PATRAM 2010

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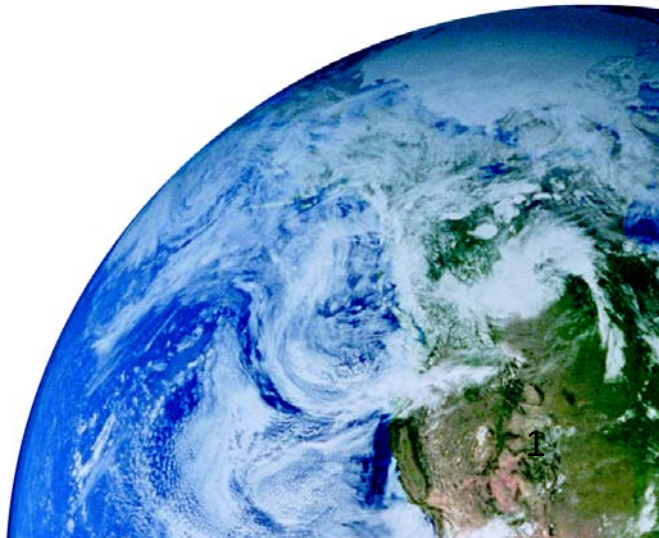
Experience in Shipping Bulk Powders and How it is Relevant to Uranium Ore Concentrate

Marc-André Charette
Guy Karrer
Al Stratemeyer



INTRODUCTION

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- Review the current methods to transport powders.
  - Bulk Carriers.
  - Freight Containers containing smaller packages.
  - Freight Containers with Bulk Capacities.
  - Specialized Freight Containers.
  - Tank Containers for Pressurized Dry-Bulk.
- Next Steps.

BACKGROUND

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- Natural Uranium Concentrate has been transported in open-head steel drums for over 50 years.
  - Meets the regulatory requirements for packaging and transport.
  - Review of current practices has not been done.
- Align with product stewardship to benchmark current practices against leading practices for transporting bulk, high density industrial powders.

BULK CARRIERS

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- Purpose built ships capable of carrying large volumes / masses of dry bulk cargo.
- Automated or grab loading and unloading
- Losses and multiple handling.
- Large investment.

GENERAL PURPOSE CONTAINERS

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- Most common container.
- Available in various lengths, heights and capacity.
  - 20’ by 8’ 6” height
  - 40’ by 8’ 6” or 9’ 6” height
- Come in various conditions and ages.
- Loading and discharging access is limited.
- 20 ft container is well suited for high density cargoes.

BAGS

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- Generally used for point of sale packaging.
- Generally limited to 50 kg.
- Inexpensive, easy to use and quick to fill.
- Generally loaded onto pallets, although can be hand loaded.
- One way packaging.
- Could be recyclable.

BIG BAGS (FLEXIBLE IBC)

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- Ideal for medium bulk quantities.
- Generally slower to fill.
- Can only be moved by fork truck.
- Generally 1 to 2 m^3 capacity.
- Fitted with top closure to retain product in the bag.
- One way packaging.
- Could be recyclable.

DRUMS

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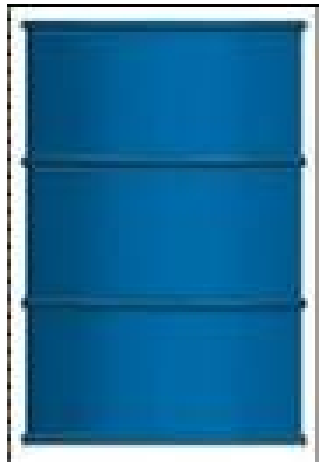
- Available in metal, plastic or fibre board.
- Available in open or closed top.
  - Powders are generally carried in open top.
- Range of sizes from 1 litre to 120 litres.
- Usually moved by fork-lift truck.
- May be multi-use which requires cleaning.
- Requires tipping to empty.



INTERMEDIATE BULK CARRIERS

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- Variety of IBCs.
- Multi use requires cleaning.
- Re-positioning required.
- Intermediate Bulk containers
  - 1.2 metre square.
  - Heavy with wasted space.
  - No stacking in freight containers.
- Tote Boxes
  - 0.79 m^3 capacity
  - Light weight, stackable.
  - Easy to load, harder to unload.

FREIGHT CONTAINERS FOR BULK

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- 20 ft container with liners.
  - Bulkheads may be needed.
- Not suitable for free flowing materials.
- Liners need to be fitted correctly.
- Light weight material, for maximum payload.
- Liners must be siftproof.
- Limited access for loading and unloading.

FREIGHT CONTAINERS WITH BULK FEATURES

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- Usually 20 foot containers:
  - Loading hatches in roof.
  - Discharge hatches in doors.
  - Full width discharge hatches in front wall or rear door.
- Usually requires tipping to unload.
- Limited supply.
- Must be re-positioned or operated in a closed loop.

OPEN-TOP CONTAINERS

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- Available in 20 ft and 40 ft.
- Material is loaded from the roof.
  - Less watertight.
  - Not suitable for cargoes susceptible to moisture.
- Hard tops can be damaged and are troublesome to fit.
- Can be fitted with liners and sealed prior to shipment.

HALF-HEIGHT CONTAINERS

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- Suitable for high density cargoes.
  - Height of 4’ 3” and 20 ft long.
- Built for specific need.
- Need closed loop or re-positioning.
- Linking half-height containers forms a standard 20 ft container.
  - Lower re-positioning cost.

NON-PRESSURIZED CONTAINERS

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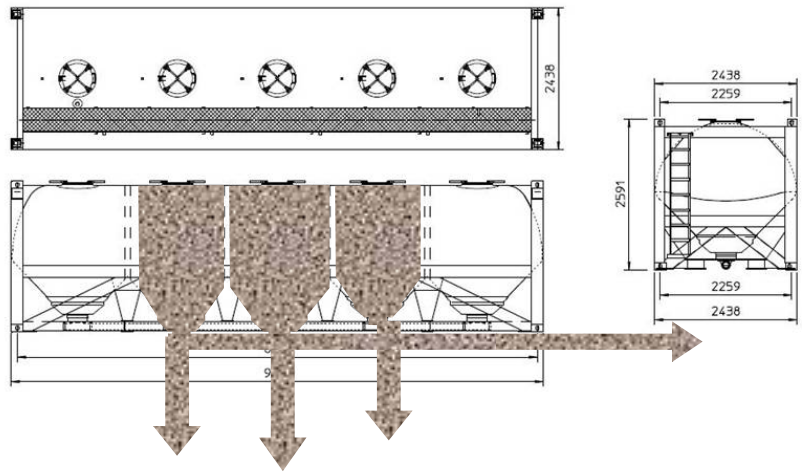
- **Box Type**
  - **20 ft container with increase end wall strength.**
  - **Withstand tipping.**
- **Hopper Type**
  - **Specially built for cargo and facility.**
  - **Loading through the top and discharge from bottom or horizontal discharge pipe.**
- **Need re-positioning or closed loop.**



PRESSURIZED TANK CONTAINERS

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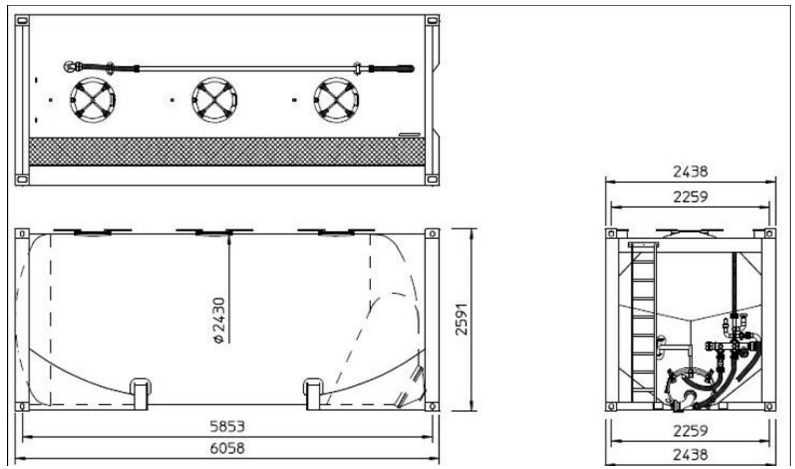
- Specialised equipment.
- Generally designed for liquids.
- Very secure method of carrying free flowing powders.
- Low tare weight.
- Can be built with aeration facilities for improving discharge.



NEXT STEPS

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- **Although not all transport methods described for bulk powders are suitable to transport Uranium Ore Concentrate some may provide a viable option.**
- **Industry members have decided to fund a feasibility study.**
  - **Study will benchmark current practice against those for bulk powder transport.**
  - **Goal of study is to identify and review the technical and commercial package design requirements and constraints for the transport of natural Uranium Ore Concentrate from producers to the converters.**