Contribution ID: **28** Type: **ORAL**

Safety and Security Considerations in the Transport of EK-10 Spent Nuclear Fuel from a Research Reactor

Synopsis
Spent fuel is highly radioactive and must be shielded and contained to be transported safely. Safe shipment requires a large, robust spent fuel container called a cask. The Nuclear Waste Policy Act sets a policy for safe, permanent disposal of spent fuel and other high-level radioactive wastes. The Nuclear Regulatory Commission (NRC) regulates nuclear research and power reactors, nuclear fuel cycle facilities, and industrial uses of nuclear materials, the transport packaging, storage, and disposal of nuclear materials, and licenses the export and import of radioactive materials. The IAEA regulations for materials packaging and transport serve as a model for the United States and other nations [1].
Proper handling of spent nuclear fuel (SNF) ensures the protection of the public, environment and plant workers. The NRC rigorously reviews spent fuel cask designs to meet the regulatory standards. The NRC regulatory safety standards for SNF cask designs must pass four key tests: impact, puncture, fire, and submersion in water to ensure the following:
- SNF must remain subcritical under all conditions, i.e., prevent criticality;
- The radiation dose rates should remain within acceptable limits
The ŠKODA VPVR/M stransport packaging system (TPS) owned and operated by ÚJV Řež, as., Czech Republic.The ŠKODA VPVR/M cask is licensed and certified for the transport and storage of SNF from Russian research reactors, namely, EK-10, S-36, VVR-M, VVR-M2, VVR-M5, VVR-M7, VVR-(S)M, IRT-2M, IRT-3M, IRT-4M, TVR-S, as shown in Figure 1 [2].
It was first deployed at the Dalat Research Reactor in Vietnam and has since been used in the Global Threat Reduction Initiative (GTRI) to transport over 3,400 fuel assemblies from countries including the Czech Republic, Bulgaria, Hungary, Poland, Ukraine, Belarus, Serbia, and Vietnam, using a total of 100 casks.
In this paper the ŠKODA, VPVR/M cask will be used for the transport of SNF of type EK-10 fuel from a typical research reactor of Russian design [3]. The source term characterization of EK-10 SNF will be calculated against different cooling times using MCNP and ORIGEN codes including:
- Gamma emission spectrum,
-Neutron emission spectrum, radioactivity, decay heat, radionuclide inventory,
- Toxicity, dose rates around the cask; and sub-criticality of the cask.
Moreover, we will present the NRC regulations for the spent fuel transport security through the protection in transit against sabotage, malicious acts or theft, which includes:
- Coordination with law enforcement agencies;
- Advance notification to States, and the NRC;
- Using a communications center and other means to monitor and tracking the shipments while in route;
- Using armed escorts, and; using devices that allow drivers and escorts to immobilize the vehicle.

Figure 1 Schematic diagram of the ŠKODAVPVR/M cask [2]
References:
[1] United States Nuclear Regulatory Commission (USNRC), Safety of Spent Fuel Transportation, NUREG/BR-0292, Rev. 2 February 2017
[2] ŠKODA VPVR/M Transport Packaging System and its Use for Transport of Spent Fuel from Research Reactors, the 17th International Symposium on the Packaging and Transportation of Radioactive Materials PATRAM 2013, Aug. 18-23, 2013, San Francisco, CA, USA
[3] Research Reactors Database, INIS- IAEA, 2020

Country or International Organization

Instructions

Author: Prof. SHAAT, Mohamed (male)

Presenter: Prof. SHAAT, Mohamed (male)

Track Classification: Track 2 Safety and Security by Design - Regulatory and Industry Perspective