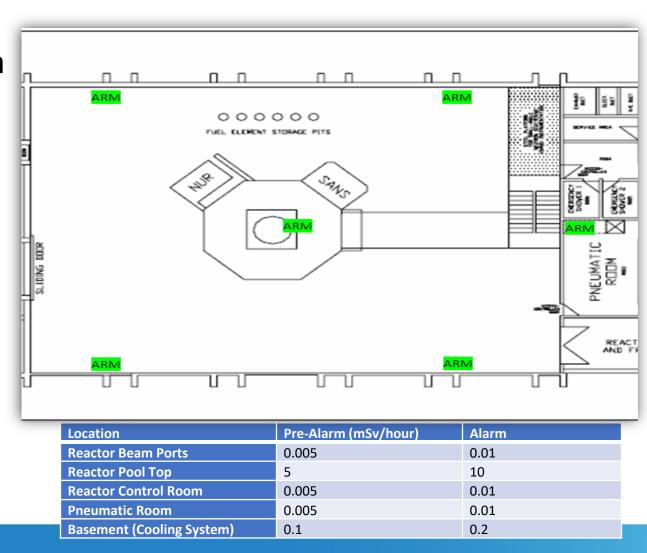
**Pneumatic Room** 

**Basement** 

☐ It is designed with alarm (audio and visual), as an additional protection system. If unwanted radiation level detected, the alarm will be sounded automatically.

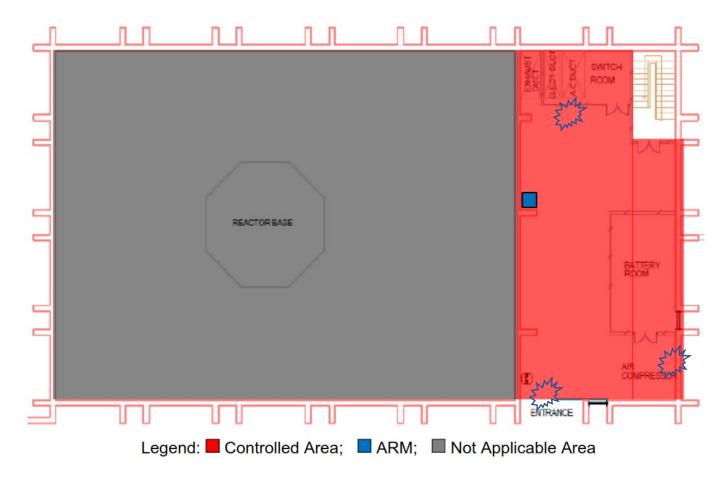


ARM's location at reactor hall.





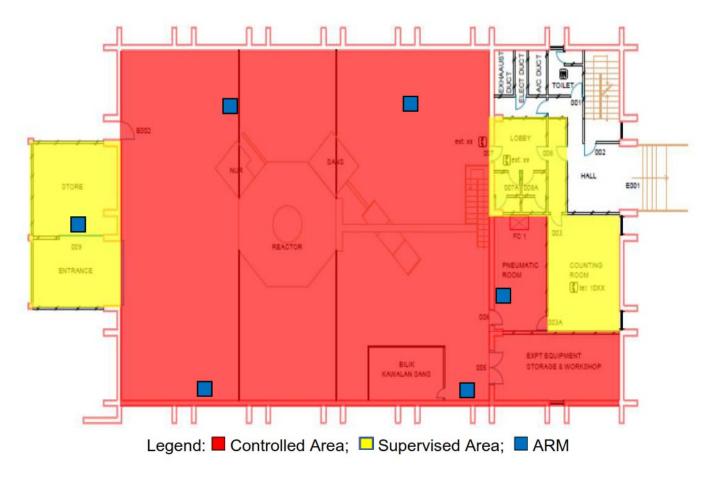
### **AREA CLASSIFICATION**



Location of controlled areas and Area Radiation Monitor (ARM) in the reactor building (Block 20) - Basement.

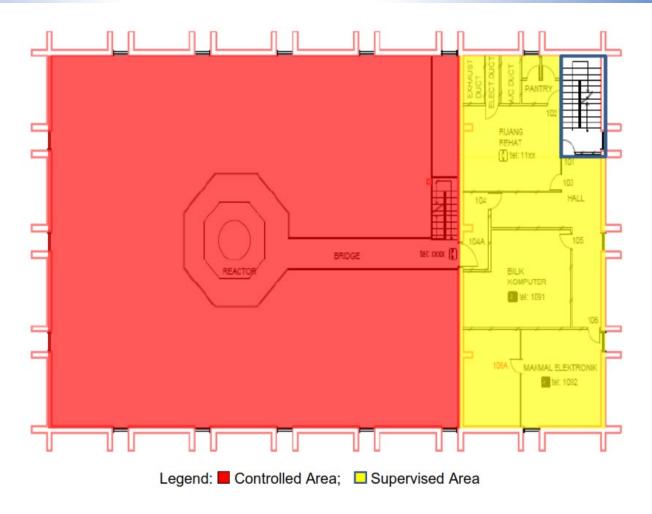


### **AREA CLASSIFICATION**



Location of controlled areas and Area Radiation Monitor (ARM) in the reactor building (Block 20) – Ground Floor.

### **AREA CLASSIFICATION**



Location of controlled areas and Area Radiation Monitor (ARM) in the reactor building (Block 20) – First Floor.



### **AUDIT AND REVIEW PROGRAMME**

- ☐ Safety audit is carried out once a year by members of the Audit Subcommittee (JKA) appointed by the Director General of Nuklear Malaysia with recommendation of the SHE Committee.
- Audits are carried out to determine adequacy of the safety system, facilities and procedures and compliance of the practices with the SHE manual.
- An audit report is prepared by the Audit Committee at the end of audit exercise and presented to the SHE Committee for taking corrective actions and improvement.
- ☐ the review of the programme will only be done when necessary as well as if there are changes to be made.

### **AUDIT AND REVIEW PROGRAMME**



#### AUDIT JKA - SHEMS

No. Dokumen : JKA/F05

Tarikh isu: 20 Jun 2012

LAPORAN RUMUSAN AUDIT

Bil. Pindaan: 1

Makmal/Loji/Kemudahan: Reaktor TRIGA PUSPATI
Tarikh Audit: 03/09/2024
Skop Audit: Audit Keselamatan Kemudahan Reaktor
Standard/ Peraturan: Safety Audit on Reaktor TRIGA PUSPATI, Pematuhan SHEMS Agensi Nuklear Malaysia (Rujuk <a href="http://localweb.nuclearmalaysia.gov.my/eshems/">http://localweb.nuclearmalaysia.gov.my/eshems/</a> )
Auditee/Pegawai Bertanggungjawab:
En. Ridzuan Abdul Mutalib (Ketua Seksyen O & M)
*Auditee lain yang terlibat boleh dirujuk dalam senarai kehadiran audit.
Senarai Juruaudit:
1. En. John Konsoh Sangau (Ketua Juruaudit) 2. En. Mohamad Suhaimi Yahaya 3. Pn. Nur Khairunisa Zahidi 4. Dr. Nurul Elma Sabri 5. Pn. Nurul Nazeerah Juraimi
Bilangan Ketidakpatuhan:
NCR Sangat NCR Serius 2 NCR Kurang 6 Pemerhatian Serius



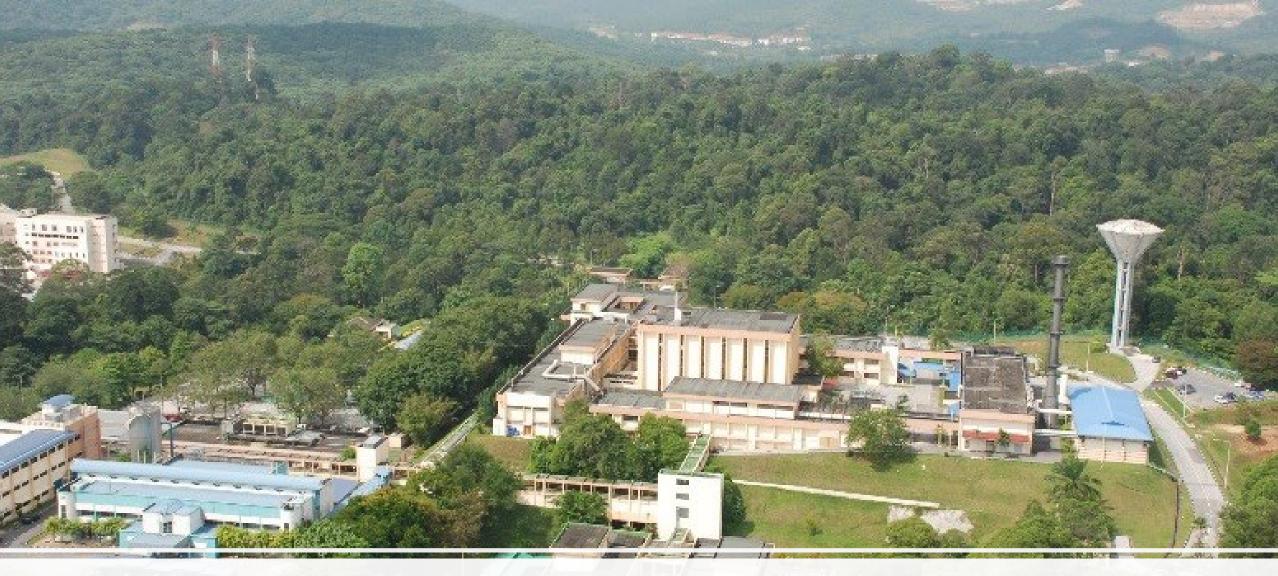
## Protect environment Protect the public Protect

#### **SUMMARY**

The TRIGA PUSPATI Research Reactor in Malaysia operates under a comprehensive Safety, Security, Health, and Environmental Management System (SHE-MS) with a strong commitment to protecting workers, the public, and the environment. This is achieved through adherence to a robust legislative framework and the Malaysian Nuclear Agency's Occupational Safety, Health and Environmental Policy.

Extensive monitoring programs are in place to ensure safety and environmental protection.

Regular safety audits are conducted to ensure the adequacy of safety systems and procedures, with findings leading to corrective actions and improvements<sup>10</sup>.



Terima kasih