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7.0 PACKAGE OPERATIONS

The following information contains the significant events relating to the routine use of fuel assembly shipping packages. Complete detailed instructions are outlined within the individual plant operating procedures and quality control instructions pertinent to each specific operation. It should be considered that in this section the term “Traveller package” refers to all variants (STD, XL, and VVER) and the term “Clamshell” refers to both the rectangular Clamshell and the hexagonal VVER Clamshell.

7.1 PACKAGE LOADING

7.1.1 Preparation for Loading

For contents to be acceptable for shipment in the Traveller package the requirements of (a) or (b) shall be met.

- a. The uranium contents meet the “unirradiated definition” of SSR-6 (§527) [1] and 10CFR71.4 [2].

Unirradiated uranium means uranium containing not more than 2×10^3 Bq of plutonium per gram of uranium-235, not more than 9×10^6 Bq of fission products per gram of uranium-235, and not more than 5×10^{-3} g of uranium-236 per gram of uranium-235.

- b. If the ^{236}U requirement of the unirradiated definition is not met, the assembly may still be shipped if the following criteria are met:
- 1) The contents meet the requirements of the UF_6 Enriched Commercial Grade specification of ASTM C996 [3], specifically the ^{236}U limit ($250 \mu\text{g } ^{236}\text{U/gU}$).
 - 2) There is less than a Type A quantity of material in the assembly.
 - For an A_2 calculation the *U(enriched to 20% or less) - Unlimited* value may not be used.
 - The A_2 calculation must be completed using the A_2 values in 10CFR71 Appendix A Table A-1 for the individual isotopes in the fuel, using the “slow lung absorption” values for uranium isotopes (i.e. for a UO_2 compound).

Note: plutonium and fission products are not allowed in the Traveller packages.

7.1.1.1 Receive Shipping Package

- Unload the shipping package from the truck.
- Report any obvious damage to the package engineer.
- Prepare a package identification route card.

7.1.1.2 Clean Shipping Package

- Use soap or a suitable detergent and/or water to clean the package, as required.
- Move the package to the refurbishing or lay down areas.

7.1.1.3 Refurbish Shipping Package

- Check package upper and lower Outerpack exterior for damage.

- Open Outerpack and check for internal damage or excessive wear.
- Repair/rework as required.
- Check Clamshell for loose parts, and if found, secure per specifications and drawings.
- Vacuum package to collect foreign debris.

7.1.1.4 Configure Package for Fuel Assembly Loading

- Configure (install) top axial restraint and axial spacers for specific fuel assembly type.
- Install accelerometers as required per site procedure.
- Check installed accelerometers for QC seal, calibration, and tripped condition. If found in tripped condition, replace with un-tripped and calibrated accelerometer.

7.1.1.5 Inspection

- Verify that the package interior/exterior Outerpack and Clamshell are clean, and in good condition.
- Verify that the top axial restraint, axial spacers and grids pads are present and in good working condition.
- Verify that outstanding applicable package non-conformances have been closed prior to release for loading.

7.1.2 Loading Contents and Closing Package

- Secure Outerpack in Upender by engaging lock pins or latch.
- Remove all but at least one of the upper Outerpack bolts on one side of the package. (All other hinge bolts remain in place).
- Raise shipping package to vertical position. Lockout support arms when using mechanical Upenders.
- Remove the remaining hinge bolt(s) from the one side.
- Loosen Outerpack swings bolts and rotate away from package.
- Open upper Outerpack door and fully rotate away from package.
- Remove the hinge pin and open Clamshell top door.
- Loosen and remove Clamshell top axial restraint assembly.
- Open lower Clamshell doors by turning latches to open position.
- Install Clamshell door stop.
- Check upper and lower accelerometers are not tripped. If found in tripped condition, replace with un-tripped and calibrated accelerometer.
- Verify that the fuel assembly has been released by Quality Assurance. Install fuel assembly by resting it on Clamshell bottom plate.
- Verify that the fuel assembly is properly oriented in the package.
- Check that grid pads are positioned at fuel assembly structural grids and nozzles.
- Remove door stop.
- Close lower Clamshell doors and secure latches by turning to lock position.
- Remove fuel tool.

- Install Clamshell top axial restraint assembly and secure axial restraint.
- Close Clamshell top door and install hinge pin.
- Close the upper Outerpack.
- Rotate Outerpack swings bolts into bracket and secure.
- Install at least one Outerpack bolt.
- Disengage upper support arm lock pins on mechanical Upender. Lower package to horizontal position. Disengage latch on powered Upender.
- Verify general cleanliness and absence of debris on the Outerpack after closing the upper Outerpack door.
- Torque the swing bolts to 20 ± 1 foot-pounds and torque the Outerpack bolts to 60 ± 5 foot-pounds.
- Verify one approved tamper proof security seal is installed on each opposite side of the package.
- Verify that the required decals, license plates, labels, stencil markings, etc. are present and legible.

7.1.3 Preparation for Transport

7.1.3.1 Conveyance Loading of Shipping Packages

- Place shipping package on conveyance equipped to permit chaining and strapping package securely.
- Center and place package lengthwise on conveyance.
- Install spacer bars, if required, and install quick release lockout pin.
- Secure packages to conveyance with stops or locating pins.
- Chain or strap the packages to conveyance using “come along” tighteners with chains of 3/8 inch minimum diameter or nylon straps with a minimum 5000 pound Working Load Limit (WLL).
- Place webbing swings over spacer bars, if required, and secure to conveyance.

7.1.3.2 Regulatory

- Conduct direct alpha surveys on both the packages and the accessible areas of the flatbed.
- Perform the removable alpha and beta-gamma external smear surveys on both the packages and the accessible areas of the flatbed. If any of the following measurements are met or exceeded, notify Regulatory Engineering or appropriate site personnel for instructions on decontamination:
 - 0.4 Bq/cm^2 ($1 \times 10^{-5} \text{ } \mu\text{Ci/cm}^2$ or 2400 dpm/100 cm^2) for beta and gamma emitters and low toxicity alpha emitters
 - 0.04 Bq/cm^2 ($1 \times 10^{-6} \text{ } \mu\text{Ci/cm}^2$ or 240 dpm/100 cm^2) for all other alpha emitters

7.1.3.3 Inspection

- Verify that packages are properly stacked and secured.
- Verify that required Health Physics, Radioactive and any other placards or labels have been properly placed.
- Verify that two tamper proof security seals have been properly placed on each package.

7.2 PACKAGE UNLOADING

7.2.1 Receipt of Package from Carrier

- Conduct radiation and contamination surveys as outlined in site-specific procedures.
- Perform an external inspection of the unopened package and record any significant observations.
- Verify that two tamper proof security seals have been properly placed on each package. If either seal is missing or damaged, record the damage and follow site procedures for possible security issues.

7.2.2 Removal of Contents

- Secure Outerpack in Upender by engaging lock pins or latch.
- Remove all but at least one of the upper Outerpack bolts on one side of the package. (All other hinge bolts remain in place).
- Raise shipping package to vertical position. Lockout support arms when using mechanical Upenders.
- Remove the remaining hinge bolt(s) from the one side.
- Loosen Outerpack swing bolts and rotate away from package.
- Open upper Outerpack door and fully rotate away from package.
- Check upper and lower accelerometers for tripped condition. If in tripped condition, disposition fuel assembly per applicable Field Specification.
- Remove the Clamshell top hinge pin and open Clamshell top door.
- Loosen and remove Clamshell top axial restraint assembly.
- Install and latch the plant fuel tool.
- Tension crane cable between 100 to 1000 pounds as needed to take pressure off Clamshell bottom plate.
- Turn lower Clamshell door latches to open position and open main doors.
- Install Clamshell door stop.
- Lift fuel assembly at least 1.5 inches above Clamshell bottom plate.
- Carefully remove fuel assembly from Clamshell.
- Move fuel assembly to dry storage or other desired location.
- Prepare to close Clamshell by removing Clamshell door stop.
- Close main Clamshell doors and secure latches.
- Install Clamshell top axial restraint assembly.
- Close Clamshell top door and install hinge pin.
- Rotate Outerpack swing bolts into bracket and install at least one Outerpack bolt.
- Verify the swing bolts and Outerpack bolts are at least hand tight using standard hand tools.
- Disengage upper support arm lock pins on mechanical Upender. Lower package to horizontal position. Disengage latch on powered Upender.

7.3 PREPARATION OF EMPTY PACKAGE FOR TRANSPORT

The requirements for preparing an empty Traveller package for transport are intended to meet the relevant requirements for shipping an empty radioactive material package in 49 CFR 173 [4] or the equivalent paragraph of SSR-6.

- Verify the package is empty of contents.
- Verify radiation levels do not exceed limits prescribed in 49 CFR 173.421(b).
- Verify non-fixed radioactive surface contamination does not exceed limits prescribed in 49 CFR 173.421(c).
- Verify the package does not contain fissile material unless an exception of 49 CFR 173.453 is met.
- Verify the packaging is in unimpaired condition and is securely closed.
- Verify the internal contamination does not exceed 100 times the limits as prescribed by 49 CFR 173.428(d).
- Remove any previously applied labels affixed for fuel shipments.
- Affix an "Empty" label.

7.4 APPENDICES

7.4.1 References

- [1] International Atomic Energy Agency, "Regulations for the Safe Transport of Radioactive Material," SSR-6, 2012.
- [2] U.S. Nuclear Regulatory Commission Code of Federal Regulations, Title 10 Part 71, "Packaging and Transport of Radioactive Material," 2016.
- [3] American Society for Testing and Materials, "Standard Specification for Uranium Hexafluoride Enriched to Less Than 5% ²³⁵U," ASTM C 996-15, 2015.
- [4] U.S. Department of Transportation Code of Federal Regulations, Title 49 Subchapter C, "Hazardous Materials Regulations," 2016.