MAINTENANCE OF THE PACKAGINGS USED FOR THE TRANSPORT OF SPENT FUEL

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Abstract

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Regular maintenance of packagings used for the transport of spent fuel has been carried out in Europe for the past three years. The three companies involved in this kind of transport (Cogéma, Nuclear Transport and Pacific Nuclear Transport) have agreed on a common policy for these operations and, in practice, perform the maintenance work at a special facility (AMEC) at the La Hague reprocessing plant in France. This facility was erected in 1983, and commissioned in January 1984. The paper deals with the typical maintenance operations at the AMEC facility, the principles of control applied during maintenance, maintenance experience and future development and prospects.

1. TYPICAL MAINTENANCE OPERATIONS AND CHRONOLOGY

The maintenance operations at the AMEC facility have two aspects:

(1) Basic maintenance (every 8–10 transports or every 2 years).
(2) Major maintenance (every 30–40 transports or every 4 years).

The different steps involved in the maintenance procedures are:

(a) Gamma, neutron and temperature surveys before unloading [1]
(b) Preliminary internal cleaning in the remote handling facility
(c) Control and transfer to the AMEC facility
(d) Removal of attached items (shock absorbers, second covers)

[1] Performed in addition to the major maintenance operations.

(e) Transfer to hot cell for internal maintenance:
  (i) Flask subcriticality check [1]
  (ii) Main plug inspection
  (iii) Inspection of orifices
  (iv) Basket inspection
  (v) First leak test of orifices
(f) Transfer to the main hall for external maintenance:
  (i) Trunnion inspection
  (ii) Ultrasonic tests[1]
  (iii) Overload tests[1]
(g) Body inspections:
  (i) Fins, fusible plugs, bagging rings
(h) Drums and shock absorber inspection:
  (i) Leak tests [1]
  (ii) Overload test of lifting points [1]
(i) Elaborated leak tests
(j) Flask reassembly and transfer to transport.

2. PRINCIPLES OF FLASK CONTROL

During flask maintenance, all flask functions and components are checked or inspected (see Table I).

3. MAINTENANCE EXPERIENCE

Since the beginning of 1984, about 600 transports have been carried out between European and Japanese nuclear power plants and the La Hague reprocessing plant. The following data summarize some of the results obtained during this maintenance experience:

(1) Number of flasks maintained:	72
(2) Mean value of time spent for	
(a) Basic maintenance:	60 man-days
(b) Main maintenance:	90 man-days
(c) Quality assurance (QA) purposes:	12 man-days
(d) Handling:	12 man-days
(3) Mean value of internal flask dose rate after cleaning (working conditions):	50–100 mrem/h.[2]

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[2] 1 rem = 1.00×10^{-2} Sv.

TABLE I. METHODS OF CONTROL OF FLASK FUNCTIONS AND COMPONENTS

Flask function or component	Method of control
Fastening systems of major components (screws, tapped holes or similar devices)	Visual examination
	Distortion detected by profile projector
	'GO/NO GO' gauge test
	Recording of characteristic dimensions
	Recording of corrosion behaviour
Tightness	Examination and restoration of sealing faces and associated grooves
	Systematic replacement of gaskets
	Vacuum or pressure leak test (identical to manufacture)
Handling devices (trunnions, handling points of lid and shock absorbers)	Visual examination and restoration of bearing surfaces
	Ultrasonic test of major welds
	Dye penetrant test of bearing surfaces and welds
	Torque check on assembly screws
	Vacuum leak test (on Transnucléaire trunnions)
	Overload test
	Recording of corrosion behaviour
Subcriticality check	Redundant procedures to check presence and adequacy of internal flask equipment
	Non-buckling test of compartments
	Measurement of the thermal neutron attenuation factor of the basket structure
Shielding efficiency	Gamma and neutron scanning of outside of flask
Heat transfer efficiency	Visual examination of heat transfer system
	Temperature scanning of outside of flask
Flask quality in event of contamination	Restoration of initial outside surface roughness
Flask appearance	

(4) Mean value of dose received by maintenance staff (per flask): 160 mrem
(5) Mean tightness safety factor versus transport criteria: 10^3–10^4
(6) Number of defects detected in tightness components versus quantity checked: 4.5×10^{-2}
(7) Number of major threaded components replaced versus quantity checked

   (a) Trunnion screws: 5×10^{-3}
   (b) Lid screws: 10^{-2}

(8) Number of trunnions replaced versus quantity checked: 2×10^{-3}

The general comments about these data are, first, that sufficient time is necessary for maintenance purposes (including QA and handling operations) and, second, the very good ratio of the flask components replaced versus the number of those checked should be noted.

4. EXPECTED DEVELOPMENTS IN FLASK CONTROL AND MAINTENANCE

It is expected that Cogéma, together with Pacific Nuclear Transport Ltd, Nuclear Transport Ltd and Transnucléaire (the designer), will seek to improve maintenance procedures with a view to enhancing safety and efficiency. The key aspects of these efforts are:

(1) Improvement in flask cleaning procedures (to reduce dose rates).
(2) Improvement in maintenance staff qualifications.
(3) Improvement in inspection and repair criteria.
(4) Introduction of partial automation to reduce time-consuming, high dose and exhausting work.
(5) Use of computer techniques for recording data.
(6) Research and development on new and existing techniques as related to flask components.

ANALYSIS AND TESTING