APPENDIX C: ROAD TRANSPORT FEASIBILITY OF IFTC/BM AND DSCTP

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1. REFERENCES

The following references were used for the completion of this study:

- *Regulations for the Safe Transport of Radioactive Material, No. TS-R-1* (international Atomic Energy Agency) **<32>**;

- *Transportation of Dangerous Goods Regulations (Transport Canada);*
  Packaging and Transport of Nuclear Substances Regulations (Canadian Nuclear Safety Commission) **<49>**;

Provincial regulations applicable to the transport of radioactive material;

- Manitoba Transportation and Government Services *Weights and Dimensions Compliance Guide* (October 2000) **<38>**;

- *Ontario Highway Traffic Act* **<41>**;

- Quebec Ministère des Transports, *Vehicle Load and Size Limits, The 2000 edition* **<43>**;
- *Guide to the Agreement on Uniform Vehicle Weights and Dimensions Limits in Atlantic Canada* (October 2001) **<31>**;

- New Brunswick Department of Transportation, Notice to transporters *: Guideline for Applying for and Obtaining Required Special Permits* (July 2001) **<40>**;

- New Brunswick Department of Transportation, *Motor Vehicle Act* **<39>**;

- Freightliner Argosy Brochure **<51>.**

2. PURPOSES

The objectives of this appendix are:

- To give the reason for the choice of one road weight transportation cask among the two (IFTC, IFTC/BM) in accordance with the regulations.

- To verify the transport feasibility of the DSCTP by road.

3. DATA

3.1. Description of the casks

- "Standard" IFTC

  Dimensions (approx.):
  - Length : 1.9 m (2.3 m with impact limiter)
  - Width : 1.6 m (2.1 m with impact limiter)
  - Height : 2.2 m
  - Weight : 35 T (total loaded weight)

- IFTC/BM

  Dimensions (approx.):
  - Length : 1.9 m (2.3 m with impact limiter)
  - Width : 1.6 m (2.1 m with impact limiter)
  - Height : 2.6 m

Calculation of the estimated weight:

Volume added to the "standard" IFTC (in dm3):
[(16.44*18.81*21.47)-(11.10*13.47*18.80)]-[(15.56*18.81*16.97)-(10.22*13.47*14.3)] = 830,1 dm3
See Appendix A for measurement details of the IFTC and IFTC/BM.

Mass = 830.1 * 7.6 = 6,309 kg (7.6 kg/dm3 is the density of the steel used in the IFTC)

IFTC mass (loaded) = 35 T
+ 6.3 T mass of the added volume
+ 0.3 T increased cap
+ 0.6 T increased impact limiter (due to the global increase of the cask)
+ 0.3 T space filler

➔ Mass of IFTC/BM: 42.5 T (total loaded estimated weight).

NB: the dimensions of the IFTC and of the IFTC/BM, when they are loaded on a low profile trailer (the same kind as the one shown on Appendix A), are within the limits of the Quebec, Ontario and New Brunswick road transport regulations [see References].

These limits are: Max. height -> 4.15m
Max. width -> 2.60m
Max. length -> 16.20m (for a tractor and a semi-trailer)

- DSCTP

  The DSCTP will be transported in horizontal position, and the dimensions are as follow:
  - Length : 5.950 m
  - Width : 3.370 m
  - Height : 3.670 m
  - Weight : 100 T (approx.)

3.2. Description of the vehicle

- Trailer (4 axles)

  The trailer we choose for this study will be the one described in Appendix A.
  - Length : 13,35 m
  - Width : 2,5 m
  - Height : 0,98 m (deck)
  - Number of axles: 4
  - Distance between two axles: 1,5 m
  - Weight: 3 T (estimated)

- Tractor

  The tractor presented in this study is as described in the “Argosy” brochure **<51>.**
  - Number of axles: 4 (3 + 1 removable)
  - Allowable front axle weight: 7,273 kg
  - Allowable tandem drive axles weight: 20,900 kg
  - Drive axle spacing: 1.5 m
  - Front axle to last axle spacing: 4.9 m
  - Weight of the tractor: 11 T

4. CALCULATIONS

4.1. Allowable Gross Weight for the vehicle

The method used for this calculation is described in the "Vehicle Weight and Dimension Limits in Ontario" Regulation.

The vehicle (tractor and semi-trailer) is composed of seven axle units and one 4 axles group (trailer) and we will not take into account the removable axle.
All axles are dual tires fitted except the steering axle of the tractor (single tire).
The maximum allowable weight of a 4 axles group (as indicated in the regulation) is 38,000 kg, if the axle group spacing is equal or superior to 7.5 m.

The maximum allowable gross weight of the vehicle will be:
Tractor front axle allowable weight: 7,273 kg (as indicated in the Argosy brochure)
+ Drive tandem axle allowable weight: 20,900 kg
+ 4 axles group max. allowable weight: 38,000 kg (27,100 kg for the presented trailer)

➔ Maximum allowable weight: **66,173 kg** or **55,273 kg** if we use the presented trailer.

4.2. Transport feasibility for each of the three casks

Estimated weight of the trailer: 3 T
Total weight of the vehicle (tractor and semi-trailer not loaded): 14 T

- "Standard" IFTC
  Weight of the cask: 35 T (loaded)
  Weight of the vehicle: 14 T
  Total weight: 49 T

➔ This cask can be transported with the presented trailer and tractor.

- IFTC/BM

  Weight of the cask: 42.5 T (estimated, loaded)
  Weight of the vehicle: 14 T
  Total weight: 56.5 T

➔ We can transport this cask with a 4 axles trailer if the axle group spacing is equal or superior to 5.0 m. *As mentioned in the regulation, the maximum allowable weight for a 4 axles group with a spacing of 5.0 m is 28,900 kg, so we have the following result: 28,900 + 20,900 + 7,273 =* ***57,073 kg****, which is sufficient to transport a loaded IFTC/BM cask.*

- DSCTP

For the DSCTP, which weigh about 100 T, the calculation is reversed, and because it cannot be transported on a standard semi-trailer we need to determine how many axles are required to transport this cask by road.

On the "Weight and dimensions limits in Ontario" regulation, the maximum weight allowable for a single axle is 10,000 kg.
We can estimate with these data that the trailer should have at least 9 single axles (an example of this kind of trailer is shown in Figure N°12 / Appendix A), as shown on the calculation next page.

Calculation for an 9 axles semi-trailer with a 3 axles tractor (see the Argosy description above, but only for weight and dimensions purposes):

Tractor front axle allowable weight:	7,273 kg (as indicated in the Argosy brochure)
+ Drive tandem axle allowable weight:	20,900 kg
+ 9 axles max. allowable weight:	86,000 kg (two 4 axles group + one single axle)
= Total allowable weight:	114,173 kg

For the transports of DSCTP a special permit for an overweight and oversized convoy will be required because of the weight and the width, which exceed the limits allowed.

5. CONCLUSIONS

As we could notice with the above calculations, the changes made from the standard IFTC to the IFTC/BM represent a 7.5 tons increase in weight. But if the axles group spacing of the trailer is designed to meet the requirement of the provincial regulations on maximum allowable weights, it is possible to transport the IFTC/BM by road without additional constraint in comparison with the standard IFTC.

Concerning the DSCTP, a special permit is needed to transport it by road, due to its weight and its dimensions.