Nuclear Activities

- Receipt foreign
- Using in Reactor - #2
- Storage in pool #2
- Transfer from pool #2 to pool #1
- Transfer from pool #1 to DSF.
Nuclear Facilities

Armenian NPP
Spent Fuel dry Storage Facility (SFDSF)

➢ The ANPP is located in 28 km from the capital of Armenia – Yerevan and consists of two WWER-440/270 power units.

➢ The ANPP Unit №1 was put into operation in 1976

➢ Unit №2 in 1980.

➢ In April 1993 ANPP Unit №2 had been restart

➢ In November 1995 Unit 2 was connected into power grid

➢ The ANPP Unit №1 is in conservation regime
CHARACTERISTICS AND MOVEMENT SFA IN ARMENIAN NPP

- Reactor #2
- Pool #2
- Pool #1
- Dry Storage
Pool # 2 and Pool #1
Pool # 2 and Pool #1

- 370 hexgone cells;
- Assembly Identity – Base and underwater TV;
- Irradiation history – Derived;
- Materials – Base;
- Weight – Base, Derived;
- Physical dimensions – Base, measured;
- Fuel integrity - Base, measured;
- Decay heat – Derived;
- Criticality – Derived;
- Nuclear inventory – Derived;
- Burn up – Derived;
- Cooling – Derived.
Spent Fuel Dry Storage Facility

Spent Fuel Dry Storage Facility includes 3 stage of buildings:

- **The first stage** – 11 Horizontal Storage Modules, 616 SFA;
- **The second stage** – 12 Horizontal Storage Modules, 672 SFA;
- **The third stage** – 12 Horizontal Storage Modules, 504 SFA (3 HSM are Empty)
Horizontal Storage Module
✓ Capacity: one DSC in one HSM
✓ Number of modules: 35 pcs.
✓ Layout: in 2 rows, end to end;
✓ Length: 5.12 m;
✓ Height: 4.7 m;
✓ Width: 2.65 m;
✓ Dose rate at surface: ALARA;
✓ Heat removal: 14.84 kW;
✓ Heat removal method: natural convection;
✓ Building materials: reinforced concrete and structural steel;
✓ Service life: 50 years.
Transfer system

- **Length** – 3.7 m
- **Diameter** – 2.173 m
- **Weight with water** – 31.6 t
- **Service life** – 50 years
- **Surface dose rate** – ALARA
- **Cross weight** – 70 tons
- **Materials** – carbon steel

- **Cover plate annulus formed by these two shells is filled with cast lead to provide gamma shielding**
- **The transfer cask also includes an outer steel jacket which is filled with water for neutron shielding.**
NUHOMS 56V Dry Shielded Canister

✓ length - 372.5 cm
✓ diameter – 170.6 cm
✓ Wall thickness – 1.5 cm
✓ Number of assemblies per – 56
✓ materials – stainless steel
✓ Inner cover plate
✓ Outer cover plate
✓ Circular spacer disk plates
Canister Cross-Section

✓ Number of cell – 56

✓ 24 cell boron stainless steel

✓ 32 cell stainless steel

✓ Cell pitch – 18 cm

✓ Cell inner dimension – 15.2 cm
Spent Fuel Assemblies

✓ Assembly length – 3.210 m
✓ Normal cross-section – 144 mm
✓ Assembly weight – 220 kg
✓ Decay heat power – 0.265 kW
✓ Initial enrichment – 3.6 w/oU-235
✓ Burn up – 42.000 MWD/MTU
✓ Post - irradiation cooling time – 5 years
HSM Air Exit Temperature

Y (ΔT), X (DSC decay heat)

- 45 C ambient temp
- 10 C ambient temp
- -30 C ambient temp
Basic Activities on Operation of NUHOMS System

- Installation (insertion) of DSC in TSC and their filling with borated water.
- Transport and placing the cask with DSC in spent fuel storage pool.
- Loading spent fuel assemblies in DSC.
- Fixing the DSC top plug.
- Removal and transport of a loaded cask to decontamination area.
- The cask decontamination reducing level in DSC cavity lower the plug level.
- Transport of the cask to the service working station.
- Installation and welding the DSC first cap, welding control.
- Water drain out of the cask and DSC cavity.
- The DSC vacuum drying.
- The DSC filling with helium.
- The cap weld helium leak-tightness test.
- Welding the DSC siphon and ventilation openings.
- Welding the DSC second cap.
- Installation of TSC cap.
- Transport and installation of TSC onto the trailer in horizontal position.
- Transport of the trailer with TSC using the truck to SFDSF.
- Approaching of TSC to the elevation of HSM hatch opening.
- Removal of TSC cap, alignment of TSC and fixing to HSM.
- Insertion of DSC into HSM.
- Removing TSC away from HSM and fixing the HSM door.
### Operational Parameters on the SFDS

#### Результаты контроля мощности эквивалентной дозы гамма излучения, мкЗв/ч

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Use of a New Type of Assembly

➢ High initial enrichment – 3.82%
➢ high burnup – 47.4 MWt.D/kg
✓ Number of cell – 56

✓ 24 cell boron stainless steel

✓ 10 additional boron stainless steel

✓ 22 cell stainless steel

✓ Cell pitch – 18 cm

✓ Cell inner dimension – 15.2 cm
Cooling Time

➢ For Assemblies 3.6% - 12 years
➢ For Assemblies 3.82% - 10 years
Disadvantages and advantages of system

The positive sides are the following:

➢ It consists of passive elements;
➢ Simplicity of operation;
➢ Unavailability of the special operating personnel;
➢ Unavailability of radioactive waste;
Disadvantages and advantages of system

The negative sides are the following:

- It occupies a large area;
- It has a large construction period;
- The system includes unique equipment, which ages rapidly and is not produced;
- Installation of dry shielded canister (DSC) in horizontal storage module (HSM) requires the implementation of work with great accuracy;
- It does not provide condition control of spent fuel assemblies inside DSC;
- It takes a long time or special equipment for transportation to another storage;
- DSFSF emergency unloading is not provided in the time of ANPP decommissioning;
SUGGESTION

Due to the fact, that Unit № 2 lifetime extension works are implemented for 10-15 years which means that the use of modern fuel is provided NUHOMS type DSFSF is offered to limit with three stages. For the storage of spent fuel assemblies choose another more modern project, which must be free from the above listed disadvantages and satisfy the following basic requirements:
SUGGESTION

• Storage capacity must provide the storage of all spent fuel assemblies during the time of 10-15 years (about 2000 pieces of fuel assemblies).
• The storage must be independent.
• Passive systems must be used as far as possible.
• The transport containers project must allow to transport them to another storage without using additional equipment.
• The system of spent fuel assemblies must allow the Republic of Armenia to implement its obligations according to NPT (IAEA Safeguards).
• It is desirable, that spent fuel assemblies system makes possible to control the condition of spent fuel assemblies inside the container.
• The storage system must be licensed in the Republic of Armenia according to established order.