Refurbishment of Drum Lifting Device for Radioactive Waste Handling inside Hot Cell Facility

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Introduction
**Introduction**

- **Triga 2000 Reactor**
  - Location: Bandung
  - Operated on 1964 with 250 kW thermal power capacity
  - Power upgrade into 2000 kW, on the year of 2000
  - Function: Research & Isotope Production

- **Kartini Reactor**
  - Location: Yogyakarta
  - Operated on 1979
  - 100 kW Thermal power capacity
  - Function: Research and human resource training facility

- **RSG G.A Siyabessy**
  - Location: Serpong, Tangerang
  - Operated on 1987
  - 30 MW Thermal power capacity
  - Function: research, isotope production and materials research
Introduction

Production of MTR Fuel for Research Reactor
(Managed by PT. INUKI)

Previous fuel: U$_3$O$_8$-Al; R&D yielded current U$_2$Si$_2$-Al fuel

Irradiation
G.A.Siwabessy Research Reactor

Post-Irradiation Examination
Installation of Radiometallurgy

Pilot production of HWR Fuel for Power Reactor

HWR Cirene fuel

Study on powder-based LWR fuels, advanced particle-based LWR & HTGR fuel

Modelling for PRTF fuel pin and cermet-based fuel

Development of prototype of U-Mo and U-Zr based fuel

Research and Development
RMI Facility

- RMI was built based on the contract between BATAN and GCNF of Germany.
- The physical construction commenced in 1990 and completed in 1991.
- The Installation consist of some hotcell arranged U-Shape, Service area & Waste cell underneath.
- The RMI was originally designed as post irradiation examination in the form DT & NDT for MTR, PWR, PHWR fuel element.
RMI Facility

101: receiving
102: dismantling & non-nuclear waste movement.
103: inspection
104: 105; 106
Metalography
107: optical microscope
108: physical
109: radio-chemical
110 & 111: mech.
\prop. Testing
112: auto radiography
Background Of Refurbishment

Due to the high radiation exposure of those spent fuel so many test equipment and tools that has been installed inside the hot cell was broken, including Drum Lifting Device (DLD) in concrete cell 102. DLD is a supporting device to move non-nuclear wastes out from inside the hot cell. High radiation exposure of the spent fuel caused pneumatic hoses of DLD was broken. Because of that, the DLD didn’t work for a long time, consequently PLC of the DLD was broken as well. Therefore it was necessary to be carried out refurbishment of the DLD.
PIE activities produce wastes, not only from rest of test specimen of the post-irradiation examination, but also wastes from chemical materials or other supporting devices which have been contaminated. The types of waste can be handled by drum lifting device are solid wastes of and supporting devices which have been contaminated. Those waste divided to two categories, are burnable and unburnable waste. The wastes from another hot cell collected in concrete cell 102 and separated based on their category. Futhermore, it’s loaded into the plastic bag and then loaded into the waste drum which carried from concrete cell 001 by DLD.
Spent nuclear fuel inside hot cell ZG 102 was moved to another cell (ZG 101) to reduce radiation exposure (200,000 µSv/h) in there. Then operators cleaned hot cell ZG 102 by wiped the floor and wall off using manipulator to remove contamination.
Refurbishment

- Personal Intervention

Based on radiation protection principle (time, distance and shielding), some workers entered into hot cell to conduct direct decontamination and to move contaminated equipments and waste (cotton/ dust cloth waste) out by main hole.
Refurbishment

Result of decontamination works (102)

2016

2017

22 μSv/h
17 Bq/cm² (β)
Refurbishment

Radiation exposure rate in hot cell ZG 102 had decreased to 100 μSv/h. Broken pneumatic hoses was replaced with the new one, then replaced PLC system of the DLD.
Result & Discussion

- Function test DLD with new PLC Program

Ladder data OMRON PLC Ltd.
Result & Discussion

Non-spent fuel waste collected in hotcell 102

Waste put into plastic bag

Using in-cell crane manipulator

Physical checking by officer

Double lid cover opened

Double lid cover closed

Waste drum moved back to concrete cell 001

Waste drum lifted up above the trolley

Trolley moved to concrete cell 002

Radiation exposure rate of waste drum surface checked by officer

Waste drum labelled and moved to interim storage (room 013)

Waste drum sent to Radioactive Waste Management Facility

Empty waste drum put above the trolley in concrete cell 002

Trolley moved to concrete cell 001

Waste drum lifted up to barrel lifting device

Waste drum grasped by barrel gripping device

Waste drum put above the support plate

Support plate moved up until reaches double lid

Waste drum put into shielding container

New mechanism of movement of non-nuclear wastes in RMI
Conclusion

Drum Lifting Device (DLD) is a tool installed inside the hot cell to move non-nuclear waste out from there, so it can be stored in the interim storage. Remote decontamination, personnel intervention and repairing DLD components are steps to refurbishment of DLD. After that refurbishment, operators can move non-nuclear wastes out easily without contact those directly anymore.
Thank You

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