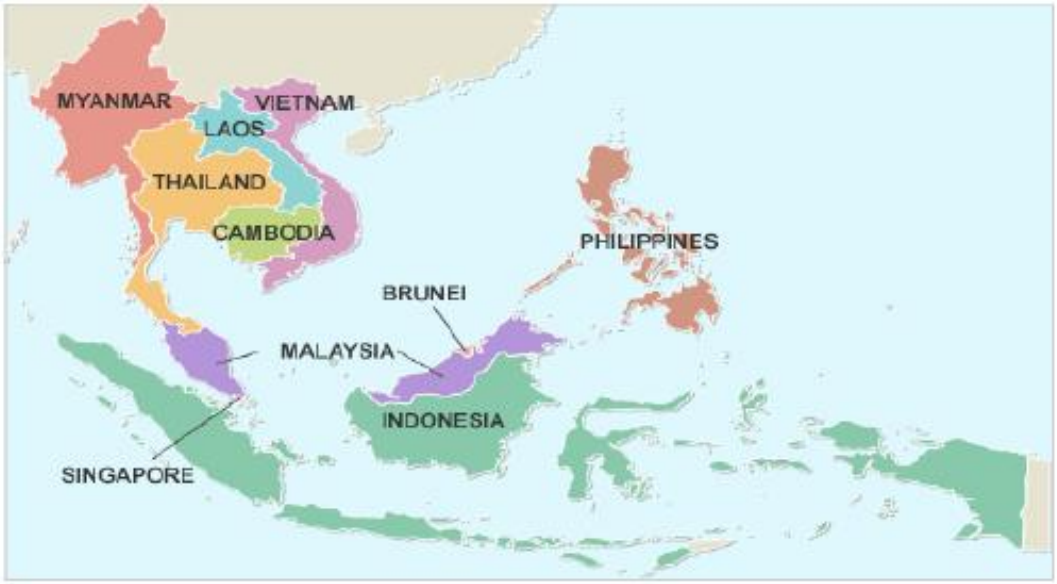
RADIOACTIVE WASTE MANAGEMENT IN MALAYSIA

By: Anis Suhana Binti Ahmad Sabri

MALAYSIA


MYANMAR
LAOS
PHILIPPINES
THAILAND
VIETNAM
CAMBODIA
MALAYSIA
BRUNEI DARUSSALAM
SINGAPORE
INDONESIA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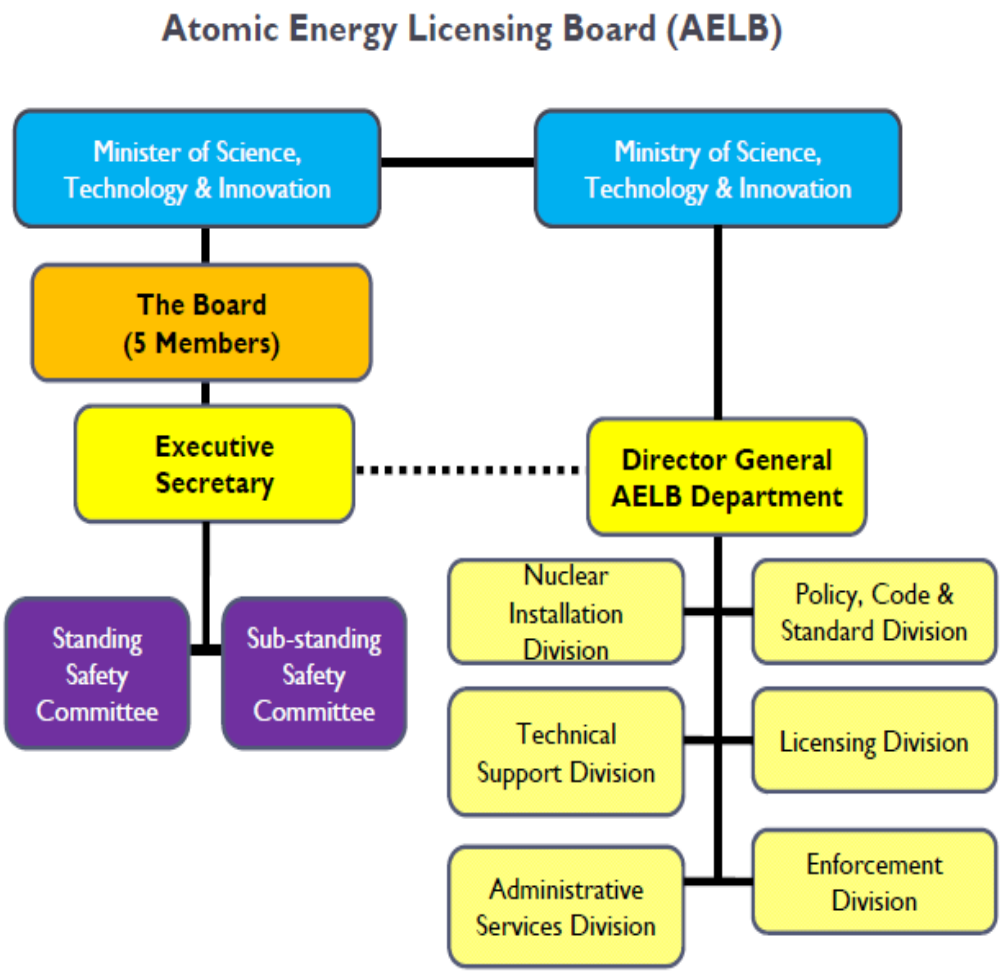
BRUNEI
MALAYSIA
INDONESIA
SINGAPORE

- Main Act:
- Atomic Energy Licensing Act 1984 (Act 304)
  - To provide for the regulation and control of atomic energy;
  - For the establishment of standards on liability for nuclear damage; and
  - For matters connected therewith or related thereto.

• Regulatory Body:

Atomic Energy Licensing Board (AELB) was establish under Section 3 of the Act. 304

Ensuring safety, security and safeguarding peaceful Nuclear Activities



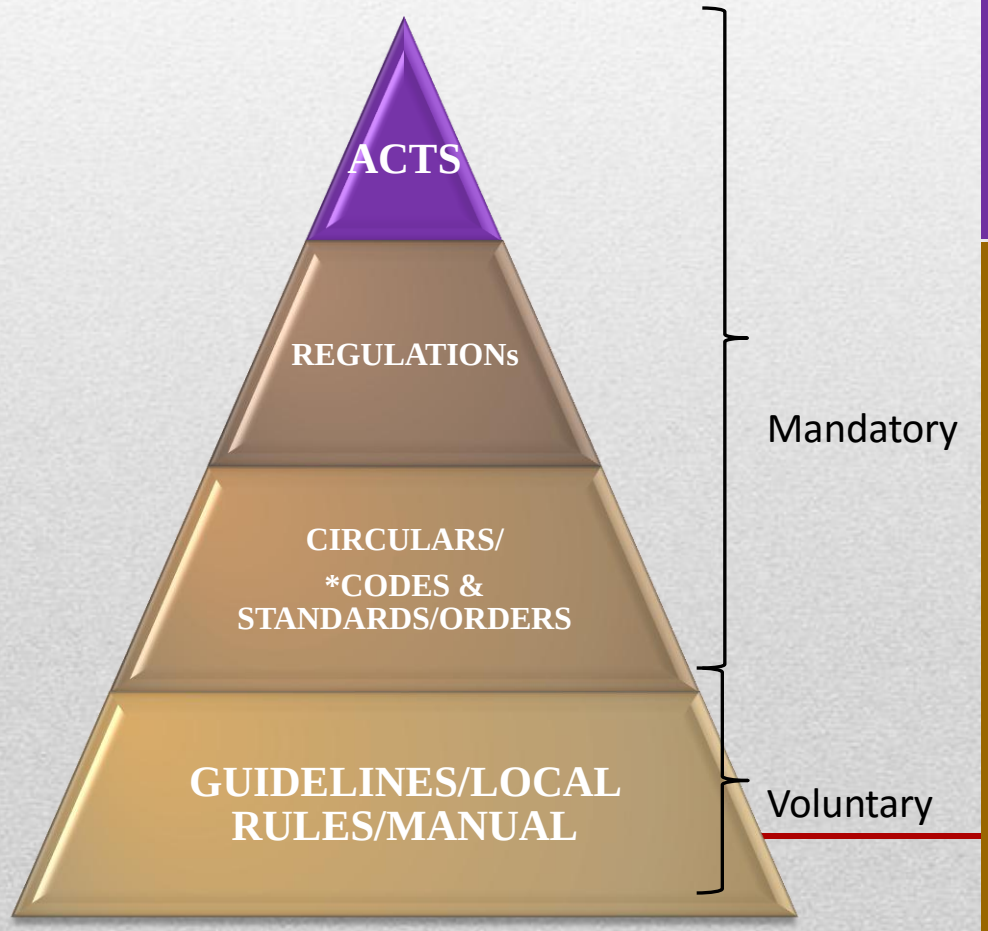
TECHNICAL SUPPORT ORGANIZATION = NUCLEAR MALAYSIA

MALAYSIAN NUCLEAR AGENCY (NUCLEAR MALAYSIA)

- Government Agency (Ministry of Science, Technology and Innovation ; MOSTI)
- Staff : more than 900
- Location : 30 km south of Kuala Lumpur
- Established
  - 19 Sept 1972 – Centre for Application of Nuclear Energy
  - 1982 – TRIGA Reactor Criticality and fully operational at current site

REGULATORY CONTROL HIERARCHY

Legislative in Malaysia is composed of 4 hierarchy : Act, Regulations, Orders and Technical guidelines



Act 304
Provides the basic law concerning the development and utilization of atomic energy and safety regulation

Regulation:
Provides more detailed provision entrusted by the Act

i. **Radiation Protection (licensing) Regulation 1986**
ii. **Radiation Protection (Transport) Regulation 1989**
iii. **Atomic Energy Licensing (BSRP) Regulations 2010**
iv. **Atomic Energy Licensing (Radioactive Waste Management) Regulations 2011**

NATIONAL POLICY:

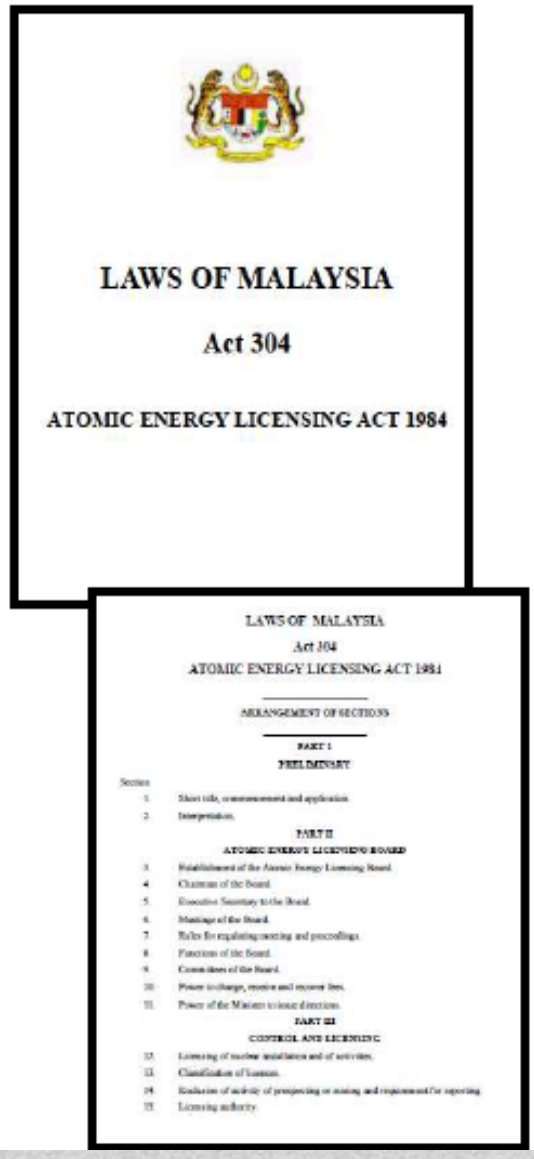
In Malaysia, the Radioactive Waste Management policy had been prepared, in the process getting approval from the government.

For implementation, the AELB **High Management (Board Meeting) has endorsed (interim) Radioactive Waste Management practice on August 24th, 1990**. The radioactive waste in Malaysia shall be managed through, if authorized, by either:

- Return back to supplier;
- Sent to the approved radioactive waste agency center (example : Malaysia Nuclear Agency).
- Stored by user at appropriate storage facility (only involves a large amount of radioactive waste;

ACT:

However, it is stated in ***Part VI – Disposal of Radioactive Waste, Atomic Energy Licensing Act 1984 (Act 304).*** It covers the control of disposal procedure & accumulation of radioactive waste in the country (to be read with the **Environmental Quality Act 1974** for the non-radiological waste discharge & disposal).



LAWS OF MALAYSIA

Act 304

ATOMIC ENERGY LICENSING ACT 1984

LAWS OF MALAYSIA

Act 304

ATOMIC ENERGY LICENSING ACT 1984

ARRANGEMENT OF SECTIONS

PART I

PRELIMINARY

Section

1. Short title, commencement and application
2. Interpretation

PART II

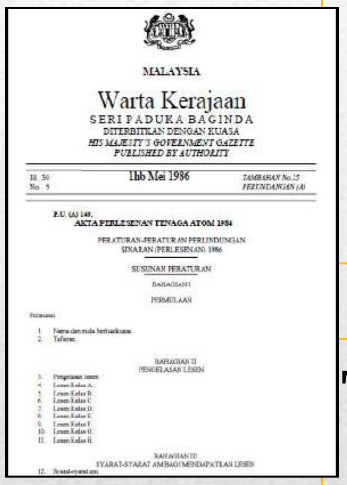
ATOMIC ENERGY LICENSING BOARD

3. Establishment of the Atomic Energy Licensing Board
4. Chairman of the Board
5. Executive Secretary to the Board
6. Meetings of the Board
7. Rules for regulating meeting and proceedings
8. Functions of the Board
9. Committees of the Board
10. Power to charge, receive and recover fees
11. Power of the Minister to issue directions

PART III

CONTROL AND LICENSING

12. Licensing of nuclear installation and of activities
13. Classification of licences
14. Exclusion of activity of prospecting or mining and requirement for reporting
15. Licensing authority



MALAYSIA

Warta Kerajaan

SERI PADUKA BAGINDA

DITERBITKAN DENGAN KUASA

HIS MAJESTY'S GOVERNMENT GAZETTE

PUBLISHED BY AUTHORITY

Jld. 30 No. 5 — 1hb Mei 1986 — *TAMBAHAN No. 25 PERUNDANGAN (A)*

P.U. (A) 140.

AKTA PERLESENAN TENAGA ATOM 1984

PERATURAN-PERATURAN PERLINDUNGAN SINARAN (PERLESENAN) 1986

SUSUNAN PERATURAN

BAHAGIAN I

PERMULAAN

Peraturan

1. Nama dan mula berkuatkuasa
2. Tafsiran

BAHAGIAN II

PENGELUARAN LESEN

3. Pengeluaran lesen
4. Lesen Kelas A
5. Lesen Kelas B
6. Lesen Kelas C
7. Lesen Kelas D
8. Lesen Kelas E
9. Lesen Kelas F
10. Lesen Kelas G
11. Lesen Kelas H

BAHAGIAN III

SYARAT-SYARAT AMBAGI MENGAPATKAN LESEN

12. Syarat-syarat am

DISPOSAL OF RADIOACTIVE WASTE

As specified under Subsection 26(1) of the Act304 –

"No person shall dispose of or cause to be disposed or accumulate any **radioactive waste** without the prior authorization in writing of the appropriate authority".

TRANSPORT OF RADIOACTIVE WASTE

As stated under Subsection 30(1) of the Act304 –

"No person shall transport any **radioactive waste** without the prior authorization in writing of the appropriate authority".

ATOMIC ENERGY LICENSING (RADIOACTIVE WASTE MANAGEMENT) REGULATIONS 2011

Free download
www.aelb.gov.my

ATOMIC ENERGY LICENSING (RADIOACTIVE WASTE MANAGEMENT) REGULATIONS 2011

5) The outline of the content of the draft are as follows:-

Part I	– Preliminary
Part II	– License To Dispose
Part III	**– Responsibilities Of Licensee**
Part IV	**– Radioactive Waste Management Officer**
Part V	**– Control of Radioactive Waste Generation**
Part VI	**– Reuse and Recycle of Radioactive Materials**
Part VII	**– Management of Sealed Source**
Part VIII	– Discharge and Disposal of Radioactive Waste
Part IX	– Management of Radioactive Waste
Part X	– Transport of Radioactive Waste
Part XI	– Quality Assurance
Part XII	– Physical Protection and Security
Part XIII	– Records and Reports
Part XIV	**- Emergency Plan and Procedures**
Part XV	**– Cessation of Operations, Decommissioning or Abandonment of Licensed Facilities**

Source of Radioactive Waste

Radioactive waste in Malaysia arises from many different activities such as:

- **Application of radionuclide in industry, medicine, and research**
- **Cleanup of contamination sites**
- **Processing of raw material containing NORM**
- **Spent nuclear fuel from RR (Reactor TRIGA PUSPATI) – all fuel still in use**

The amount of different type of waste collected from 1984 -2009 (RWMC)

- DSRS : > 3000 units (<100/yr)
- Liquid waste (Aq.) : > 1000 m^3/yr
- Liquid waste (Org.) : > 80 m^3 (< 1 m^3/yr)
- Solid Waste : > 400 m^3 (<10 m^3 /yr)

GENERAL INVENTORY OF RW IN MALAYSIA

Type of radioactive waste	Main source	Amount produced/method of waste management
a) NORM WASTES		
Thorium hydroxide	Monazite & xenotime processing (NORM – from tin mining)	16,200 tonnes (now dispose of at NSDF - kept in drums for long term storage prior disposal)
Red gypsum	Ilmenite sand processing (sulphate process in chemical plant)	3,428,195 tonnes (landfill)
Ferum oxide	Ilmenite sand processing	122,546 tonnes (landfill)
Tin slag	Tin smelting	1,137.8 tonnes (stockpile)
Oil sludge & oil scale	Oil & gas exploration activities	2,713 tonnes (sludge farming for treatment & landfill)
b) SOLID WASTE	Industry / Medical / R&D activities	approximate 10 m^3 /year (storage drums)
c) DSRS	Industry/medical/R&D activities	approximate 100 unit /year (storage drums)
d) LIQUID WASTE (AQUEOUS)	Medical / R&D activities	approximately 1000 m^3 /year (storage tank -delay and decay, dilute & disperse) http://www.aelb.go

CURRENT PRACTICE: RADIOACTIVE WASTE MANAGEMENT

DSRS:

1. Return back to the supplier
2. Sent to RWMC (Malaysian Nuclear Agency)

NORM WASTE:

All the NORM wastes are stored in the landfill and temporary storage:

1. Stored by the generator (Temporary storage)
2. Waste minimization – R&D to reuse/recycle

SPENT FUELS:

1. All the nuclear fuels are **still in-use**
2. All nuclear fuel are in the reactor building (research reactor)
3. Any decision related to decommissioning of the RR would certainly involve the policy regarding status of spent fuel, storage, packaging, transport and disposal
4. No decision yet on the return or disposal of spent fuel

CURRENT PRACTICE
RADIOACTIVE WASTE MANAGEMENT

- Radioactive waste management facilities can be grouped into:
    i. waste treatment facility,
    ii. onsite storage facility and
    iii. disposal facility.

- Malaysia has **national storage facility at the Malaysian Nuclear Agency, with cover treatment facility, generally including waste segregation, cementation and compaction.**

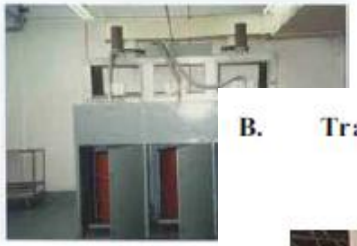
- **Disposal facility owned by the operator of monazite cracking plant, to store the yellow** cake generated from the process in 1970s. The plant, closed down in 1994 and all the radioactive waste are disposed at the disposal facility (**near surface facility, engineered type)**

RWMC
STORAGE FACILITIES

MALAYSIAN NUCLEAR AGENCY

WASTE MANGEMENT FACILITY

A. Laboratory



B. Transport

C. Treatment Plant

Collection Tanks

Treatment

Chemical Tanks

Mixing Tanks

Sludge

Settling Tanks

Treated Effluent

Retention Tanks

D. Compactor

E. Storage Facility

Storage 1 (Initial Storage)

Storage 2 (Treated/Conditioned Waste)

Rad Waste Treatment

- Services and Consultancies

NORM WASTE

- In Malaysia, Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) are mainly found in scales and sludges from the oil and gas industries, thorium hydroxide from the processing of xenotime and monazite, and iron oxide and red gypsum from the processing of ilmenite. Other TENORM are tin slag produced from the smelting of tin, and ilmenite, zircon, and monazite produced from the processing of tin tailing (generically termed amang)

- These unwanted materials containing TENORM have subsequently been called TENORM wastes. These activities are regulated and controlled by the Atomic Energy Licensing Act, 1984 (Act 304).

- The licensing authority of the Act 304 is the Atomic Energy Licensing Board (AELB).

EXAMPLE OF WASTE CONTAINING NATURALLY OCCURING RADIONUCLIDES IN MALAYSIA

GYPSUM:
^{226}Ra:77, ^{228}Ra:121Bq/kg

IRON OXIDE:
^{226}Ra:4970, ^{228}Ra:1500Bq/kg

OIL SLUDGE:
^{226}Ra: 286, ^{228}Ra:278 Bq/kg

TIN TAILING (AMANG):
^{238}U: 219, ^{232}Th: 1410Bq/kg

TIN SLAG:
^{238}U:1122, ^{232}Th:834 Bq/kg

MOSTI AELB ATOMIC ENERGY LICENSING BOARD

http://www.aelb.gov.my

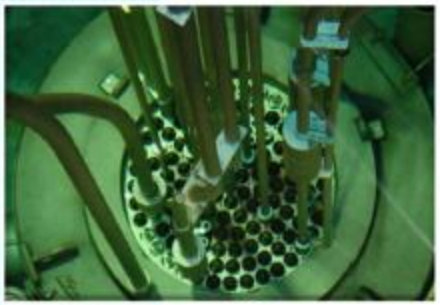
PUSPATI TRIGA Reactor (RTP)

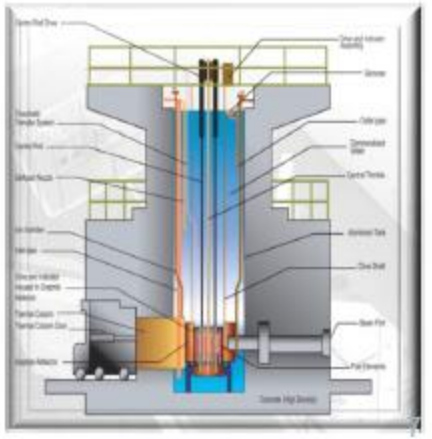
1 MW PUSPATI TRIGA MkII Reactor

LEU Fuel: UZrH
Control Rod: B_4C
Coolant/Moderator: H_2O
Reflector: Graphite
No Fuel: 112
No CR: 4
Facilities: 4 beamport, Incore PTS, Rotary Rack, DNA, Dry Tube

Utilization:

Training & Education
R & D
Isotope Production
Public Awareness Programme

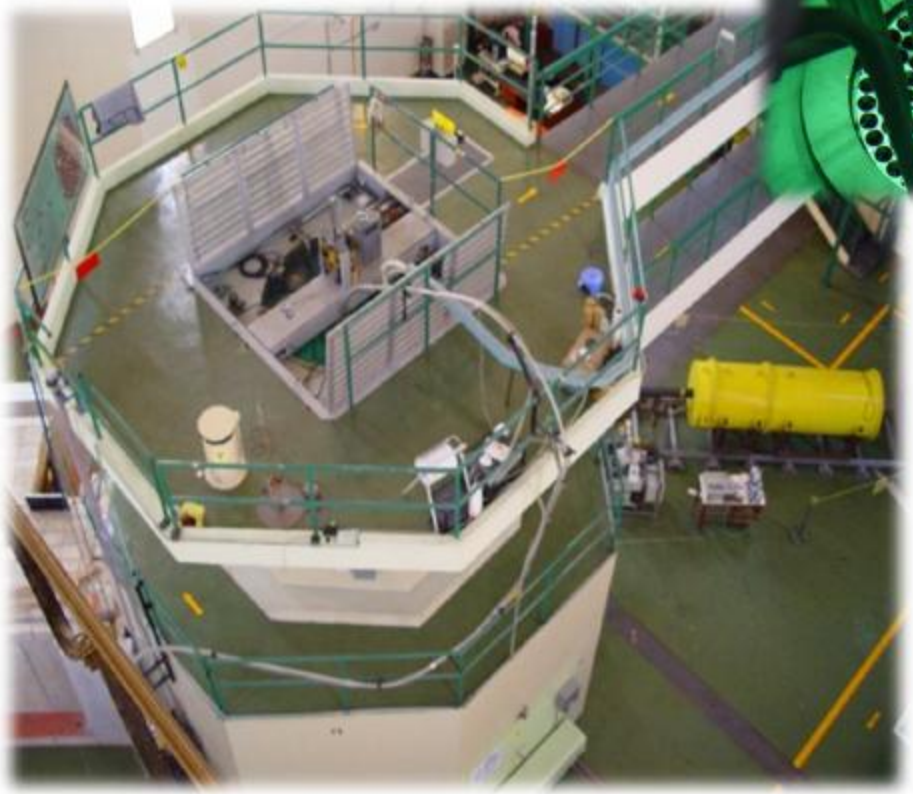




Operational since 28 June 1982

Reaktor TRIGA PUSPATI (RTP)

- NAA
- Isotopes
- Neutron Beam Application
- Education and Training



Justification for regulatory control

i. **Activity concentration of naturally occurring radionuclides in the raw material and waste (Bq g-1)**

Control limit (licensing) for NORM activities is based on the activity concentration of naturally occuring radionuclides in the raw material and waste generated. The Atomic Energy Licensing (Radioactive Waste Management) Regulations 2011, as well as, the IAEA *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, GSR Part 3 (2011) imposed the control limit for 40K and other naturally occuring radionuclides from 238U and 232Th decay series for 10 Bq g-1 and 1 Bq g-1 respectively.*

ii. **Total Dose Rate (mSv yr-1)**

Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, GSR Part 3 (2011) also imposed the dose to the individual from the activity concentration of radionuclides below the control limit are unlikely to exceed 1 mSv yr-1.

iii. **Dose limit used in the national and international standards**

Act 304 and the ICRP 60 (1991) stated the annual dose limit to the members of the public is 1 mSv yr-1.

CONTROL OF PROCESSING AND DISPOSAL OF MATERIALS CONTAINING NORM

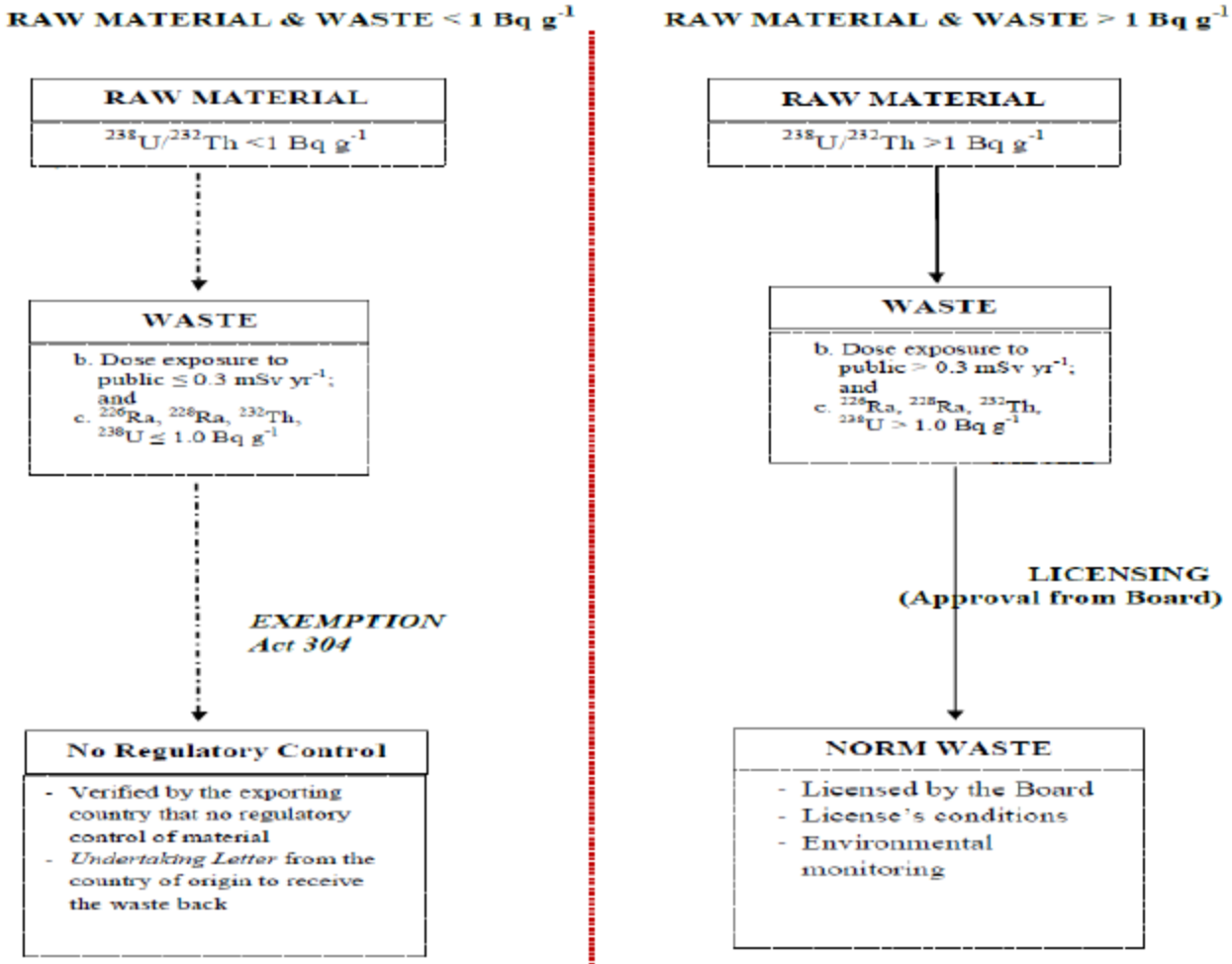
Control limit (licensing) for the activity concentration of raw material and waste containing NORM

Radionuclide	Activity Concentration (Bq g^{-1})
^{40}K	10
Each radionuclide in the chain of Uranium and Thorium decay	1

Ref:

- IAEA *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, GSR Part 3* (2011)
- Malaysia, The Atomic Energy Licensing (Radioactive Waste Management) Regulations 2011

Flow chart of the implementation of regulatory control for milling and disposal of material containing NORM in Malaysia



Radioactive waste management in University Malaya Medical Centre

In Medical, radioactive material are widely in use in diagnostic and therapeutic procedures.

Radioactive source commonly used in UMMC

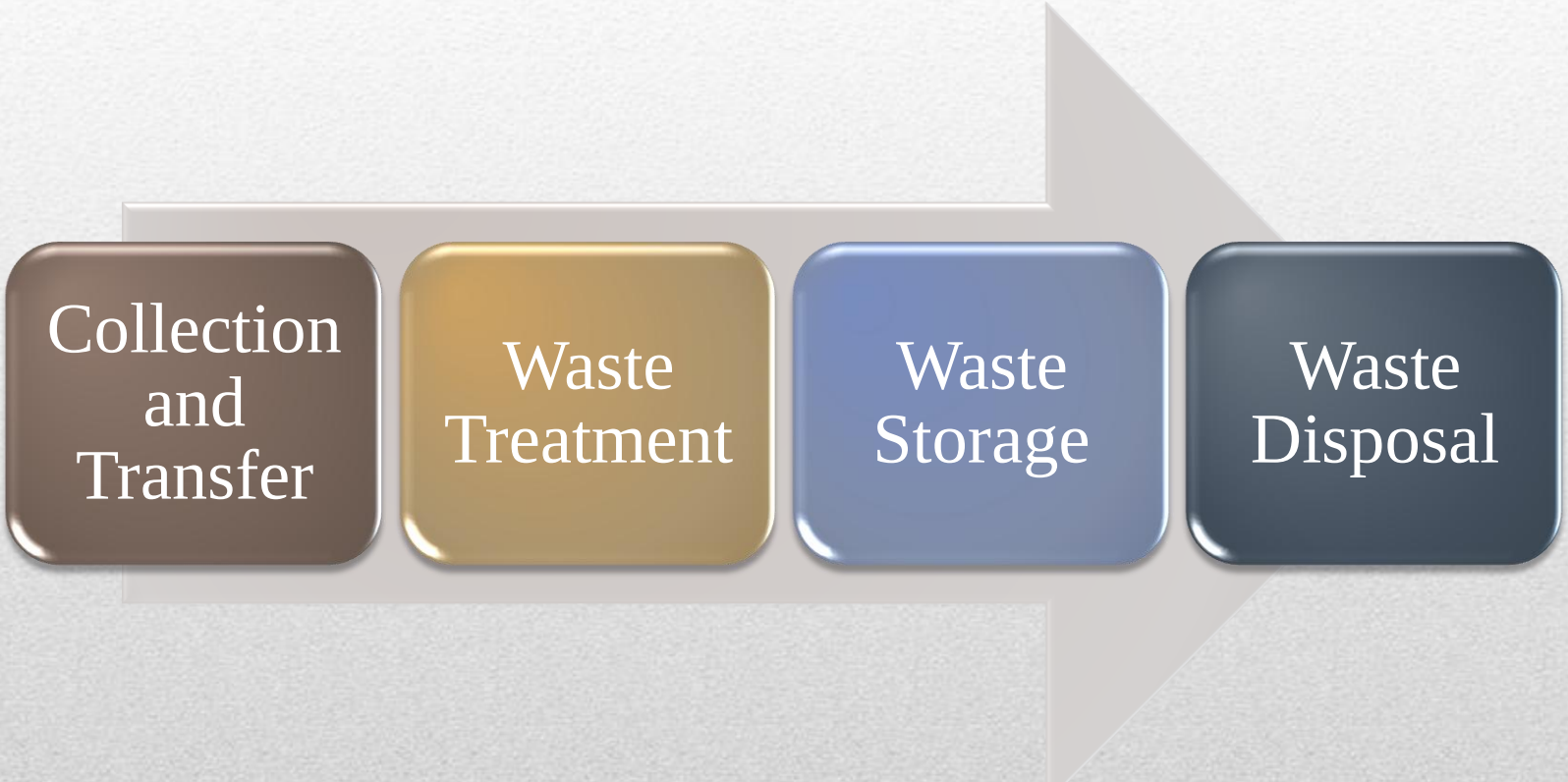
a) Sealed source - 1 Ci of Cs-137 (Blood Irridiator) – ½ life 30yrs
   80 Gbq of Co-60 (HDR Brachytherapy) – ½ life 5yrs
   15 mCi Co-57 flood source – ½ life 9month
   Calibration sealed source (Cs137, Co57, Eu152, Gd153,etc.)

a) Unsealed source used for treatment and NM imaging
   I-131, Tc-99m, Ytt-90, Cr-51, Ga-67


RADIOACTIVE
WASTE
NON SHARP


RADIOACTIVE
WASTE
SHARP BIN
NEEDLE
GLASS

Flow of Managing Radioactive waste

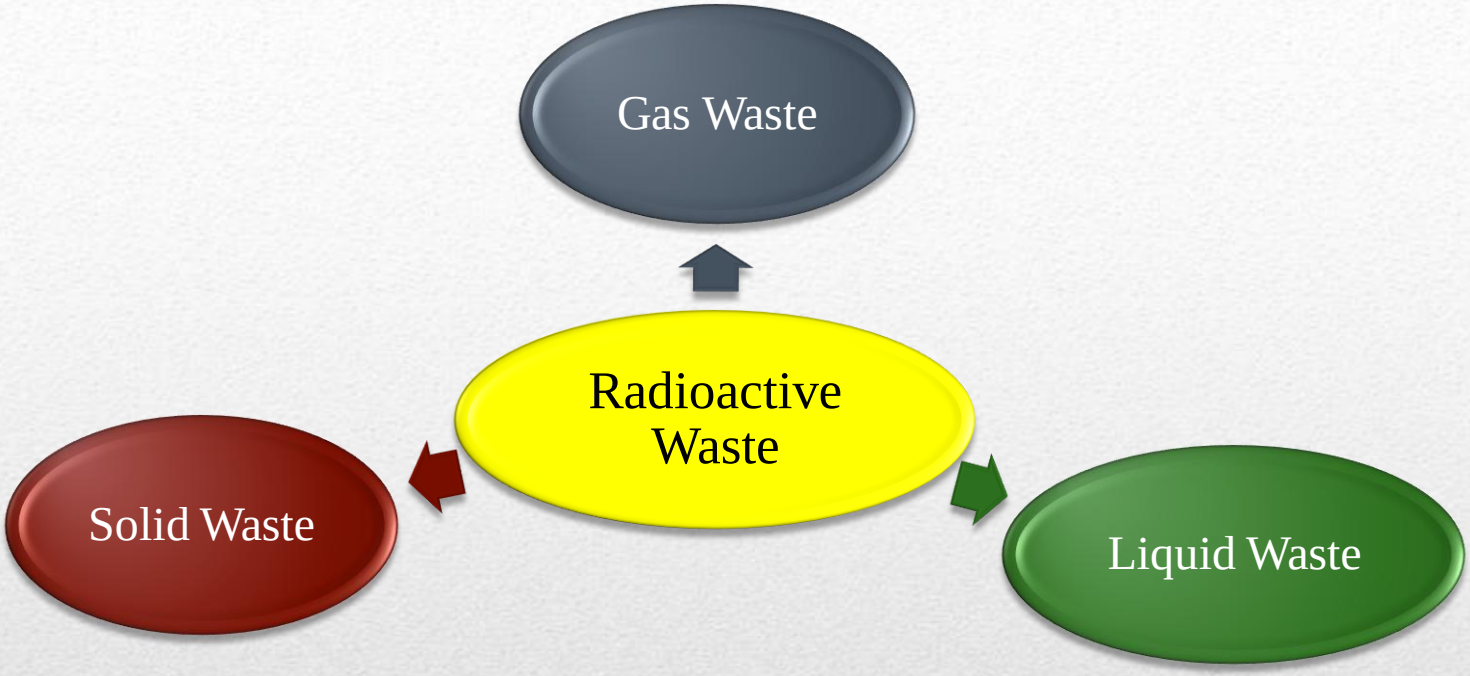


Disposal : Is consider if there is no intention to recycle or reuse the radioactive waste in future

3 Basic Principle		
Delay and Decay	Dilute and Disperse	Concentrate and Confine

UMMC only apply ***Delay and Decay*** Principle due to the usage of short and medium half life radioactive unsealed source for diagnostic and treatment procedure.

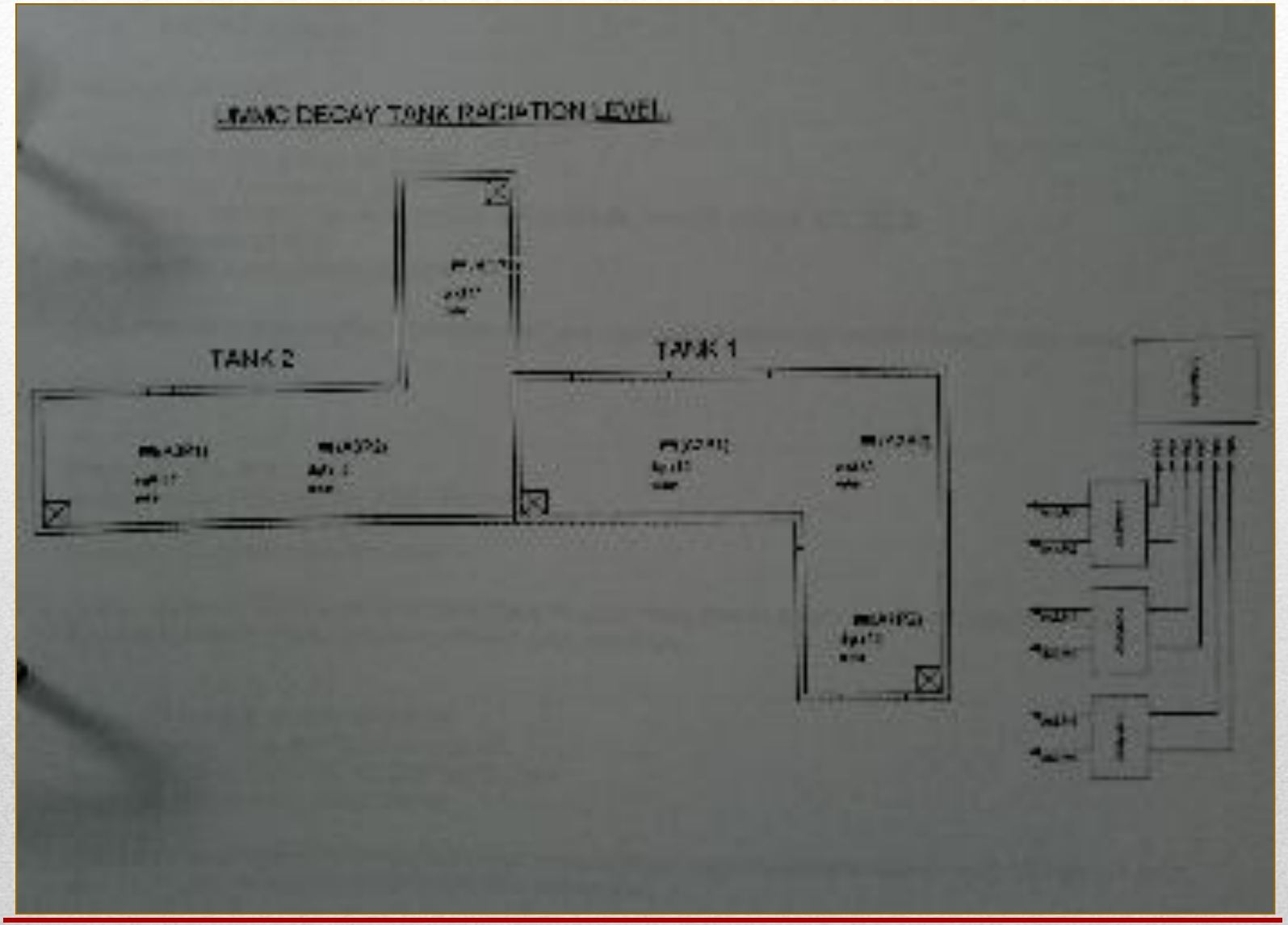
Eg: Tc99m (6.02hrs) & I-131 (8days)



Sharp material (syringe, bottle) and linen which is contaminate with radioactive source were stored in temporary storage room until passing 10 half life @ <0.5µSv/hr

(Tc99m - 60hrs, I131-80 days

Liquid waste from radioiodine ward and nuclear medicine unit is flush into separate radioactive decay tank and keep for 90 days @ <0.5µSv/hr before discharge to normal septic tank


DECAY TANK RADIATION LEVEL
TANK 2
TANK 1

Radioactive Decay Tank

Radioactive waste from nuclear medicine unit and radioiodine ward need to be monitored before discharge to normal septic tank

SCHEDULE OF SEPTIC TANK WASTE DISCHARGED (EAST TOWER)

NO	DATE	TANK 1 (µSv/h)	TANK 2 (µSv/h)	DISCHARGED BY	VERIFIED BY	REMARKS
1.	19/11/2013	A1P2 : 0.416 A2P1 : 0.426 A2P2 : 0.454	-	MR KANA	PN AZLEEN	Tank 1 been discharged at 1200 PM
2.	22/1/2014	-	A1P1 : 0.3385 A3P1 : 0.3954 A3P2 : 0.3795	PN AZLEEN	PN AZLEEN	Discharged at 115 PM (Tank 2)
3.	1/4/2014	A1P2 : 0.451 A2P1 : 0.3225 A2P2 : 0.3164	-	PN. ANIS	PN. AZLEEN	Discharged at 2.20 pm
4.	5/6/2014	-	A1P1 : 0.287 A3P1 : 0.3513 A3P2 : 0.3331	FAIZAH	PN AZLEEN	Discharged at 0850 am *continue filling on Tank 1 for 60 days
5.	5/9/2014	A1P2 : 0.5011 A2P1 : 0.5103 A2P2 : 0.5475	-	FAIZAH	PN. AZLEEN	Discharged at 0945 am
6.	23/12/2014	A1P2 : 0.4951 A2P1 : 0.4981 A2P2 : 0.5293	-	FAIZAH	PN. AZLEEN	Discharge at 1310 pm.
7.	23/2/2015	-	A1P1 : 0.3954 A3P1 : 0.3985 A3P2 : 0.4327	FAIZAH	PN. AZLEEN	Discharge at 1030 am.
8.	24/4/2015	A1P2 : 0.4499 A2P1 : 0.3954 A2P2 : 0.4327	-	MR KANA	FAIZAH	manually discharge at 1100 am. Discharge button was disable on SCADA.

UNIVERSITI MALAYA

PUSAT PERUBATAN UM

Medical PHYSICS

SCHEDULE OF SEPTIC TANK WASTE DISCHARGED (EAST/SOUTH TOWER)

MEDICAL PHYSICS UNIT, UMMC

NO	DATE	TANK 1 (µSv/h)	TANK 2 (µSv/h)	DISCHARGED BY	VERIFIED BY	REMARKS
9.	23/6/2015	-	A1P1 : 0.296 A3P1 : 0.343 A3P2 : 0.374	MR KANA	FAIZAH	Discharge manually at 11.15 AM. SCADA still in progress for repairing
10.						
11.	15/10/2015	-	A1P1 : 0.5011 A3P1 : 0.3612 A3P2 : 0.4669	MR KANA	FAIZAH	- Discharge manually at 1220 PM. SCADA still in repairing

Disposal of Radioactive Sealed Source in UMMC

- Notify MOH regarding radioactive sealed source disposal
- Request permission for disposal of radioactive material according to the Act 304 from AELB
- Proceed with disposal process after receiving approval letter from AELB
- Inform RPO regarding disposal process
- Contact the manufacturer of the radioactive sealed source to sent back the source to manufacturer or sent to RWMC
- Inform MOH and AELB after complete disposal process

THANK YOU