INDONESIA

a. National Framework for management of radioactive waste and spent fuel

Indonesia does not have nuclear power plant. Radioactive waste in Indonesia comes from research reactors and utilization of radioactive sources and radiation generators for a wide variety of peaceful purposes, in industry, medicine, research and education.

There are two government institutions that play important role in radioactive waste management in Indonesia, the National Nuclear Energy Agency (BATAN) and the Nuclear Energy Regulatory Agency (BAPETEN). BATAN responsible in conducting research, development and utilization of nuclear energy and radioactive waste management while BAPETEN is an independent regulatory body dealing with the inspection, licensing and the making of regulations.

BATAN has several research and development centers including three research reactors located in Serpong, Bandung, and Yogyakarta with the power range of 100 kW – 30 MW. BATAN has also the Center for Radioactive Waste Technology (CRWT) that responsible to manage spent fuel and radioactive waste in Indonesia.

It is a policy of Indonesian government to return spent nuclear fuels, radioactive waste and disused sources to the origin countries if possible. If re-exporting is not possible, they will be transferred to and managed by CRWT. All waste producers have obliged to pay the cost of waste management to the government.

b. National legal and regulatory framework

The main legislation on radioactive waste management in Indonesia are the Act No. 10/1997 on Nuclear Energy and the Government Regulation No. 61/2013 on Radioactive Waste Management. The GR 61/2013 stipulates the classification of radioactive waste, roles of BATAN as executor of radioactive waste management, obligations of waste producers, and stages of radioactive waste management consisting of: gathering and grouping, processing and storage, transport and disposal, recording and reporting. The GR also regulates the reuse and recycle of DSRS, management of spent nuclear fuel, transboundary movements and administrative sanctions. In addition, the GR also stipulates that BATAN is assigned to conduct technical and educational guidance to the radioactive waste producers and institutions that cooperate with BATAN in managing radioactive waste.

The Government of the Republic of Indonesia has ratified “the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management”, as ratified by the President Regulation No. 84/2010 on 28 December 2010. BAPETEN has developed regulations on spent fuel and radioactive waste management, such as BAPETEN Chairman Regulation No. 03/1999 which are already in-line with BSS-115. BAPETEN also performs inspections to license holders to verify their compliance with the nuclear laws.

c. Radioactive waste management, decommissioning and spent fuel strategy and current practices & technologies

c.1 Radioactive Waste Management Strategy

The objective of radioactive waste management in Indonesia is to protect workers, public and the environment, now and in the future without imposing undue burdens to Indonesia's future generations.

As stipulated by the the Act 10/1997 and Government Regulation 61/2013, the management of radioactive waste in Indonesia can only be performed by BATAN. In managing such radioactive waste; it may cooperate with or appoint other institutions, such as state owned companies and/or private companies.

Spent nuclear fuel and radioactive waste management has the policy to re-export spent fuels, disused sealed sources and spent sources to the origin country whenever applicable or managed them in CRWT.

c.2 Classification of radioactive waste

The radioactive wastes are classified as: low level radioactive waste, intermediate level radioactive waste, and high level radioactive waste. The low level radioactive waste are sub classed into: very short half life, very low level, and relative low level. The intermediate level radioactive waste consists of: disused sealed sources with half life less than 15 years, with half life between 15 and 30 years, and with half life more than 30 years; and other than disused sealed sources. The high level radioactive waste is spent nuclear fuel.

c.3 Radioactive waste management practices

BATAN has established the Centralized Radioactive Waste Management Station (RWMS) as a part of CRWT in 1989 which are located in Serpong.

The RWMS has the facilities (processing units) of: Evaporation System, Compaction System, Incinerator System, Cementation System, Interim Storage for Embedded Waste, and Interim Storage for High Level Waste (ISHLW). However, ISHLW is not a facility to store high level waste, i.e. spent fuels; it is only used to store radioactive waste which categorised as high radioactivity waste by the RWMS.

c.4 Spent Fuel Management Strategy

Indonesia's national policy for the spent fuel management is to re-export the spent fuel to the country of origin or store it in interim pool storage of the reactor or in interim storage for spent fuel (ISSF). Spent fuels originated from the United States (US) were returned to US, while spent fuels from other than US were stored in the site prior to disposal into an adequate facility.

c.5 Spent Fuel Management Practices

BATAN managed the three research reactors in Serpong, Bandung, and Yogyakarta. Spent fuel from each research reactor are temporarily stored in wet interim storage prior to being sent to

Interim Storage for Spent Fuels (ISSF) as a part of the CRWT. The ISSF is a wet type storage with capacity of 1,448 pieces of spent nuclear fuels.

c.6 Decommissioning Program

At present, there is no nuclear facility being decommissioned. However, decommissioning has been specified in BAPETEN Chairman Regulation No.4/2009 on Decommissioning of Nuclear Reactor and BAPETEN Chairman Regulation No.6/2011 on Decommissioning of Non-Reactor Nuclear Facility. Licensee shall develop decommissioning program. The decommissioning program contains inter alia radioactive waste handling, radiation protection, and financial estimation.The program shall be proposed to BAPETEN as a part of requirement to apply an operation license.

d. Radioactive waste in Storage

Table 1 Radioactive Waste In Storage (as estimated at 31 Des 2013)

Route Waste Class	Processed (type)/ Unprocessed)	Total Current Volume (m^3)	Estimated Disposal Volume (m^3)	Distribution (%)						
				RO	FFE	RP	NA	DF	DC / RE	ND
LLW		246.5	246.5	62	0	0	38	0	0	0
ILW		83.8	83.8	0	0	0	40	0	60	0

NEWMDB waste origin type codes:
RO – reactor operations
FFE – fuel fabrication & enrichment
RP – fuel reprocessing
NA – nuclear applications
DF - defence
DC/RE – decommissioning & remediation
ND – Not Determined

Table 2 Spent fuel in Storage (MTHM) (as of 31 Des 2013)

Type	Current Amount (NPP)	Current Amount (Research Reactors)
Total Spent Fuel Storage	-	0.281
Wet storage (AR)	-	0.281
Wet storage (AFR)	-	-
Dry storage (AR)	-	-
Dry storage (AFR)	-	-
Total spent fuel held in storage for other countries (amounts also included above)	-	-

Table 3 Translation matrix that can be used for transition from Indonesia Waste Classification to IAEA classification

Indonesia Waste Classification	VLLW	LLW	ILW	HLW
Low Level Waste (consists of Very Short Life Waste, Very Low Level Waste, Relative Low Level Waste)	30%	70%		
Intermediate Level Waste			100%	
High Level Waste (Spent Nuclear Fuel)				100%

Table 4 Processing, Storage and Disposal Facilities

Type	Planned	Construction	Commissioning	In Operation	Shutdown	Decomm.	Other	Total
Spent Fuel Storage	0	0	0	1	0	0	0	1
Spent Fuel Reprocessing and Recycling	0	0	0	0	0	0	0	0
Spent Fuel Conditioning	0	0	0	0	0	0	0	0
Spent Fuel disposal	0	0	0	0	0	0	0	0
Waste processing	0	0	0	1	0	0	0	1
Waste storage:	0	0	0	3	0	0	0	3
Waste disposal:	0	0	0	0	0	0	0	0

Table 5 Summary of major sources of waste

Type	Planned	Construction	Commissioning	In Operation	Shutdown	Decomm.	Other	Total
Research reactors	0	0	0	3	0	0	0	3
Nuclear Power reactors	0	0	0	0	0	0	0	0
Spent Fuel Reprocessing and Recycling	0	0	0	0	0	0	0	0

Note: "Planned" means it has been identified in a national report, strategy, or formal plan. It includes: Planned, Under Study-Assessment, Siting-Design phases

e. Trends and future prospects (volumes of waste and spent fuel arising, waste and spent fuel management facilities)

Table 6 provides information on spent fuel and waste management trends and future prospects.

Table 6 Trends and future prospects

Type	Current amount	Estimated Current amount when prepared for disposal*	Current Disposal Capacity	Total forecast at 2030	Total forecast at 2050
Spent Fuel Storage	0.281 MTHM			0.695 MTHM	1.525 MTHM
Wet storage (AR)	0.281 MTHM			0.695 MTHM	1.525 MTHM
Wet storage (AFR)	-			-	-
Dry storage (AR)	-			-	-
Dry storage (AFR)	-			-	-
Total amount Spent Fuel sent to Reprocessing and Recycling	-			-	-
Total amount Spent fuel disposed	-		-	-	-
Waste in storage:	330 m3	330 m3		525 m3	1040 m3
Waste disposal:	-		-	-	-

AR = “at reactor site”
AFR = “away from reactor site”

Assumptions

For the future spent nuclear fuel and radioactive waste forecast, it is assumed that:

- amount of processed radioactive waste is increased by 5 pieces of 950 liter concrete shell and 40 pieces of 200 liter drums per year
- the research reactor produces 24 pieces of spent nuclear fuels per year
- the research reactor is operated until 2050, or there is a new similar research reactor.

Prepared by:
Center for Radioactive Waste Technology
National Nuclear Energy Agency, Indonesia

Contact information:
Sumarbagiono
Head of Division,Waste Facility Development Division,
Indonesian CC for NEWMDB
bagya@batan.go.id

March 2015