

CONCEPTUAL DESIGN OF TENORM LANDFILL FROM THE TIN INDUSTRY IN INDONESIA BASED ON THE REGULATORY, SECURITY AND SAFETY ASPECT OVERVIEW



Hendra Adhi Pratama, Dadong Iskandar, and Sucipta
Center for Radioactive Waste Technology - BATAN



INTRODUCTION

- Indonesia ranks second as the largest tin producer country in the world with Bangka Belitung island is the top tin producing (>90% of Indonesia's tin).
- The tin exploration, mining, and processing activities also generating waste and by-products containing enhanced natural radioactivity.
- The final tin slag from the smelting process (TENORM) remains an issue to the environmental problem due to it has potential long-term hazards.
- The temporary storages of tin tailings or tin slag from the smelter are not safely and properly managed.
- One of solution to reduce the risk of the radiological hazard to the public and environment is by put the TENORM waste in the landfill.
- The purpose of this study is to design landfill for TENORM waste from the tin industry in Bangka island.

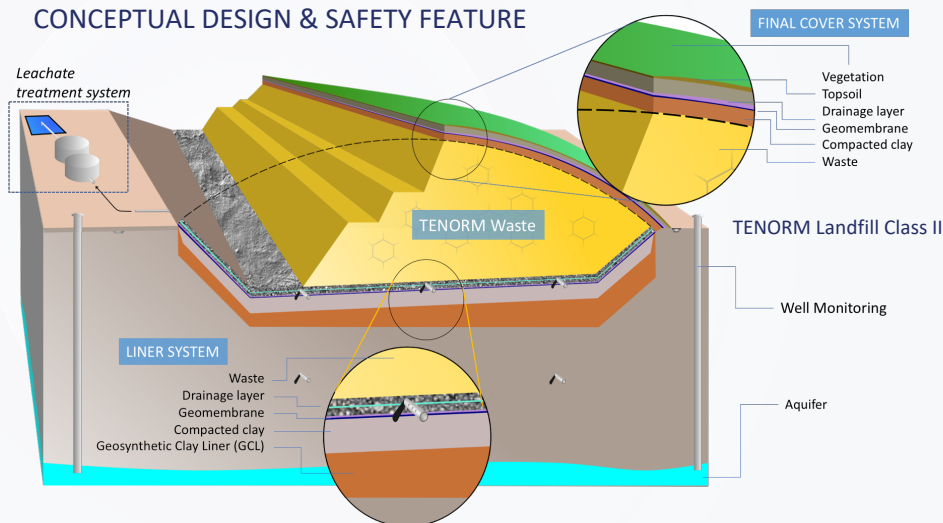
METHODOLOGY

- Conceptual design of TENORM landfill from the tin industry in Indonesia is carried out in the following sequence:
 - Identification of relevant regulations regarding the management of TENORM waste in Indonesia.
 - Surveys and estimates of potential inventory of TENORM waste from the tin industry in Bangka Belitung.
 - Learn from the best practice of landfill from the IAEA guidance and international experience.
 - Develop the TENORM landfill design.
- The research area covers the Bangka island.

Tin Slag's Temporary Storage



CONCEPTUAL DESIGN & SAFETY FEATURE



- We proposed the conceptual design of TENORM landfill facilities are consist of main components:
- Waste layer (TENORM and hazardous waste)
 - Foundation and liner system
 - Cover system
 - Systems for leachate and gas management
 - Security and Monitoring System: Fencing, Gates & Security Cameras/Alarm

REGULATION ASPECTS

- Act No. 10 Year 1997 on Nuclear Energy
- Act No. 32 Year 2009 on Environmental Protection and Management
- The Government Regulation No. 101 Year 2014 concerning Hazardous Waste Management, TENORM waste is classified as hazardous waste from the specific source: category 2 special specific source, that have radioactive contamination level equal to or greater than 1 Bq/cm² and/or have activity concentration:
 - 1 Bq/g for each radionuclide of member of Uranium and Thorium series; or
 - 10 Bq/g for Kalium
- The requirement and procedure for landfill are regulated in the Minister of Environment and Forestry Regulation No. P.63/Menlhk/Setjen/KUM.1/7/2016 Year 2016. TENORM waste must be dispose in the landfill **class II** or **class I**.

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Class I	Class II	Class III
Protection layer during operation	Protection layer during operation	Protection layer during operation
Leachate Collection and Transfer System layer	Leachate Collection and Transfer System layer	Leachate Collection and Transfer System layer I
Geomembrane layer I	Geomembrane layer I	Soil Barrier layer
Soil Barrier layer	Soil Barrier layer	Leachate Collection and Transfer System layer II
Leak detection systems layer	Leak detection systems layer	Base layer
Geomembrane layer II	Base layer	
Base layer		

- TENORM waste is classified as hazardous waste from the specific source: category 2 special specific source.
- The requirement and procedures for hazardous waste landfill are regulated in the requirement and procedure for landfill are also regulated in the Minister of Environment and Forestry Regulation No. P.63/Menlhk/Setjen/KUM.1/7/2016 Year 2016.
- TENORM waste must be carried out in the landfill class I or class II.
- The proposed of TENORM landfill conceptual design is consists of cover system, waste layer, foundation and liner system, systems for leachate and gas management, and security and monitoring system.