APPENDIX E: Conceptual design and description for all the UFTS components in the case of "Mostly rail" mode for each current Storage Site

1. INTERFACES FOR EACH CURRENT STORAGE SITE

Tables N°4, 5, 6, 7 and 8 of Appendix B.

2. WHITESHELL

Baskets in Silo (See Appendix B, Table N° 4)
From Douglas Point Facility to the Centralised Facility
Quantity of bundles to transport from 2035 to 2064: see Appendix B, Table N° 2.

2.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

« Whiteshell includes a single facility: Whiteshell Laboratories. While the Whiteshell facility was not visited as part of this review, the facility's location, paired with the very small number of used fuel bundles to be transported, suggests that road transport would be the most efficient means of completing the deliveries to either the northern or southern Ontario regions. Accordingly, a specific investigation of rail and/or water links was not conducted.

Recommendation: On the above basis, it is recommended that the small volume of used fuel originating at the Whiteshell facility be transported by road.

The hypothesised routing would involve transport on the Trans Canada Highway to provincial roadways [**<52>**, **<53>**, **<27>**and **<54>**].»

2.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a trailer.

See phases 3, 4, 5 of paragraph 2.9 of the present document.

2.3. Transporter (vehicle)

Conceptual design of trailer and tractors (phase 6 of table paragraph 2.9)

2.3.1. Trolley with tractor

In order to transfer:

- The baskets from the silo to the packaging (phase 2 of table paragraph 2.9),
- The full packaging from loading area of the packaging to the transportation area of the transportation cask (phase 5 of table paragraph 2.9).

2.3.2. Trailer for the road transportation (phase 6 of table paragraph 2.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic or air ride suspension to cushion the load
- Trailer equipped with four axles
- One loaded cask per trailer
- 2 drivers and no escort

2.3.3. Tractor for the road transportation (phase 6 of table paragraph 2.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 9,075 kg.

2.3.4. Weather cover for the road transportation (phase 7 of table paragraph 2.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can rolls on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

2.3.5. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.
The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

2.3.6. Specific equipment

- GPS antenna (tracking) on the tractor
- Turning light (“Girophare”) on the tractor
- Tools box adapted to the Transportation cask

2.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance equipment for IFTC/BM: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.

- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

2.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: similar to the IFTC.
- IFTC/BM: See chapter 2, section 2.4.7.1.3, Figure N° 6 of Appendix A, Appendix C.

2.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Leakage and purging equipment :
  One complete equipment with vacuum pumps and gauges (see phase 4 of table paragraph 2.9)
- Gantry Crane:
  One for loading the baskets from the Transfer flask to the packaging (see phase 3 of table paragraph 2.9)
  One for loading the Transportation cask on the trailer (see phase 6 of table paragraph 2.9)
- Lifting beam:
  One for the lid of the packaging (see phase 3 of table paragraph 2.9)
  One for the Transfer flask (see phase 3 of table paragraph 2.9)
  One for the packaging and transportation cask (see phases 5 and 6 of table paragraph 2.9)
  One for the impact limiter of the Transportation cask (see phase 5 of table paragraph 2.9)
- Decontamination equipment (see paragraph 3.2. of Chapter 3).

2.7. UFTS Transportation system operation

Loading of packages onto the trailers, security, transportation, emergency response:

- Loading of packages onto the trailers, security, transportation as described in phase 6 of table paragraph 2.9
- Emergency response plan: see paragraph 9 of Appendix E.
- Real time tracking: see paragraph 9 of Appendix E.

2.8. Decommissioning

Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.2 of Chapter 3).

2.9. Table: Analysis of the operational phases of transport

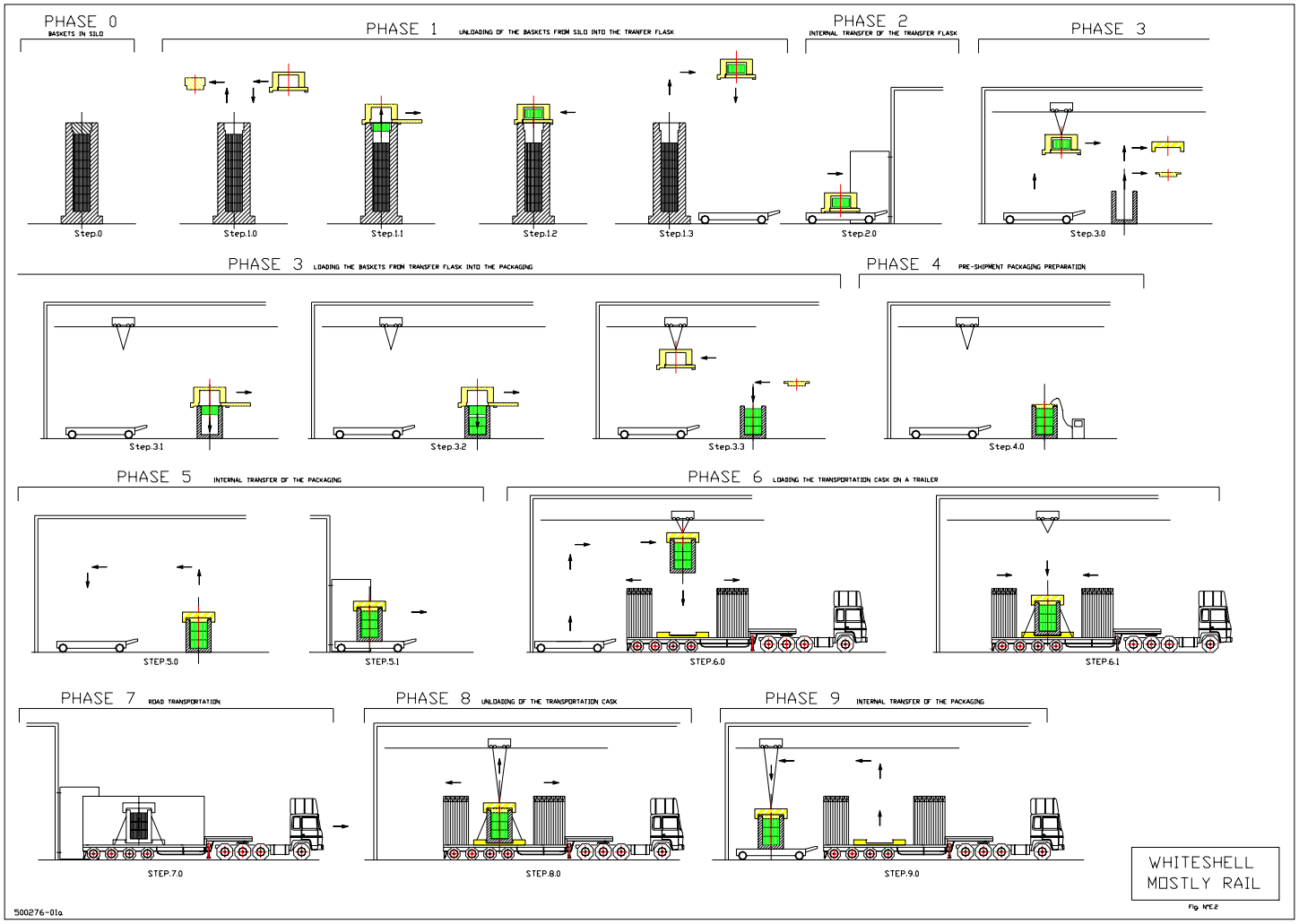
PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.2
Phase 0	Baskets in Silo	Interim storage	Initial phase			0
Phase 1	Unloading of the baskets from the Silo into the transfer flask	Interim storage				1.0, 1.1, 1.2, 1.3
Phase 2	Internal transfer of the transfer flask	Interim storage				2.0
Phase 3	Loading the baskets from the transfer flask into the packaging. Note(1)	UFTS	With the gantry, take the impact limiter handling tool of the packaging.	Packaging	IFTC/BM : See section 2.4.7.1.3 of D#5 Appendix A, Figure N° 6,	3.0
				Impact limiter handling tool of the packaging		3.0
				Gantry crane	With 2 hoists (of 60 tons for the IFTC/BM and Transfer flask and 10 tons for the impact limiter and the lid of IFTC/BM)	3.0
			Raise the impact limiter and store it in a place			3.0
			With the gantry, take the lid handling tool of the packaging.	Lid handling tool of the packaging		3.0
			Raise the lid and store it in a place			3.0
			With the gantry, take the transfer flask	Transfer flask	Similar to Gentilly 2 : Shielded fuel transfer cask, Appendix A, Figure N°10 - 26 tons with 60 bundles basket and with irradiated fuel - “Sliding” gate - Electric hoist for lifting or lowering a basket into the IFTC/BM - Chain - Basket lifting grapple - Shielding	3.0
				Lifting Beam for the Transfer flask		3.0
			Mate the transfer flask with the flask lid of the packaging.		Appendix A, Figure N°9	3.1
			Load the baskets.			3.1, 3.2
			With the gantry, take off the transfer flask Bolting of the lid with the associated platform			3.3
			With the gantry, close the packaging with the lid.			3.3

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.2
Phase 4	Pre-shipment packaging preparation	UFTS	Drying the cavity	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves,	4.0
			Filling the cavity with helium	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves, compressed air line	
			Leaktightness check	Leaktightness equipement		
			Depressurising the cavity	Vacuum circuit		
Phase 5	Internal transfer of the packaging	UFTS	Radiological control of the packaging	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Approach of the trolley	Trolley	Trolley with tractor	5.0
			Radiological control of the trolley	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Installing the impact limiter			5.0
			Loading of the full Transportation cask on the trolley			5.0
			Radiological control of the Transportation cask and the trolley	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Internal transfer	Tie down		5.1
Phase 6	Loading the Transportation cask on a trailer	UFTS	Radiological control of the Transportation cask and the trailer	Non contamination, Dose Rate	“Smear test”, Radiameter	6.0
			Open the weather cover	Weather cover		6.0
			Loading the Transportation cask on a trailer	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	6.0
				Lifting Beam for packaging	To carry of the IFTC/BM (similar to the lifting beam of IFTC)	6.0
				Trailer (Appendix A, Figures N°13, 14)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with four axles - One loaded cask per trailer	6.0
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	6.0
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15 , **<3>**)	6.1
			Check the condition of the Transportation cask , trailer			6.1
			Fit the transport seals			6.1
			Close the weather cover	Weather cover		6.1
			Radiological control of the trailer and the Transportation cask	Non contamination, Dose Rate	“Smear test”, Radiameter	6.1

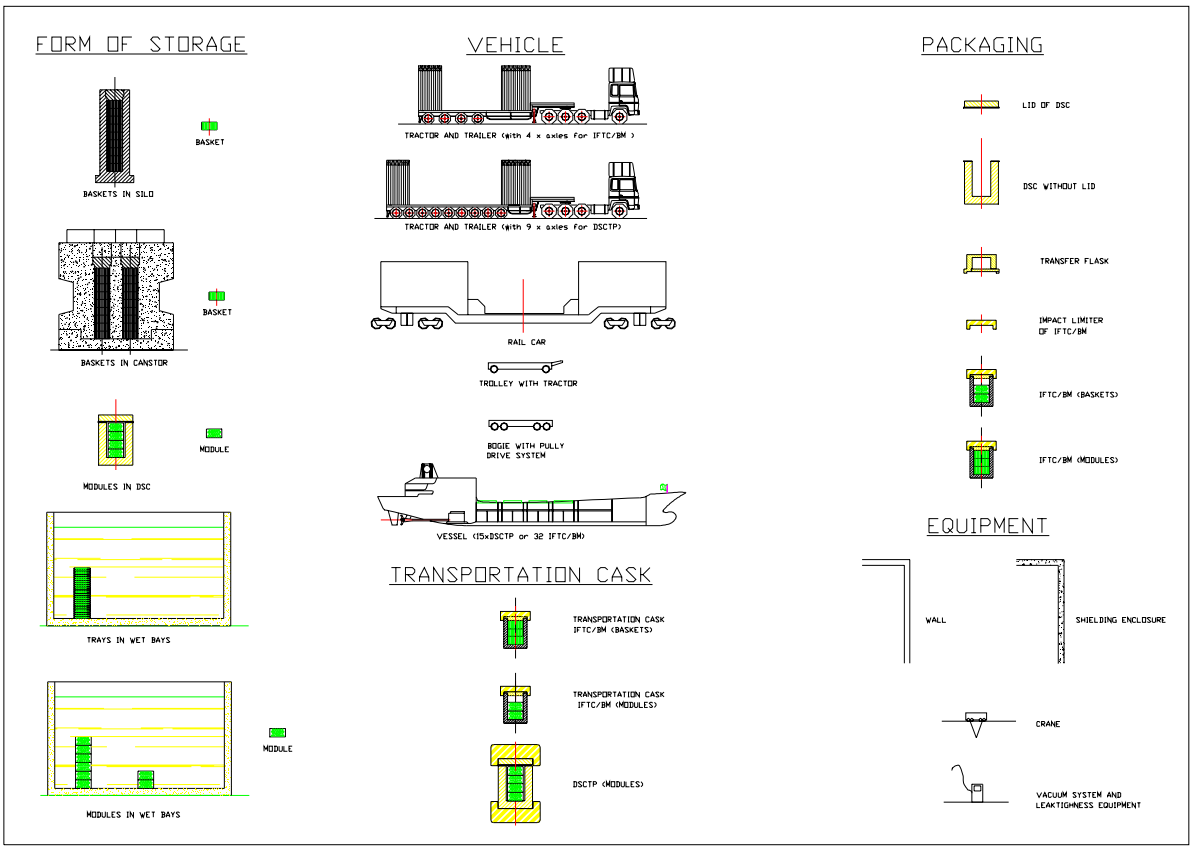
PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.2
Phase 7	Road transportation	UFTS	Road transportation of the Transportation cask from the Facility to the Centralised Facility			7.0
				Real time tracking	Appendix H	7.0
Phase 8	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the trailer			8.0
Phase 9	Internal transfer of loaded Transportation cask	DGR/CES				9.0
Phase 10	Unloading the baskets from the Transportation cask	DGR/CES				
Phase 11	Storage of the baskets on the Centralised Facility	DGR/CES				
Phase 12	Road transportation of the empty Transportation cask from the Centralised Facility	DGR/CES				

Note (1): The removal of the flask and the replacement of the lid have to be co-ordinated, as it done at present (throughout). The IFTC/BM lid could be designed to be suitable for this operation.

This operation has to repeated three times.


PHASE 0
BASKETS IN SILO
PHASE 1
UNLOADING OF THE BASKETS FROM SILO INTO THE TRANFER FLASK
PHASE 2
INTERNAL TRANSFER OF THE TRANSFER FLASK
PHASE 3
Step.0
Step.1.0
Step.1.1
Step.1.2
Step.1.3
Step.2.0
Step.3.0
PHASE 3
LOADING THE BASKETS FROM TRANSFER FLASK INTO THE PACKAGING
PHASE 4
PRE-SHIPMENT PACKAGING PREPARATION
Step.3.1
Step.3.2
Step.3.3
Step.4.0
PHASE 5
INTERNAL TRANSFER OF THE PACKAGING
PHASE 6
LOADING THE TRANSPORTATION CASK ON A TRAILER
STEP.5.0
STEP.5.1
STEP.6.0
STEP.6.1
PHASE 7
ROAD TRANSPORTATION
PHASE 8
UNLOADING OF THE TRANSPORTATION CASK
PHASE 9
INTERNAL TRANSFER OF THE PACKAGING
STEP.7.0
STEP.8.0
STEP.9.0
WHITESHELL
MOSTLY RAIL
500276-01a

Key:


FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

3. BRUCE

3.1. Modules in DSC (See Appendix B, Table N°8)

From WUFDSF to the Centralised Facility
Quantity of bundles to be transported from 2035 to 2064: see appendix B, Table N° 2.

3.1.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

Road: Road transport is clearly feasible from Bruce [**<52>**, **<53>**, **<27>**and **<54>**]. Public roadways are adequate to support transport from the site. Some strengthening of on-site roadways may be required to support the high volume of transports necessary for this portion of the shipping campaign. Such infrastructure improvements would be necessary for road transport, as well as to support transport to a railway or a waterway. Accordingly, such improvements are deemed necessary for the program.

Given the volume of used fuel to be transported to the site, use of the road mode would result in a larger number of individual shipments and offers the least potential for a consolidated transport program. The term “consolidated” refers to the physical consolidation of cargo into larger consignments as well as to the coordination of shipments between sites, according to the context.

Creation of two rail road terminals:

Example given Appendix G: Example of the COGEMA LOGISTICS road rail Terminal at Valognes.

3.1.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a trailer and rail car.

See phases 1, 2 of paragraph 3.1.9 of the present document.

3.1.3. Transporter (vehicle)

3.1.3.1. Rail car (phase 5 of table paragraph 3.1.9)

The sample rail transportation system is predicated on the following elements:

- The train is dedicated to movement of used fuel under exclusive use conditions;
- Use of depressed center, flat bed car see Appendix A, Figure N°16;
- Each flat car is loaded with two IFTC/BMs or one DSCTP;
- Each train equipped with locomotive and caboose;
- The locomotive is assumed to have sufficient power to safely and efficiently haul the load.

3.1.3.2. Weather cover for the rail transportation (phase 5 of table paragraph 3.1.9)

- Rolling removable aluminium weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. One man can manually open or close the weather cover which can rolls on a rail fixed on the frame of the rail car.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts. The real time tracking system is placed on the two parts (See Appendix H).

3.1.3.3. Specific equipment for the rail transportation

- GPS antenna (tracking) on the rail car (Appendix H)
- Tools box adapted to the Transportation cask

3.1.3.4. Trailer for the road transportation (phases 4, 8 of table paragraph 3.1.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic suspension to cushion the load
- Trailer equipped with nine axles
- One loaded cask per trailer
- 2 drivers and an escort (see section 3.5.1 Chapter 3)

3.1.3.5. Tractor for the road transportation (phases 4, 8 of table paragraph 3.1.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 11 t.

3.1.3.6. Weather cover for the road transportation (phases 3, 7 of table paragraph 3.1.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can rolls on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

3.1.3.7. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.
The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

3.1.3.8. Specific equipment

- GPS antenna (tracking) on the tractor
- Turning light (“Girophare”) on the tractor
- Tools box adapted to the Transportation cask

3.1.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance Equipment for DSCTP: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.

- Maintenance Equipment for Rail car: shared facility at the centralised site (see paragraph 3.4 of Chapter 3).

- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

3.1.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: for DSCTP on railcar as described in <**8**> Appendix A, Figure N° 17.

- DSCTP: See Chapter 2, section 2.4.7.1.3, Figure N° 8 in Appendix A, Appendix C.

3.1.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Gantry Crane:

  One for the pre-shipment of the packaging (see phase 2 of table paragraph 3.1.9) and for loading the Transportation cask on the trailer (see phase 3 of table paragraph 3.1.9).
  One for loading the Transportation cask on the rail car (see phase 5 of table paragraph 3.1.9).
  One for loading the Transportation cask on the trailer (see phase 7 of table paragraph 3.1.9).

- Lifting beam:

  One for the packaging (see phase 2 of table paragraph 3.1.9)
  One for the impact limiter of the packaging (see phase 2 of table paragraph 3.1.9)
  One for the Transportation cask (see phases 2, 3, 5, 7 of table paragraph 3.1.9)

- Decontamination equipment (see paragraph 3.2 of Chapter 3).

3.1.7. UFTS Transportation system operation

Loading of Transportation cask onto the rail cars, security, transportation, emergency response:

- Loading of Transportation cask onto the trailer, the rail car, security, transportation as described in phases 3, 5, 7 of table paragraph 3.1.9.
- Emergency response plan: see paragraph 9 of Appendix E.
- Real time tracking: see paragraph 9 of Appendix E.

3.1.8. Decommissioning

Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.2 of Chapter 3).

3.1.9. Table : Analysis of the operational phases of transport

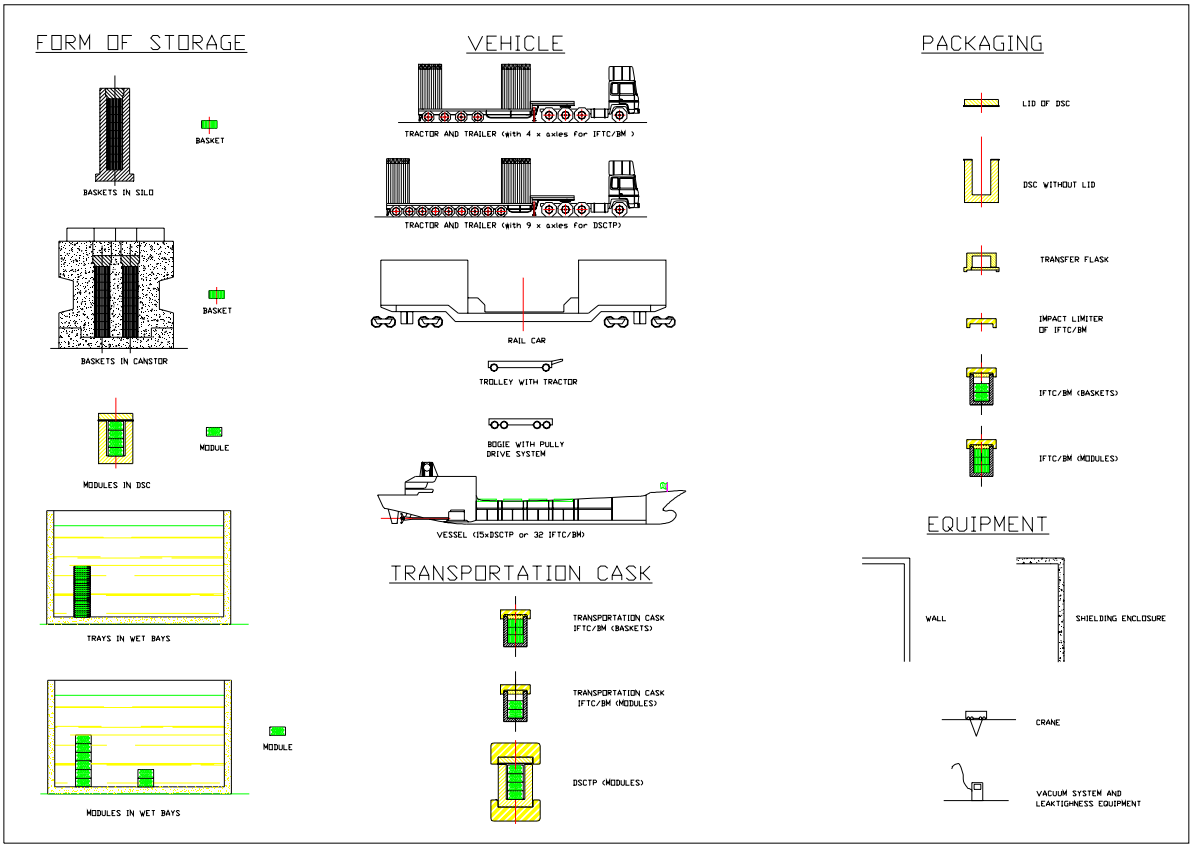
PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG N° E.3.1
Phase 0	Modules in DSC	Interim storage	Initial phase			0
Phase 1	Internal transfer of the DSC	Interim storage			DSC, Appendix A, Figure N°7	1.0
Phase 2	Pre-shipment packaging preparation **<8>**	UFTS	Radiological control of the packaging	Non contamination, Dose Rate	"Smear test", Radiameter	2.0
				Transportation cask	DSCTP, Appendix A, Figure N° 8	
				Weather cover		
			Load impact limiter onto rotation frame	Gantry crane	With 1 hoist (of 120 tons for the DSCTP)	2.0
				Rotation frame		
				Lifting Beam impact limiter		
			Place DSC in bottom impact limiter	Lifting Beam for packaging		2.1
			Place Top impact limiter			2.2
			Attach wire rape assemblies			2.3
			Rotate frame	Rotation equipment to rotate the frame		2.4
Phase 3	Loading the Transportation cask on a trailer	UFTS	Radiological control of the packaging and the trailer	Non contamination, Dose Rate	"Smear test", Radiameter	3.0
			Open the weather cover	Weather cover		3.0
			Loading the packaging on a trailer	Trailer (Appendix A, Figure N°12)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with nine axles - One loaded cask per trailer	3.1
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 11 t.	3.1
				Gantry crane	With 1 hoist (of 120 tons for the DSCTP)	3.1
			Packaging tie-down on the trailer	Tie-down	Similar to the Tie-down of the DSCTP for the rail (Appendix A, Figure N°17 , **<8>**)	3.1
			Check the condition of the packaging, trailer			3.1
			Fit the transport seals			3.1
			Close the weather cover	Weather cover		3.1
			Radiological control of the trailer and of the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	3.1

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.3.1
Phase 4	Road transportation	UFTS	Road transportation of the Transportation cask from the Facility to the Road Rail Terminal			4.0
				Real time tracking	Appendix H	4.0
Phase 5	Road/Rail transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask and the rail car	Non contamination, Dose Rate	"Smear test", Radiameter	5.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the trailer to the rail car	Gantry Crane	With 1 hoist (of 120 tons for the DSCTP)	
				Lifting Beam for Transportation cask	**<8>**	
				Rail car (Appendix A, Figure 16 **<3>**)	- The train is dedicated to movement of used fuel under exclusive use conditions; - Use of depressed centre, flat bed car; - Each flat car is loaded with two Transportation casks; - Each train equipped with locomotive and caboose; - The locomotive is assumed to have sufficient power to safely and efficiently haul the load.	
			Packaging tie-down on the rail car	Tie down	Tie-down of the DSCTP for the rail (Appendix A, Figure N°17 , **<8>**)	
			Check the condition of the packaging, rail car			
			Fit the transport seals			
			Close the weather cover of the rail car	Weather cover		
			Radiological control of the rail car and of the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
Phase 6	Rail transportation	UFTS	Rail transportation of the Transportation cask from the road rail terminal to the rail road terminal			6.0
				Real Time Tracking	Appendix H	
Phase 7	Rail/Road transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car and the trailer	Non contamination, Dose Rate	"Smear test", Radiameter	7.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the rail car to the trailer	Gantry Crane	With 1 hoist (of 120 tons for the DSCTP)	
				Lifting Beam for Transpor-tation cask	**<8>**	

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.3.1
				Trailer (Appendix A, Figure N°12,)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with eight axles - One loaded cask per trailer	
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie-down of the DSCTP for the rail (Appendix A, Figure N°17 , **<8>**)	
			Check the condition of the packaging, trailer			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Radiological control of the trailer and of the Transportation cask	Non contamination, Dose Rate	“Smear test”, Radiameter	
Phase 8	Road transportation	UFTS	Road transportation of the Transportation cask from the rail road terminal to the Centralised Facility			8.0
				Real time Tracking	Appendix H	
Phase 9	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the trailer			
Phase 10	Internal transfer of the packaging	DGR/CES				


PHASE 0
MODULES IN DSC
PHASE 1
INTERNAL TRANSFER OF DSC
PHASE 2
PRE-SHIPMENT
Step.0
Step.1.0
Step.2.0
Step.2.1
Step.2.2
Step.2.3
PHASE 2
PHASE 3
LOADING THE TRANSPORTATION CASK ON A TRAILER
PHASE 4
ROAD TRANSPORTATION
Step.2.4
Step.3.0
STEP.3.1
STEP.4.1
PHASE 5
ROAD / RAIL TRANSFER
Step.5.1
Step.5.2
PHASE 6
RAIL TRANSPORTATION
PHASE 7
RAIL / ROAD TRANSFER
PHASE 8
ROAD TRANSPORTATION
Step.6.0
Step.7.0
STEP.7.1
STEP.8.0
BRUCE-MODULES IN DSC
MOSTLY RAIL
500276-01a

Key:


FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

3.2. Trays In wet bays (See Appendix B, Table N° 6)

From Bruce B to the Centralised Facility
Quantity of bundles *to be transported* from 2035 to 2064: see Appendix B, Table N°2**.**

3.2.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

Road: Road transport is clearly feasible from Bruce [**<52>**, **<53>**, **<27>**and **<54>**]. Public roadways are adequate to support transport from the site. Some strengthening of on-site roadways may be required to support the high volume of transports necessary for this portion of the shipping campaign. Such infrastructure improvements would be necessary for road transport, as well as to support transport to a railway or a waterway. Accordingly, such improvements are deemed necessary for the program.

Given the volume of used fuel to be transported to the site, use of the road mode would result in a larger number of individual shipments and offers the least potential for a consolidated transport program. The term “consolidated” refers to the physical consolidation of cargo into larger consignments as well as to the coordination of shipments between sites, according to the context.

Creation of two rail road terminals :
Example given Appendix G: Example of the COGEMA LOGISTICS road rail Terminal at Valognes.

3.2.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a trailer and rail car.

See phases 3, 4 of paragraph 3.2.9 of the present document.

3.2.3. Transporter (vehicle)

3.2.3.1. Trolley with tractor

In order to transfer:

- The full packaging from loading area of the packaging to the transportation area of the transportation cask (phases 2 to 5 of table paragraph 3.2.9).

3.2.3.2. Rail car (phase 7 of table paragraph 3.2.9)

The sample rail transportation system is predicated on the following elements:

- The train is dedicated to movement of used fuel under exclusive use conditions;
- Use of depressed center, flat bed car see Appendix A, Figure N° 16;
- Each flat car is loaded with two IFTC/BMs or one DSCTP;
- Each train equipped with locomotive and caboose;
- The locomotive is assumed to have sufficient power to safely and efficiently haul the load.

3.2.3.3. Weather cover for the rail transportation (phase 7 of table paragraph 3.2.9)

- Rolling removable aluminium weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. One man can manually open or close the weather cover which can rolls on a rail fixed on the frame of the rail car.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts. The real time tracking system is placed on the two parts (See Appendix H).

3.2.3.4. Frame or support of the Transportation cask for the rail transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the frame of the rail car. This frame is fixed on the frame of the rail car with calculated fixations in the three directions to follow the regulations concerning the accelerations. The weather cover can rolls on a rail fixed on the frame of the rail car. A drip pan is installed under the frame of the rail car in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

3.2.3.5. Specific equipment for the rail transportation

- GPS antenna (tracking) on the rail car (Appendix H)
- Tools box adapted to the Transportation cask

3.2.3.6. Trailer for the road transportation (phases 6, 10 of table paragraph 3.1.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic suspension to cushion the load
- Trailer equipped with four axles
- One loaded cask per trailer
- 2 drivers and no escort

3.2.3.7. Tractor for the road transportation (phases 6, 10 of table paragraph 3.1.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 9,075 kg.

3.2.3.8. Weather cover for the road transportation (phases 6, 10 of table paragraph 3.1.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can rolls on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

3.2.3.9. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.

The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

3.2.3.10. Specific equipment for the road transportation

- GPS antenna (tracking) on the tractor
- Turning light ("Girophare") on the tractor
- Tools box adapted to the Transportation cask

3.2.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance Equipment for IFTC/BM: concerning the site of Bruce shall be developed at the in accordance with the number of transportation and with Section 3.2 of Chapter 3.

- Maintenance Equipment for Rail car: shared facility at the centralised site (see paragraph 3.4 of Chapter 3).

- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

3.2.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: similar to the IFTC for road **<3>**, but adapted to the accelerations for rail.

- IFTC/BM: See chapter 2, section 2.4.7.1.3, Figure N° 5 of Appendix A, Appendix C.

3.2.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Leakage and purging equipment:
  One complete equipment with vacuum pumps and gauges (see phase 3 of table paragraph 3.2.9)

- Gantry Crane:
  One for the pre-shipment of the packaging (see phase 3 of table paragraph 3.2.9) and for loading the Transportation cask on the trailer (see phase 5 of table paragraph 3.2.9).
  One for loading the Transportation cask on the rail car (see phase 7 of table paragraph 3.2.9).
  One for loading the Transportation cask on the trailer (see phase 9 of table paragraph 3.2.9).

- Lifting beam:
  One for the packaging and Transportation cask (see phases 3 to 5 of table paragraph 3.2.9)
  One for the impact limiter of the packaging (see phase 4 of table paragraph 3.2.9)
  One for the Transportation cask (see phases 7, 9 of table paragraph 3.2.9)

- Decontamination equipment (see paragraph 3.2 of Chapter 3).

3.2.7. UFTS Transportation system operation

Loading of packages onto the rail cars and trailers, security, transportation, emergency response:

- Loading of Transportation cask onto the rail car and the trailer, security, transportation as described in phases 5, 7, 10 of table paragraph 3.2.9.
- Emergency response plan: see paragraph 9 of Appendix E.
- Real time tracking: see paragraph 9 of Appendix E.

3.2.8. Decommissioning

Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.2 of Chapter 3).

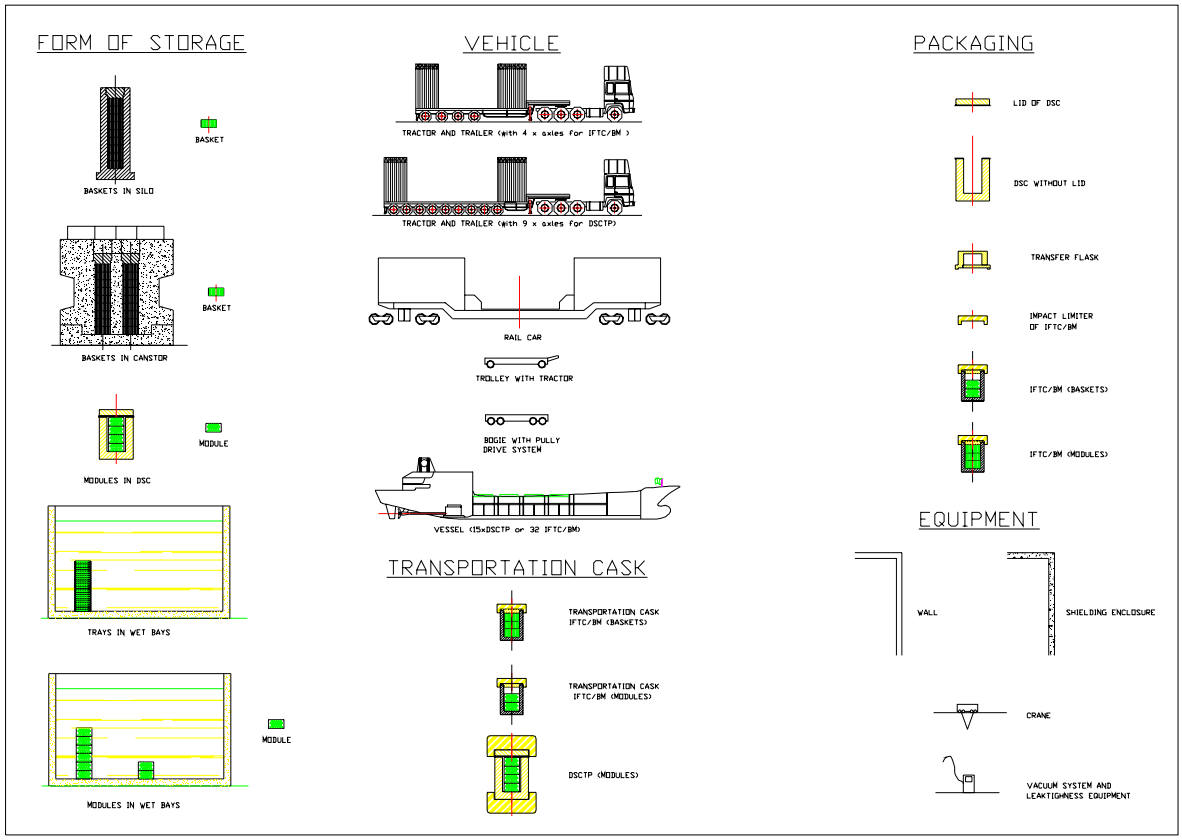
3.2.9. Table : Analysis of the operational phases of transport

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG N° E.3.2
Phase 0	Trays in wet bays	Interim storage	Initial phase			0
Phase 1	Unloading of the bundles from the trays into the modules	Interim storage				1.0
Phase 2	Loading the modules into the packaging in the pool	UFTS	Loading the modules into the packaging in the pool		Identical than the IFCT in the pool Decontamination of the IFTC/BM: identical as IFTC **<3>**	2.0, 2.1
				Packaging	IFTC/BM : See chapter 2., section 2.4.7.1.3 of D#5 Appendix A, Figure N° 5	
Phase 3	Pre-shipment packaging preparation	UFTS	Unloading of the packaging from the trolley	Gantry crane	60 tons	3.1
			Drainage			3.0, 3.1
			Drying the cavity	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves,	
			Filling the cavity with helium	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves, compressed air line	
			Leaktightness check	Leaktightness equipment		
			Depressurising the cavity	Vacuum circuit		
Phase 4	Internal transfer of the packaging	UFTS	Radiological control of the packaging	Non contamination, Dose Rate	“Smear test”, Radiameter	4.0, 4.1
			Approach of the Trolley	Trolley	Trolley with tractor	
			Radiological control of the Trolley	Non contamination, Dose Rate	“Smear test”, Radiameter	
			Installing the impact limiter	Gantry crane	10 tons	
				Lifting beam of the impact limiter		
			Loading of the full Transportation cask on Trolley			
			Radiological control of the Transportation cask and the Trolley	Non contamination, Dose Rate	“Smear test”, Radiameter	
			Internal transfer	Tie down		
Phase 5	Loading the Transportation cask on a trailer	UFTS	Radiological control of the Transportation cask and the trailer	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0, 5.1
			Open the weather cover	Weather cover		

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.2
			Loading the Transportation cask on a trailer	Trailer (Appendix A, Figures N°13, 14)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with four axles - One loaded cask per trailer	
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC. (Appendix A, Figure N°15, **<3>**)	
			Check the condition of the Transportation cask , trailer			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Radiological control of the trailer and of the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
Phase 6	Road transportation	UFTS	Road transportation of the Transportation cask from the Facility to the Road Rail Terminal			6.0
				Real time tracking	Appendix H	4.0
Phase 7	Road/Rail transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask and the rail car	Non contamination, Dose Rate	"Smear test", Radiameter	7.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the trailer to the rail car	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM or IFTC)	
				Lifting Beam for the Trans-portation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Rail car (Appendix A, Figure 16 **<3>**)	- The train is dedicated to movement of used fuel under exclusive use conditions; - Use of depressed centre, flat bed car; - Each flat car is loaded with two Transportation casks; - Each train equipped with locomotive and caboose; - The locomotive is assumed to have sufficient power to safely and efficiently haul the load.	
			Packaging tie-down on the rail car	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	
			Check the condition of the packaging, rail car			
			Fit the transport seals			

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.2
			Close the weather cover of the rail car	Weather cover		
			Radiological control of the rail car and of the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
Phase 8	Rail transportation	UFTS	Rail transportation of the Transportation cask from the road rail terminal to the rail road terminal			8.0
				Real time tracking	Appendix H	
Phase 9	Rail/Road transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car and the trailer	Non contamination, Dose Rate	"Smear test", Radiameter	9.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the rail car to the trailer	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	
				Lifting Beam for Transportation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Trailer (Appendix A, Figures N°13, 14)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with four axles - One loaded cask per trailer	
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC. (Appendix A, Figure N°15, **<3>**)	
			Check the condition of the Transportation cask, trailer			
			Close the weather cover	Weather cover		
			Radiological control of the trailer and of the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
			Fit the transport seals			
Phase 10	Road transportation	UFTS	Road transportation of the Transportation cask from the rail road terminal to the Centralised Facility			10.0
				Real time Tracking	Appendix H	
Phase 11	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the trailer			
Phase 12	Internal transfer of the packaging	DGR/CES				


PHASE 0
TRAYS IN WET BAYS
Step.0
PHASE 1
UNLOADING OF THE BUNDLES FROM TRAYS INTO THE MODULES
Step.1.0
PHASE 2
LOADING THE MODULES INTO THE PACKAGING IN THE POOL
Step.2.0
Step.2.1
PHASE 3
PRE-SHIPMENT PACKAGING PREPARATION
Step.3.0
Step.3.1
PHASE 4
INTERNAL TRANSFER OF THE PACKAGING
STEP.4.0
STEP.4.1
PHASE 5
LOADING THE TRANSPORTATION CASK ON A TRAILER
STEP.5.0
STEP.5.1
PHASE 6
ROAD TRANSPORTATION
STEP.6.0
PHASE 7
ROAD/RAIL TRANSFER OF THE TRANSPORTATION CASK
STEP.7.0
STEP.7.1
PHASE 8
RAIL TRANSPORTATION
STEP.8.0
PHASE 9
RAIL/ROAD TRANSFER OF THE TRANSPORTATION CASK
STEP.9.0
PHASE 10
ROAD TRANSPORTATION
STEP.10.0
BRUCE-TRAYS IN WET BAYS
MOSTLY RAIL
500276-01a


FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

3.3. Baskets in Silo (See Appendix B, Table N° 4)

From Douglas Point to the Centralised Facility
Quantity of bundles to be transported from 2035 to 2064: see Appendix B, Table N° 2.

3.3.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

Road: Road transport is clearly feasible from Bruce [**<52>**, **<53>**, **<27>**and **<54>**]. Public roadways are adequate to support transport from the site. Some strengthening of on-site roadways may be required to support the high volume of transports necessary for this portion of the shipping campaign. Such infrastructure improvements would be necessary for road transport, as well as to support transport to a railway or a waterway. Accordingly, such improvements are deemed necessary for the program.

Given the volume of used fuel to be transported to the site, use of the road mode would result in a larger number of individual shipments and offers the least potential for a consolidated transport program. The term “consolidated” refers to the physical consolidation of cargo into larger consignments as well as to the coordination of shipments between sites, according to the context.

Creation of two rail road terminals:

Example given Appendix G: Example of the COGEMA LOGISTICS road rail Terminal at Valognes.

3.3.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a rail car.

See phases 3, 4, 5 of paragraph 3.3.9 of the present document.

3.3.3. Transporter (vehicle)

3.3.3.1. Trolley with tractor

In order to transfer:

- The baskets from the silo to the packaging (phases 2 and 3 of table paragraph 3.3.9).

3.3.3.2. Bogie pulley drive system

In order to transfer:

- The IFTC/BM in the hot cell (phase 3 of table paragraph 3.3.9),
- The IFTC/BM to the pre-shipment packaging area (phase 4 of table paragraph 3.3.9),
- The IFTC/BM to the shipment area (phases 5 and 6 of table paragraph 3.3.9).

3.3.3.3. Rail car (phase 8 of table paragraph 3.3.9)

The sample rail transportation system is predicated on the following elements:

- The train is dedicated to movement of used fuel under exclusive use conditions;
- Use of depressed center, flat bed car see Appendix A, Figure N°16
- Each flat car is loaded with two IFTC/BMs or one DSCTP;
- Each train equipped with locomotive and caboose;
- The locomotive is assumed to have sufficient power to safely and efficiently haul the load.

3.3.3.4. Weather cover for the rail transportation (phase 8 of table paragraph 3.3.9)

- Rolling removable aluminium weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. One man can manually open or close the weather cover which can rolls on a rail fixed on the frame of the rail car.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts. The real time tracking system is placed on the two parts (See Appendix H).

3.3.3.5. Frame or support of the Transportation cask for the rail transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the frame of the rail car. This frame is fixed on the frame of the rail car with calculated fixations in the three directions to follow the regulations concerning the accelerations. The weather cover can rolls on a rail fixed on the frame of the rail car. A drip pan is installed under the frame of the rail car in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

3.3.3.6. Specific equipment for the road transportation

- GPS antenna (tracking) on the rail car (Appendix H)
- Tools box adapted to the Transportation cask

3.3.3.7. Specific equipment for the rail transportation

- GPS antenna (tracking) on the rail car (Appendix H)
- Tools box adapted to the Transportation cask

3.3.3.8. Trailer for the road transportation (phases 6, 10 of table paragraph 3.1.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic suspension to cushion the load
- Trailer equipped with four axles
- One loaded cask per trailer
- 2 drivers and no escort

3.3.3.9. Tractor for the road transportation (phases 6, 10 of table paragraph 3.1.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 9,075 kg.

3.3.3.10. Weather cover for the road transportation (phases 6, 10 of table paragraph 3.1.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can rolls on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

3.3.3.11. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.
The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

3.3.3.12. Specific equipment for the road transportation

- GPS antenna (tracking) on the tractor
- Turning light (“Girophare”) on the tractor
- Tools box adapted to the Transportation cask

3.3.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance equipment for IFTC/BM: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.

- Maintenance equipment for Rail car: shared facility at the centralised site (see paragraph 3.4 of Chapter 3).
-
- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

3.3.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: similar to the IFTC for road but adapted to the accelerations for rail.

- IFTC/BM: See chapter 2, section 2.4.7.1.3, Figure N° 6 of Appendix A, Appendix C.

3.3.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Leakage and purging equipment:
  One complete equipment with vacuum pumps and gauges (see phase 4 of table paragraph 3.3.9)

- Gantry Crane :
  One for installing the Transfer flask on the top of the hot cell (see phase 3 of table paragraph 3.3.9)
  One for loading the Transportation cask on the trailer (see phase 6 of table paragraph 3.3.9)
  One for loading the Transportation cask on the rail car (see phase 8 of table paragraph 3.3.9)

- Lifting beam :
  One for the Transfer flask (see phase 3 of table paragraph 3.3.9)
  One for the Transportation cask (see phases 6 and 8 of table paragraph 3.3.9)
  One for the impact limiter of the packaging (see phase 4 of table paragraph 3.3.9)

- Decontamination equipment (see paragraph 3.2. of Chapter 3).

3.3.7. UFTS Transportation system operation

Loading of packages onto the rail cars, security, transportation, emergency response:

- Loading of the Transportation cask onto the trailer, rail car, security, transportation as described in phases 6, 8, 10 of table paragraph 3.3.9.

- Emergency response plan : see paragraph 9 of Appendix E.

- Real time tracking: see paragraph 9 of Appendix E.

3.3.8. Decommissioning

Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

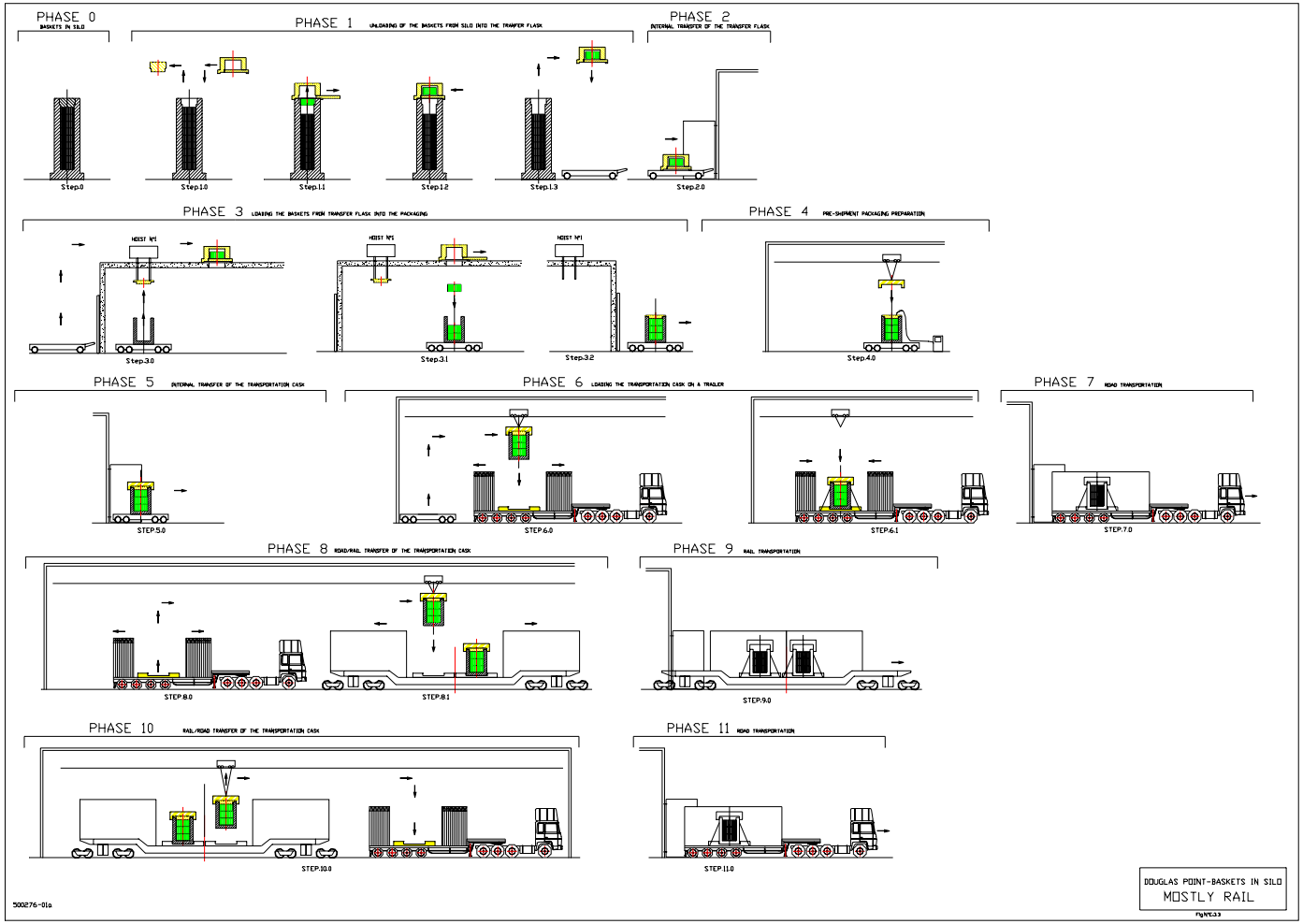
Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.2 of Chapter 3).

3.3.9. Table : Analysis of the operational phases of transport

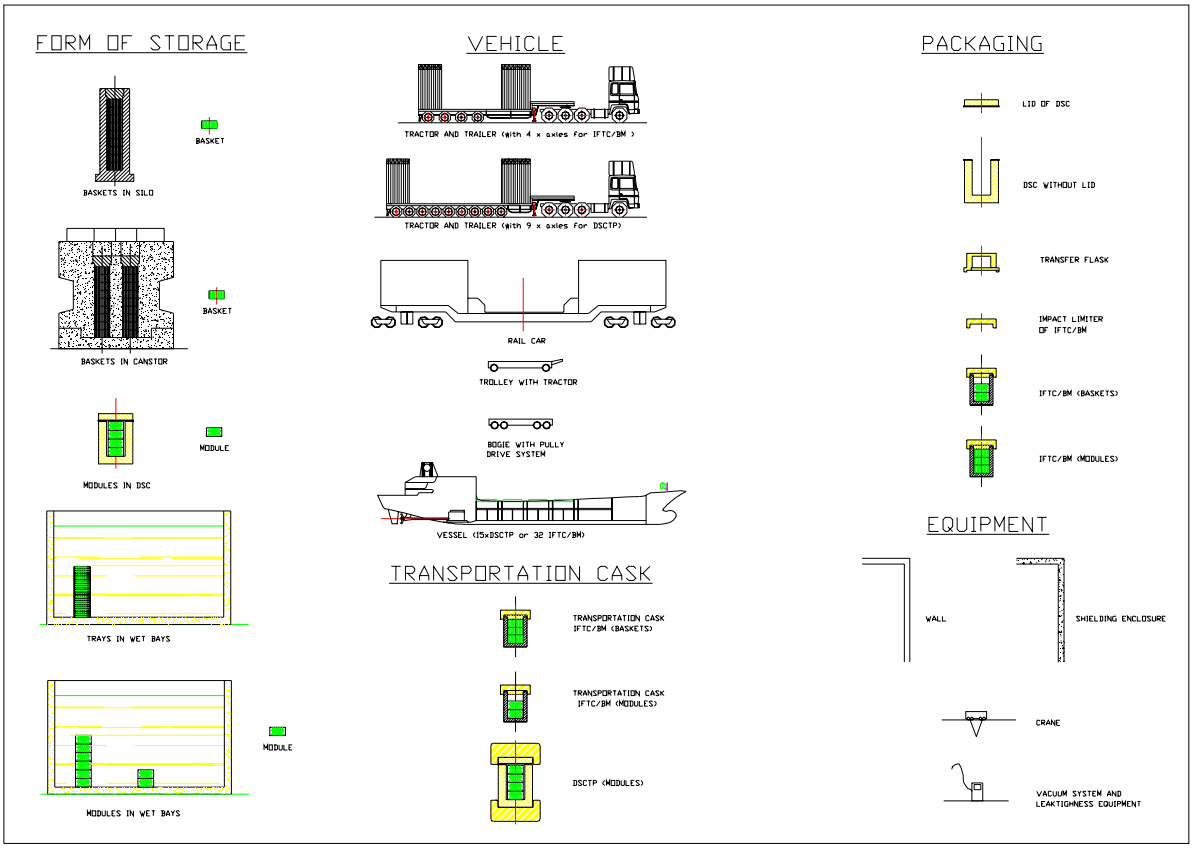
PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG N° E.3.3
Phase 0	Baskets in Silo	Interim storage	Initial phase			0
Phase 1	Unloading of the baskets from the Silo into the transfer flask	Interim storage				1.0, 1.1, 1.2, 1.3
Phase 2	Internal transfer of the transfer flask	Interim storage				2.0
Phase 3	Loading the baskets from the transfer flask into the packaging	UFTS	With a gantry crane , place the transfer flask on the hot cell	Transfer flask	Similar to Gentilly 2, Appendix A, Figure N°10: - Shielded fuel transfer cask - 26 tons with 60 bundles basket and with irradiated fuel - “Sliding” gate - Electric hoist for lifting or lowering a basket into the IFTC/BM - Chain - Basket lifting grapple - Shielding	3.0
				Gantry crane	For the Transfer flask	3.0
				Lifting Beam for Transfer flask		3.0
			With the hoist N°1, open the lid of the packaging in a hot cell.	Packaging	IFTC/BM : See chapter 2., section 2.4.7.1.3 of D#5 Appendix A, Figure N° 6	3.0
			Load the baskets into the packaging			3.1
Phase 4	Pre-shipment packaging preparation	UFTS	Drying the cavity	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves,	4.0
			Filling the cavity with helium	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves, compressed air line	
			Leaktightness check	Leaktightness equipement		
			Depressurising the cavity	Vacuum circuit		
			Installing the impact limiter			
Phase 5	Internal transfer of the packaging	UFTS	Radiological control of the Transportation cask	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Approach of the Bogie	Bogie	Bogie with pulley drive system	5.0
			Radiological control of the Bogie	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Loading of the full Transportation cask on the Bogie			5.0
			Radiological control of the Transportation cask and the Bogie	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Internal transfer	Tie down		5.1
Phase 6	Loading the Transportation cask on a trailer	UFTS	Radiological control of the Transportation cask and the trailer	Non contamination, Dose Rate	“Smear test”, Radiameter	6.0

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.3.3
			Open the weather cover	Weather cover		
			Loading the Transportation cask on a trailer	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	
				Lifting Beam for the Transportation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Trailer (Appendix A, Figures N°12, 13, 14	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with four axles - One loaded cask per trailer	
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	
			Check the condition of Transportation cask, trailer			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Radiological control of the trailer and the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
Phase 7	Road transportation	UFTS	Road transportation of the Transportation cask from facility to the road rail terminal			7.0
				Real Time Tracking	Appendix H	
Phase 8	Road/Rail transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car	Non contamination, Dose Rate	"Smear test", Radiameter	8.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the trailer to the rail car	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	
				Lifting Beam for Transpor-tation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Rail car (Appendix A, Figure N°16 **<3>**)	- The train is dedicated to movement of used fuel under exclusive use conditions; - Use of depressed centre, flat bed car; - Each flat car is loaded with two Transportation casks; - Each train equipped with locomotive and caboose; - The locomotive is assumed to have sufficient power to safely and efficiently haul the load.	

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.3.3
			Packaging tie-down on the rail car	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**) but for rail	
			Check the condition of the packaging, rail car			
			Fit the transport seals			
			Close the weather cover of the rail car	Weather cover		
			Radiological control of the rail car and the transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
Phase 9	Rail transportation	UFTS	Rail transportation of the Transportation cask from the road rail terminal to the rail road terminal			9.0
				Real Time Tracking	Appendix H	
Phase 10	Rail/Road transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car and the trailer	Non contamination, Dose Rate	"Smear test", Radiameter	7.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the rail car to the trailer	Gantry Crane	With 2 hoists (of 60 tons for the IFTC/BM)	
				Lifting Beam for Transpor-tation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Trailer (Appendix A, Figures N°13 , 14)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with for axles - One loaded cask per trailer	
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	
			Check the condition of the packaging, trailer			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Radiological control of the trailer and the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
Phase 11	Road transportation	UFTS	Road transportation of the Transportation cask from rail road terminal to the Centralised site			11.0
Phase 12	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the rail car			


PHASE 0
BASKETS IN SILO
PHASE 1
UNLOADING OF THE BASKETS FROM SILO INTO THE TRANFER FLASK
PHASE 2
INTERNAL TRANSFER OF THE TRANSFER FLASK
Step.0
Step.1.0
Step.1.1
Step.1.2
Step.1.3
Step.2.0
PHASE 3
LOADING THE BASKETS FROM TRANSFER FLASK INTO THE PACKAGING
PHASE 4
PRE-SHIPMENT PACKAGING PREPARATION
HOIST N°1
Step.3.0
Step.3.1
Step.3.2
Step.4.0
PHASE 5
INTERNAL TRANSFER OF THE TRANSPORTATION CASK
PHASE 6
LOADING THE TRANSPORTATION CASK ON A TRAILER
PHASE 7
ROAD TRANSPORTATION
STEP.5.0
STEP.6.0
STEP.6.1
STEP.7.0
PHASE 8
ROAD/RAIL TRANSFER OF THE TRANSPORTATION CASK
PHASE 9
RAIL TRANSPORTATION
STEP.8.0
STEP.8.1
STEP.9.0
PHASE 10
RAIL/ROAD TRANSFER OF THE TRANSPORTATION CASK
PHASE 11
ROAD TRANSPORTATION
STEP.10.0
STEP.11.0
500276-01a
DOUGLAS POINT-BASKETS IN SILO
MOSTLY RAIL

Key:


FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

4. PICKERING

4.1. Modules in DSC (See Appendix B, Table N° 8)

From PUFDSF to the Centralised Facility
Quantity of bundles to be transported from 2035 to 2064: see appendix B, Table N°2.

4.1.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

***Rail**:* Rail transport is generally feasible from the Pickering site [**<52>**, **<53>**, **<27>**and **<54>**]. The existing rail spur adjacent to the site could be extended closer to the dry cask storage area and the reactor pools. Cask handling equipment, such as suitable cranes, would need to be added to ensure sufficient lift power for loading of the rail cars.

Rail transport offers the ability to consolidate a larger number of casks per shipment than would road transport. Given the volumes involved for Pickering, consolidation has clear merits.

Creation of a rail road terminal:

Example given Appendix G: Example of the COGEMA LOGISTICS road rail Terminal at Valognes.

4.1.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a rail car.

See phases 1, 2 of paragraph 4.1.9 of the present document.

4.1.3. Transporter (vehicle)

4.1.3.1. Rail car (phase 3 of table paragraph 4.1.9)

The sample rail transportation system is predicated on the following elements:

- The train is dedicated to movement of used fuel under exclusive use conditions;
- Use of depressed center, flat bed car see Appendix A, Figure N°16;
- Each flat car is loaded with two IFTC/BMs or one DSCTP;
- Each train equipped with locomotive and caboose;
- The locomotive is assumed to have sufficient power to safely and efficiently haul the load.

4.1.3.2. Weather cover for the rail transportation (phase 3 of table paragraph 4.1.9)

- Rolling removable aluminium weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. One man can manually open or close the weather cover which can roll on a rail fixed on the frame of the rail car.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts. The real time tracking system is placed on the two parts (See Appendix H).

4.1.3.3. Specific equipment for the rail transportation

- GPS antenna (tracking) on the rail car (Appendix H)
- Tools box adapted to the Transportation cask

4.1.3.4. Trailer for the road transportation (phases 5, 6 of table paragraph 4.1.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic suspension to cushion the load
- Trailer equipped with nine axles
- One loaded cask per trailer
- 2 drivers and an escort (see section 3.5.1 Chapter 3)

4.1.3.5. Tractor for the road transportation (phases 5, 6 of table paragraph 4.1.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 11 t.

4.1.3.6. Weather cover for the road transportation (phases 5, 6 of table paragraph 4.1.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can rolls on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

4.1.3.7. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.
The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

4.1.3.8. Specific equipment for the road transportation

- GPS antenna (tracking) on the tractor
- Turning light (“Girophare”) on the tractor
- Tools box adapted to the Transportation cask

4.1.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance Equipment for DSCTP: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.
- Maintenance Equipment for Rail Car: shared facility at the centralised site (see paragraph 3.4 of Chapter 3).
- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).
- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

4.1.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: for DSCTP on rail car as described in **<8>**, Appendix A, Figure N° 17.
- DSCTP: See Chapter 2, section 2.4.7.1.3, Figure N° 8 of Appendix A, Appendix C.

4.1.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Gantry Crane:
  One for the pre-shipment of the packaging (see phase 2 of table paragraph 4.1.9) and one for loading the Transportation cask on the rail car (see phase 3 of table paragraph 4.1.9).
  One for the rail road transfer of the transportation cask (see phase 5 of table paragraph 4.1.9)
- Lifting beam:
  One for the packaging (see phase 2 of table paragraph 4.1.9)
  One for the impact limiter of the packaging (see phase 2 of table paragraph 4.1.9)
  One for the Transportation cask (see phase 5, of table paragraph 4.1.9)
- Decontamination equipment (see paragraph 3.2. of Chapter 3).

4.1.7. UFTS Transportation system operation

Loading of Transportation cask onto the rail car, trailer, security, transportation, emergency response:

- Loading of Transportation cask onto the rail car, the trailer security, transportation as described in phases 3, 5 of table paragraph 4.1.9.
- Emergency response plan: see paragraph 9 of Appendix E.
- Real time tracking: see paragraph 9 of Appendix E.

4.1.8. Decommissioning

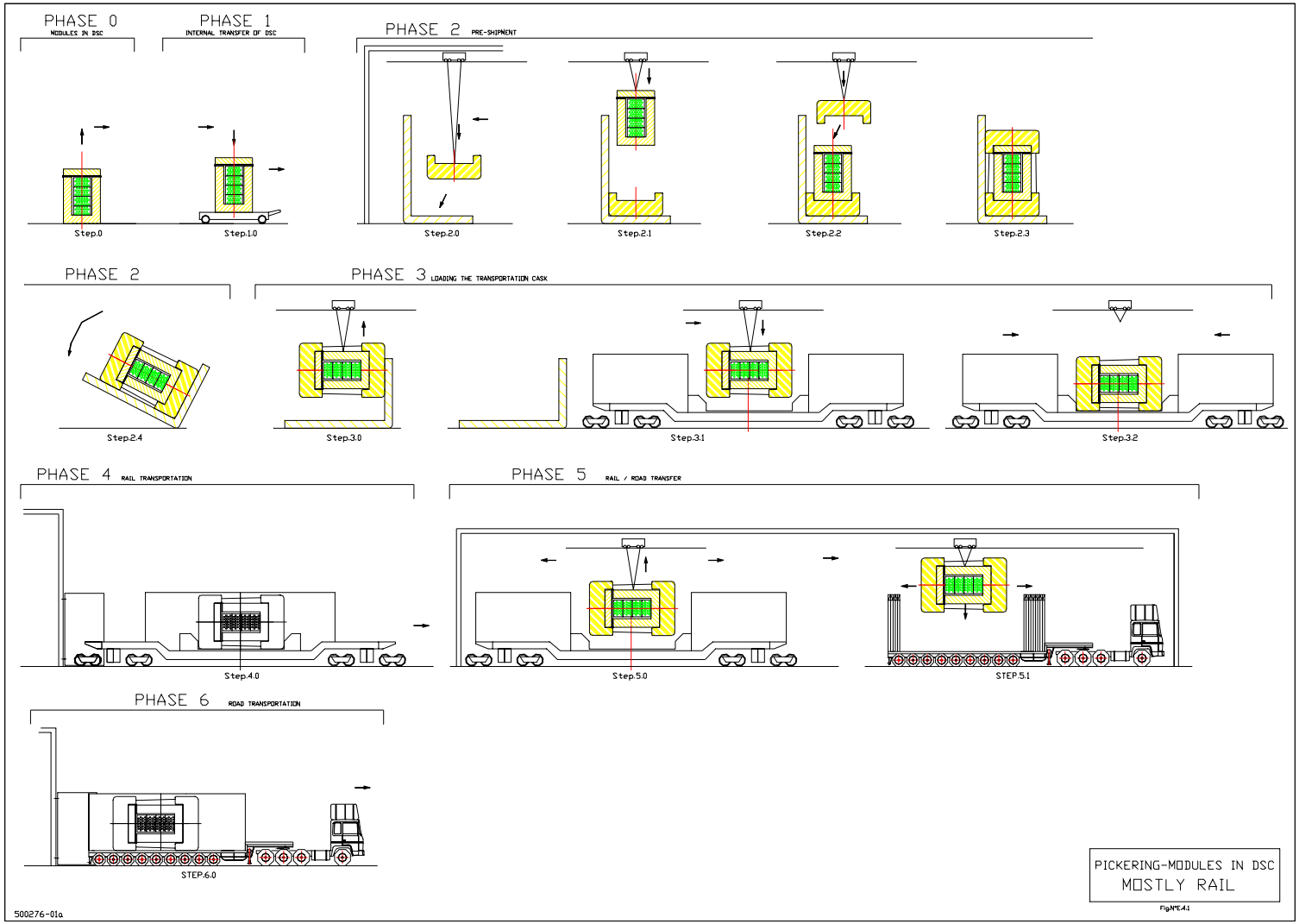
Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.2 of Chapter 3).

4.1.9. Table: Analysis of the operational phases of transport

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG N° E.4.1
Phase 0	Modules in DSC	Interim storage	Initial phase			0
Phase 1	Internal transfer of the DSC	Interim storage			DSC, Appendix A, Figure N°7	1.0
Phase 2	Pre-shipment packaging preparation <10>	UFTS	Radiological control of the packaging	Non contamination, Dose Rate	"Smear test", Radiameter	2.0
				Transportation cask	DSCTP, Appendix A, Figure N° 8	
				Weather cover		
			Load impact limiter onto rotation frame	Gantry crane	With 1 hoist (of 120 tons for the DSCTP)	2.0
				Rotation frame		
				Lifting Beam impact limiter		
			Place DSC in bottom impact limiter	Lifting Beam for packaging		2.1
			Place Top impact limiter			2.2
			Attach wire rape assemblies			2.3
			Rotate frame	Rotation equipment to rotate the frame		2.4
Phase 3	Loading the Transportation cask on a rail car **<8>**	UFTS	Open the weather cover of the railcar	Rail car (Appendix A, Figures N°16)	• The train is dedicated to movement of used fuel under exclusive use conditions; • Use of depressed center, flat bed car • Each flat car is loaded with one DSCTP; • Each train equipped with locomotive and caboose; • The locomotive is assumed to have sufficient power to safely and efficiently haul the load.	3.0
			Lift package in horizontal position	Gantry crane	120 tons	3.0
			Lower package onto railcar and tiedowns		Appendix A, Figure N°17	3.1
			Package loaded on railcar and tiedowns secured			3.2
			Check the condition of the packaging, rail car			3.2
			Close the weather cover	Weather cover		3.2
			Fit the transport seals			3.2
			Radiological control of the rail car	Non contamination, Dose Rate	"Smear test", Radiameter	3.2

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.4.1
Phase 4	Rail transportation	UFTS	Rail transportation of the Transportation cask from the site to the rail road terminal			4.0
				Real Time Tacking	Appendix H	4.0
Phase 5	Rail/Road transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car and the trailer	Non contamination, Dose Rate	"Smear test", Radiameter	5.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the rail car to the trailer	Gantry Crane	With 1 hoist (of 120 tons for the DSCTP)	
				Lifting Beam for Transportation cask	**<8>**	
				Trailer (Appendix A, Figure N°12,)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic suspension to cushion the load - Trailer equipped with nine axles - One loaded cask per trailer	
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 11 t.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the DSCTP for the rail (Appendix A, Figure N°17 , **<8>**)	
			Check the condition of the packaging, trailer			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Check the condition of the packaging, rail car			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Radiological control of the trailer and of the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
Phase 6	Road transportation	UFTS	Road transportation of the Transportation cask from the rail road terminal to the Centralised Facility			6.0
				Real time Tracking	Appendix H	
Phase 7	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the trailer			
Phase 8	Internal transfer of the packaging	DGR/CES				


PHASE 0
MODULES IN DSC
PHASE 1
INTERNAL TRANSFER OF DSC
PHASE 2
PRE-SHIPMENT
Step.0
Step.1.0
Step.2.0
Step.2.1
Step.2.2
Step.2.3
PHASE 2
PHASE 3
LOADING THE TRANSPORTATION CASK
Step.2.4
Step.3.0
Step.3.1
Step.3.2
PHASE 4
RAIL TRANSPORTATION
PHASE 5
RAIL / ROAD TRANSFER
Step.4.0
Step.5.0
STEP.5.1
PHASE 6
ROAD TRANSPORTATION
STEP.6.0
PICKERING-MODULES IN DSC
MOSTLY RAIL
FigNTE.4.1
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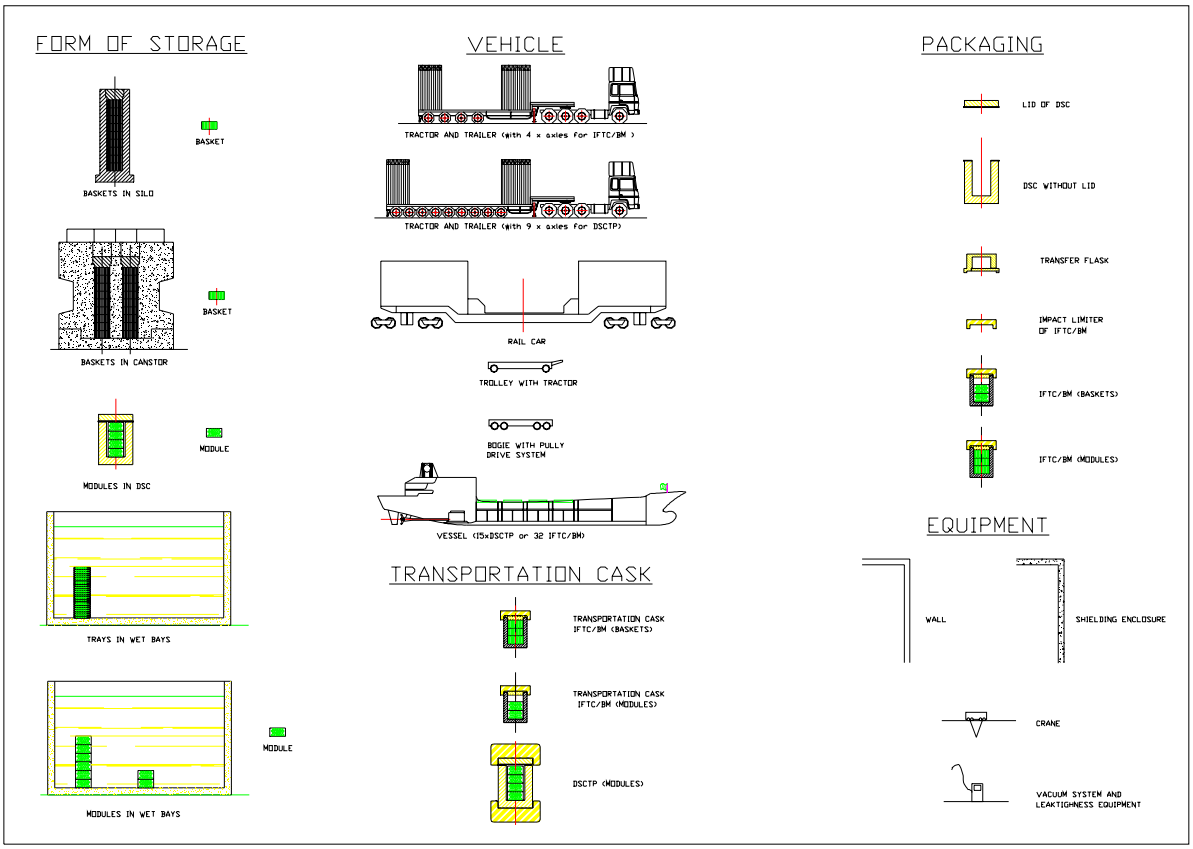

FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

4.2. Modules In wet bays (See Appendix B, Table N°7)

From Pickering to the Centralised Facility.
Quantity of bundles *to be transported* from 2035 to 2064: see Appendix B, Table N°2.

4.2.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

Rail: Rail transport is generally feasible from the Pickering site [**<52>**, **<53>**, **<27>**and **<54>**]. The existing rail spur adjacent to the site could be extended closer to the dry cask storage area and the reactor pools. Cask handling equipment, such as suitable cranes, would need to be added to ensure sufficient lift power for loading of the rail cars.

Rail transport offers the ability to consolidate a larger number of casks per shipment than would road transport. Given the volumes involved for Pickering, consolidation has clear merits.

Creation of a rail road terminal:

Example given Appendix G: Example of the COGEMA LOGISTICS road rail Terminal at Valognes.

4.2.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a rail car.

See phases 2, 3 of paragraph 4.2.9 of the present document.

4.2.3. Transporter (vehicle)

4.2.3.1. Trolley with tractor

In order to transfer:

- The full packaging from loading area of the packaging to the transportation area of the transportation cask (phases 1 to 4 of table paragraph 4.2.9).

4.2.3.2. Rail car (phase 4 of table paragraph 4.2.9)

The sample rail transportation system is predicated on the following elements:

- The train is dedicated to movement of used fuel under exclusive use conditions;
- Use of depressed center, flat bed car see Appendix A, Figure N°16;
- Each flat car is loaded with two IFTC/BMs or one DSCTP;
- Each train equipped with locomotive and caboose;
- The locomotive is assumed to have sufficient power to safely and efficiently haul the load.

4.2.3.3. Weather cover for the rail transportation (phase 4 of table paragraph 4.2.9)

- Rolling removable aluminium weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. One man can manually open or close the weather cover which can rolls on a rail fixed on the frame of the rail car.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts. The real time tracking system is placed on the two parts (See Appendix H).

4.2.3.4. Frame or support of the Transportation cask for the rail transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the frame of the rail car. This frame is fixed on the frame of the rail car with calculated fixations in the three directions to follow the regulations concerning the accelerations. The weather cover can rolls on a rail fixed on the frame of the rail car. A drip pan is installed under the frame of the rail car in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

4.2.3.5. Specific equipment for the rail transportation

- GPS antenna (tracking) on the rail car (Appendix H)
- Tools box adapted to the Transportation cask

4.2.3.6. Trailer for the road transportation (phase 6 of table paragraph 3.1.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic suspension to cushion the load
- Trailer equipped with four axles
- One loaded cask per trailer
- 2 drivers and no escort

4.2.3.7. Tractor for the road transportation (phase 6 of table paragraph 3.1.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 9,075 kg.

4.2.3.8. Weather cover for the road transportation (phase 6 of table paragraph 3.1.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can rolls on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

4.2.3.9. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.
The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

4.2.3.10. Specific equipment for the road transportation

- GPS antenna (tracking) on the tractor
- Turning light (“Girophare”) on the tractor
- Tools box adapted to the Transportation cask

4.2.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance equipment for IFTC/BM: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.

- Maintenance equipment for Rail car: shared facility at the centralised site (see paragraph 3.4 of Chapter 3).

- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

4.2.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: similar to the IFTC for road <**3** >, but adapted to the accelerations for rail.

- IFTC/BM: See chapter 2, section 2.4.7.1.3, Figure N° 5 of Appendix A, Appendix C.

4.2.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Leakage and purging equipment:
  One complete equipment with vacuum pumps and gauges (see phase 2 of table paragraph 4.2.9)

- Gantry Crane:
  One for the pre-shipment of the packaging (see phase 2 of table paragraph 4.2.9)
  One for loading the Transportation cask on the rail car (see phase 4 of table paragraph 4.2.9).
  One for loading the Transportation cask on the trailer (see phase 6 of table paragraph 4.2.9).

- Lifting beam:
  One for the packaging and Transportation cask (see phases 1 to 4 of table paragraph 4.2.9)
  One for the impact limiter of the packaging (see phase 3 of table paragraph 4.2.9)
  One for the Transportation cask (see phase 6 of table paragraph 4.2.9)

- Decontamination equipment (see paragraph 3.2 of Chapter 3).

4.2.7. UFTS Transportation system operation

Loading of packages onto the rail car, trailer, security, transportation, emergency response:

- Loading of the Transportation cask onto the rail car, trailer, security, transportation as described in phases 4, 6 of table paragraph 4.2.9.

- Emergency response plan: see paragraph 9 of Appendix E.

- Real time tracking: see paragraph 9 of Appendix E.

4.2.8. Decommissioning

Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

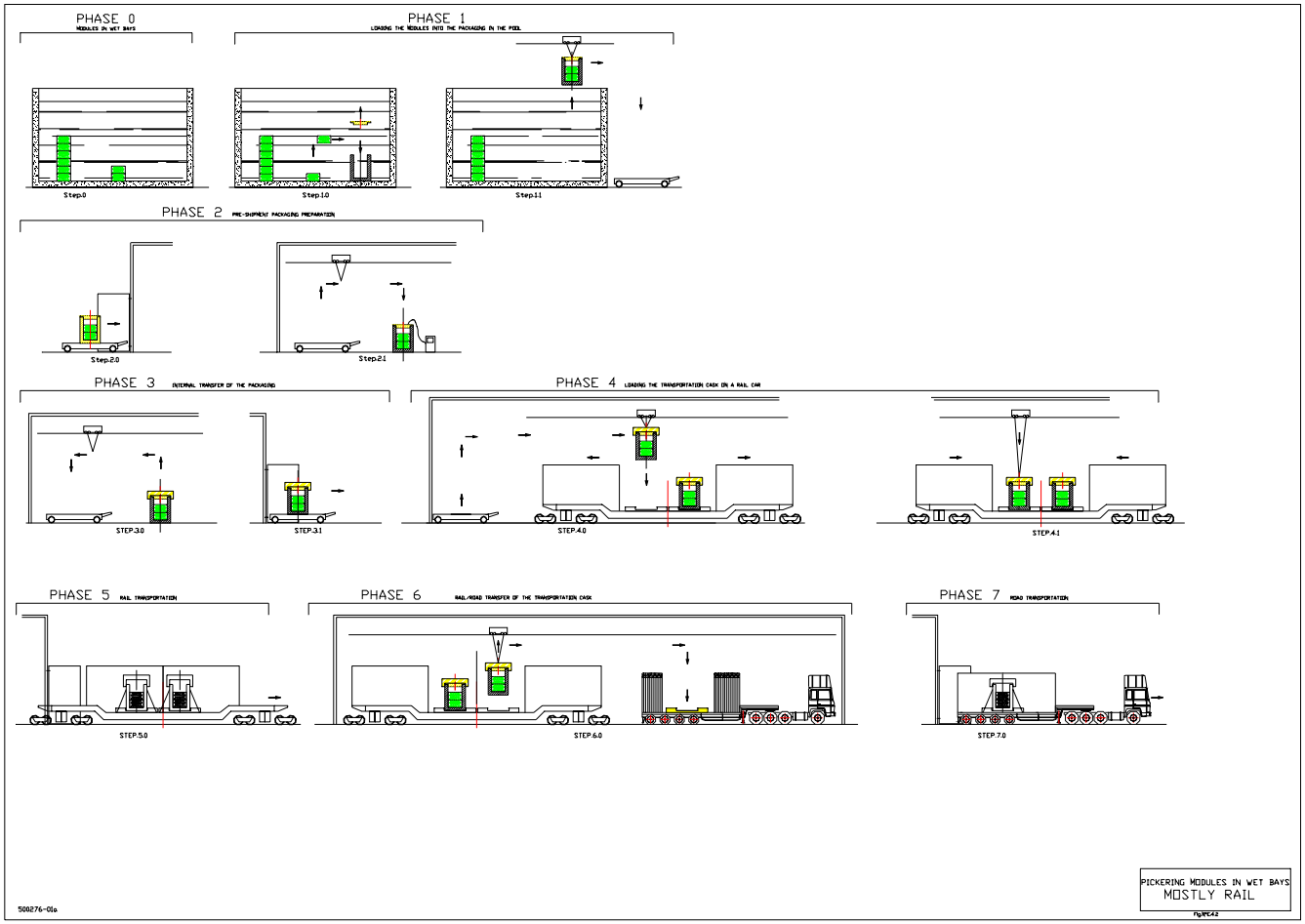
Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.2 of Chapter 3).

4.2.9. Table: Analysis of the operational phases of transport

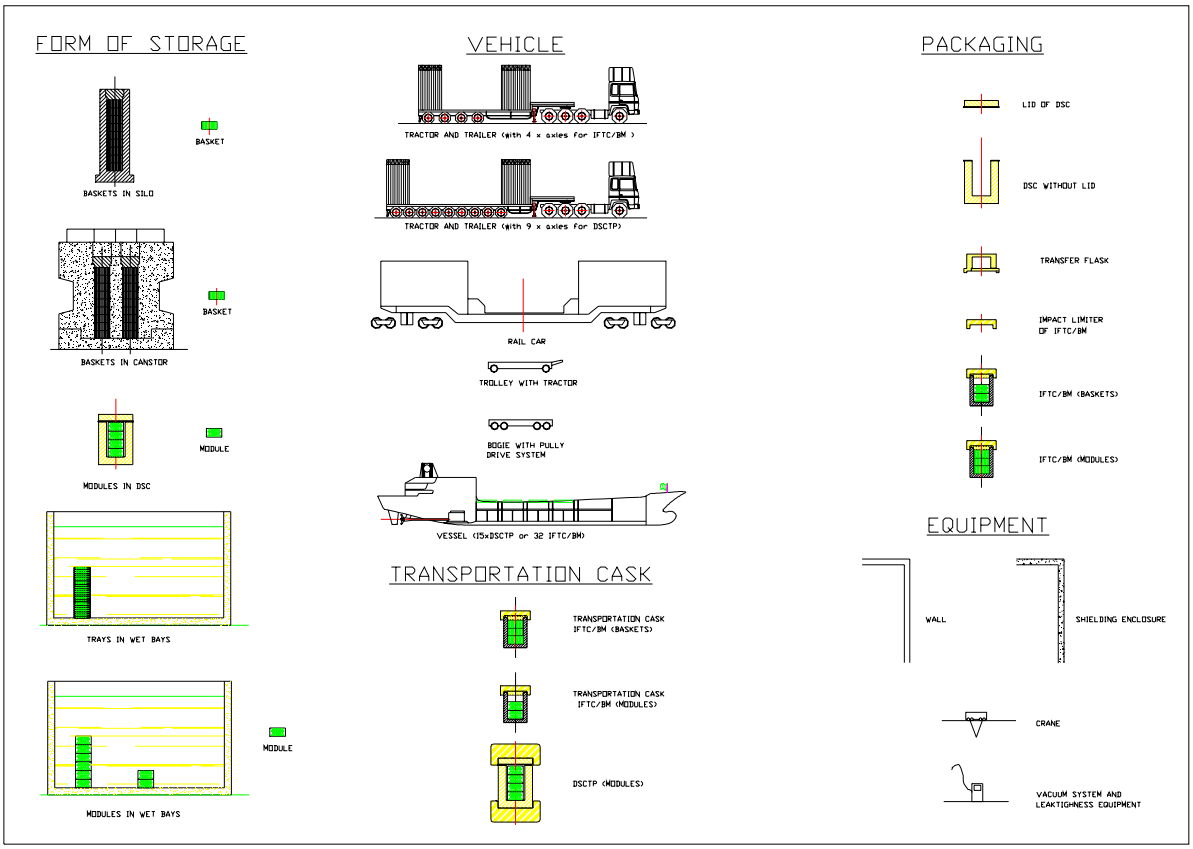
PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.4.2
Phase 0	Modules in wet bays	Interim storage	Initial phase			0
Phase 1	Loading the modules into the packaging in the pool	UFTS			Identical than the IFCT in the pool Decontamination of the IFTC/BM: identical as IFTC **<3>**	2.0, 2.1
				Packaging	IFTC/BM: See chapter 2., section 2.4.7.1.3 of D#5 Appendix A, Figure N° 5	
Phase 2	Pre-shipment packaging preparation	UFTS	Unloading the packaging from the trolley	Gantry crane	60 tons	2.1
			Drainage			2.0, 2.1
			Drying the cavity	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves,	
			Filling the cavity with helium	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves, compressed air line	
			Leaktightness check	Leaktightness equipement		
			Depressurising the cavity	Vacuum circuit		
Phase 3	Internal transfer of the packaging	UFTS	Radiological control of the packaging	Non contamination, Dose Rate	“Smear test”, Radiameter	3.0, 3.1
			Approach of the Trolley	Trolley	Trolley with tractor	
			Radiological control of the Trolley	Non contamination, Dose Rate	“Smear test”, Radiameter	
			Installing the impact limiter	Lifting beam for the impact limiter		
			Loading of the full Transportation cask on the Trolley			
			Radiological control of the Transportation cask and the Trolley	Non contamination, Dose Rate	“Smear test”, Radiameter	
			Internal transfer	Tie down		
Phase 4	Loading the Transportation cask on a rail car	UFTS	Radiological control of the Transportation cask and the rail car	Non contamination, Dose Rate	“Smear test”, Radiameter	4.0
			Open the weather cover	Weather cover		4.0
			Loading the Transportation cask on a rail car	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	4.0
				Lifting Beam for Transportation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	4.0

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.4.2
				Rail car (Appendix A, Figure 16 **<3>**)	- The train is dedicated to movement of used fuel under exclusive use conditions; - Use of depressed centre, flat bed car; - Each flat car is loaded with two Transportation casks; - Each train equipped with locomotive and caboose; - The locomotive is assumed to have sufficient power to safely and efficiently haul the load.	40
			Packaging tie-down on the rail car	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**) but for the rail	4.1
			Check the condition of the Transportation cask , rail car			4.1
			Fit the transport seals			4.1
			Close the weather cover	Weather cover		4.1
			Radiological control of the rail car and the Transportation cask	Non contamination, Dose Rate	“Smear test”, Radiameter	4.1
Phase 5	Rail transportation	UFTS	Rail transportation of the Transportation cask from the site to the rail road terminal			5.0
				Real Time Tracking	Appendix H	5.0
Phase 6	Rail/Road transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car and the trailer	Non contamination, Dose Rate	“Smear test”, Radiameter	6.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the rail car to the trailer	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	
				Lifting Beam for Transportation cask	To carry of the IFTC/BM or IFTC (similar to the IFTC, **<3>)**	
				Trailer (Appendix A, Figures N°13, 14)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with four axles - One loaded cask per trailer	
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	
			Check the condition of the packaging, trailer			
			Fit the transport seals			

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.4.2
			Close the weather cover	Weather cover		
			Check the condition of the packaging, rail car			
			Radiological control of the trailer and of the Transportation cask	Non contamination, Dose Rate	“Smear test”, Radiameter	
Phase 7	Road transportation	UFTS	Road transportation of the Transportation cask from the rail road terminal to the Centralised Facility			7.0
				Real time Tracking	Appendix H	
Phase 8	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the trailer			
Phase 9	Internal transfer of the packaging	DGR/CES				


PHASE 0
MODULES IN WET BAYS
Step.0
PHASE 1
LOADING THE MODULES INTO THE PACKAGING IN THE POOL
Step.1.0
Step.1.1
PHASE 2
PRE-SHIPMENT PACKAGING PREPARATION
Step.2.0
Step.2.1
PHASE 3
INTERNAL TRANSFER OF THE PACKAGING
STEP.3.0
STEP.3.1
PHASE 4
LOADING THE TRANSPORTATION CASK ON A RAIL CAR
STEP.4.0
STEP.4.1
PHASE 5
RAIL TRANSPORTATION
STEP.5.0
PHASE 6
RAIL/ROAD TRANSFER OF THE TRANSPORTATION CASK
STEP.6.0
PHASE 7
ROAD TRANSPORTATION
STEP.7.0
500276-01a
PICKERING MODULES IN WET BAYS
MOSTLY RAIL

Key:


FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

5. DARLINGTON

5.1. Modules in DSC (See Appendix B, Table N°8)

From DUFDSF to the Centralised Facility
Quantity of bundles to be transported from 2035 to 2064: see appendix B, Table N°2.

5.1.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

Rail: Rail access exists to the Darlington site [**<52>**, **<53>**, **<27>**and **<54>**]. There is a rail siding relatively close to the proposed site area for Darlington Used Fuel Storage facility. Minor infrastructure improvements would allow extension of the siding directly to the storage facility.

At present, there is no loading capability at the rail siding, nor does Darlington currently possess mobile cranes. Heavy lift capability would need to be added in order to further the rail transport option.

Rail transport offers the ability to consolidate a larger number of casks per shipment than would road transport. Given the volumes involved for Darlington, consolidation has clear merits.

Creation of a rail road terminal:

Example given Appendix G: Example of the COGEMA LOGISTICS road rail Terminal at Valognes.

5.1.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a rail car.

See phases 1, 2 of paragraph 5.1.9 of the present document.

5.1.3. Transporter (vehicle)

5.1.3.1. Rail car (phase 3 of table paragraph 5.1.9)

The sample rail transportation system is predicated on the following elements:

- The train is dedicated to movement of used fuel under exclusive use conditions;
- Use of depressed center, flat bed car see Appendix A, Figure N°16;
- Each flat car is loaded with two IFTC/BMs or one DSCTP;
- Each train equipped with locomotive and caboose;
- The locomotive is assumed to have sufficient power to safely and efficiently haul the load.

5.1.3.2. Weather cover for the rail transportation (phase 3 of table paragraph 5.1.9)

- Rolling removable aluminium weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. One man can manually open or close the weather cover which can rolls on a rail fixed on the frame of the rail car.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts. The real time tracking system is placed on the two parts (See Appendix H).

5.1.3.3. Specific equipment for the rail transportation

- GPS antenna (tracking) on the rail car (Appendix H)
- Tools box adapted to the Transportation cask

5.1.3.4. Trailer for the road transportation (phases 5, 6 of table paragraph 5.1.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic suspension to cushion the load
- Trailer equipped with nine axles
- One loaded cask per trailer
- 2 drivers and an escort (see section 3.5.1 Chapter 3)

5.1.3.5. Tractor for the road transportation (phases 5, 6 of table paragraph 5.1.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 11 t.

5.1.3.6. Weather cover for the road transportation (phases 5, 6 of table paragraph 5.1.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can rolls on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

5.1.3.7. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.
The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

5.1.3.8. Specific equipment for the road transportation

- GPS antenna (tracking) on the tractor
- Turning light (“Girophare”) on the tractor
- Tools box adapted to the Transportation cask

5.1.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance equipment for DSCTP: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.

- Maintenance equipment for Rail car: shared facility at the centralised site (see paragraph 3.4 of Chapter 3).

- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

5.1.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: for DSCTP on rail car as described in **<8>**, Appendix A, Figure N° 17.

- DSCTP: See Chapter 2, section 2.4.7.1.3, Figure N° 8 of Appendix A, Appendix C.

5.1.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Gantry Crane:
  One for the pre-shipment of the packaging (see phase 2 of table paragraph 5.1.9) and one for loading the Transportation cask on the rail car (see phase 3 of table paragraph 5.1.9).
  One for the rail road transfer of the transportation cask (see phase 5 of table paragraph 5.1.9)

- Lifting beam:
  One for the packaging (see phase 2 of table paragraph 5.1.9)
  One for the impact limiter of the packaging (see phase 2 of table paragraph 5.1.9)
  One for the Transportation cask (see phase 5 of table paragraph 5.1.9)

- Decontamination equipment (see paragraph 3.2 of Chapter 3).

5.1.7. UFTS Transportation system operation

Loading of Transportation cask onto the rail car, trailer, security, transportation, emergency response:

- Loading of Transportation cask onto the rail car, the trailer security, transportation as described in phases 3, 5 of table paragraph 5.1.9.
- Emergency response plan: see paragraph 9 of Appendix E.
- Real time tracking: see paragraph 9 of Appendix E.

5.1.8. Decommissioning

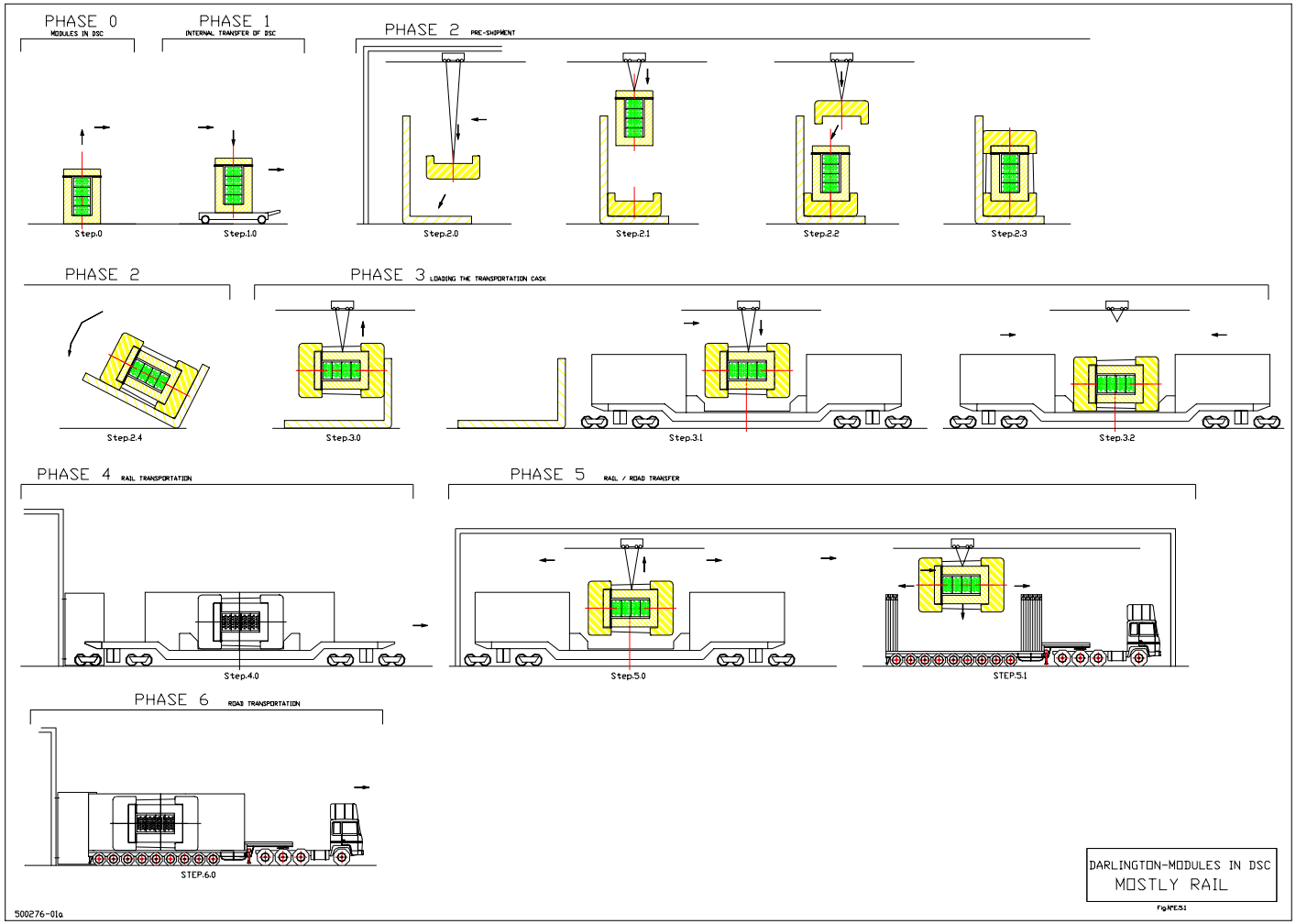
Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.2 of Chapter 3).

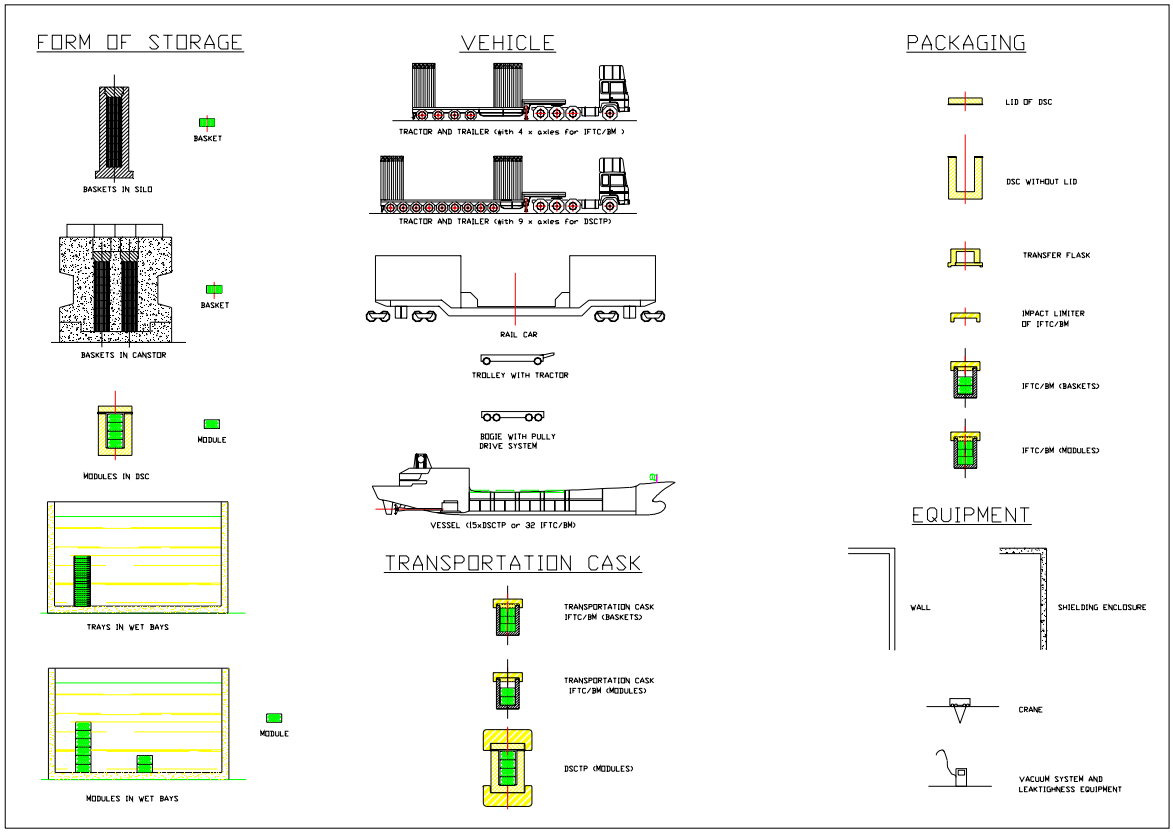
5.1.9. Table : Analysis of the operational phases of transport

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG N° E.5.1
Phase 0	Modules in DSC	Interim storage	Initial phase			0
Phase 1	Internal transfer of the DSC	Interim storage			DSC, Appendix A, Figure N°7	1.0
Phase 2	Pre-shipment packaging preparation **<8>**	UFTS	Radiological control of the packaging	Non contamination, Dose Rate	"Smear test", Radiameter	2.0
				Transportation cask	DSCTP, Appendix A, Figure N° 8	
				Weather cover		
			Load impact limiter onto rotation frame	Gantry crane	With 1 hoist (of 120 tons for the DSCTP)	2.0
				Rotation frame		
				Lifting Beam impact limiter		
			Place DSC in bottom impact limiter	Lifting Beam for packaging		2.1
			Place Top impact limiter			2.2
			Attach wire rape assemblies			2.3
			Rotate frame	Rotation equipment to rotate the frame		2.4
Phase 3	Loading the Transportation cask on a rail car **<8>**	UFTS	Open the weather cover of the railcar	Rail car (Appendix A, Figures N°16)	• The train is dedicated to movement of used fuel under exclusive use conditions; • Use of depressed center, flat bed car • Each flat car is loaded with one DSCTP; • Each train equipped with locomotive and caboose; • The locomotive is assumed to have sufficient power to safely and efficiently haul the load.	
			Lift package in horizontal position	Gantry crane	120 tons	3.0
			Lower package onto railcar and tiedowns		Appendix A, Figure N°17	3.1
			Package loaded on railcar and tiedowns secured			3.2
			Check the condition of the packaging, rail car			
			Close the weather cover	Weather cover		3.2
			Fit the transport seals			3.2

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.5.1
			Radiological control of the rail car	Non contamination, Dose Rate	"Smear test", Radiameter	3.2
Phase 4	Rail transportation	UFTS	Rail transportation of the Transportation cask from the site to the rail road terminal			4.0
				Real Time Tacking	Appendix H	4.0
Phase 5	Rail/Road transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car and the trailer	Non contamination, Dose Rate	"Smear test", Radiameter	5.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the rail car to the trailer	Gantry Crane	With 1 hoist (of 120 tons for the DSCTP)	
				Lifting Beam for Transportation cask	**<8>**	
				Trailer (Appendix A, Figure N°12,)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic suspension to cushion the load - Trailer equipped with nine axles - One loaded cask per trailer	
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 11 t.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the DSCTP for the rail (Appendix A, Figure N°17 , **<8>**)	
			Check the condition of the packaging, trailer			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Check the condition of the packaging, rail car			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Radiological control of the trailer and of the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
Phase 6	Road transportation	UFTS	Road transportation of the Transportation cask from the rail road terminal to the Centralised Facility			6.0
				Real time Tracking	Appendix H	
Phase 7	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the trailer			
Phase 8	Internal transfer of the packaging	DGR/CES				


PHASE 0
MODULES IN DSC
PHASE 1
INTERNAL TRANSFER OF DSC
PHASE 2 PRE-SHIPMENT
Step.0
Step.1.0
Step.2.0
Step.2.1
Step.2.2
Step.2.3
PHASE 2
PHASE 3 LOADING THE TRANSPORTATION CASK
Step.2.4
Step.3.0
Step.3.1
Step.3.2
PHASE 4 RAIL TRANSPORTATION
PHASE 5 RAIL / ROAD TRANSFER
Step.4.0
Step.5.0
STEP.5.1
PHASE 6 ROAD TRANSPORTATION
STEP.6.0
DARLINGTON-MODULES IN DSC
MOSTLY RAIL
FIGURE 5.1
500276-01a

Key:


FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

5.2. Modules In wet bays (See Appendix B, Table N° 7)

From Darlington to the Centralised Facility
Quantity of bundles *to be transported* from 2035 to 2064: see Appendix B, Table N° 2.

5.2.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

Rail: Rail access exists to the Darlington site [**<52>**, **<53>**, **<27>**and **<54>**]. There is a rail siding relatively close to the proposed site area for Darlington Used Fuel Storage facility. Minor infrastructure improvements would allow extension of the siding directly to the storage facility.

At present, there is no loading capability at the rail siding, nor does Darlington currently possess mobile cranes. Heavy lift capability would need to be added in order to further the rail transport option.

Rail transport offers the ability to consolidate a larger number of casks per shipment than would road transport. Given the volumes involved for Darlington, consolidation has clear merits.

5.2.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a rail car.

See phases 2, 3 of paragraph 5.2.9 of the present document.

5.2.3. Transporter (vehicle)

5.2.3.1. Trolley with tractor

In order to transfer:

- The full packaging from loading area of the packaging to the transportation area of the transportation cask (phases 1 to 4 of table paragraph 5.2.9).

5.2.3.2. Rail car (phase 4 of table paragraph 5.2.9)

The sample rail transportation system is predicated on the following elements:

- The train is dedicated to movement of used fuel under exclusive use conditions;
- Use of depressed center, flat bed car see Appendix A, Figure N°16;
- Each flat car is loaded with two IFTC/BMs or one DSCTP;
- Each train equipped with locomotive and caboose;
- The locomotive is assumed to have sufficient power to safely and efficiently haul the load.

5.2.3.3. Weather cover for the rail transportation (phase 4 of table paragraph 5.2.9)

- Rolling removable aluminium weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. One man can manually open or close the weather cover which can rolls on a rail fixed on the frame of the rail car.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts. The real time tracking system is placed on the two parts (See Appendix H).

5.2.3.4. Frame or support of the Transportation cask for the rail transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the frame of the rail car. This frame is fixed on the frame of the rail car with calculated fixations in the three directions to follow the regulations concerning the accelerations. The weather cover can rolls on a rail fixed on the frame of the rail car. A drip pan is installed under the frame of the rail car in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

5.2.3.5. Specific equipment for the rail transportation

- GPS antenna (tracking) on the rail car (Appendix H)
- Tools box adapted to the Transportation cask

5.2.3.6. Trailer for the road transportation (phase 6 of table paragraph 3.1.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic suspension to cushion the load
- Trailer equipped with four axles
- One loaded cask per trailer
- 2 drivers and no escort

5.2.3.7. Tractor for the road transportation (phase 6 of table paragraph 3.1.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 9,075 kg.

5.2.3.8. Weather cover for the road transportation (phase 6 of table paragraph 3.1.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can rolls on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

5.2.3.9. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.
The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

5.2.3.10. Specific equipment for the road transportation

- GPS antenna (tracking) on the tractor
- Turning light (“Girophare”) on the tractor
- Tools box adapted to the Transportation cask

5.2.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance equipment for IFTC/BM: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.

- Maintenance equipment for Rail car: shared facility at the centralised site (see paragraph 3.4 of Chapter 3).

- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

5.2.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: similar to the IFTC for road **<3** >, but adapted to the accelerations for rail.

- IFTC/BM: See chapter 2, section 2.4.7.1.3, Figure N° 5 of Appendix A, Appendix C.

5.2.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Gantry Crane:
  One for the pre-shipment of the packaging (see phase 2 of table paragraph 5.2.9)
  One for loading the Transportation cask on the rail car (see phase 4 of table paragraph 5.2.9).
  One for loading the Transportation cask on the trailer (see phase 6 of table paragraph 5.2.9).

- Lifting beam:
  One for the packaging and Transportation cask (see phases 1 to 4 of table paragraph 5.2.9)
  One for the impact limiter of the packaging (see phase 3 of table paragraph 5.2.9)
  One for the Transportation cask (see phase 6 of table paragraph 5.2.9)

- Decontamination equipment (see paragraph 3.2 of Chapter 3).

5.2.7. UFTS Transportation system operation

Loading of packages onto the rail car, trailer, security, transportation, emergency response:

- Loading of the Transportation cask onto the rail car, trailer, security, transportation as described in phases 4, 6 of table paragraph 5.2.9.

- Emergency response plan: see paragraph 9 of Appendix E.

- Real time tracking: see paragraph 9 of Appendix E.

5.2.8. Decommissioning

Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

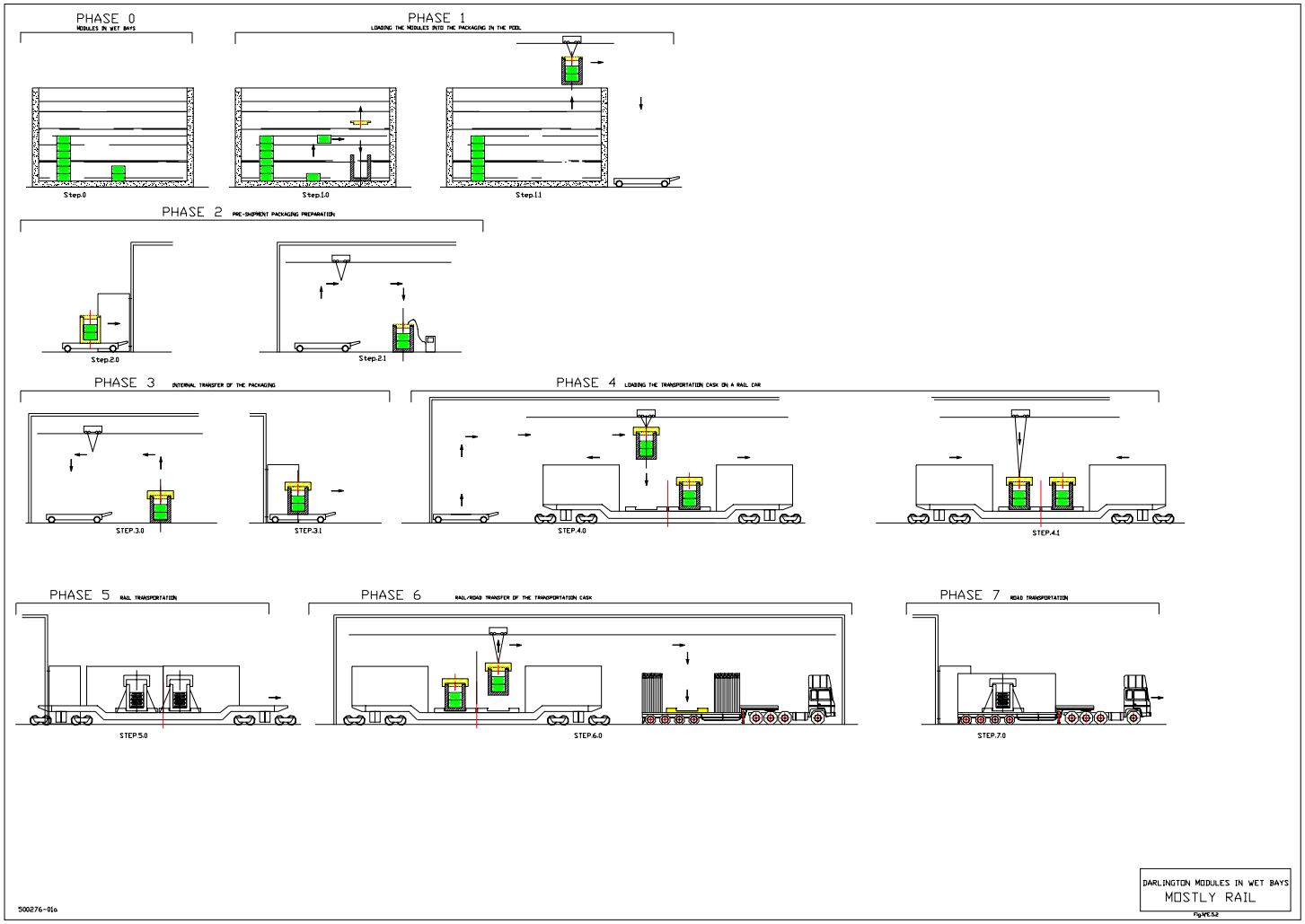
Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.2 of Chapter 3).

5.2.9. Table : Analysis of the operational phases of transport

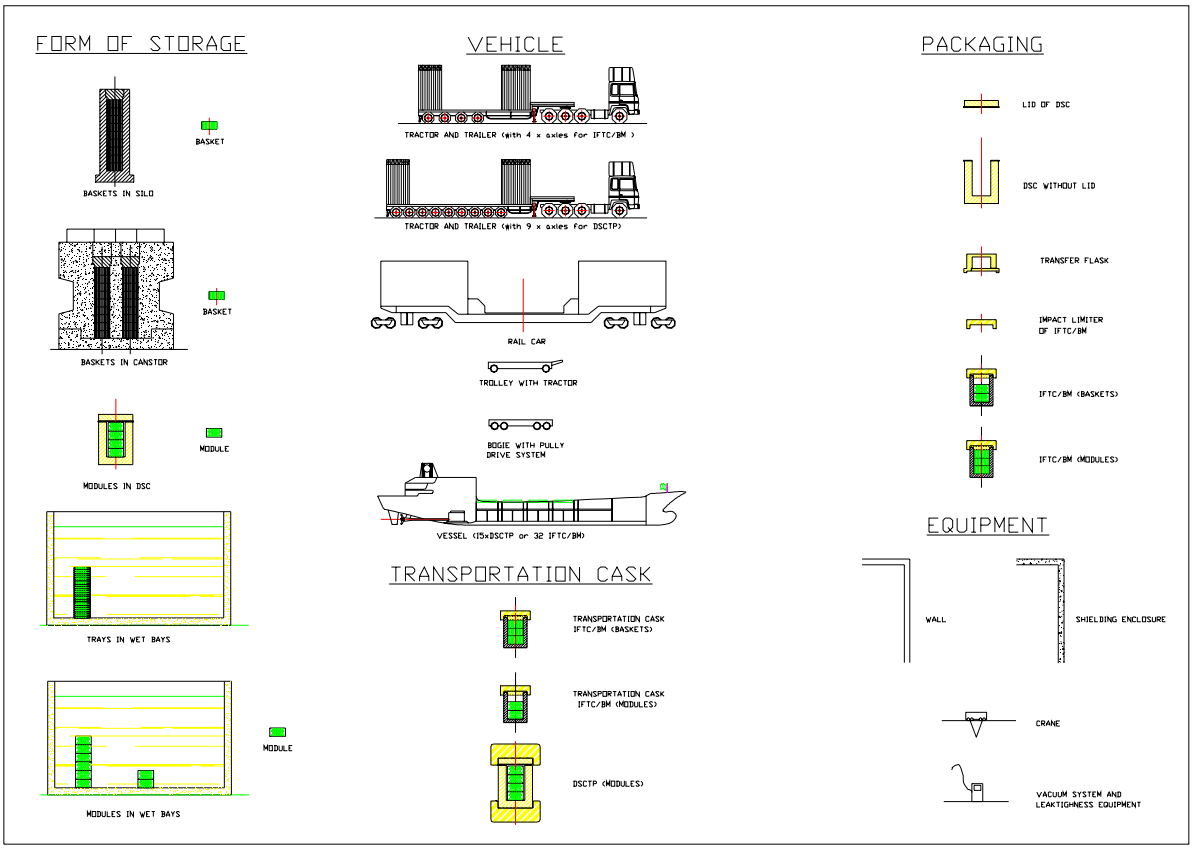
PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG N° E.5.2
Phase 0	Modules in wet bays	Interim storage	Initial phase			0
Phase 1	Loading the modules into the packaging in the pool	UFTS	Loading the modules into the packaging in the pool		Identical than the IFCT in the pool Decontamination of the IFTC/BM: identical as IFTC **<3>**	2.0, 2.1
				Packaging	IFTC/BM: See chapter 2., section 2.4.7.1.3 of D#5 Appendix A, Figure N° 5	
Phase 2	Pre-shipment packaging preparation	UFTS	Unloading the packaging from the trolley	Gantry crane	60 tons	
			Drainage			2.0, 2.1
			Drying the cavity	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves,	
			Filling the cavity with helium	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves, compressed air line	
			Leaktightness check	Leaktightness equipement		
			Depressurising the cavity	Vacuum circuit		
Phase 3	Internal transfer of the packaging	UFTS	Radiological control of the packaging	Non contamination, Dose Rate	“Smear test”, Radiameter	3.0, 3.1
			Approach of the Trolley	Trolley	Trolley with tractor	
			Radiological control of the Trolley	Non contamination, Dose Rate	“Smear test”, Radiameter	
			Installing the impact limiter	Lifting beam of the impact limiter		
			Loading of the full Transportation cask on the vehicle			
			Radiological control of the Transportation cask and the Trolley	Non contamination, Dose Rate	“Smear test”, Radiameter	
			Internal transfer	Tie down		
Phase 4	Loading the Transportation cask on a rail car	UFTS	Radiological control of the Transportation cask and the rail car	Non contamination, Dose Rate	“Smear test”, Radiameter	4.0
			Open the weather cover	Weather cover		4.0
			Loading the Transportation cask on a rail car	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	4.0
				Lifting Beam for the Transportation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	4.0

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.5.2
				Rail car (Appendix A, Figure 16 **<3>**)	- The train is dedicated to movement of used fuel under exclusive use conditions; - Use of depressed centre, flat bed car; - Each flat car is loaded with two Transportation casks; - Each train equipped with locomotive and caboose; - The locomotive is assumed to have sufficient power to safely and efficiently haul the load.	40
			Packaging tie-down on the rail car	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	4.1
			Check the condition of the Transportation cask, rail car			4.1
			Fit the transport seals			4.1
			Close the weather cover	Weather cover		4.1
			Radiological control of the rail car and the Transportation cask	Non contamination, Dose Rate	“Smear test”, Radiameter	4.1
Phase 5	Rail transportation	UFTS	Rail transportation of the Transportation cask from the site to the rail road terminal			5.0
				Real Time Tracking	Appendix H	5.0
Phase 6	Rail/Road transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car and the trailer	Non contamination, Dose Rate	“Smear test”, Radiameter	6.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the rail car to the trailer	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	
				Lifting Beam for Transpor-tation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Trailer (Appendix A, Figures N°13, 14)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with four axles - One loaded cask per trailer	
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	
			Check the condition of the packaging, trailer			
			Fit the transport seals			

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.5.2
			Close the weather cover	Weather cover		
			Check the condition of the packaging, rail car			
			Radiological control of the trailer and of the Transportation cask	Non contamination, Dose Rate	“Smear test”, Radiameter	
Phase 7	Road transportation	UFTS	Road transportation of the Transportation cask from the rail road terminal to the Centralised Facility			7.0
				Real time Tracking	Appendix H	
Phase 8	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the trailer			
Phase 9	Internal transfer of the packaging	DGR/CES				


PHASE 0
MODULES IN WET BAYS
PHASE 1
LOADING THE MODULES INTO THE PACKAGING IN THE POOL
Step.0
Step.1.0
Step.1.1
PHASE 2
PRE-SHIPMENT PACKAGING PREPARATION
Step.2.0
Step.2.1
PHASE 3
INTERNAL TRANSFER OF THE PACKAGING
PHASE 4
LOADING THE TRANSPORTATION CASK IN A RAIL CAR
STEP.3.0
STEP.3.1
STEP.4.0
STEP.4.1
PHASE 5
RAIL TRANSPORTATION
PHASE 6
RAIL/ROAD TRANSFER OF THE TRANSPORTATION CASK
PHASE 7
ROAD TRANSPORTATION
STEP.5.0
STEP.6.0
STEP.7.0
500276-01a
DARLINGTON MODULES IN WET BAYS
MOSTLY RAIL

Key:


FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

6. POINT LEPREAU

Baskets in Silo (See Appendix B, Table N° 4)
From Point Lepreau to the Centralised Facility
Quantity of bundles to be transported from 2035 to 2064: see Appendix B, Table N°2.

6.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

Rail: The Point Lepreau site does not have a rail siding. The closest rail into the nearby city of Saint Johns is privately owned. More significantly, however, the line crosses into the State of Maine in the United States before crossing back into Canadian territory [**<52>**, **<53>**, **<27>**and **<54>**]. While transit through the United States is technically feasible, the moderate benefits presented by rail transport may not justify the international shipment.

The next closest rail line is in Moncton, roughly 150 km away. The infrastructure improvements would be most significant for this mode. In this case, road transport from the reactor site to the railhead would be necessary; transfer from the road to rail mode would be required, necessitating a transfer facility equipped with suitable cranes and handling equipment.

It is also noted that a large portion of the rail line runs along St. Lawrence Seaway and passes through the same populated regions as do the parallel road and waterway systems. Rail transport, therefore, does not provide any significant benefits (i.e., shorter routes, avoidance of population centers, etc.) as compared with road or water transport.

Creation of two rail road terminals:

Example given Appendix G: Example of the COGEMA LOGISTICS road rail Terminal at Valognes.

6.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a trailer.

See phases 3, 4, 5 of paragraph 6.9 of the present document.

6.3. Transporter (vehicle)

6.3.1. Trolley with tractor

In order to transfer:

- The baskets from the silo to the packaging (phases 2 and 3 of table paragraph 6.9).

6.3.2. Bogie pulley drive system

In order to transfer:

- The IFTC/BM in the hot cell (phase 3 of table paragraph 6.9),
- The IFTC/BM to the pre-shipment packaging area (phase 4 of table paragraph 6.9),
- The IFTC/BM to the shipment area (phases 5 and 6 of table paragraph 6.9).

6.3.3. Trailer for the road transportation (phases 6, 8 of table paragraph 6.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic or air ride suspension to cushion the load
- Trailer equipped with four axles
- One loaded cask per trailer
- 2 drivers and no escort

6.3.4. Tractor for the road transportation (phases 6, 8 of table paragraph 6.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 9,075 kg.

6.3.5. Weather cover for the road transportation (phases 6, 10 of table paragraph 6.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can rolls on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

6.3.6. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.
The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

6.3.7. Specific equipment for the road transportation

- GPS antenna (tracking) on the tractor
- Turning light (“Girophare”) on the tractor
- Tools box adapted to the Transportation cask

6.3.8. Rail car (phase 8 of table paragraph 6.9)

The sample rail transportation system is predicated on the following elements:

- The train is dedicated to movement of used fuel under exclusive use conditions;
- Use of depressed center, flat bed car see Appendix A, Figure N°13;
- Each flat car is loaded with two IFTC/BM or one DSCTP;
- Each train equipped with locomotive and caboose;
- The locomotive is assumed to have sufficient power to safely and efficiently haul the load.

6.3.9. Weather cover for the rail transportation (phase 6 of table paragraph 6.9)

- Rolling removable aluminium weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. One man can manually open or close the weather cover which can rolls on a rail fixed on the frame of the rail car.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts. The real time tracking system is placed on the two parts (See Appendix H).

6.3.10. Frame or support of the Transportation cask for the rail transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the frame of the rail car. This frame is fixed on the frame of the rail car with calculated fixations in the three directions to follow the regulations concerning the accelerations. The weather cover can rolls on a rail fixed on the frame of the rail car. A drip pan is installed under the frame of the rail car in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

6.3.11. Specific equipment for the road transportation

- GPS antenna (tracking) on the rail car (Appendix H)
- Tools box adapted to the Transportation cask

6.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance equipment for IFTC/BM: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.

- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Rail car: shared facility at the centralised site as developed in paragraph 3.4 of Chapter 3.

6.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: similar to the IFTC for road but adapted to the accelerations for rail.
- IFTC/BM: See chapter 2, section 2.4.7.1.3, Figure N° 6 of Appendix A, Appendix C.

6.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Leakage and purging equipment :
  One complete equipment with vacuum pumps and gauges (see phase 4 of table paragraph 6.9)
- Gantry Crane :
  One for installing the Transfer flask on the top of the hot cell (see phase 3 of table paragraph 6.9)
  One for loading the Transportation cask on the trailer (see phase 6 of table paragraph 6.9)
  One for loading the Transportation cask on the rail car (see phase 8 of table paragraph 6.9)
- Lifting beam :
  One for the Transfer flask (see phase 3 of table paragraph 6.9)
  One for the Transportation cask (see phases 6, 8 of table paragraph 6.9)
  One for the impact limiter of the packaging (see phase 4 of table paragraph 6.9)
- Decontamination equipment (see paragraph 3.2. of Chapter 3).

6.7. UFTS Transportation system operation

Loading of the Transportation cask onto the rail car, trailer, security, transportation, emergency response:

- Loading of packaging onto the rail car, security, transportation as described in phase 6 of table paragraph 6.9.
- Loading of Transportation cask from the rail car to the trailer, security, transportation as described in phase 8 of table paragraph 6.9.
- Emergency response plan: see paragraph 9 of Appendix E.
- Real time tracking: see paragraph 9 of Appendix E.

6.8. Decommissioning

Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.2 of Chapter 3).

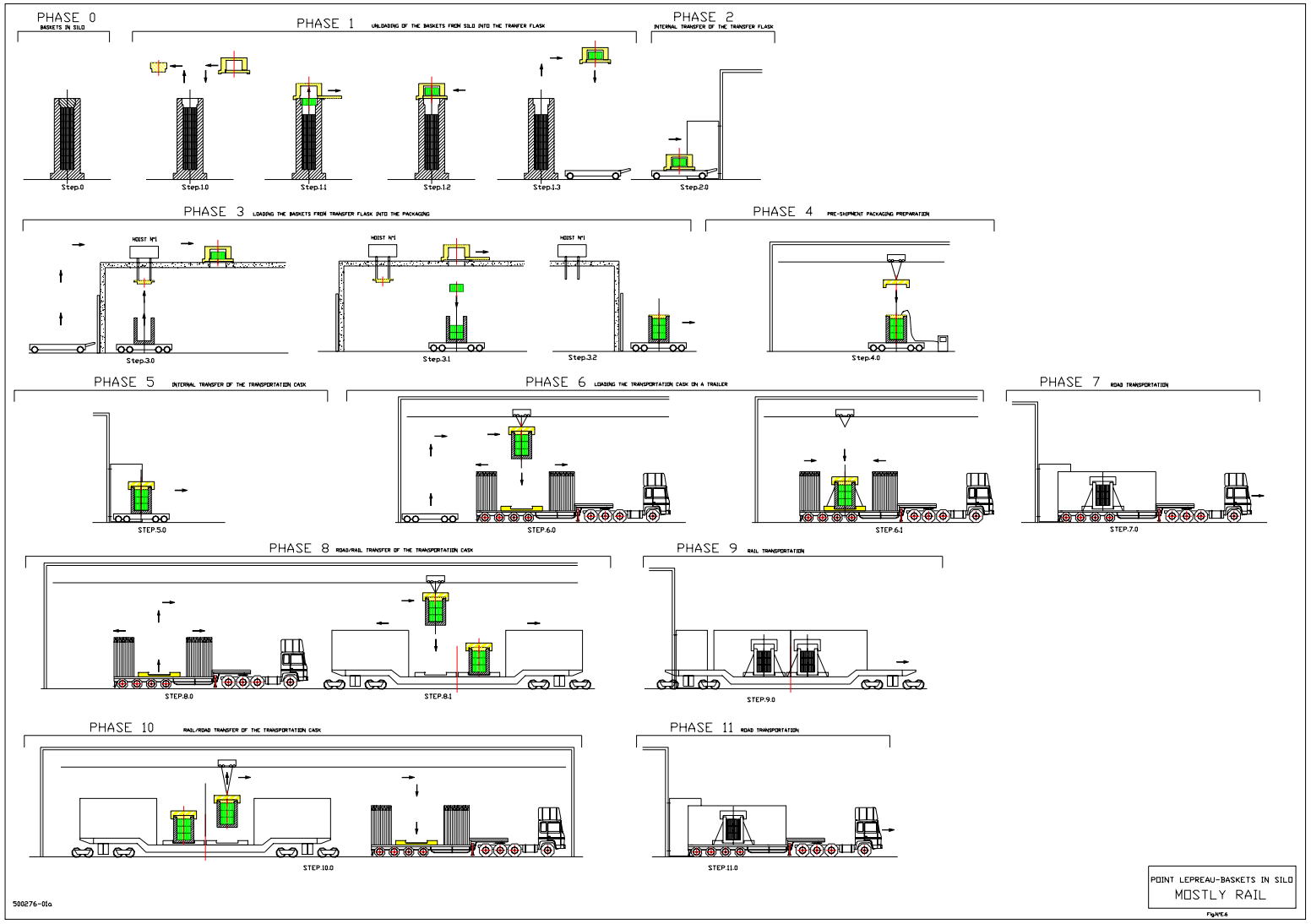
6.9. Table: Analysis of the operational phases of transport

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG N° E.6
Phase 0	Baskets in Silo	Interim storage	Initial phase			0
Phase 1	Unloading of the baskets from the Silo into the transfer flask	Interim storage				1.0, 1.1, 1.2, 1.3
Phase 2	Internal transfer of the transfer flask	Interim storage				2.0
Phase 3	Loading the baskets from the transfer flask into the packaging	UFTS	With a gantry crane , place the transfer flask on the hot cell	Transfer flask	Similar to Gentilly 2, Appendix A, Figure N°10: - Shielded fuel transfer cask - 26 tons with 60 bundles basket and with irradiated fuel - "Sliding" gate - Electric hoist for lifting or lowering a basket into the IFTC/BM - Chain - Basket lifting grapple - Shielding	3.0
				Gantry crane	For the Transfer flask	3.0
				Lifting Beam for Transfer flask		3.0
			With the hoist N°1, open the lid of the packaging in a hot cell.	Packaging	IFTC/BM: See chapter 2., section 2.4.7.1.3 of D#5 Appendix A, Figure N° 6	3.0
			Load the baskets into the packaging			3.1
Phase 4	Pre-shipment packaging preparation	UFTS	Drying the cavity	Vacuum circuit	Air/water separator, pump, vacuum gauges, valves,	4.0
			Filling the cavity with helium	Vacuum circuit	Air/water separator, pump, vacuum gauges, valves, compressed air line	
			Leaktightness check	Leaktightness equipement		
			Depressurising the cavity	Vacuum circuit		
Phase 5	Internal transfer of the packaging	UFTS	Radiological control of the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	5.0
			Approach of the Bogie	Bogie	Bogie with pulley drive system	5.0
			Radiological control of the Bogie	Non contamination, Dose Rate	"Smear test", Radiameter	5.0
			Loading of the full Transportation cask on the Bogie			5.0
			Radiological control of the Transportation cask and the Bogie	Non contamination, Dose Rate	"Smear test", Radiameter	5.0
			Internal transfer	Tie down		5.1
Phase 6	Loading the Transportation cask on a trailer	UFTS	Radiological control of the Transportation cask and the trailer	Non contamination, Dose Rate	"Smear test", Radiameter	6.0
			Open the weather cover	Weather cover		

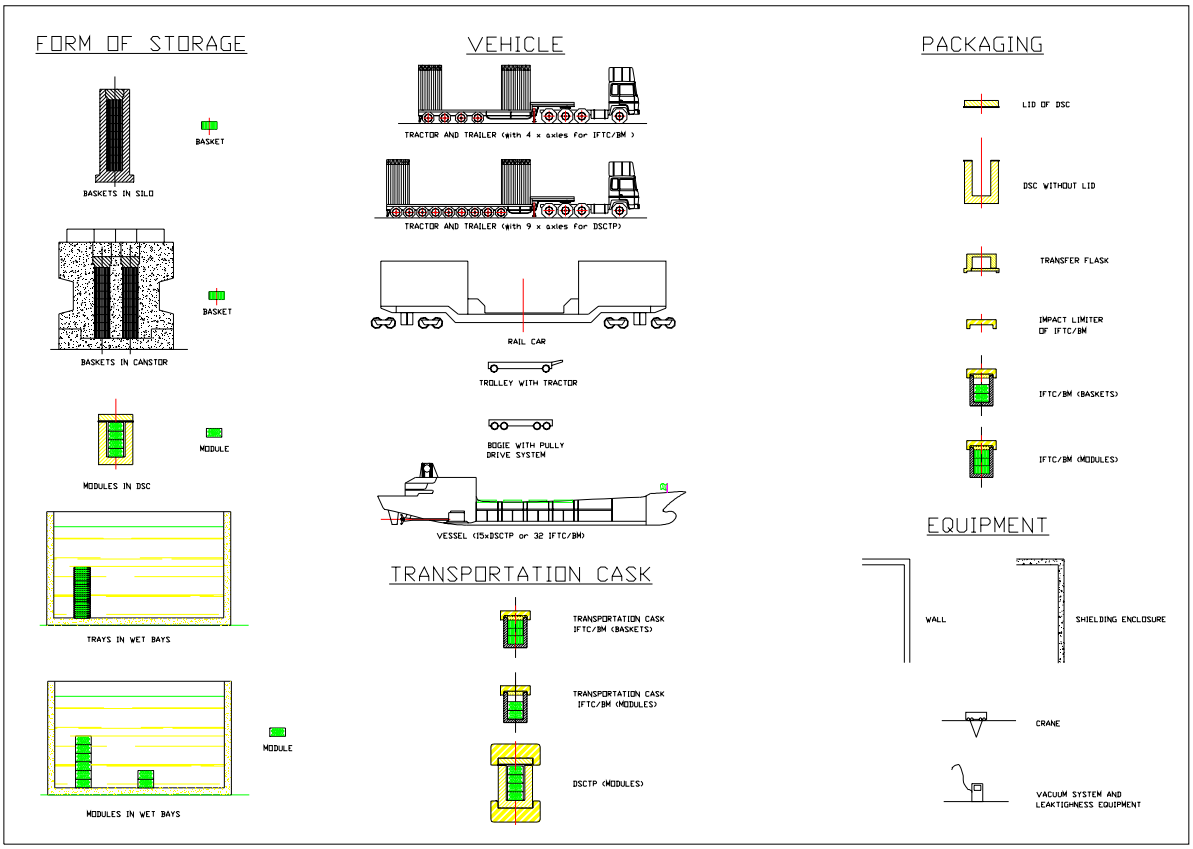
PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.6
			Loading the Transportation cask on a trailer	Gantry Crane	With 1 hoists (of 60 tons for the IFTC/BM)	
				Lifting Beam for the Trans-portation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Trailer (Appendix A, Figures N°13, 14	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with four axles - One loaded cask per trailer	
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	
			Check the condition of Transportation cask, trailer			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Radiological control of the trailer and the Transportation cask	Non contamination, Dose Rate	“Smear test”, Radiameter	
Phase 7	Road transportation	UFTS	Road transportation of the Transportation cask from facility to the road rail terminal			7.0
				Real Time Tracking	Appendix H	
Phase 8	Road/Rail transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car	Non contamination, Dose Rate	“Smear test”, Radiameter	8.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the trailer to the rail car	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	
				Lifting Beam for Transportation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Rail car (Appendix A, Figure N°16 **<3>**)	- The train is dedicated to movement of used fuel under exclusive use conditions; - Use of depressed centre, flat bed car; - Each flat car is loaded with two Transportation casks; - Each train equipped with locomotive and caboose; - The locomotive is assumed to have sufficient power to safely and efficiently haul the load.	

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.6
			Packaging tie-down on the rail car	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**) but for rail	
			Check the condition of the packaging, rail car			
			Fit the transport seals			
			Close the weather cover of the rail car	Weather cover		
			Radiological control of the rail car and the transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
Phase 9	Rail transportation	UFTS	Rail transportation of the Transportation cask from the road rail terminal to the rail road terminal			9.0
				Real Time Tracking	Appendix H	
Phase 10	Rail/Road transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car and the trailer	Non contamination, Dose Rate	"Smear test", Radiameter	7.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the rail car to the trailer	Gantry Crane	With 2 hoists (of 60 tons for the IFTC/BM)	
				Lifting Beam for Transportation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Trailer (Appendix A, Figures N°13 , 14)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with for axles - One loaded cask per trailer	
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	
			Check the condition of the packaging, trailer			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Radiological control of the trailer and the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.6
Phase 11	Road transportation	UFTS	Road transportation of the Transportation cask from rail road terminal to the Centralised site			11.0
Phase 12	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the rail car			


PHASE 0
BASKETS IN SILO
Step.0
PHASE 1
UNLOADING OF THE BASKETS FROM SILO INTO THE TRANFER FLASK
Step.1.0
Step.1.1
Step.1.2
Step.1.3
PHASE 2
INTERNAL TRANSFER OF THE TRANSFER FLASK
Step.2.0
PHASE 3
LOADING THE BASKETS FROM TRANSFER FLASK INTO THE PACKAGING
HOIST N°1
Step.3.0
Step.3.1
Step.3.2
PHASE 4
PRE-SHIPMENT PACKAGING PREPARATION
Step.4.0
PHASE 5
INTERNAL TRANSFER OF THE TRANSPORTATION CASK
STEP.5.0
PHASE 6
LOADING THE TRANSPORTATION CASK ON A TRAILER
STEP.6.0
STEP.6.1
PHASE 7
ROAD TRANSPORTATION
STEP.7.0
PHASE 8
ROAD/RAIL TRANSFER OF THE TRANSPORTATION CASK
STEP.8.0
STEP.8.1
PHASE 9
RAIL TRANSPORTATION
STEP.9.0
PHASE 10
RAIL/ROAD TRANSFER OF THE TRANSPORTATION CASK
STEP.10.0
PHASE 11
ROAD TRANSPORTATION
STEP.11.0
500276-01a
POINT LEPREAU-BASKETS IN SILO
MOSTLY RAIL

Key:


FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

7. CHALK RIVER

Baskets in Silo (See Appendix B, Table N° 4)
From Douglas Point Facility to the Centralised Facility
Quantity of bundles to transport from 2035 to 2064: see Appendix B, Table N° 2 .

7.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

Road transport is clearly feasible from Chalk River [**<52>**, **<53>**, **<56>**, **<27>**and **<54>**]. The public road system is generally adequate to support the lower volume shipments from this site, however some improvement may be necessary to public roadways at the time of shipment. On-site roadways would also likely require strengthening and re-grading (especially noting the grade leaving the site storage area).

Road transport would be appropriate for Chalk River used fuel being transferred to either the northern or southern Ontario repository. This transport mode is consistent with the volume of used fuel to be removed from the site.

7.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a trailer.

See phases 3, 4, 5 of paragraph 7.9 of the present document.

7.3. Transporter (vehicle)

Conceptual design of trailer and tractors (phase 6 of table paragraph 7.9)

7.3.1. Trolley with tractor

In order to transfer:

- The baskets from the silo to the packaging (phases 2 and 3 of table paragraph 7.9).

7.3.2. Bogie pulley drive system

In order to transfer:

- The IFTC/BM in the hot cell (phase 3 of table paragraph 7.9),
- The IFTC/BM to the pre-shipment packaging area (phase 4 of table paragraph 7.9),
- The IFTC/BM to the shipment area (phases 5 and 6 of table paragraph 7.9).

7.3.3. Trailer for the road transportation (phase 6 of table paragraph 7.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic or air ride suspension to cushion the load
- Trailer equipped with four axles
- One loaded cask per trailer
- 2 drivers and no escort

7.3.4. Tractor for the road transportation (phase 6 of table paragraph 7.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 9,075 kg.

7.3.5. Weather cover for the road transportation (phase 7 of table paragraph 7.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can roll on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

7.3.6. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.
The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

7.3.7. Specific equipment

- GPS antenna (tracking) on the tractor
- Turning light (“Girophare”) on the tractor
- Tools box adapted to the Transportation cask

7.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance equipment for IFTC/BM: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.

- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

7.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: similar to the IFTC, Appendix A, Figure N° 15 **<3>**.

- IFTC/BM: See chapter 2, section 2.4.7.1.3, Figure N° 5 of Appendix A, Appendix C.

7.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Leakage and purging equipment:
  One complete equipment with vacuum pumps and gauges (see phase 4 of table paragraph 7.9)

- Gantry Crane :
  One for installing the Transfer flask on the top of the hot cell (see phase 3 of table paragraph 7.9)
  One for loading the Transportation cask on the trailer (see phase 6 of table paragraph 7.9)

- Lifting beam :
  One for the Transfer flask (see phase 3 of table paragraph 7.9)
  One for the Transportation cask (see phase 6 of table paragraph 7.9)
  One for the impact limiter of the packaging (see phase 4 of table paragraph 7.9)

- Decontamination equipment (see paragraph 3.7 of Chapter 3).

7.7. UFTS Transportation system operation

Loading of packages onto the trailers, security, transportation, emergency response:

- Loading of packages onto the trailer, security, transportation as described in phase 6 of table paragraph 7.9.

- Emergency response plan: see paragraph 9 of Appendix F.

- Real time tracking: see paragraph 9 of Appendix F.

7.8. Decommissioning

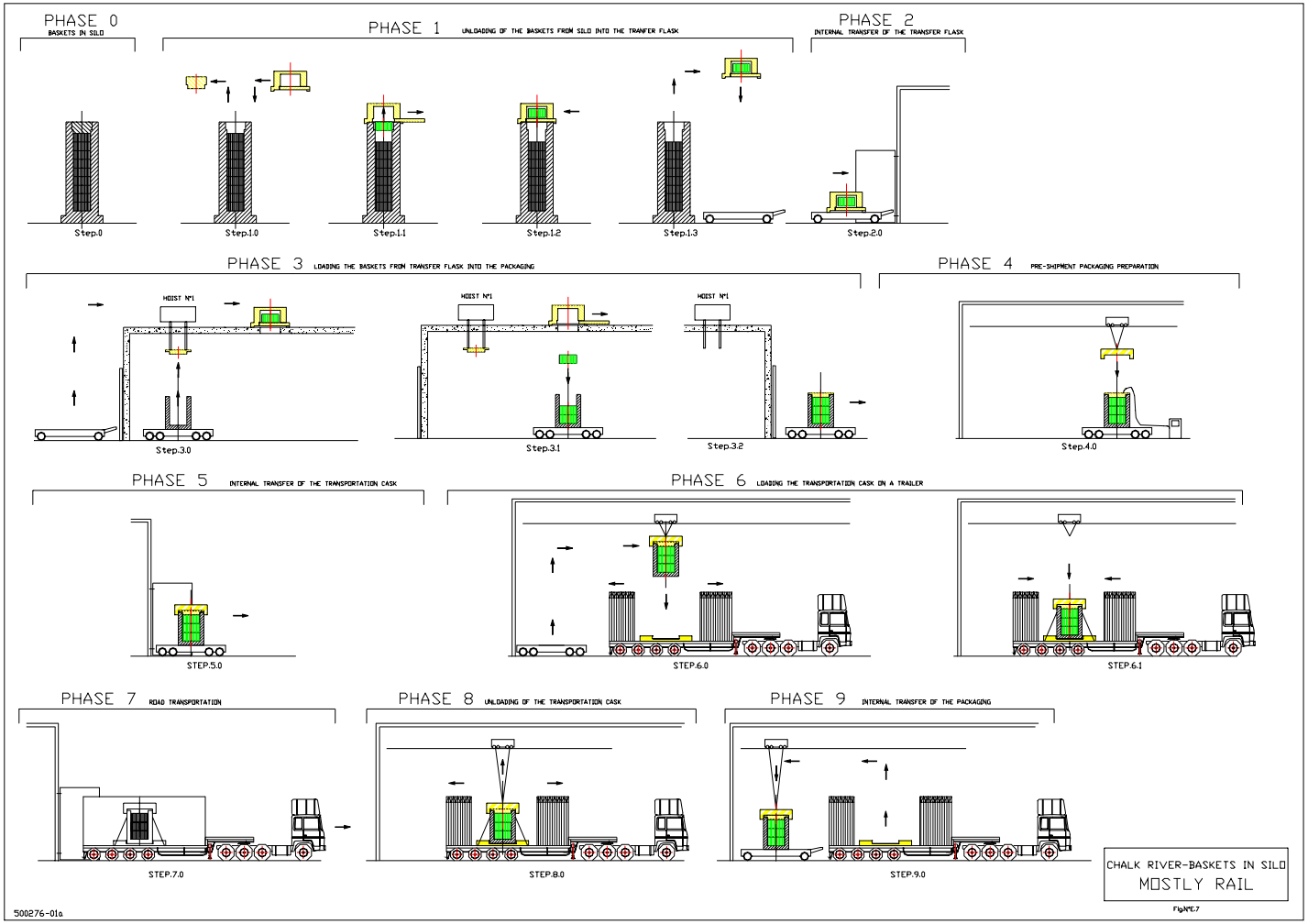
Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.7 of Chapter 3).

7.9. Table : Analysis of the operational phases of transport

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.7
Phase 0	Baskets in Silo	Interim storage	Initial phase			0
Phase 1	Unloading of the baskets from the Silo into the transfer flask	Interim storage				1.0, 1.1, 1.2, 1.3
Phase 2	Internal transfer of the transfer flask	Interim storage				2.0
Phase 3	Loading the baskets from the transfer flask into the packaging	UFTS	With a gantry crane , place the transfer flask on the hot cell	Transfer flask	Similar to Gentilly 2, Appendix A, Figure N°10 : - Shielded fuel transfer cask - 26 tons with 60 bundles basket and with irradiated fuel - “Sliding” gate - Electric hoist for lifting or lowering a basket into the IFTC/BM - Chain - Basket lifting grapple - Shielding	3.0
				Gantry crane	For the Transfer flask	3.0
				Lifting Beam for Transfer flask		3.0
			With the hoist N°1, open the lid of the packaging in a hot cell.	Packaging	IFTC/BM: See chapter 2., section 2.4.7.1.3 of D#5 Appendix A, Figure N° 6	3.0
			Load the baskets into the packaging			3.1
Phase 4	Pre-shipment packaging preparation	UFTS	Drying the cavity	Vacuum circuit	Air/water separator, pump, vacuum gauges, valves,	4.0
			Filling the cavity with helium	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves, compressed air line	
			Leaktightness check	Leaktightness equipement		
			Depressurising the cavity	Vacuum circuit		
			Installing the impact limiter	Lifting beam for the impact limiter		
Phase 5	Internal transfer of the packaging	UFTS	Radiological control of the packaging	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Approach of the trolley	Bogie	Bogie with pulley drive system	5.0
			Radiological control of the Bogie	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Loading of the full Transportation cask on the Bogie			5.0
			Radiological control of the Transportation cask and the Bogie	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Internal transfer	Tie down		5.1

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.7
Phase 6	Loading the Transportation cask on a trailer	UFTS	Radiological control of the Transportation cask and the trailer	Non contamination, Dose Rate	"Smear test", Radiameter	6.0
			Open the weather cover	Weather cover		6.0
			Loading the Transportation cask on a trailer	Gantry Crane	With 1 hoists (of 60 tons for the IFTC/BM)	6.0
				Lifting Beam for the Transportation cask	To carry of the IFTC/BM (similar to the lifting beam of IFTC)	6.0
				Trailer (Appendix A, Figures N°13, 14)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with four axles - One loaded cask per trailer	6.0
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled refe-rence tractor is roughly 9,075 kg.	6.0
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15 , **<3>**)	6.1
			Check the condition of the packaging, trailer			6.1
			Fit the transport seals			6.1
			Close the weather cover	Weather cover		6.1
			Radiological control of the trailer and the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	6.1
Phase 7	Road transportation	UFTS	Road transportation of the Transportation cask from the Facility to the Centralised Facility			7.0
				Real time tracking	Appendix H	7.0
Phase 8	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the trailer			8.0
Phase 9	Internal transfer of loaded Transportation cask	DGR/CES				9.0
Phase 10	Unloading the baskets from the Transportation cask	DGR/CES				
Phase 11	Storage of the baskets on the Centralised Facility	DGR/CES				


PHASE 0
BASKETS IN SILO
PHASE 1
UNLOADING OF THE BASKETS FROM SILO INTO THE TRANFER FLASK
PHASE 2
INTERNAL TRANSFER OF THE TRANSFER FLASK
Step.0
Step.1.0
Step.1.1
Step.1.2
Step.1.3
Step.2.0
PHASE 3
LOADING THE BASKETS FROM TRANSFER FLASK INTO THE PACKAGING
PHASE 4
PRE-SHIPMENT PACKAGING PREPARATION
HOIST N°1
Step.3.0
Step.3.1
Step.3.2
Step.4.0
PHASE 5
INTERNAL TRANSFER OF THE TRANSPORTATION CASK
PHASE 6
LOADING THE TRANSPORTATION CASK ON A TRAILER
STEP.5.0
STEP.6.0
STEP.6.1
PHASE 7
ROAD TRANSPORTATION
PHASE 8
UNLOADING OF THE TRANSPORTATION CASK
PHASE 9
INTERNAL TRANSFER OF THE PACKAGING
STEP.7.0
STEP.8.0
STEP.9.0
CHALK RIVER-BASKETS IN SILO
MOSTLY RAIL
Fig N°E.7
500276-01a

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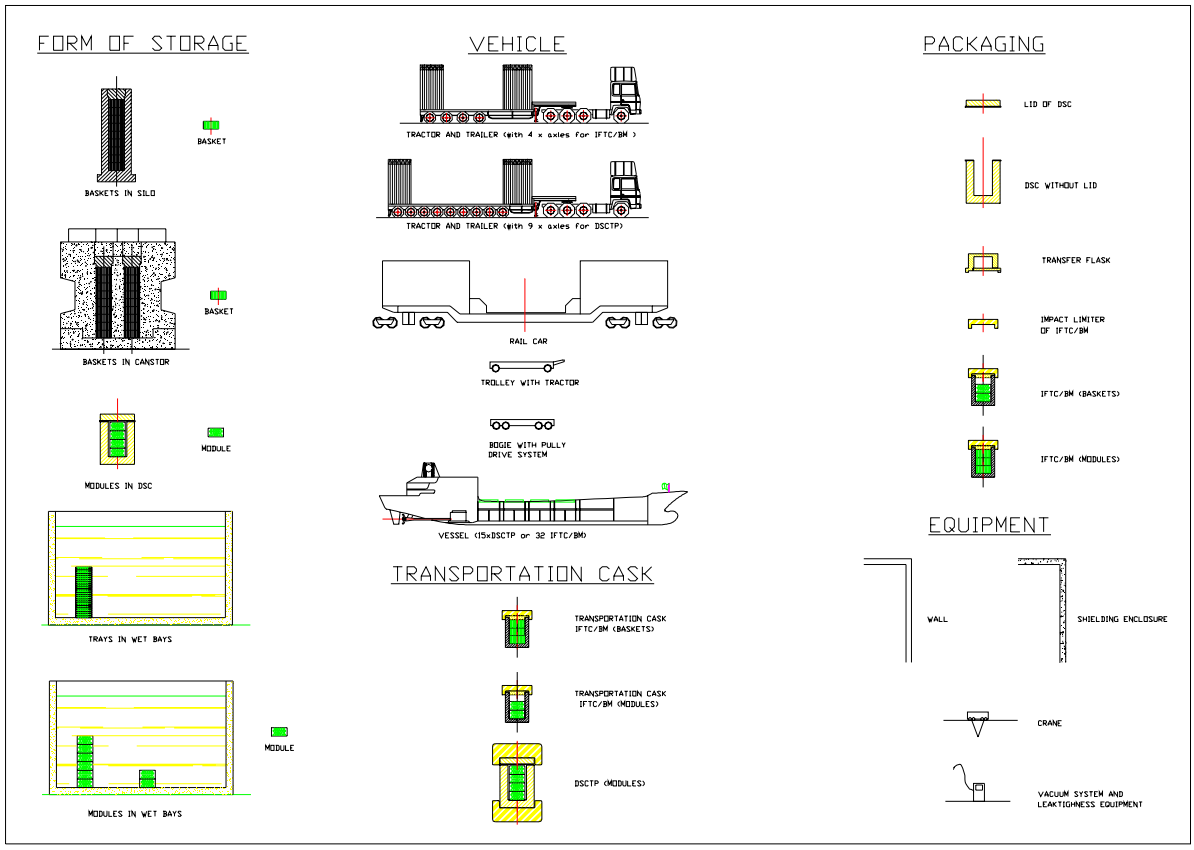

FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

8. GENTILLY

8.1. Baskets in Silo (See Appendix B, Table N°4)

From Gentilly 1 to the Centralised Facility
Quantity of bundles to be transported from 2035 to 2064: see Appendix B, Table N° 2.

8.1.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

Rail: Rail transport from the Gentilly sites is possible [**<52>**, **<53>**, **<56>**, **<58>**, **<54>**, and **<57>**]. There is no operating rail line into the facility. It would therefore be necessary to either extend the line to Gentilly (the site map indicates a rail line just outside the one kilometer exclusion zone) or to transport loaded casks from the site by road to the rail line where it would also be necessary to construct the necessary transfer and loading station (including equipping the site with necessary lift power).

The volumes of used fuel to be transferred from the Gentilly site could benefit from the consolidation opportunities presented by rail.

Creation of a rail road terminal:

Example given Appendix G: Example of the COGEMA LOGISTICS road rail Terminal at Valognes.

8.1.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a trailer.

See phases 3, 4, 5 of paragraph 8.1.9 of the present document.

8.1.3. Transporter (vehicle)

8.1.3.1. Trolley with tractor

In order to transfer:

- The baskets from the silo to the packaging (phases 2 and 3 of table paragraph 8.1.9).

8.1.3.2. Bogie pulley drive system

In order to transfer:

- The IFTC/BM in the hot cell (phase 3 of table paragraph 8.1.9),
- The IFTC/BM to the pre-shipment packaging area (phase 4 of table paragraph 8.1.9),
- The IFTC/BM to the shipment area (phases 5 and 6 of table paragraph 8.1.9).

8.1.3.3. Trailer for the road transportation (phase 8 of table paragraph 8.1.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic or air ride suspension to cushion the load
- Trailer equipped with four axles

- One loaded cask per trailer
- 2 drivers and no escort

8.1.3.4. Tractor for the road transportation (phase 8 of table paragraph 8.1.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 9,075 kg.

8.1.3.5. Weather cover for the road transportation (phase 8 of table paragraph 8.1.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can rolls on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

8.1.3.6. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.
The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

8.1.3.7. Specific equipment for the road transportation

- GPS antenna (tracking) on the tractor
- Turning light (“Girophare”) on the tractor
- Tools box adapted to the Transportation cask

8.1.3.8. Rail car (phase 6 of table paragraph 8.1.9)

The sample rail transportation system is predicated on the following elements:

- The train is dedicated to movement of used fuel under exclusive use conditions;
- Use of depressed center, flat bed car see Appendix A, Figure N°13;
- Each flat car is loaded with two IFTC/BMs or one DSCTP;
- Each train equipped with locomotive and caboose;
- The locomotive is assumed to have sufficient power to safely and efficiently haul the load.

8.1.3.9. Weather cover for the rail transportation (phase 6 of table paragraph 8.1.9)

- Rolling removable aluminium weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. One man can manually open or close the weather cover which can roll on a rail fixed on the frame of the rail car.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts. The real time tracking system is placed on the two parts (See Appendix H).

8.1.3.10. Frame or support of the Transportation cask for the rail transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the frame of the rail car. This frame is fixed on the frame of the rail car with calculated fixations in the three directions to follow the regulations concerning the accelerations. The weather cover can rolls on a rail fixed on the frame of the rail car. A drip pan is installed under the frame of the rail car in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

8.1.3.11. Specific equipment for the road transportation

- GPS antenna (tracking) on the rail car (Appendix H)
- Tools box adapted to the Transportation cask

8.1.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance equipment for IFTC/BM: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.

- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Rail car: shared facility at the centralised site (see paragraph 3.4 of Chapter 3).

8.1.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: similar to the IFTC.

- IFTC/BM: See chapter 2, section 2.4.7.1.3, Figure N° 5 of Appendix A, Appendix C.

8.1.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Leakage and purging equipment:
  One complete equipment with vacuum pumps and gauges (see phase 4 of table paragraph 8.1.9)

- Gantry Crane :
  One for installing the Transfer flask on the top of the hot cell (see phase 3 of table paragraph 8.1.9)
  One for loading the Transportation cask on the rail car (see phase 6 of table paragraph 8.1.9)
  One for loading the Transportation cask on the tariler (see phase 8 of table paragraph 8.1.9)

- Lifting beam :
  One for the Transfer flask (see phase 3 of table paragraph 8.1.9)
  One for the Transportation cask (see phase 6 of table paragraph 8.1.9)
  One for the impact limiter of the packaging (see phase 4 of table paragraph 8.1.9)

- Decontamination equipment (see paragraph 3.2. of Chapter 3).

8.1.7. UFTS Transportation system operation

Loading of packages onto the rail car, trailer, security, transportation, emergency response:

- Loading of the Transportation cask onto the rail car, security, transportation as described in phase 6 of table paragraph 8.1.9.

- Loading of Transportation cask from the rail car to the trailer, security, transportation as described in phase 8 of table paragraph 8.1.9.

- Emergency response plan: see paragraph 9 of Appendix E.

- Real time tracking: see paragraph 9 of Appendix E.

8.1.8. Decommissioning

Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

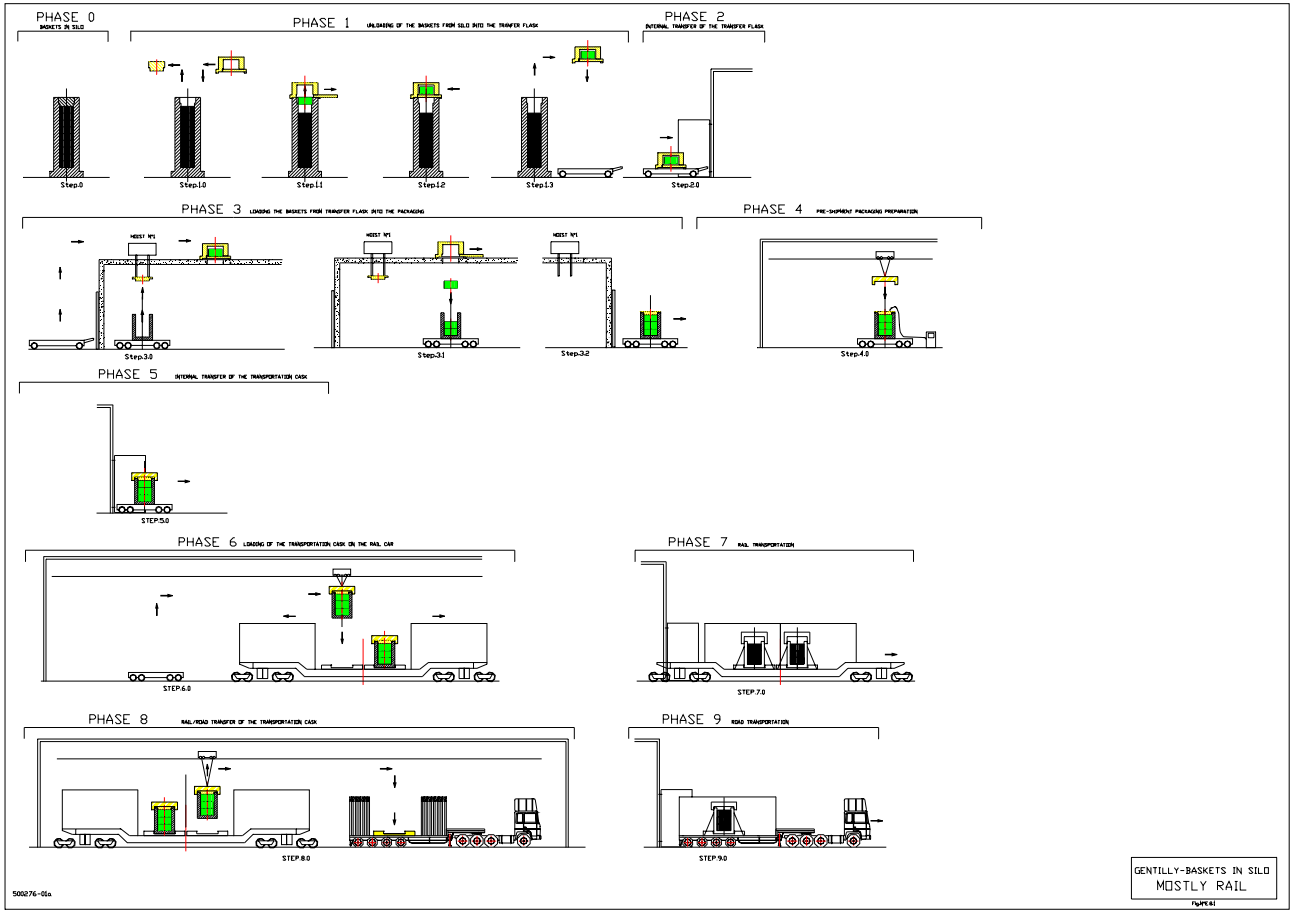
Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.2. of Chapter 3).

8.1.9. Table : Analysis of the operational phases of transport

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.8.1
Phase 0	Baskets in Silo	Interim storage	Initial phase			0
Phase 1	Unloading of the baskets from the Silo into the transfer flask	Interim storage				1.0, 1.1, 1.2, 1.3
Phase 2	Internal transfer of the transfer flask	Interim storage				2.0
Phase 3	Loading the baskets from the transfer flask into the packaging	UFTS	With a gantry crane , place the transfer flask on the hot cell	Transfer flask	Similar to Gentilly 2, Appendix A, Figure N°10: - Shielded fuel transfer cask - 26 tons with 60 bundles basket and with irradiated fuel - "Sliding" gate - Electric hoist for lifting or lowering a basket into the IFTC/BM - Chain - Basket lifting grapple - Shielding	3.0
				Gantry crane	For the Transfer flask	
				Lifting Beam for Transfer flask		3.0
			With the hoist N°1, open the lid of the packaging in a hot cell.	Packaging	IFTC/BM: See chapter 2., section 2.4.7.1.3 of D#5 Appendix A, Figure N° 6	3.0
			Load the baskets into the packaging			3.1
Phase 4	Pre-shipment packaging preparation	UFTS	Drying the cavity	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves,	4.0
			Filling the cavity with helium	Vacuum circuit	Air/water separator, pump, vacuum gauges, valves, compressed air line	
			Leaktightness check	Leaktightness equipement		
			Depressurising the cavity	Vacuum circuit		
			Installing the impact limiter	Lifting beam of the impact limiter		
Phase 5	Internal transfer of the packaging	UFTS	Radiological control of the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	5.0
			Approach of the vehicle	Bogie	Bogie with pulley drive system	5.0
			Radiological control of the Bogie	Non contamination, Dose Rate	"Smear test", Radiameter	5.0
			Loading of the full Transportation cask on the Bogie			5.0
			Radiological control of Transportation cask the and the Bogie	Non contamination, Dose Rate	"Smear test", Radiameter	5.0
			Internal transfer	Tie down		5.1

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.8.1
Phase 6	Loading the Transportation cask on a rail car	UFTS	Radiological control of the Transportation cask and the rail car	Non contamination, Dose Rate	"Smear test", Radiameter	6.0
			Open the weather cover	Weather cover		
			Loading the Transportation cask on a rail car	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	
				Lifting Beam for packaging	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Rail car (Appendix A, Figure 16 **<3>**)	- The train is dedicated to movement of used fuel under exclusive use conditions; - Use of depressed centre, flat bed car; - Each flat car is loaded with two Transportation casks; - Each train equipped with locomotive and caboose; - The locomotive is assumed to have sufficient power to safely and efficiently haul the load.	
			Packaging tie-down on the rail car	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	
			Check the condition of the Transportation cask , rail car			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Radiological control of the rail car and the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
Phase 7	Rail transportation	UFTS	Rail transportation of the Transportation cask from the site to the rail road terminal			7.0
				Real Time Tracking	Appendix H	
Phase 8	Rail/Road transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car and the trailer	Non contamination, Dose Rate	"Smear test", Radiameter	8.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the rail car to the trailer	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	
				Lifting Beam for Transportation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Trailer (Appendix A, Figures N°13, 14)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with four axles - One loaded cask per trailer	

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.8.1
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	
			Check the condition of the packaging, trailer			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Check the condition of the packaging, rail car			
			Radiological control of the trailer and of the Transportation cask	Non contamination, Dose Rate	“Smear test”, Radiameter	
Phase 9	Road transportation	UFTS	Road transportation of the Transportation cask from the rail road terminal to the Centralised Facility			9.0
				Real time Tracking	Appendix H	
Phase 10	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the trailer			10.0
Phase 11	Internal transfer of the packaging	DGR/CES				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PHASE 1
PHASE 2
Step.0
Step.1.0
Step.1.1
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Step.2.0
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PHASE 4
Step.3.0
Step.3.1
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Step.4.0
PHASE 5
STEP.5.0
PHASE 6
PHASE 7
STEP.6.0
STEP.7.0
PHASE 8
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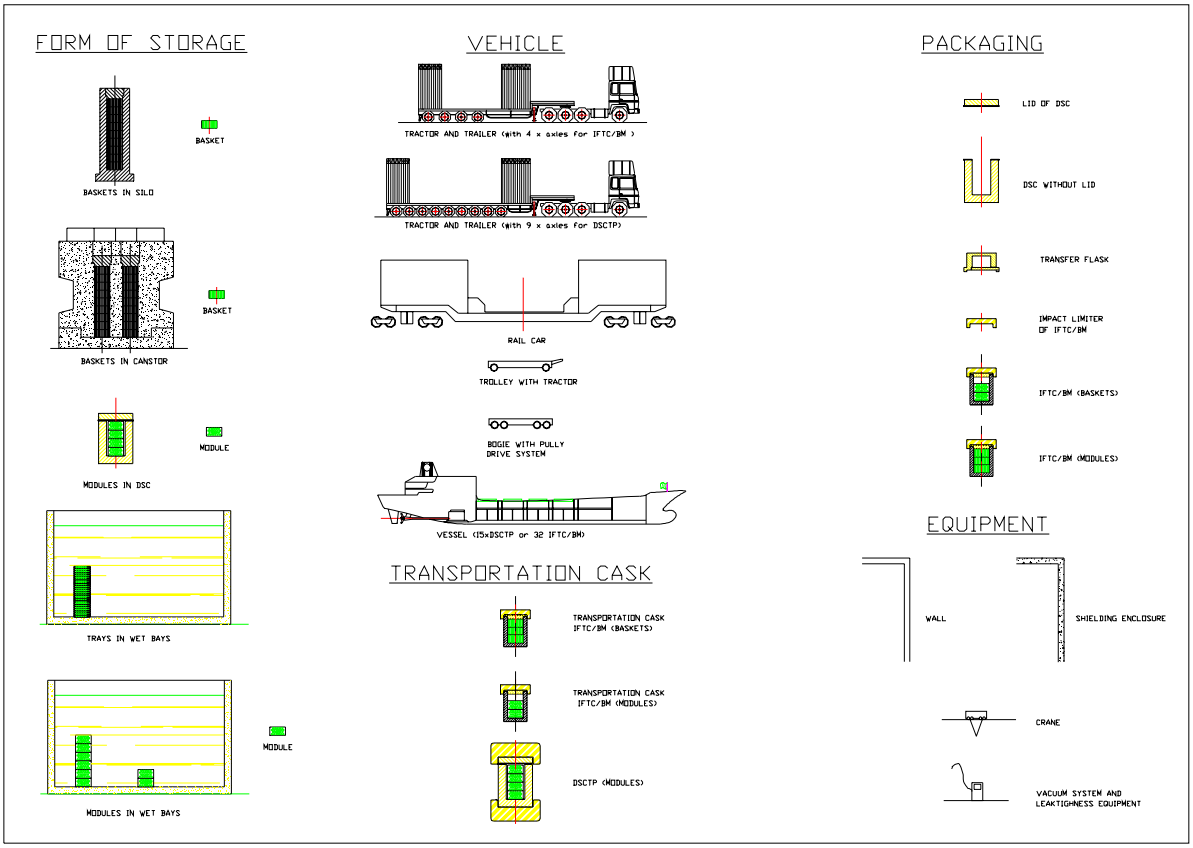
STEP.8.0
STEP.9.0
500276-01a
GENTILLY-BASKETS IN SILO
MOSTLY RAIL

Key:


FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

8.2. Baskets in Canstor (See Appendix B, Table N°5)

From Gentilly 2 to the Centralised Facility
Quantity of bundles to be transported from 2035 to 2064: see Appendix B, Table N° 2.

8.2.1. Mode and route development

Feasibility of transporting used fuel from the different current storage site to the centralised facility.
Viability of shipping by road and the identification of a preferred shipping route.

Rail: Rail transport from the Gentilly sites is possible [**<52>**, **<53>**, **<56>**, **<58>**, **<54>**, and **<57>**]. There is no operating rail line into the facility. It would therefore be necessary to either extend the line to Gentilly (the site map indicates a rail line just outside the one kilometer exclusion zone) or to transport loaded casks from the site by road to the rail line where it would also be necessary to construct the necessary transfer and loading station (including equipping the site with necessary lift power).

The volumes of used fuel to be transferred from the Gentilly site could benefit from the consolidation opportunities presented by rail.

Creation of a rail road terminal:

Example given Appendix G: Example of the COGEMA LOGISTICS road rail Terminal at Valognes.

8.2.2. Nuclear facility loading

Receive and prepare the used fuel and packages for loading, prepare packages for loading into transportation packages, pre-shipment tests, and prepare transportation package for transfer to a trailer.

See phases 3, 4, 5 of paragraph 8.2.9 of the present document.

8.2.3. Transporter (vehicle)

8.2.3.1. Trolley with tractor

In order to transfer:

- The baskets from the silo to the packaging (phases 2 and 3 of table paragraph 8.2.9).

8.2.3.2. Bogie pulley drive system

In order to transfer:

- The IFTC/BM in the hot cell (phase 3 of table paragraph 8.2.9),
- The IFTC/BM to the pre-shipment packaging area (phase 4 of table paragraph 8.2.9),
- The IFTC/BM to the shipment area (phases 5 and 6 of table paragraph 8.2.9).

8.2.3.3. Trailer for the road transportation (phase 8 of table paragraph 8.2.9)

- Modified 48 foot flatted trailer with integrated tie-down
- Trailer equipped with hydraulic or air ride suspension to cushion the load
- Trailer equipped with four axles
- One loaded cask per trailer
- 2 drivers and no escort

8.2.3.4. Tractor for the road transportation (phase 8 of table paragraph 8.2.9)

- Standard commercial tractor sufficient for the loaded weight
- The weight for the fuelled reference tractor is roughly 9,075 kg.

8.2.3.5. Weather cover for the road transportation (phase 8 of table paragraph 8.2.9)

- Rolling removable plastic weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. Two men (one on each side of the trailer) can manually open or close the weather cover which can rolls on a rail fixed on the frame of the Transportation cask.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts: one with a fixed metallic panel at the rear side, one with a fixed metallic panel at the front side. The weather cover can be taken off from the trailer with a specific frame fixed at the rear side of the frame for the Transportation cask.

8.2.3.6. Frame of the Transportation cask for the road transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the axles. This frame is fitted to the vehicle with twistlock devices plus a metal fitting designed for the appropriate accelerations. The numbers of attachments for the frame means it is still better to remove the cask from the frame, rather than taking than cask and the frame as unit during intermodal transfers.
The weather cover can rolls on a rail fixed on the frame of the Transportation cask. A drip pan is installed under the frame in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

8.2.3.7. Specific equipment for the road transportation

- GPS antenna (tracking) on the tractor
- Turning light (“Girophare”) on the tractor
- Tools box adapted to the Transportation cask

8.2.3.8. Rail car (phase 6 of table paragraph 8.2.9)

The sample rail transportation system is predicated on the following elements:

- The train is dedicated to movement of used fuel under exclusive use conditions;
- Use of depressed center, flat bed car see Appendix A, Figure N° 13;
- Each flat car is loaded with two IFTC/BMs or one DSCTP;
- Each train equipped with locomotive and caboose;
- The locomotive is assumed to have sufficient power to safely and efficiently haul the load.

8.2.3.9. Weather cover for the rail transportation (phase 6 of table paragraph 8.2.9)

- Rolling removable aluminium weather cover in order to protect the Transportation cask from rain and to not have a publicly Transportation cask. One man can manually open or close the weather cover which can rolls on a rail fixed on the frame of the rail car.

- Holes and a ventilation shaft on the top of the cover are calculated to create an adequate draught around the Transportation cask during the transport. The weather cover is composed with two parts. The real time tracking system is placed on the two parts (See Appendix H).

8.2.3.10. Frame or support of the Transportation cask for the rail transportation

Specific frame to fix the Transportation cask and to have an evenly distributed load on the frame of the rail car. This frame is fixed on the frame of the rail car with calculated fixations in the three directions to follow the regulations concerning the accelerations. The weather cover can rolls on a rail fixed on the frame of the rail car. A drip pan is installed under the frame of the rail car in order to collect the drain of water coming from the condensation of the Transportation cask. A manual valve with a padlock is installed at the lower level of the drip pan in order to collect the water.

8.2.3.11. Specific equipment for the road transportation

- GPS antenna (tracking) on the rail car (Appendix H)
- Tools box adapted to the Transportation cask

8.2.4. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance equipment for IFTC/BM: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.

- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).

- Maintenance equipment for Rail car: shared facility at the centralised site (see paragraph 3.4 of Chapter 3).

8.2.5. Casks

Conceptual design for the Transportation package and tie-down systems for UFTS:

- Tie-down: similar to the IFTC.

- IFTC/BM: See chapter 2, section 2.4.7.1.3, Figure N° 5 of Appendix A, Appendix C.

8.2.6. UFTS Auxiliary equipment

Conceptual design for Auxiliary equipment work:

- Leakage and purging equipment :
  One complete equipment with vacuum pumps and gauges (see phase 4 of table paragraph 8.2.9)

- Gantry Crane :
  One for installing the Transfer flask on the top of the hot cell (see phase 3 of table paragraph 8.2.9)
  One for loading the Transportation cask on the rail car (see phase 6 of table paragraph 8.2.9)
  One for loading the Transportation cask on the trailer (see phase 8 of table paragraph 8.2.9)

- Lifting beam :
  One for the Transfer flask (see phase 3 of table paragraph 8.2.9)
  One for the Transportation cask (see phase 6 of table paragraph 8.2.9)
  One for the impact limiter of the packaging (see phase 4 of table paragraph 8.2.9)

- Decontamination equipment (see paragraph 3.2 of Chapter 3).

8.2.7. UFTS Transportation system operation

Loading of the Transportation cask onto the trailer, rail car, security, transportation, emergency response:

- Loading of packaging onto the rail car, security, transportation as described in phases 6 of table paragraph 8.2.9.

- Loading of Transportation cask from the rail car to the trailer, security, transportation as described in phase 8 of table paragraph 8.2.9.

- Emergency response plan: see paragraph 9 of Appendix E.

- Real time tracking: see paragraph 9 of Appendix E.

8.2.8. Decommissioning

Where possible the equipment would be salvaged and decontaminated for sale and the remainder would be sent to a disposal facility.

Some of the decontaminated equipment can be decontaminated on the current storage site and some of them can be decontaminated at the Centralised Facility in order to avoid the transportation of contaminated equipment (see paragraph 3.2 of Chapter 3).

8.2.9. Table : Analysis of the operational phases of transport

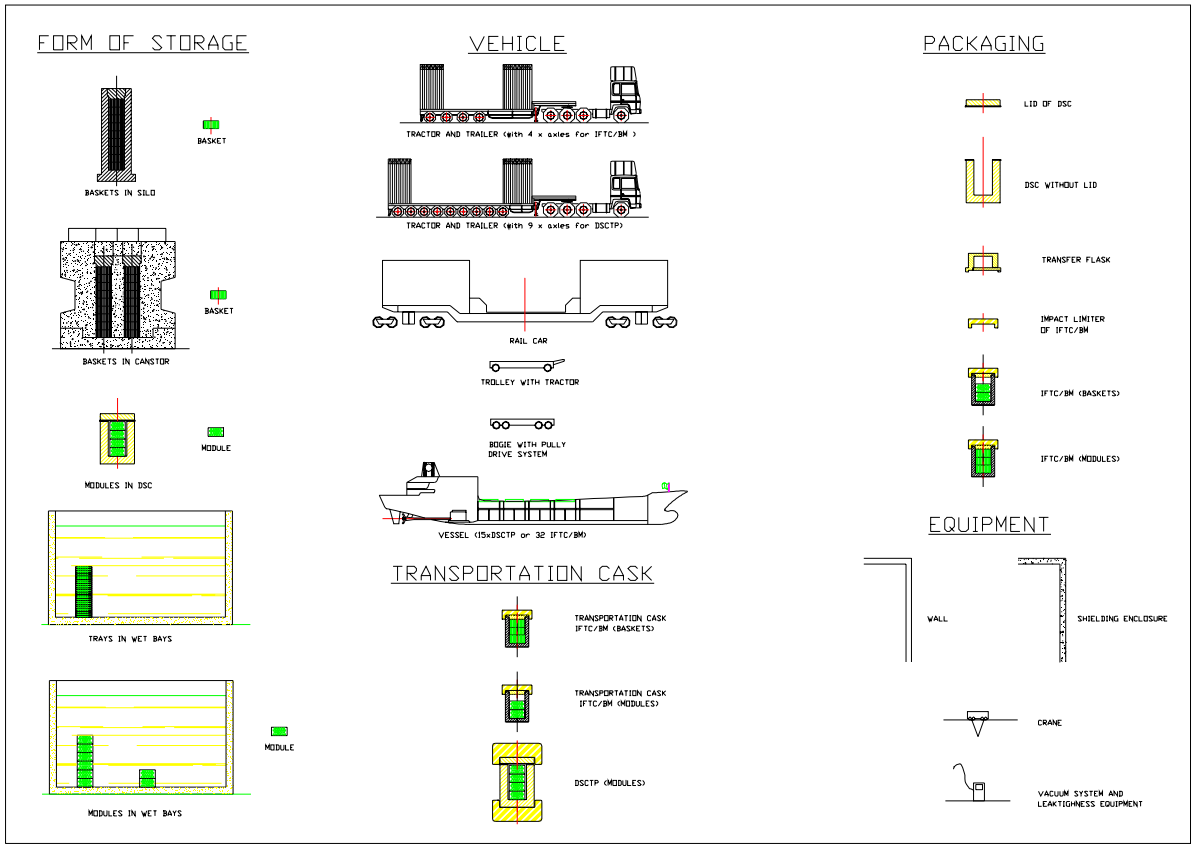
PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.8.2
Phase 0	Baskets in Canstor	Interim storage	Initial phase			0
Phase 1	Unloading of the baskets from the Silo into the transfer flask	Interim storage				1.0, 1.1, 1.2, 1.3
Phase 2	Internal transfer of the transfer flask	Interim storage				2.0
Phase 3	Loading the baskets from the transfer flask into the packaging	UFTS	With a gantry crane , place the transfer flask on the hot cell	Transfer flask	Similar to Gentilly 2, Appendix A, Figure N°10: - Shielded fuel transfer cask - 26 tons with 60 bundles basket and with irradiated fuel - “Sliding” gate - Electric hoist for lifting or lowering a basket into the IFTC/BM - Chain - Basket lifting grapple - Shielding	3.0
				Gantry crane	For the Transfer flask	3.0
				Lifting Beam for Transfer flask		3.0
			With the hoist N°1, open the lid of the packaging in a hot cell.	Packaging	IFTC/BM : See chapter 2., section 2.4.7.1.3 of D#5 Appendix A, Figure N° 6	3.0
			Load the baskets into the packaging			3.1
Phase 4	Pre-shipment packaging preparation	UFTS	Drying the cavity	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves,	4.0
			Filling the cavity with helium	Vacuum circuit	Air/water separator , pump, vacuum gauges, valves, compressed air line	
			Leaktightness check	Leaktightness equipement		
			Depressurising the cavity	Vacuum circuit		
			Installing the impact limiter	Lifting beam of the impact limiter		
Phase 5	Internal transfer of the packaging	UFTS	Radiological control of the Transportation cask	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Approach of the vehicle	Bogie	Bogie with pulley drive system	5.0
			Radiological control of the Bogie	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Loading of the full Transportation cask on the Bogie			5.0
			Radiological control of Transportation cask the and the Bogie	Non contamination, Dose Rate	“Smear test”, Radiameter	5.0
			Internal transfer	Tie down		5.1

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.8.2
Phase 6	Loading the Transportation cask on a rail car	UFTS	Radiological control of the Transportation cask and the rail car	Non contamination, Dose Rate	"Smear test", Radiameter	6.0
			Open the weather cover	Weather cover		
			Loading the Transportation cask on a rail car	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	
				Lifting Beam for packaging	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Rail car (Appendix A, Figure 16 **<3>**)	- The train is dedicated to movement of used fuel under exclusive use conditions; - Use of depressed centre, flat bed car; - Each flat car is loaded with two Transportation casks; - Each train equipped with locomotive and caboose; - The locomotive is assumed to have sufficient power to safely and efficiently haul the load.	
			Packaging tie-down on the rail car	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	
			Check the condition of the Transportation cask , rail car			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Radiological control of the rail car and the Transportation cask	Non contamination, Dose Rate	"Smear test", Radiameter	
Phase 7	Rail transportation	UFTS	Rail transportation of the Transportation cask from the site to the rail road terminal			7.0
				Real Time Tracking	Appendix H	
Phase 8	Rail/Road transfer of the Transportation cask	UFTS	Radiological control of the Transportation cask, the rail car and the trailer	Non contamination, Dose Rate	"Smear test", Radiameter	8.0
			Open the weather covers of the trailer and of the rail car	Weather covers		
			Loading the packaging from the rail car to the trailer	Gantry Crane	With 1 hoist (of 60 tons for the IFTC/BM)	
				Lifting Beam for Transportation cask	To carry of the IFTC/BM (similar to the IFTC, **<3>)**	
				Trailer (Appendix A, Figures N°13, 14)	- Modified 48 foot flatted trailer with integrated tie-down - Trailer equipped with hydraulic or air ride suspension to cushion the load - Trailer equipped with four axles - One loaded cask per trailer	

PHASE	DESIGNATION	STUDIED IN	DESCRIPTION OF PHASE	COMPONENTS	DESCRIPTION OF COMPONENTS	N° STEP IN SEQUENCE DIAGRAM FIG. N° E.8.2
				Tractor (Appendix A, Figure N°14)	- Standard commercial tractor sufficient for the loaded weight - The weight for the fuelled reference tractor is roughly 9,075 kg.	
			Packaging tie-down on the trailer	Tie down	Similar to the Tie down of the IFTC (Appendix A, Figure N°15, **<3>**)	
			Check the condition of the packaging, trailer			
			Fit the transport seals			
			Close the weather cover	Weather cover		
			Check the condition of the packaging, rail car			
			Radiological control of the trailer and of the Transportation cask	Non contamination, Dose Rate	“Smear test”, Radiameter	
Phase 9	Road transportation	UFTS	Road transportation of the Transportation cask from the rail road terminal to the Centralised Facility			9.0
				Real time Tracking	Appendix H	
Phase 10	Unloading of the Transportation cask	DGR/CES	Unloading of the Transportation cask from the trailer			10.0
Phase 11	Internal transfer of the packaging	DGR/CES				


PHASE 0
BASKETS IN CANISTER
PHASE 1
UNLOADING OF THE BASKETS FROM SILO INTO THE TRANSFER FLASK
PHASE 2
INTERNAL TRANSFER OF THE TRANSFER FLASK
Step.0
Step.1.0
Step.1.1
Step.1.2
Step.1.3
Step.2.0
PHASE 3
LOADING THE BASKETS FROM TRANSFER FLASK INTO THE PACKAGING
PHASE 4
PRE-SHIPMENT PACKAGING PREPARATION
HOIST N°1
Step.3.0
Step.3.1
Step.3.2
Step.4.0
PHASE 5
INTERNAL TRANSFER OF THE TRANSPORTATION CASK
STEP.5.0
PHASE 6
LOADING OF THE TRANSPORTATION CASK ON THE RAIL CAR
PHASE 7
RAIL TRANSPORTATION
STEP.6.0
STEP.7.0
PHASE 8
RAIL/ROAD TRANSFER OF THE TRANSPORTATION CASK
PHASE 9
ROAD TRANSPORTATION
STEP.8.0
STEP.9.0
GENTILLY-BASKET IN CANSTOR
MOSTLY RAIL
500276-01a

Key:


FORM OF STORAGE
BASKET
BASKETS IN SILO
BASKET
BASKETS IN CANSTOR
MODULE
MODULES IN DSC
TRAYS IN WET BAYS
MODULE
MODULES IN WET BAYS
VEHICLE
TRACTOR AND TRAILER (with 4 x axles for IFTC/BM)
TRACTOR AND TRAILER (with 9 x axles for DSCTP)
RAIL CAR
TROLLEY WITH TRACTOR
BOGIE WITH PULLY DRIVE SYSTEM
VESSEL (15xDSCTP or 32 IFTC/BM)
TRANSPORTATION CASK
TRANSPORTATION CASK IFTC/BM (BASKETS)
TRANSPORTATION CASK IFTC/BM (MODULES)
DSCTP (MODULES)
PACKAGING
LID OF DSC
DSC WITHOUT LID
TRANSFER FLASK
IMPACT LIMITER OF IFTC/BM
IFTC/BM (BASKETS)
IFTC/BM (MODULES)
EQUIPMENT
WALL
SHIELDING ENCLOSURE
CRANE
VACUUM SYSTEM AND LEAKTIGHNESS EQUIPMENT

9. CENTRALISED SITE

Quantity of bundles to transport from 2035 to 2064: see Appendix A, Table N° 2.

9.1. Mode and route development

In accordance with the shipment rate:

- Creation of a area to unload the Transportation cask from the trailer (scope of DGR/CES site)

9.2. Transportation system maintenance facility

Design, procurement and construction of maintenance equipment, and the commissioning of the maintenance facility for UFTS:

- Maintenance equipment for IFTC/BM: shared facility at the centralised site as developed in paragraph 3.2 of Chapter 3.
- Maintenance equipment for Trailer: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).
- Maintenance equipment for Tractor: shared facility at the centralised site (see paragraph 3.3 of Chapter 3).
- Maintenance equipment for rail cars: shared facility at the centralised site (see paragraph 3.4 of Chapter 3).

9.3. UFTS Transportation system operation

Emergency response plan:

As described in chapter 4 of D#5 an Emergency response plan for transportation, is needed.
The crisis cell will be located in a specially built crisis room at the Centralised Facility fully equipped with communication means (Vehicles tracking system, telephones, telefax, teleconference system,...) and all the necessary documentation (regulations, maps, safety files, ERPT and specific plans,…).

The crisis room is operated permanently during our transports using the real Time tracking system:

- Location of the vehicle (trucks, wagons, ship) with the GPS system
- Transmission of information with the Inmarsat system

In addition, we are thinking that OPG, as COGEMA LOGISTICS needs to own a **recovery system for heavy casks**. It may be needed if the casks are placed accidentally in a location where no classical means of recovery can be efficiently used.

Real time tracking:

As described in chapter 5 of D#5, dedicated sea and ground transports for UFTS can be real time tracked from an OPG headquarters to be located at the Centralised Facility. Road vehicles, railway wagons as well as dedicated vessels involved in the logistic network for UFTS can be equipped with specific tracking systems.