



nordion
SCIENCE ADVANCING HEALTH

**Journey of a Package:
Category 1 Source (Co-60) Shipment with Several
Border Crossings, Multiple Modes (IAEA/CN-187/1A/4)**

**IAEA International Conference on the Safe and
Secure Transport of Radioactive Materials**

Vienna, Session 1A

Paul Gray

October 17, 2011

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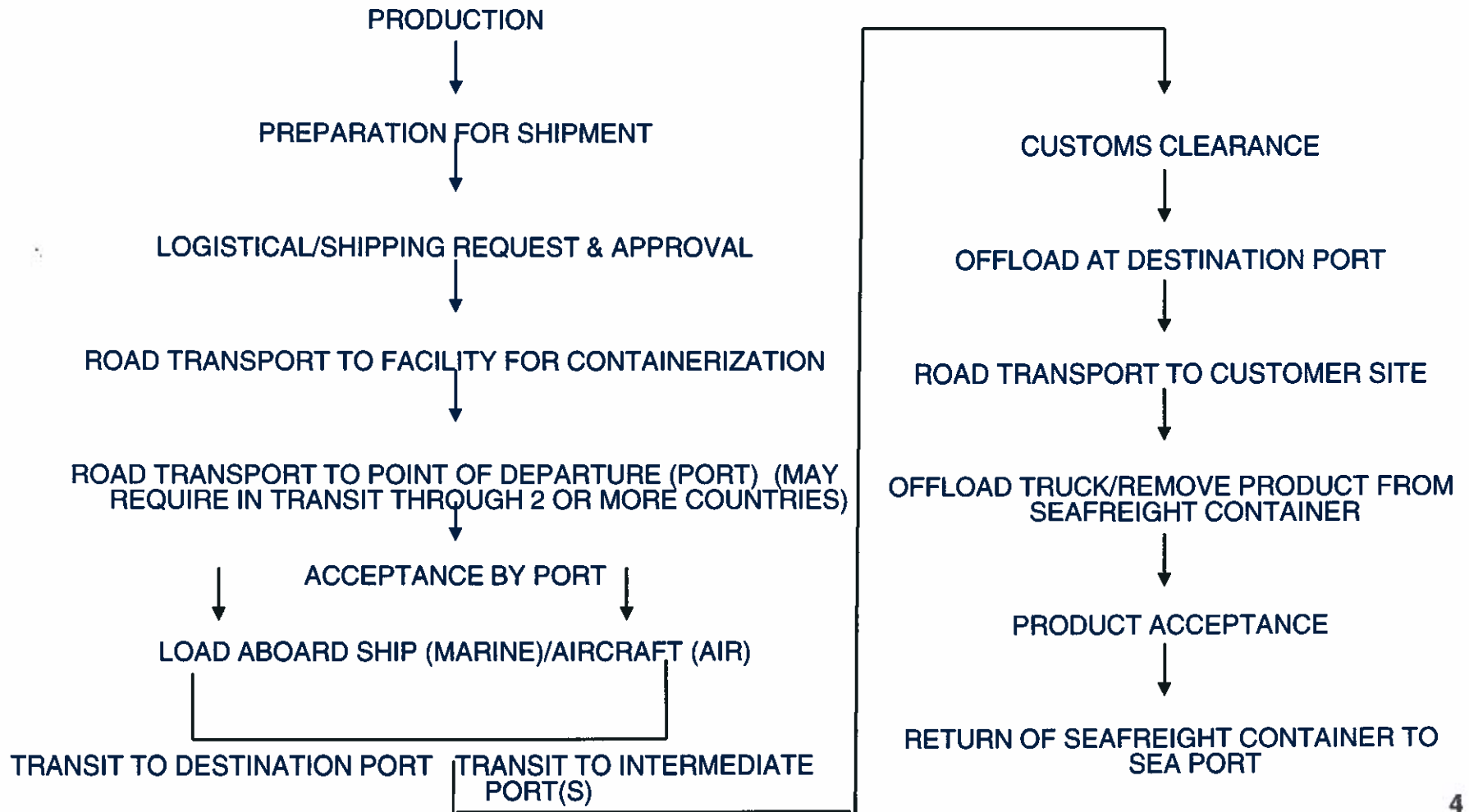
- International Conference on the Safe and Secure Transport of Radioactive Materials : The Next 50 Years - Creating a Safe, Secure and Sustainable Framework
- “over several decades of transport, there has never been an in-transit accident with severe human health, economic or environmental consequences attributable to the radioactive nature of the goods” (IAEA GC, 2003)
- Journey of a package of Category 1 sources via multiple modes through and to various IAEA Member States

Stages of the Journey

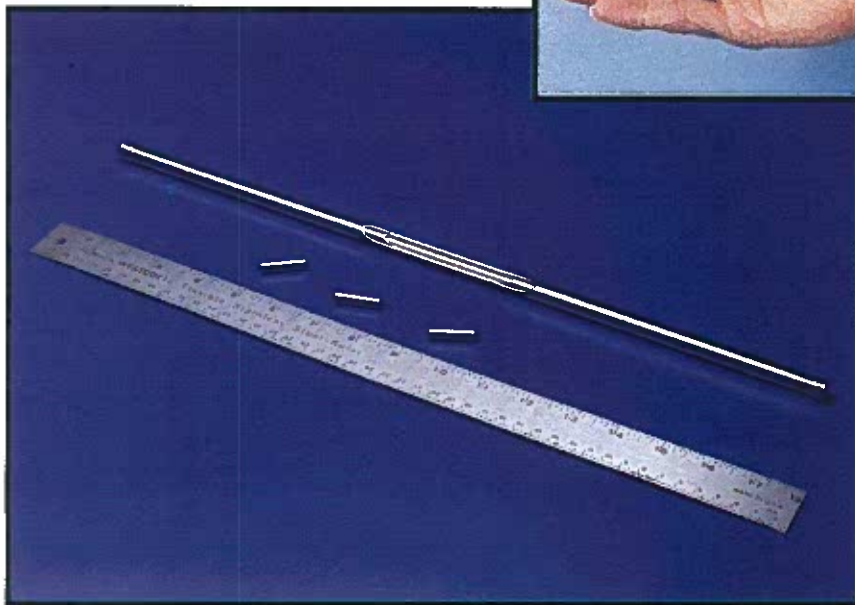
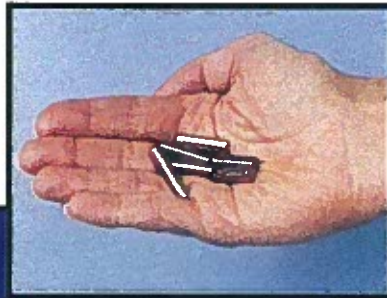


- Sales Order
- Truck/Vessel Arrangements
- Import/Export Requirements
- Regulatory Requirements
- Transport and Delivery to Customer
- Installation
- Return Shipment of Container (Empty or With Spent Sources)

Typical Shipping Process

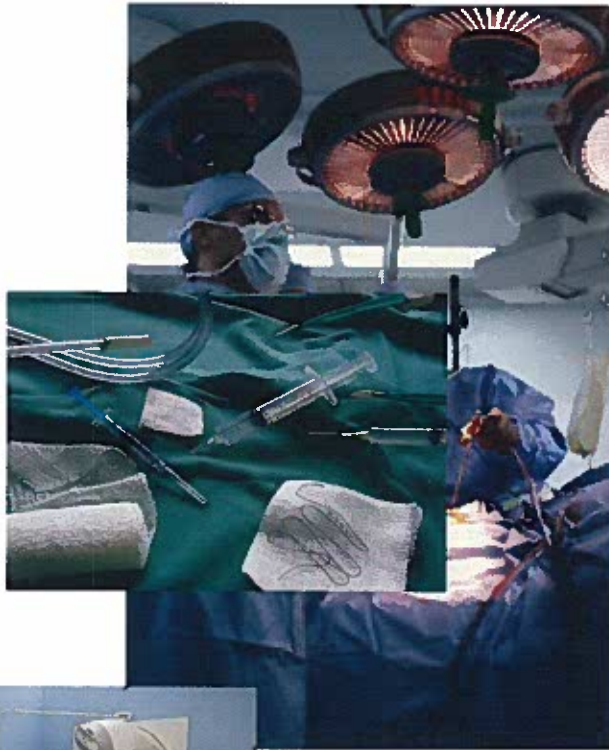


What is Cobalt 60?



- Cobalt-60 pencils emit gamma radiation - this energy is harnessed to eliminate pathogens and microbes
- Cobalt-60:
 - A solid metal
 - Non-fissionable
 - Non-soluble
 - Non-dispersible
 - Non-flammable
 - Long half life
 - Large quantities per container
 - Sources and containers licensed

Cobalt-60 Uses



- Cobalt-60 is depended upon to sterilize some 45% of all single-use medical supplies and devices in the world (sutures, catheters, syringes, heart valves, artificial joints and an estimated 80% of all surgeons' gloves)
- Certain products can only be sterilized with cobalt-60 (e.g. endoscopic/blood gathering products, alcohol swabs, biological materials for transplant)
- Treating cancer (45,000 treatments/day in > 50 countries)
- Blood transfusions – to prevent TA – GVHD
- Necessary for drug development and delivery (sterile lab ware)
- Cobalt-60 is increasingly relied upon to enhance food safety and preservation

Sealed Source Testing



- Sealed sources must meet, as a minimum, the following tests:
 - Impact test
 - Bend Test
 - High temperature test
 - 10 CFR, 49 CFR, ANSI
N43.6, ISO 2919,
IAEA TS-R- 1
- After all tests, the source must still retain its leak tightness in order to be certified

Package Licensing

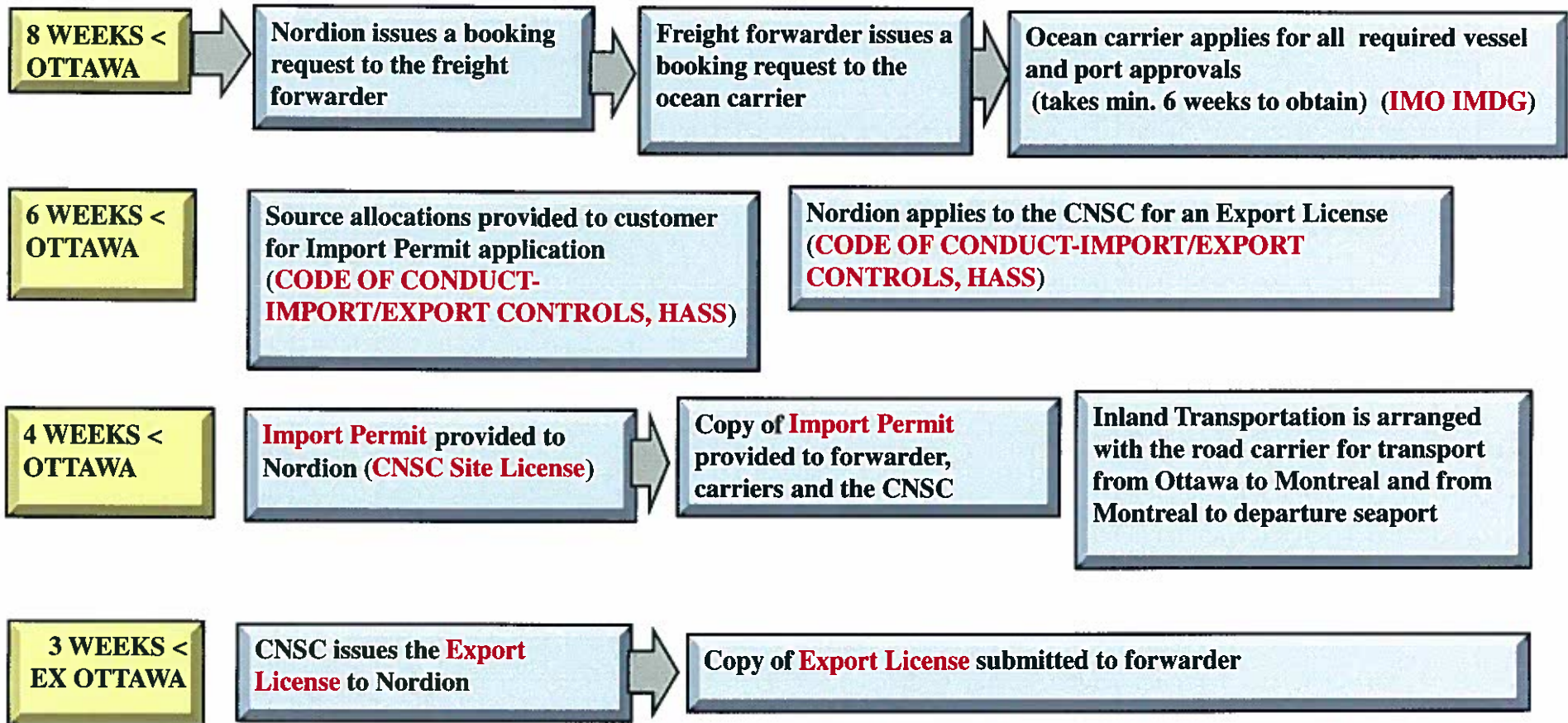


Sealed source pencils: approx. 0.5" diameter x 18" length

Container: approx. 45" diameter x 62" height (not incl. shipping skid)

- F-168 packages licensed by Canadian Nuclear Safety Commission and other competent authorities (NRC, DOT, etc.) (**Transport Container Licencing**)
- Designed to contain large quantities of radioactive material and worst case transport accident conditions (**TS-R-1; 49 CFR, 10 CFR**)

Multimodal Transport Timeline



Multimodal Transport Timeline



7 DAYS <
OTTAWA

Individual source serial numbers and activity provided to CNSC. (**IAEA CODE OF CONDUCT AND CNSC- SEALED SOURCE TRACKING**)

Pre-shipment notification issued to US DOT, USNRC, each in transit state en route to departure seaport (**US DOT 49 CFR and USNRC SGI**) Updates provided on a regular basis , as required, during transport.

Receipt of vessel/port approvals and subsequent booking confirmation

7 DAYS <
EXPORT
FROM
CANADA

Pre-shipment notification submitted to the Importing Country Competent Authority and the CNSC. (**IAEA CODE OF CONDUCT**)

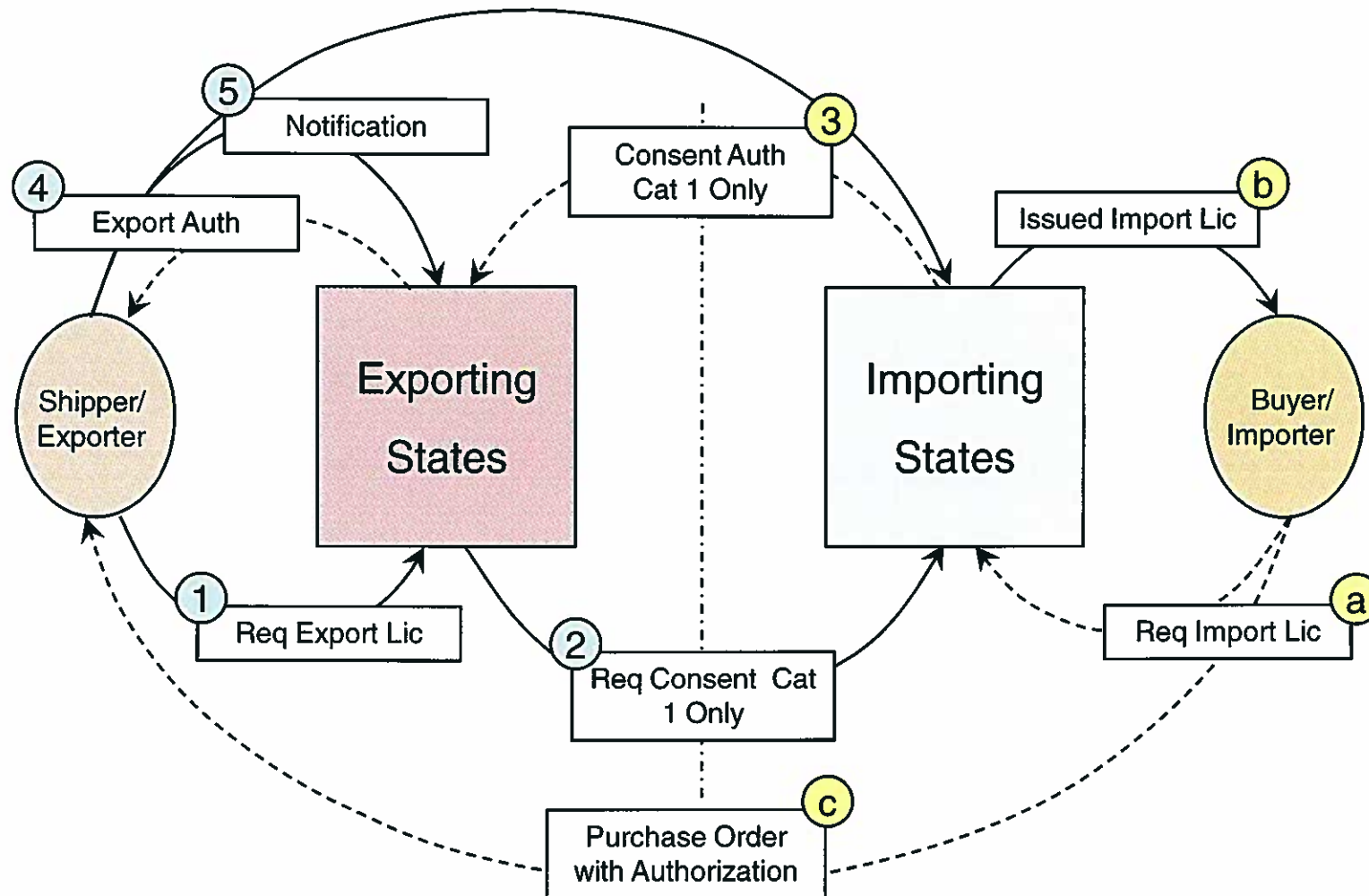
Electronic reporting of Export Declaration (**CANADA CUSTOMS**)

Code of Conduct: Import/Export Requirements

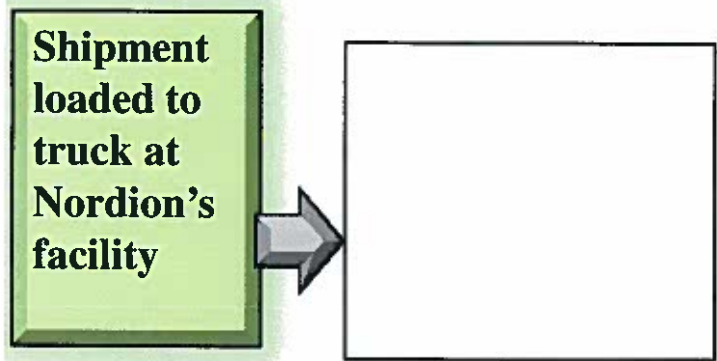


- Nordion submits an application for an Export Permit to the CNSC (Canadian Nuclear Safety Commission)
- Nordion requests a copy of the customer's import permit
- Nordion provides a copy of the import permit to CNSC, the freight forwarder/ocean carrier
- A copy of the Government issued Export Permit accompanies each shipment along with a copy of the Export Declaration issued by Nordion
- IAEA Code of Conduct – Export/Import Controls

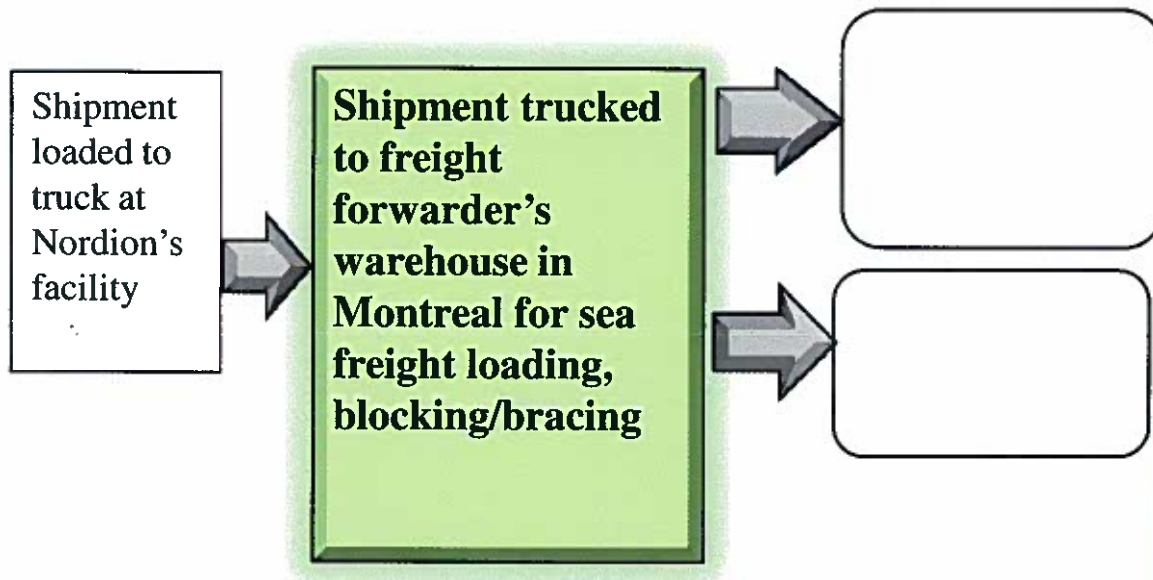
Code of Conduct: Import/Export Requirements



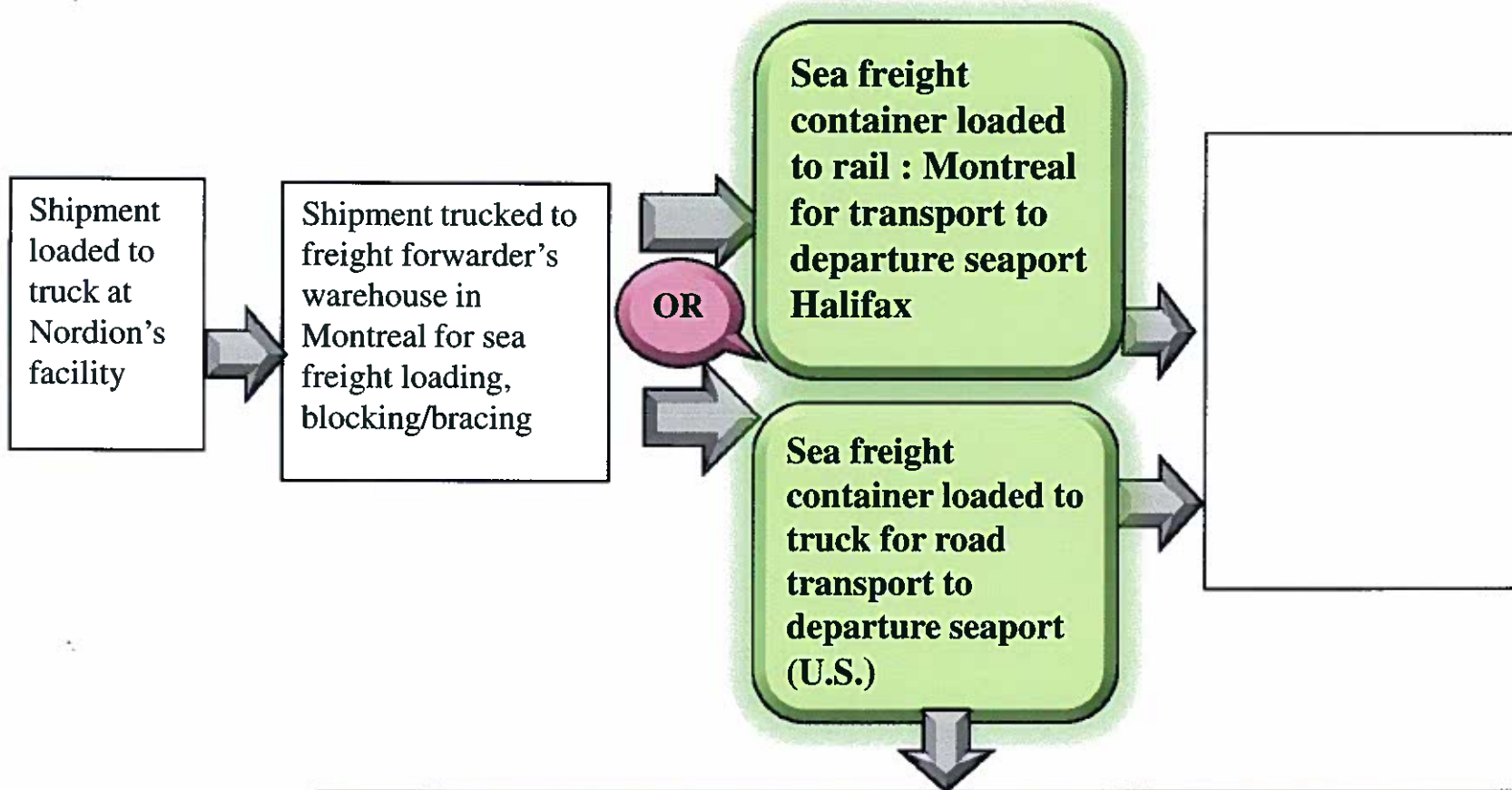
Transport and Delivery



TRANSPORT AND DELIVERY



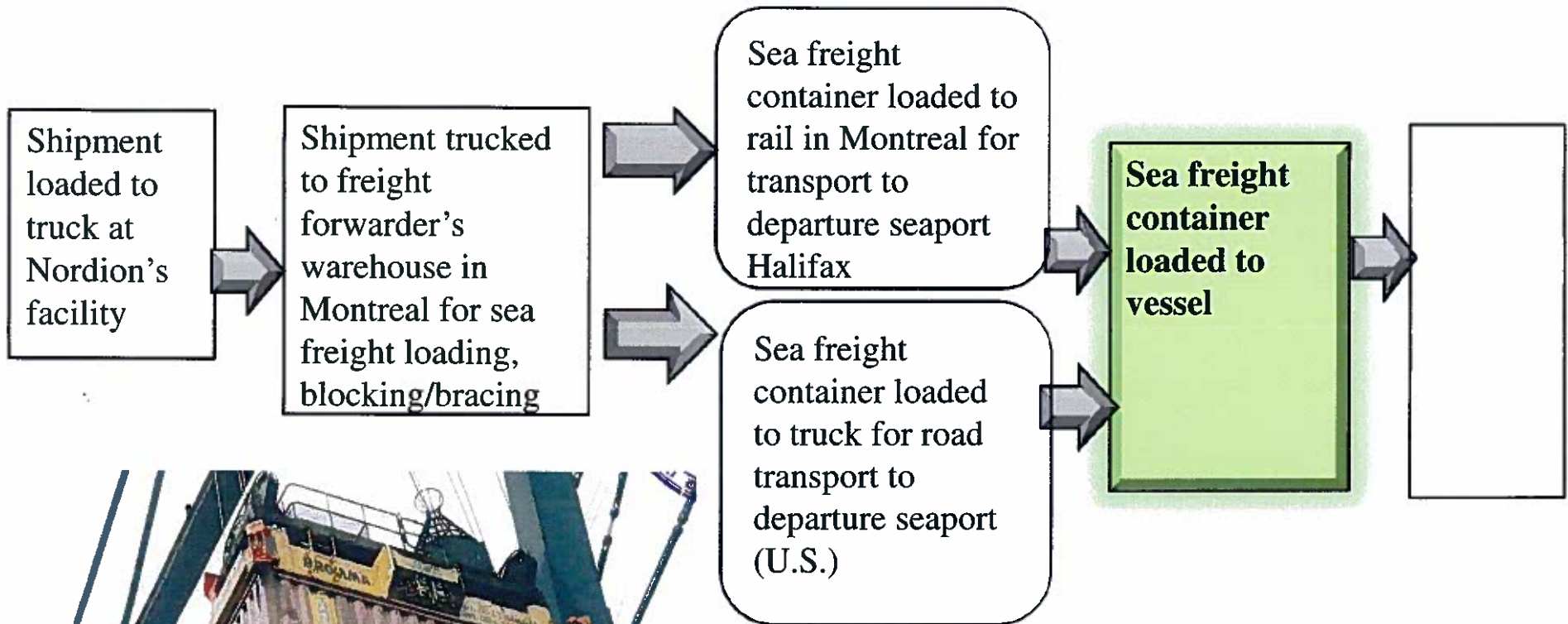
Transport and Delivery



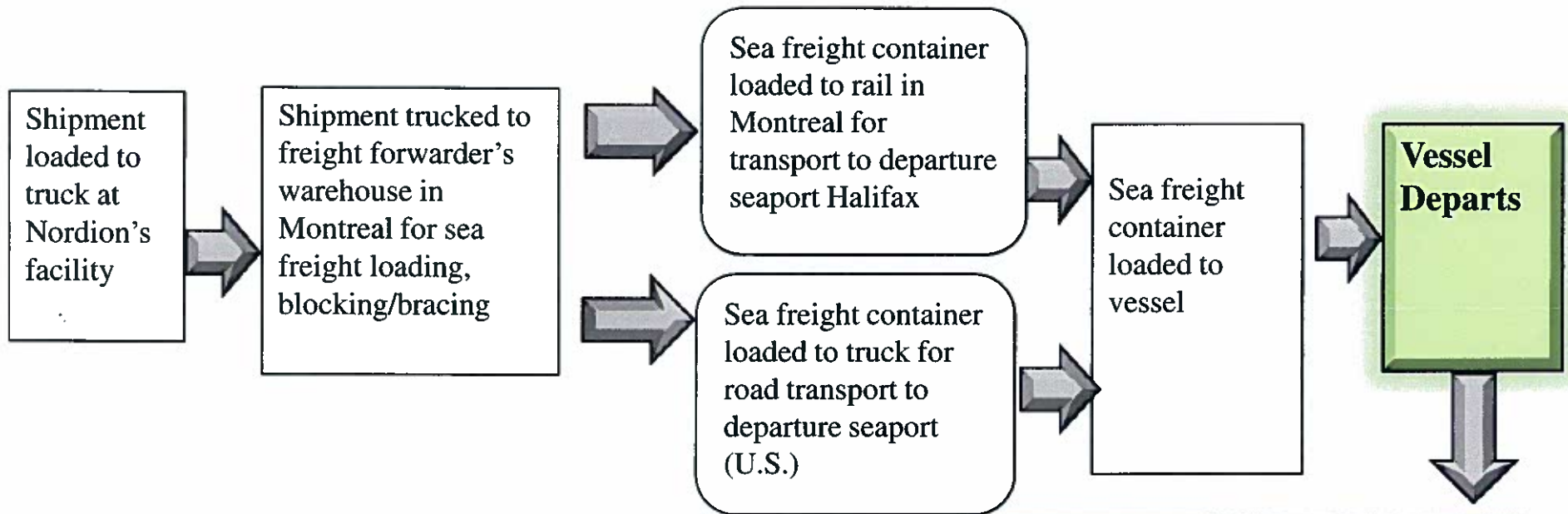
- 7 day pre-shipment notification
- 24/7 monitoring
- Ongoing updates
- GPS
- Level VI Inspections
- CNSC advised of export from Canada

- NRC
- DOT
- CBSA
- DHS CBP
- State Authorities

Transport and Delivery



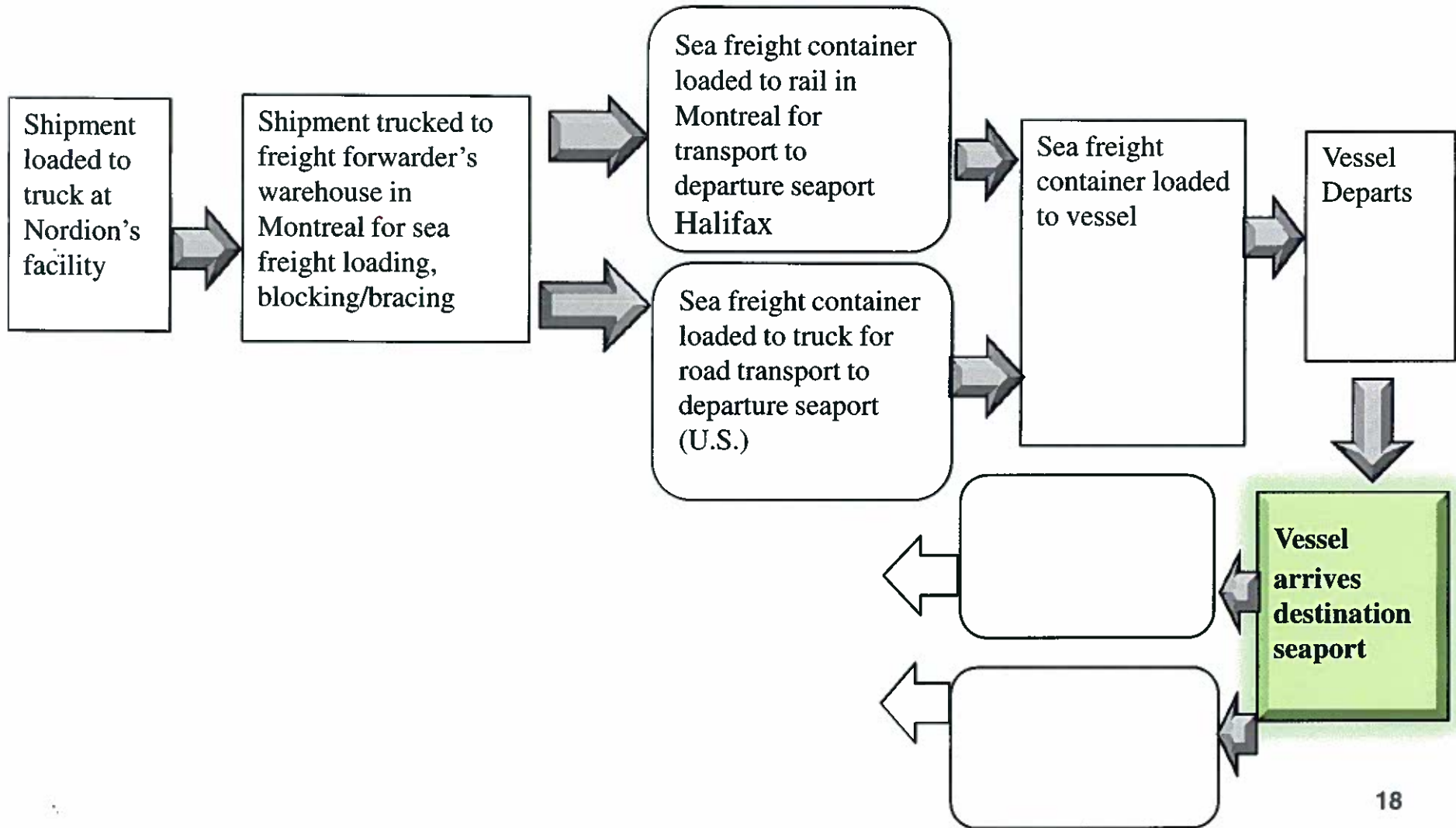
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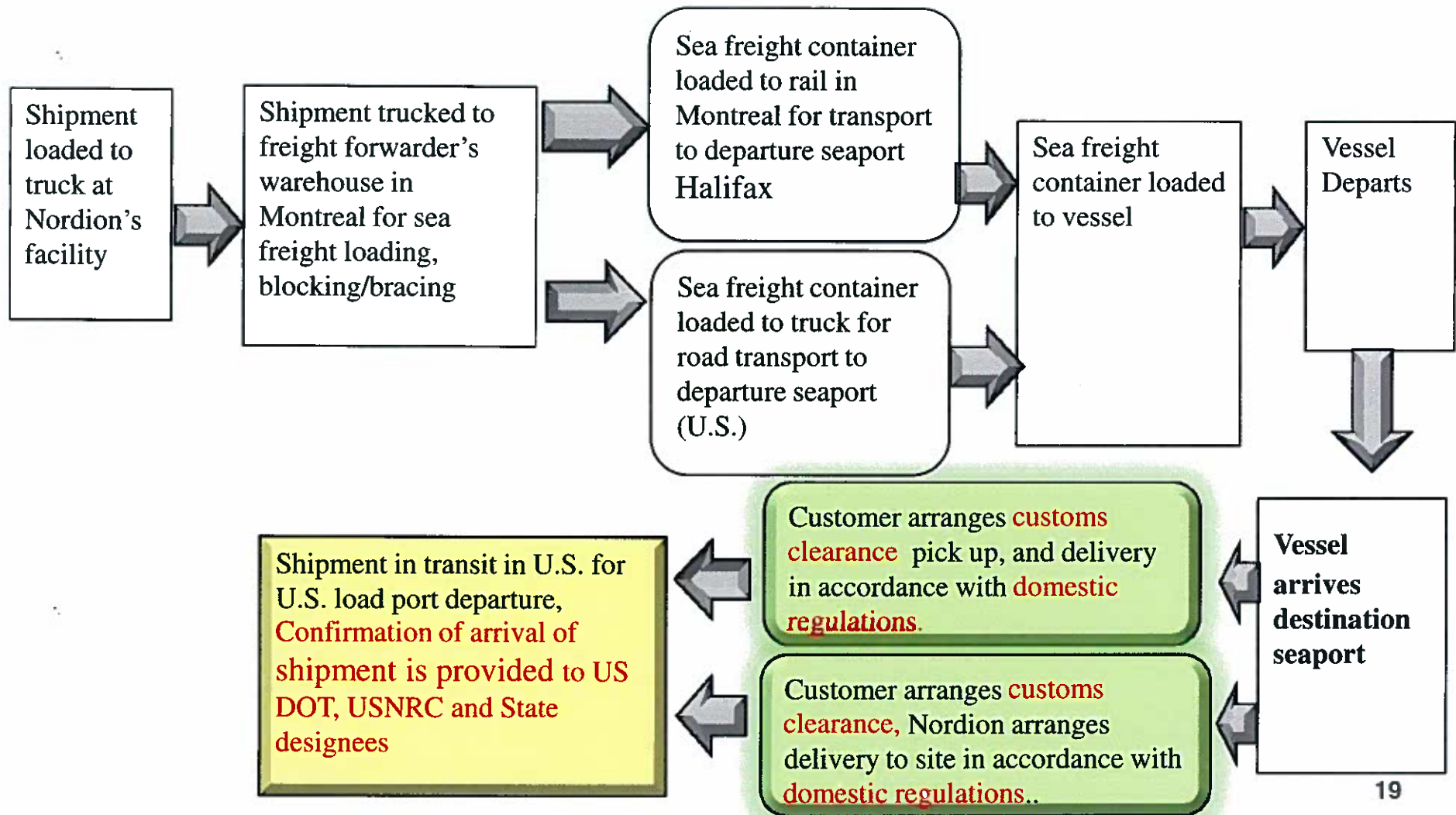
Departure from Canadian load port:
Confirmation of vessel departure communicated to CNSC
Departure from U.S. load port:: Communication of vessel departure to U.S. Federal Agencies and State Designees



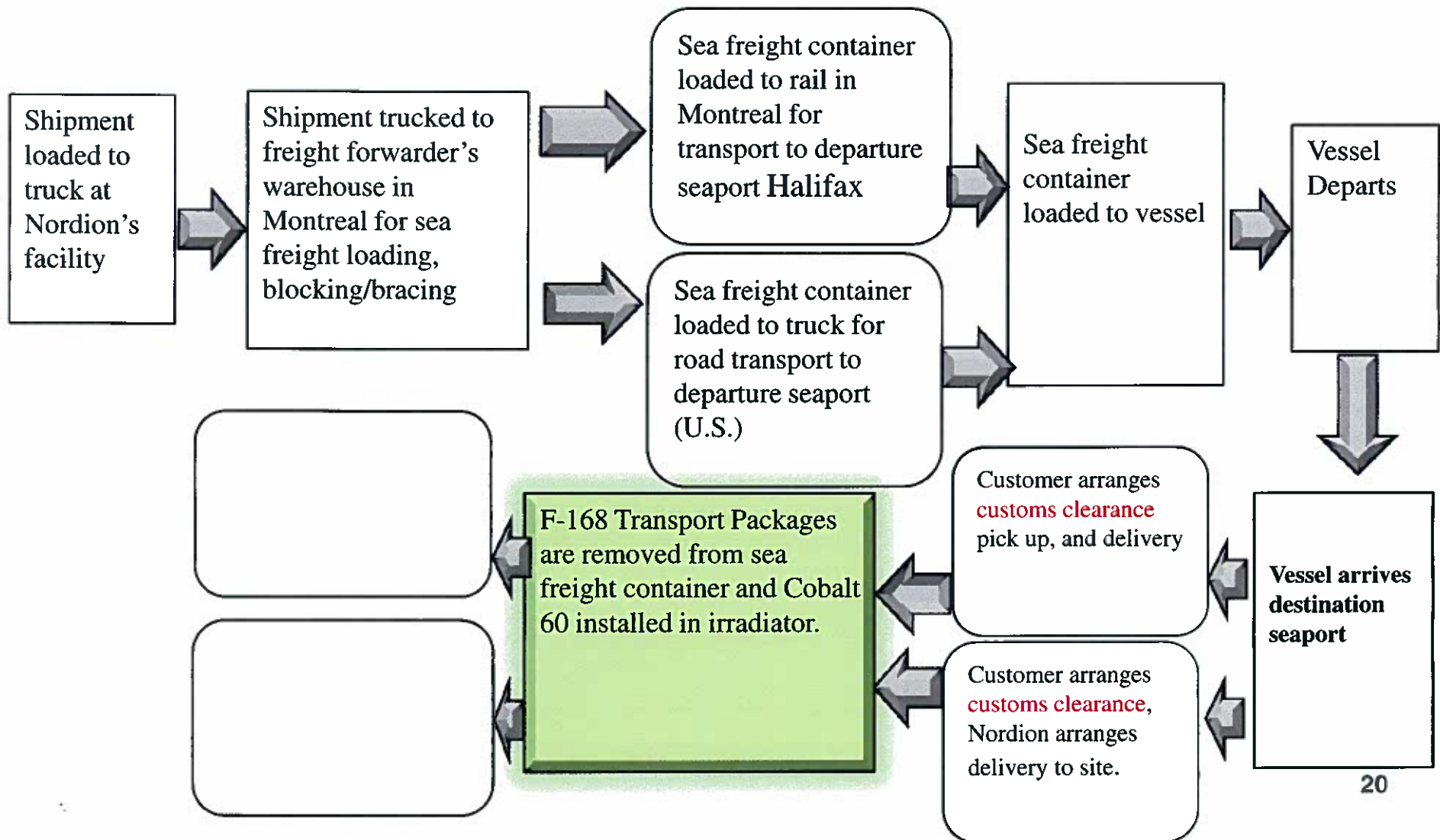
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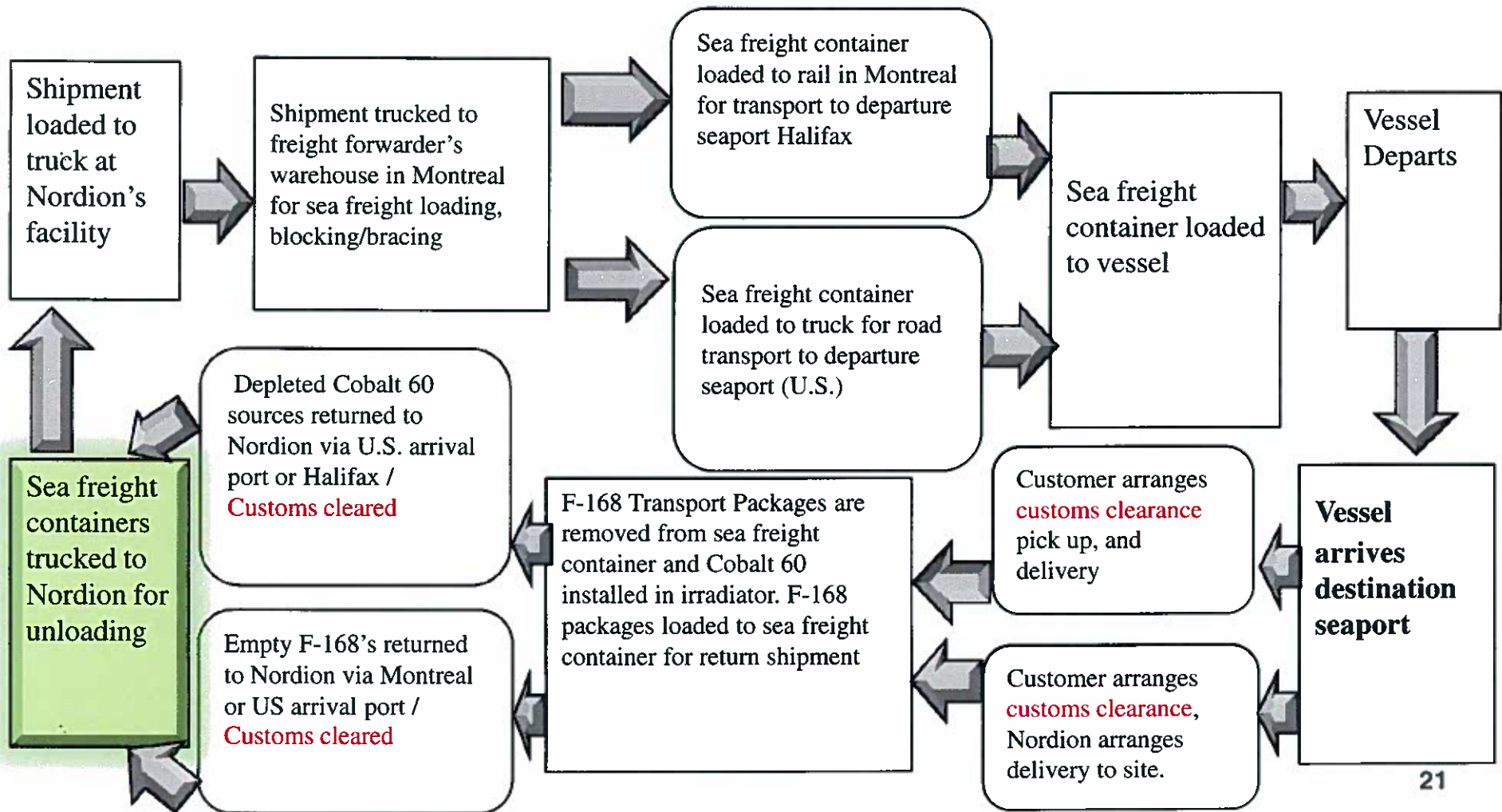
Transport and Delivery



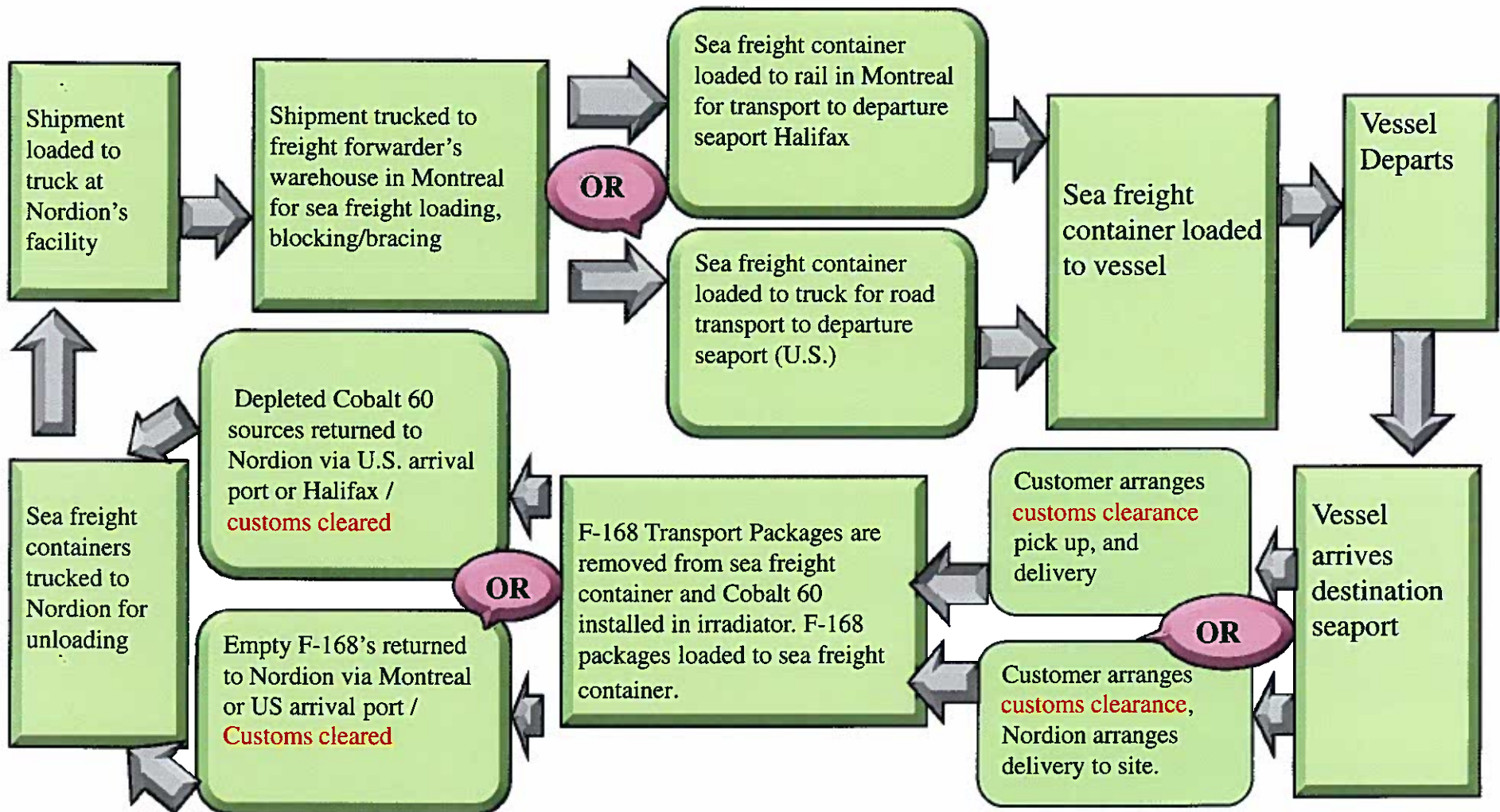
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Transport and Delivery



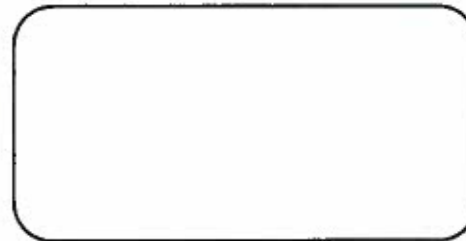
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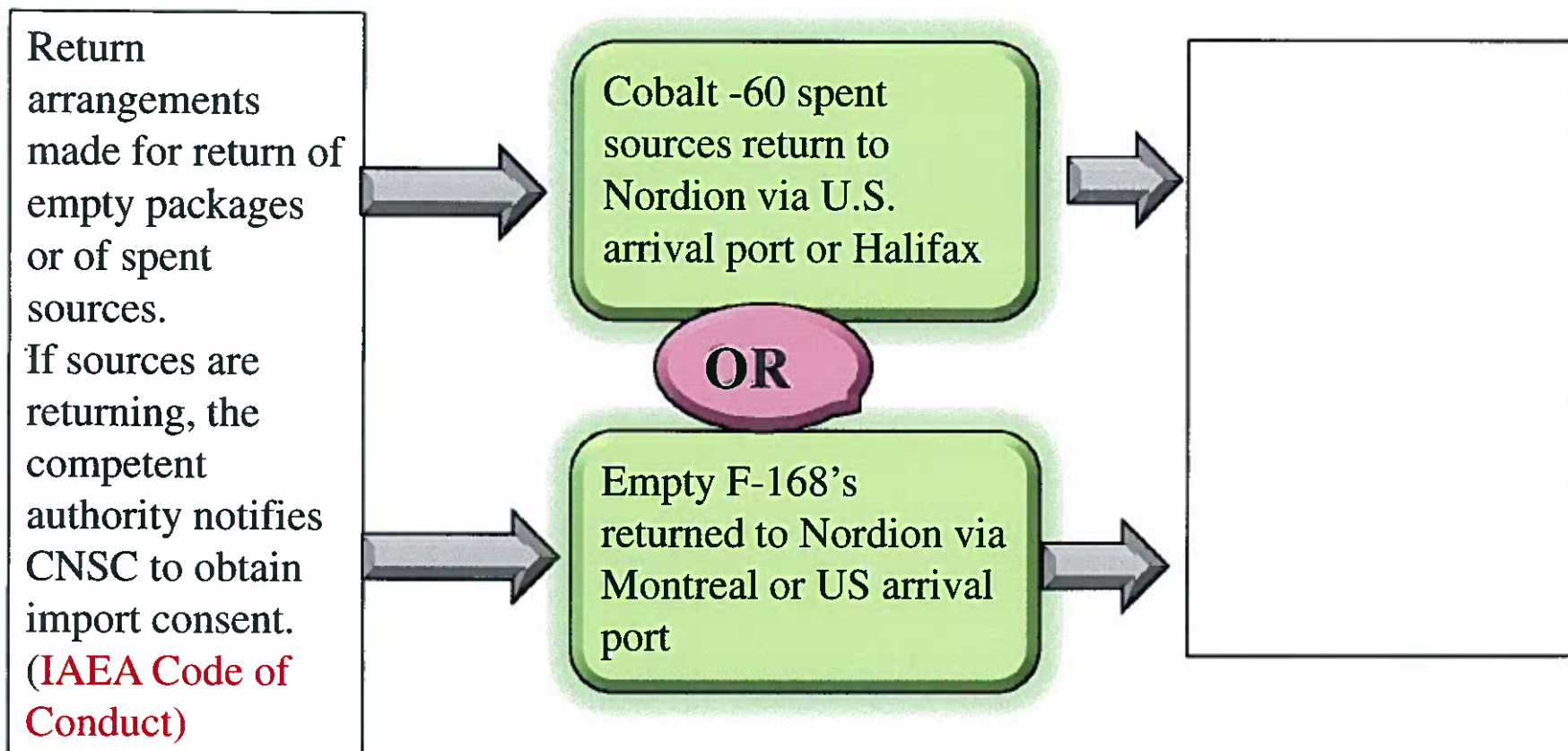
Return Transport Process

Return arrangements made for return of empty packages or of spent sources.

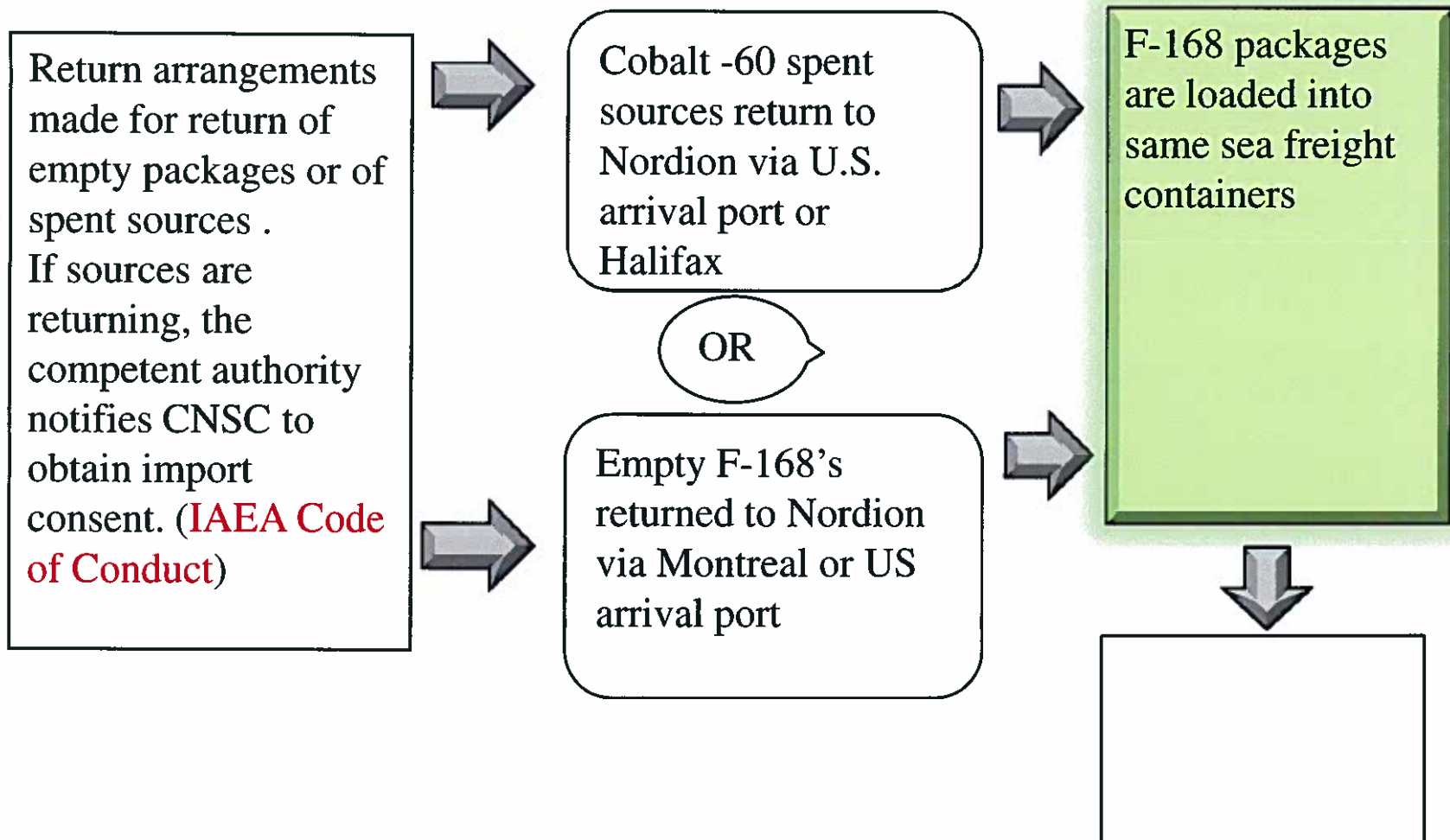
If sources are returning, the competent authority notifies CNSC to obtain import consent. (IAEA Code of Conduct)



Return Transport Process



Return Transport Process

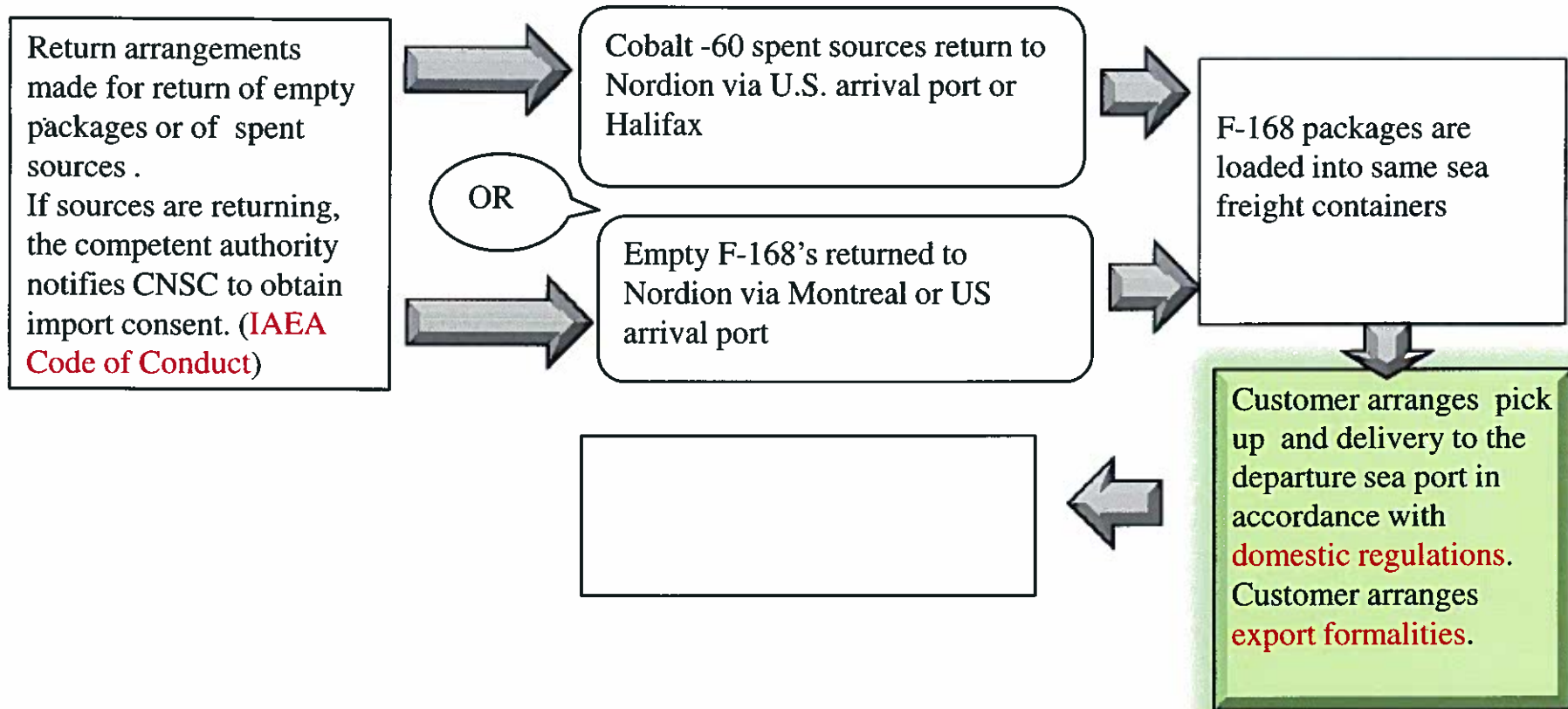


Return Transport Process

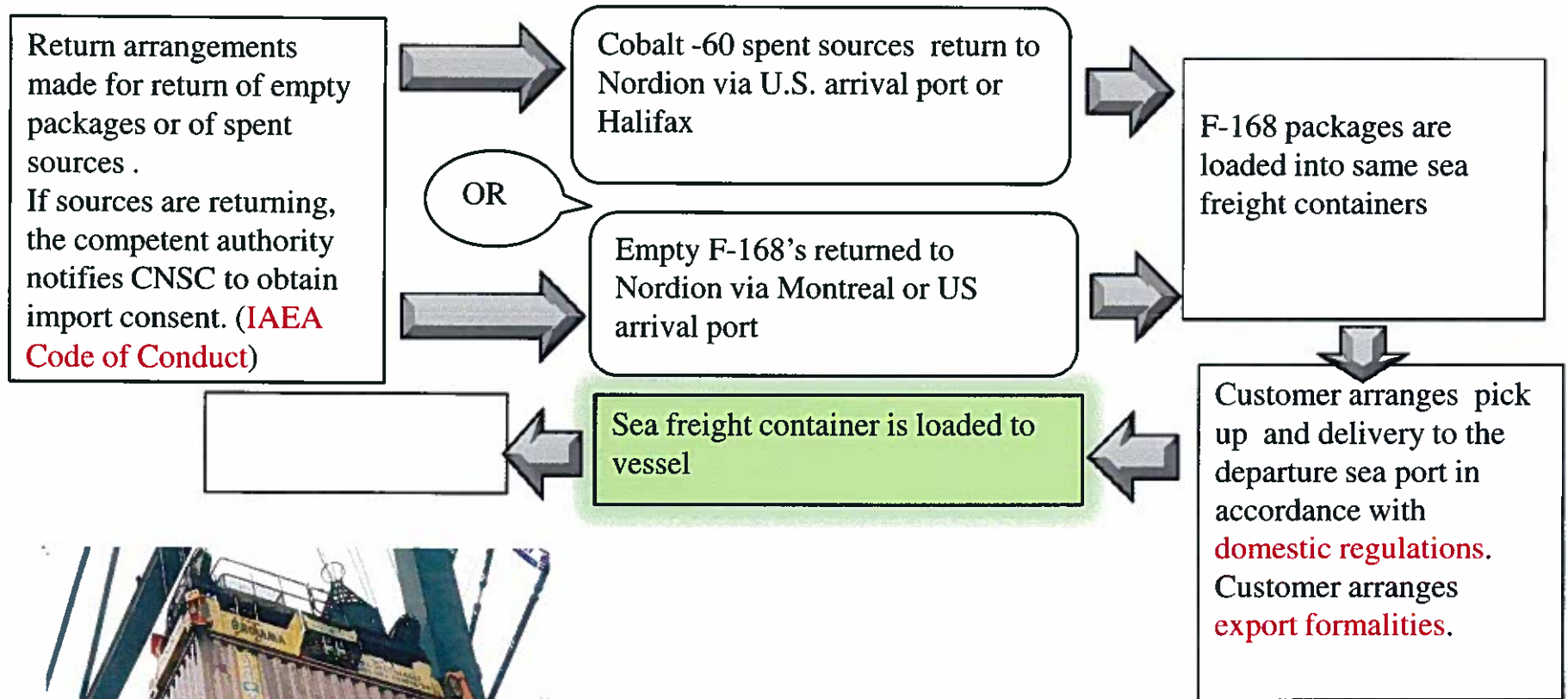
Utilization of same sea freight container



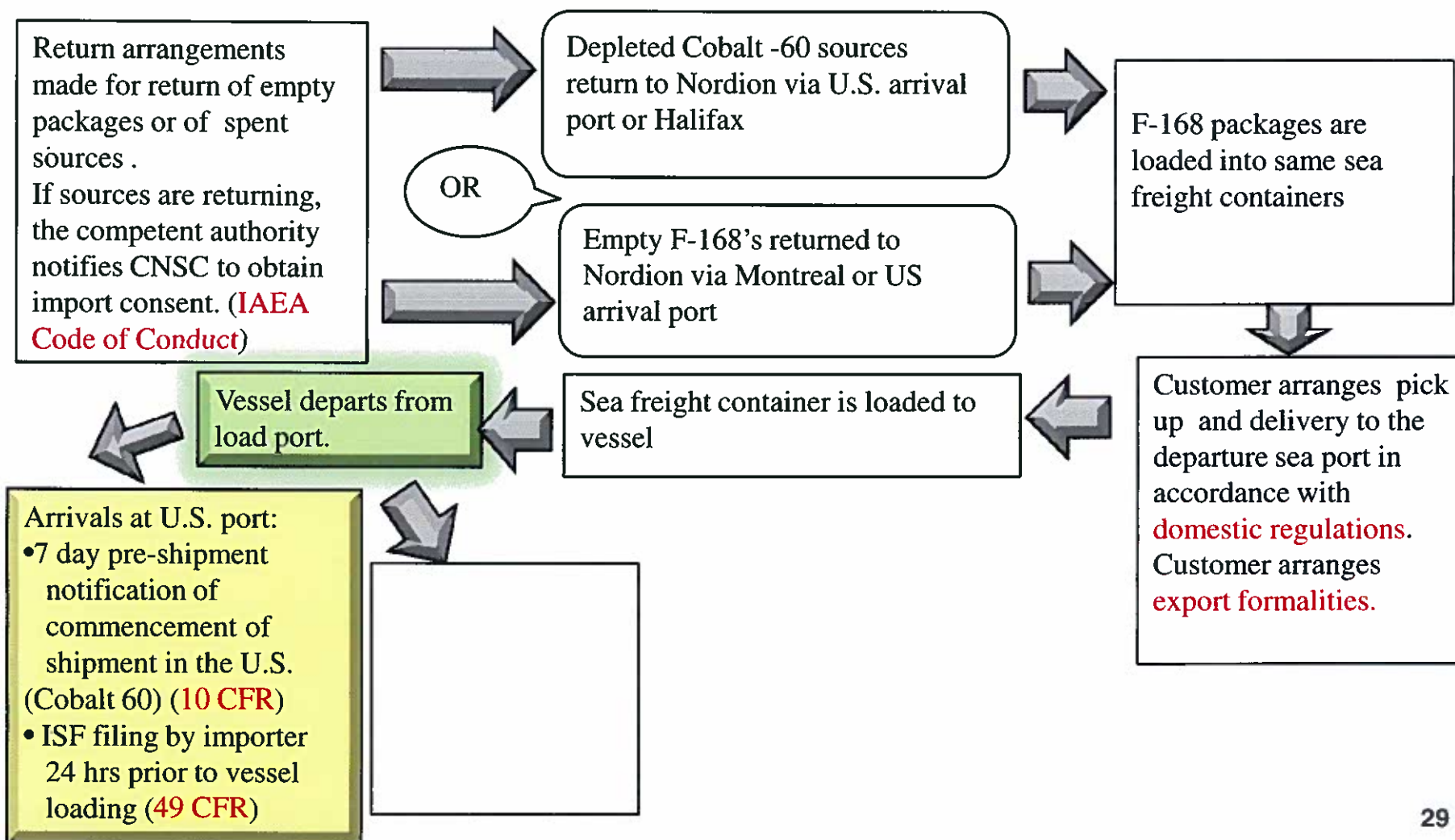
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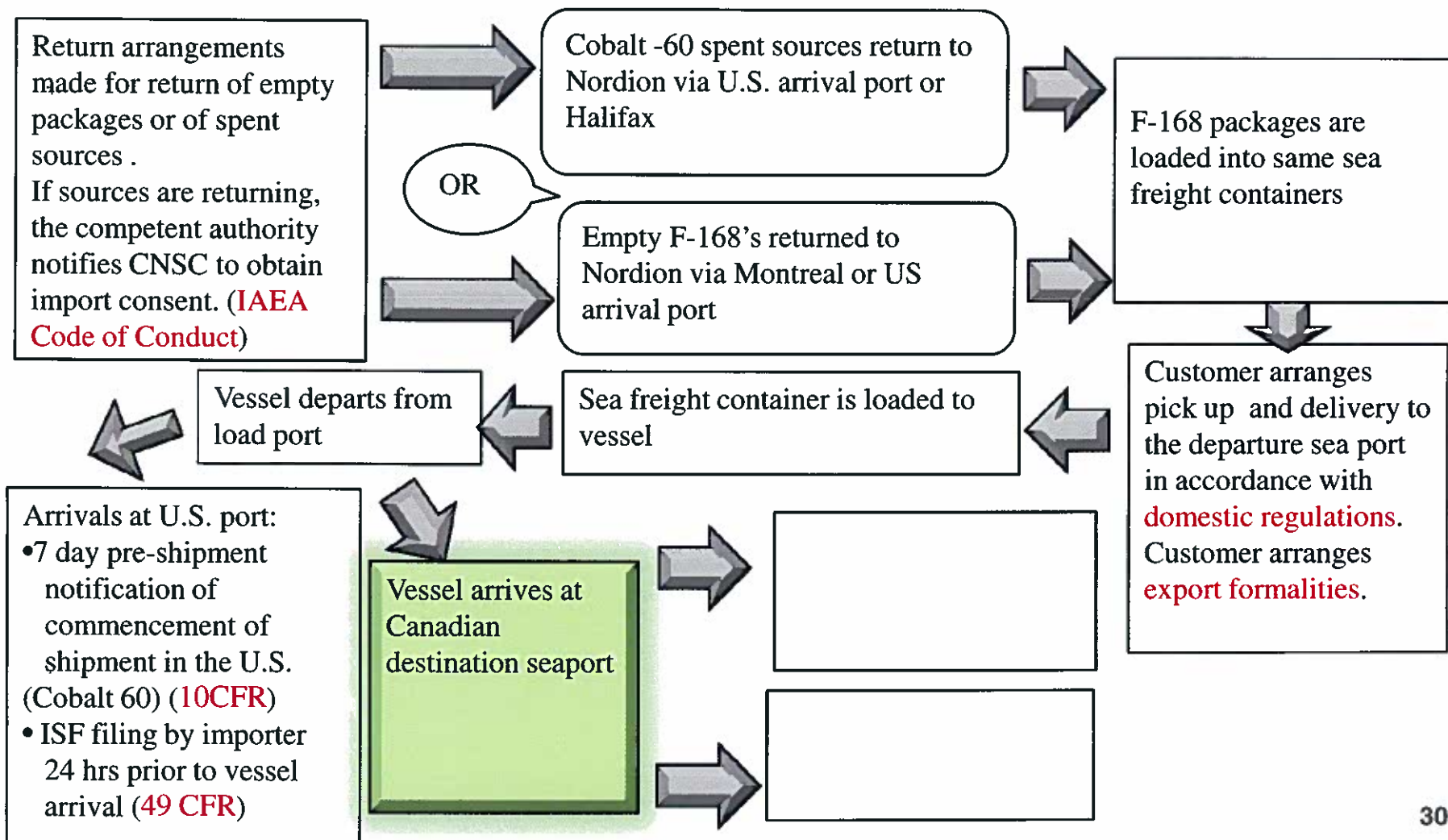
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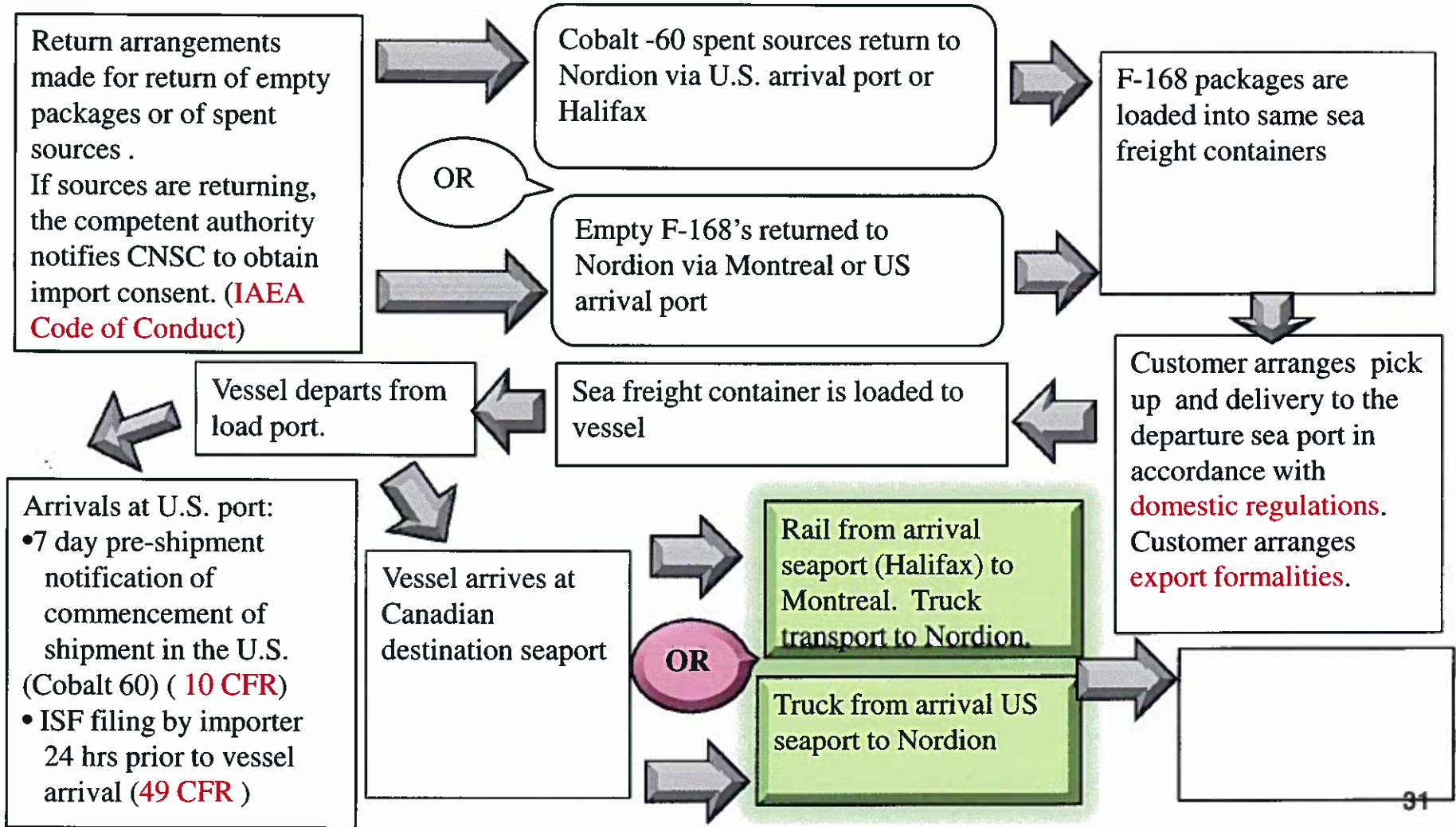
Return Transport Process



Return Transport Process



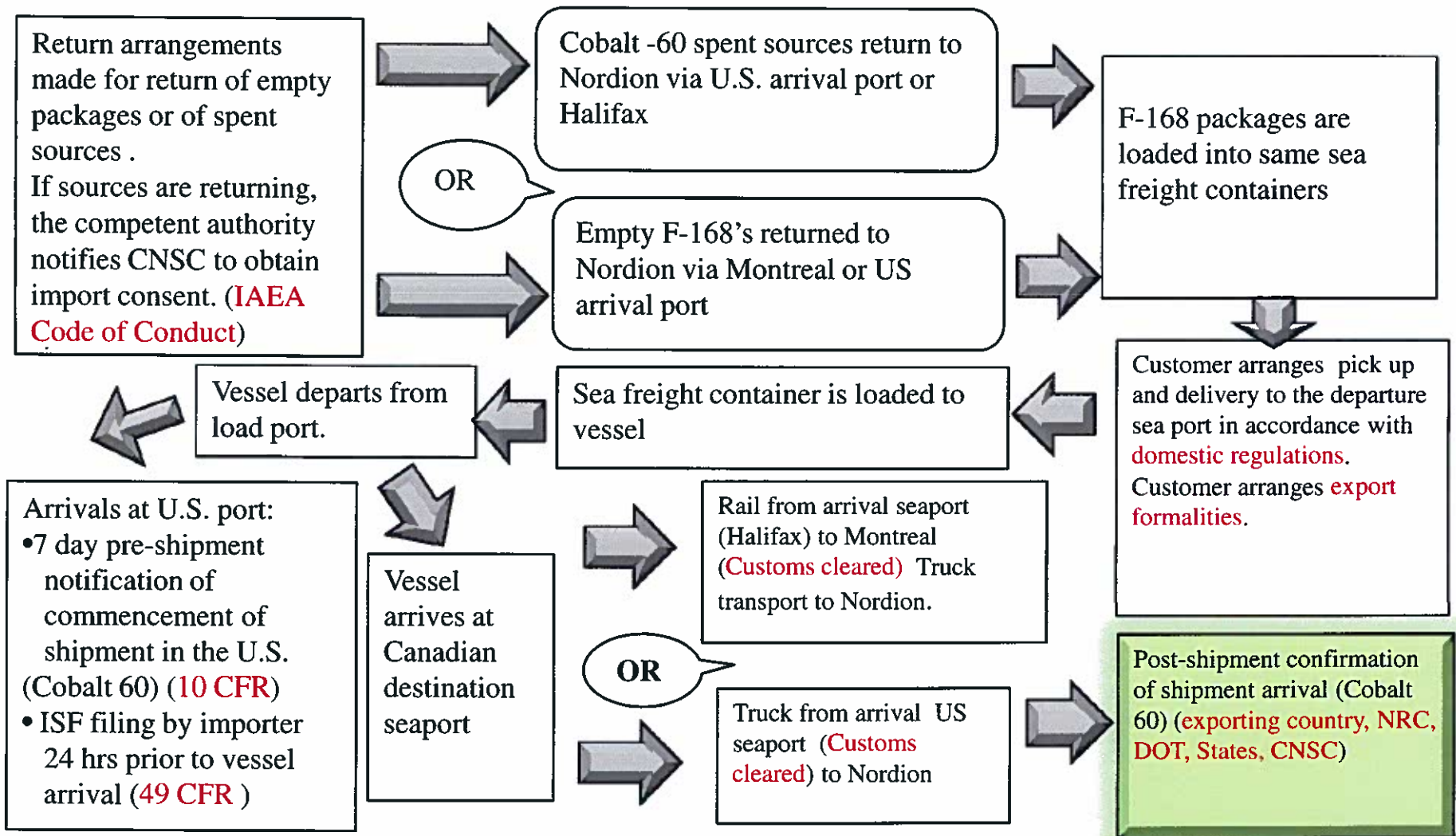
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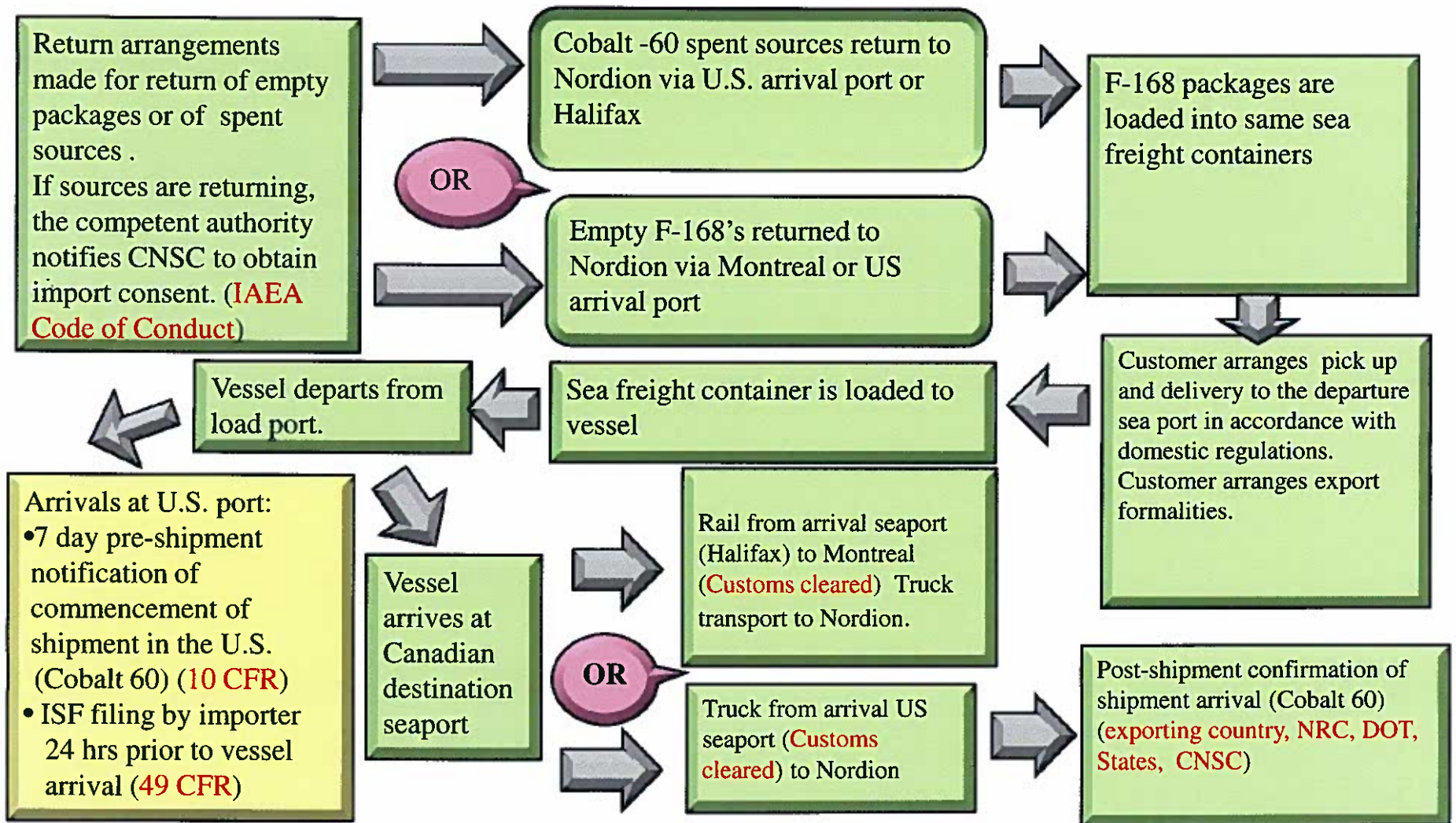
Return Transport Process



Return Transport Process



Return Transport Process



Transport Considerations



Road

- Carriers must be licensed and trained in transport regulations
- Carriers must have documented and approved Security plan incl. qualified / security cleared drivers; communication plan, ER plan, etc.)
- Federal and Local approvals
- Real time communications (GPS, Cell phone) to regulators, shipper and home office
- Nordion communicates routing information to Federal and State Regulators
- Co-ordination of Escorts (police or alternate authority)
- Discussion and amendment of route plan with state authorities, pending special events and timing of shipment
- CVSA Level VI Inspections (point of origin)

Transport Considerations



Marine

- Capability and licenced to carry Class 7, including insurance and vessel construction restrictions
- Availability of seafreight containers
- Routing varies (weather, time of year, cargo volumes, extraordinary events (pirates, war and strife) verified prior to any shipment preliminary acceptance
- Co-sharing restrictions
- Vessel approvals by owners
- Port Approvals (Class 7) of all in-transit Ports prior to final carriage approval provision
- Denial of Shipment – always a risk (Wednesday Agenda Item)

Regulatory Requirements



- **International**
 - International Atomic Energy Agency (IAEA) :
 - : TS-R-1 – Regulations for the Safe Transport of Radioactive Materials
 - : Code of Conduct – Import / Export Controls

- **Modal**
 - IMDG , IATA , ICAO

- **Country Specific**
 - Europe ADR
 - Country of import and export regulations
 - Canada : TDG ; NSDSR ; PTNSR
 - USA : DOT. PHMSA, CFR 49; NRC 10 CFR; FMCSA;
SGI

Regulatory Requirements



- Regional / local specific : often where Port resides
- Customs requirements (country – specific)
- Port requirements
- Carrier requirements

- Significant communication and monitoring with international, national, and local authorities starts well before shipment is even produced, let alone shipped, and continues until safe and secure arrival at the customer's site

Conclusions



- Process is formal, specific & *generally* consistent (future opportunity)
- Experience is exemplary – safety and security recommendations, regulations and standards do work
- Industry typically uses these as a minimum standard
- Effective communication, integration between member states, shipper and carrier
- Ongoing integration and continuous improvement is required - one of the objectives of “The Next 50 Years – Creating a Safe, Secure and SUSTAINABLE Framework”
- Sustainable **MUST** consider current state; cost of additional requirement implementation (law of diminishing returns), need for global consistency and harmonization; and utilization of an integrated regulator / industry interface (use NFPs and RNs)

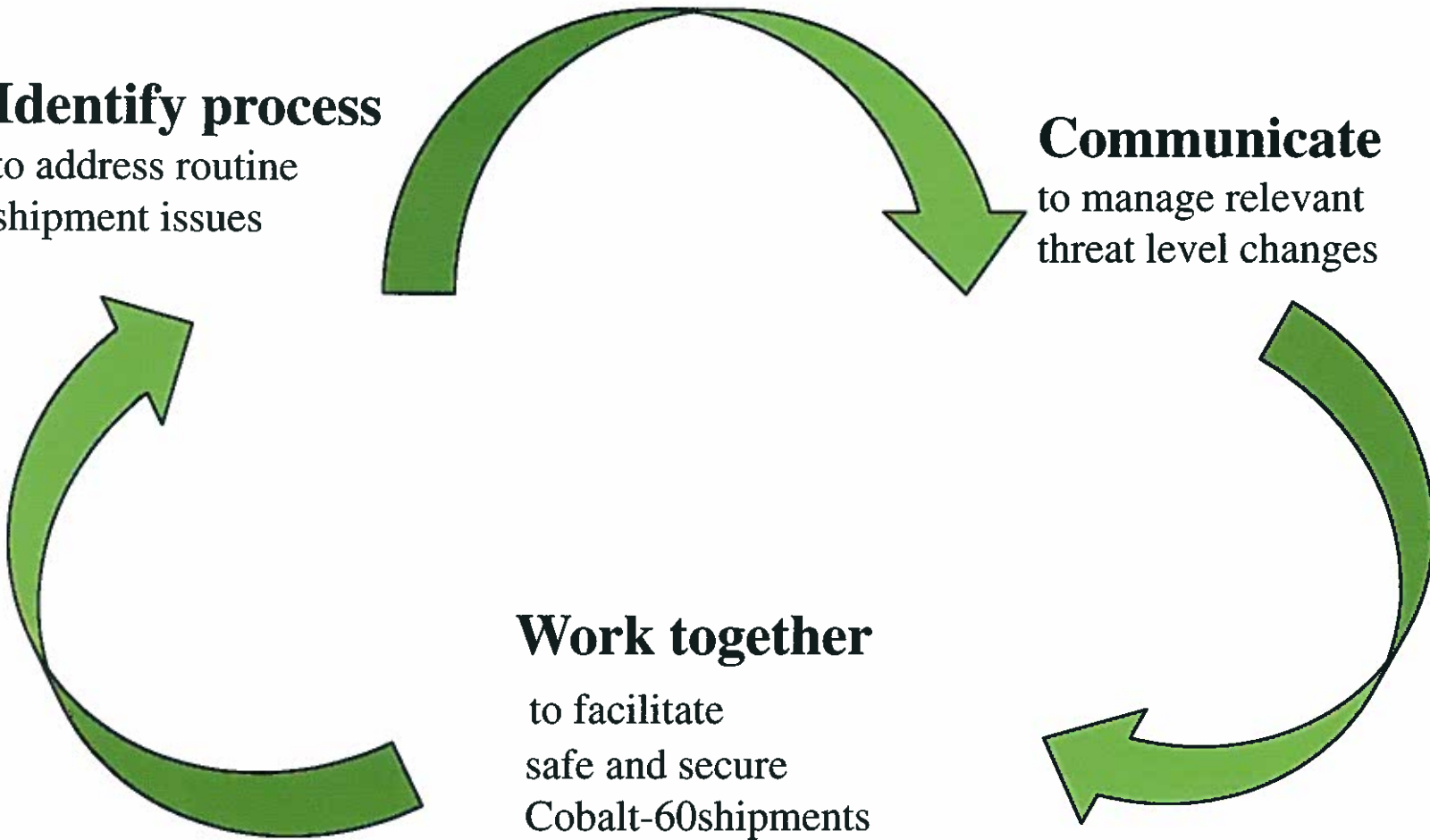
Continue to Work Together



Identify process
to address routine
shipment issues

Communicate
to manage relevant
threat level changes

Work together
to facilitate
safe and secure
Cobalt-60 shipments



Lack of Acceptance Due to:



- Carrier policy not to carry RAM
- Captain refused to load RAM
- Port refusal to allow access where capability exists
- Municipal/Federal government refused to allow Port Access
- Municipal/Federal government refused to allow in-transit/transshipment

ARE DENIALS

(i.e. where physical capability does exist but those involved refuse to accept product)

Lack of Acceptance Due to:



- Inconsistency in regulations between Member States and sometimes with the same member State
- Inability to integrate between modes since requirements are inconsistent
- Lack of awareness amongst supply chain and regulatory bodies

2011 Oct. 19; Problems in Shipping Radioactive Material



- Session 3B at 1100 for more details and discussion regarding denials and actions of IAEA International Steering Committee on Denials of Shipment of Radioactive Materials
- What can we do, together, to facilitate the transport of radioactive material over **“THE NEXT FIFTY YEARS”**