



# *The Planning, Licensing, Modifications, and Use of a Russian Vessel for Shipping SNF by Sea in Support of the DOE RRRFR Program*

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## ***Presentation Overview***

- **Russia Research Reactor Fuel Return(RRRFR) Program**
- **MCL Trader Vessel**
- **Vessel Refitting**
- **Shipping Experience**
- **Conclusions**

## ***RRRFR and GTRI Programs***

**United States Department of Energy**

- ◆ **National Nuclear Security Administration**
  - ◆ **Global Threat Reduction Initiative**
    - ◆ **RRRFR Program – reduce nuclear proliferation threats worldwide by transferring Russian-origin HEU research reactor fuel from ex-Soviet Union countries to the Russian Federation**



# ***Background***

## **Russia Research Reactor Fuel Return(RRRFR) Program needed sea transport option**

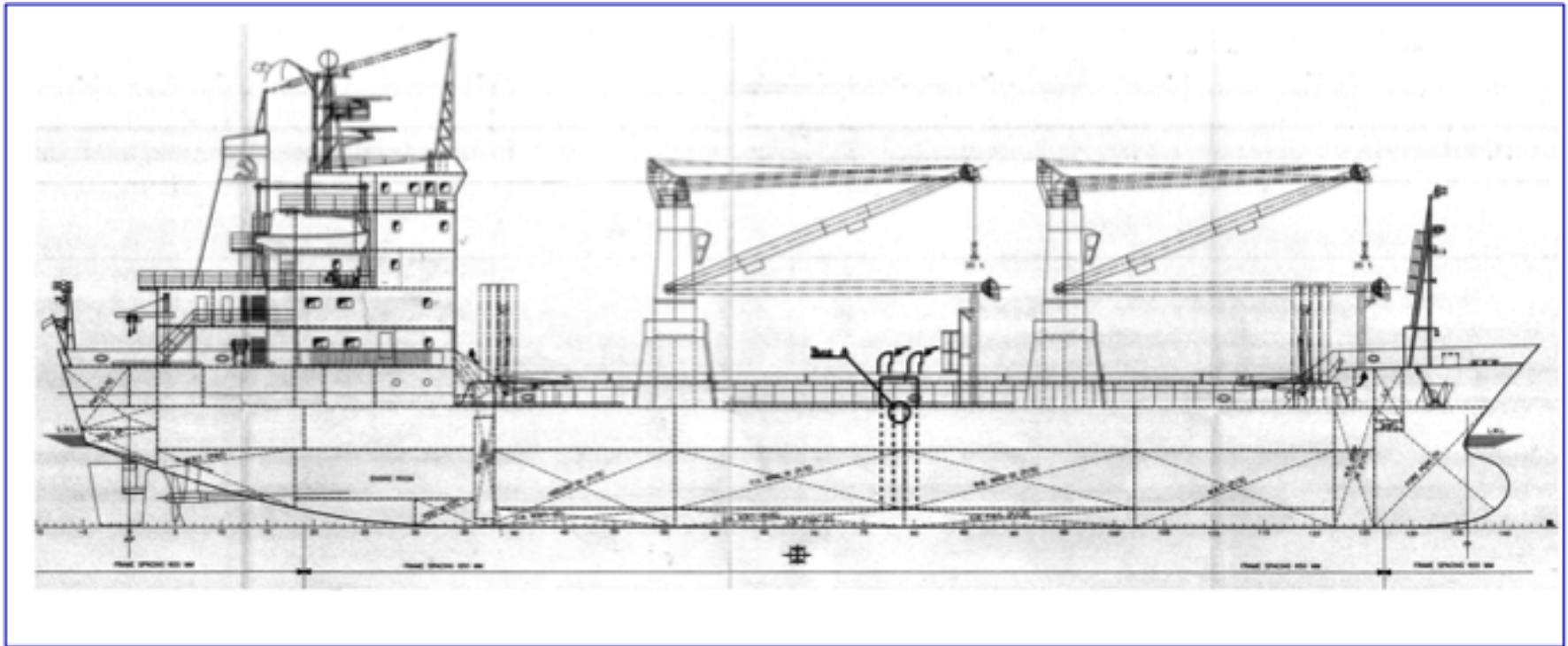
- ◆ **Russian flagged vessel required**
- ◆ **ASPOL-Baltic managed first RRRFR shipment from Hungary to Russia - non-Russian flagged vessel**
- ◆ **ASPOL-Baltic owns and operates fleet of vessels – including MCL Trader**
- ◆ **MCL Trader vessel – converted for SNF shipments**



## ***MCL Trader Vessel***

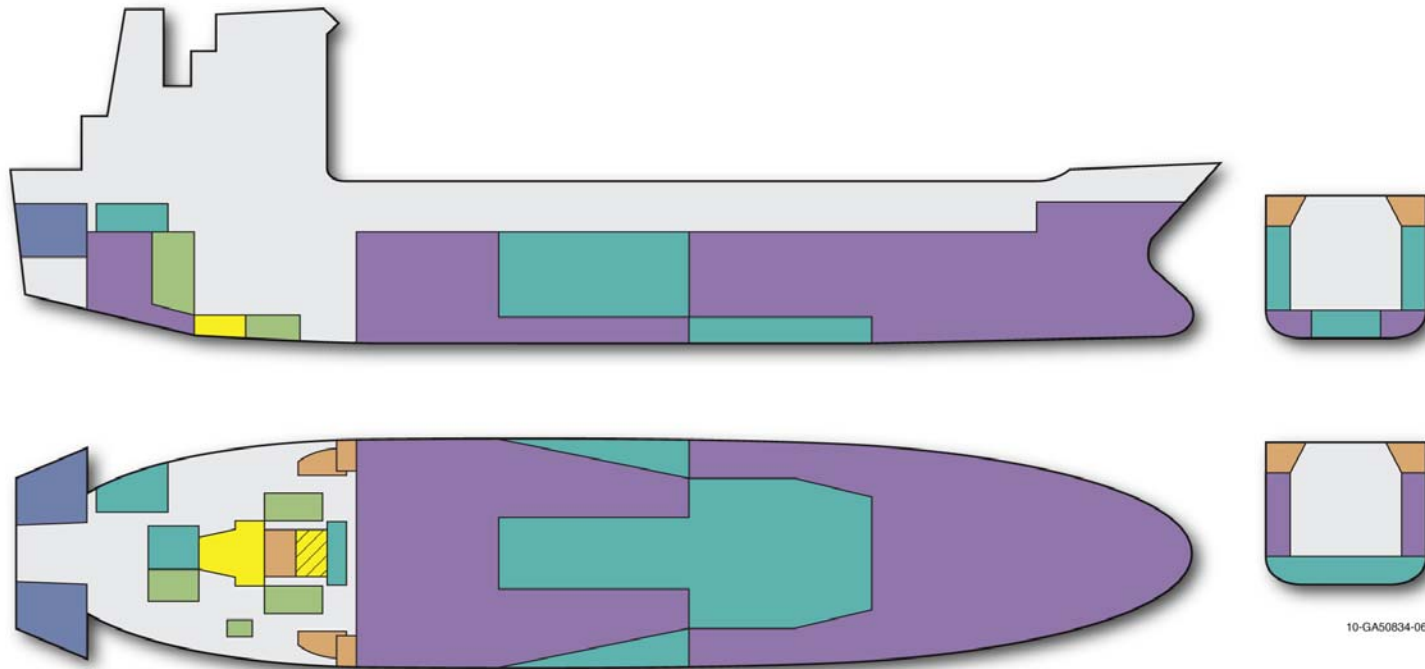
- **Owner – ASPOL-Baltic**
- **Russian-flagged vessel**
- **Built in Singapore, 1990**
- **Designed/built for hauling Russian nuclear missiles**
- **Specially modified and licensed for transport of spent nuclear fuel (SNF) in support of the RRRFR Program**

## ***MCL Trader Vessel - Main Dimensions***









- Length overall - 95.00 m
- Length between perpendiculars - 87.00 m
- Breadth - 15.80 m
- Depth - 7.80 m
- Deadweight - 4,195 t
- Full speed in calm deep water - 15.0 kn
- Main engine capacity - 2 × 1765 kW

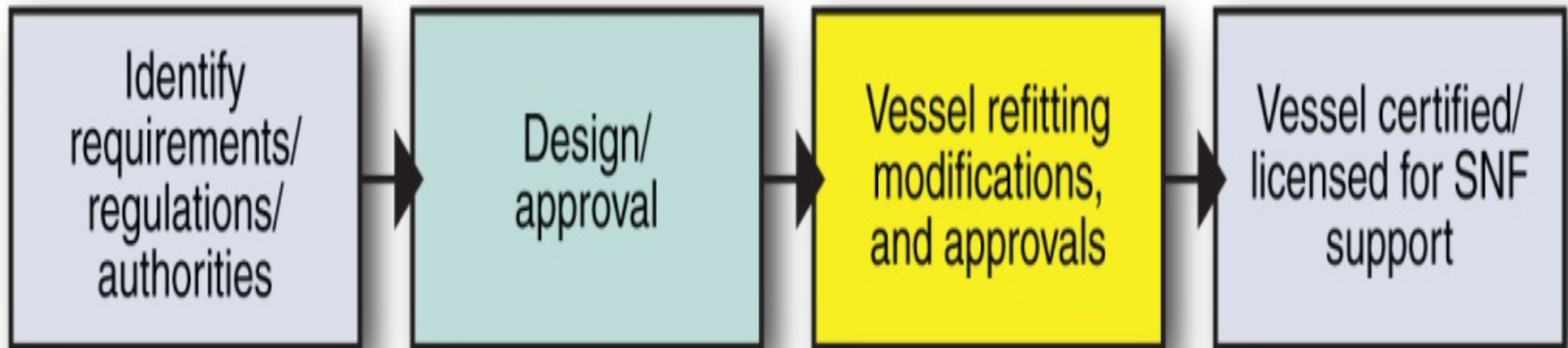
# Vessel Tank Capacities



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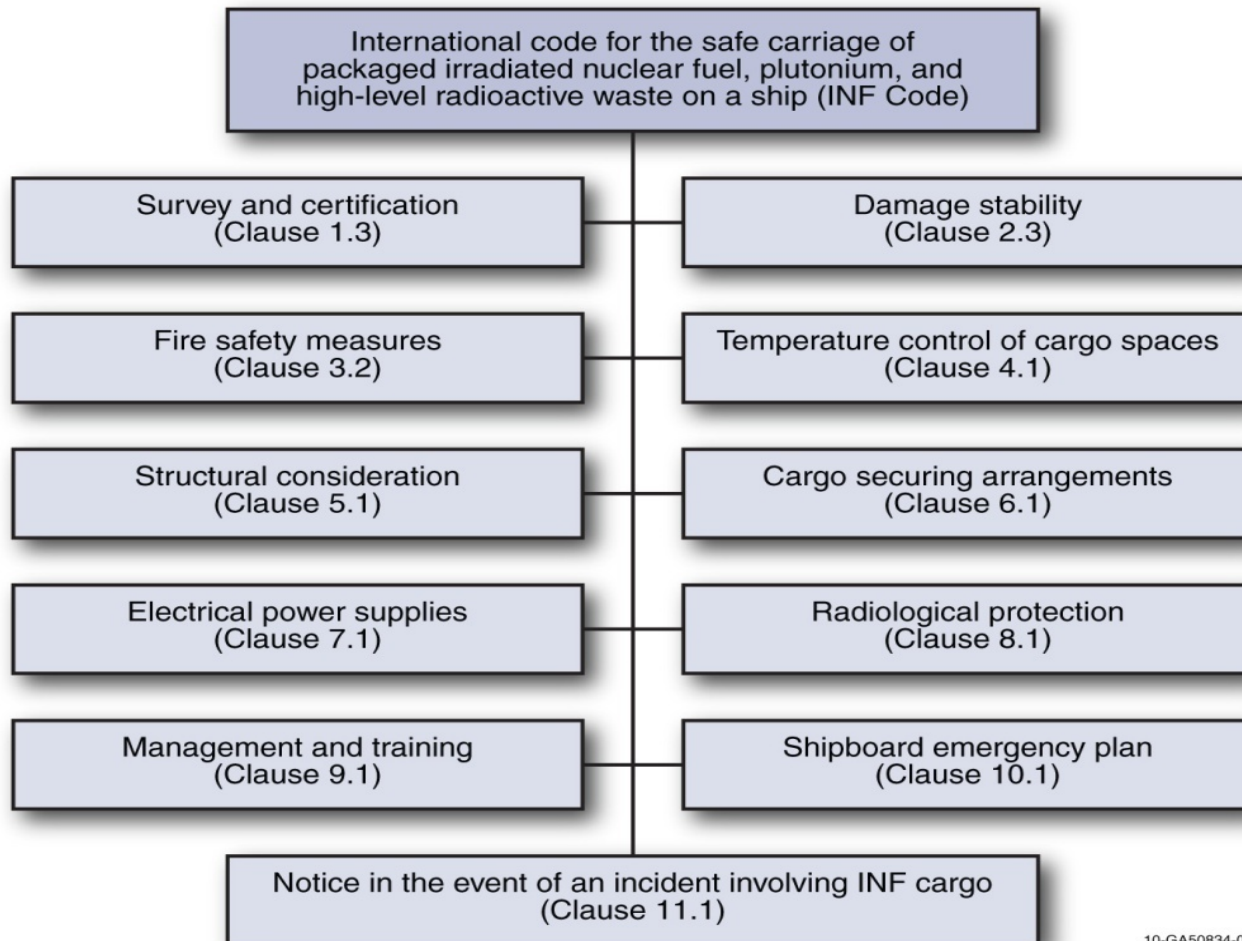
- |   |  |
|---|--|
|  Ballast Water (1191.3 Tons) |  Lube Oil (22.4 Tons)                       |
|  Fresh Water (133.2 Tons)    |  Sludge, Dirty Oil, Bilge Water (51.8 Tons) |
|  Fuel Bunker Oil (517 Tons)  |  Sewage Water (9.88 Tons)                   |

# *Vessel Refitting Process*





# Identify Requirements: INF Code for licensing a vessel to haul SNF



## ***Identify Requirements: Russian/International Regulatory Requirements***

- **Class INF-2 [IMO Resolution MSC.88 (71)]**
- **IMDC International Code Rules (radioactive materials), Class 7 (dangerous cargo)**
- **International Convention for Safety of Life at Sea (SOLAS-73/78)**
  - **Stability in a damaged condition**
  - **Water fire-control and cooling systems**
  - **Vessel holds drainage, fire alarm, and carbon dioxide firefighting systems**
- **Russian International Register of Shipping Rules, 2007**

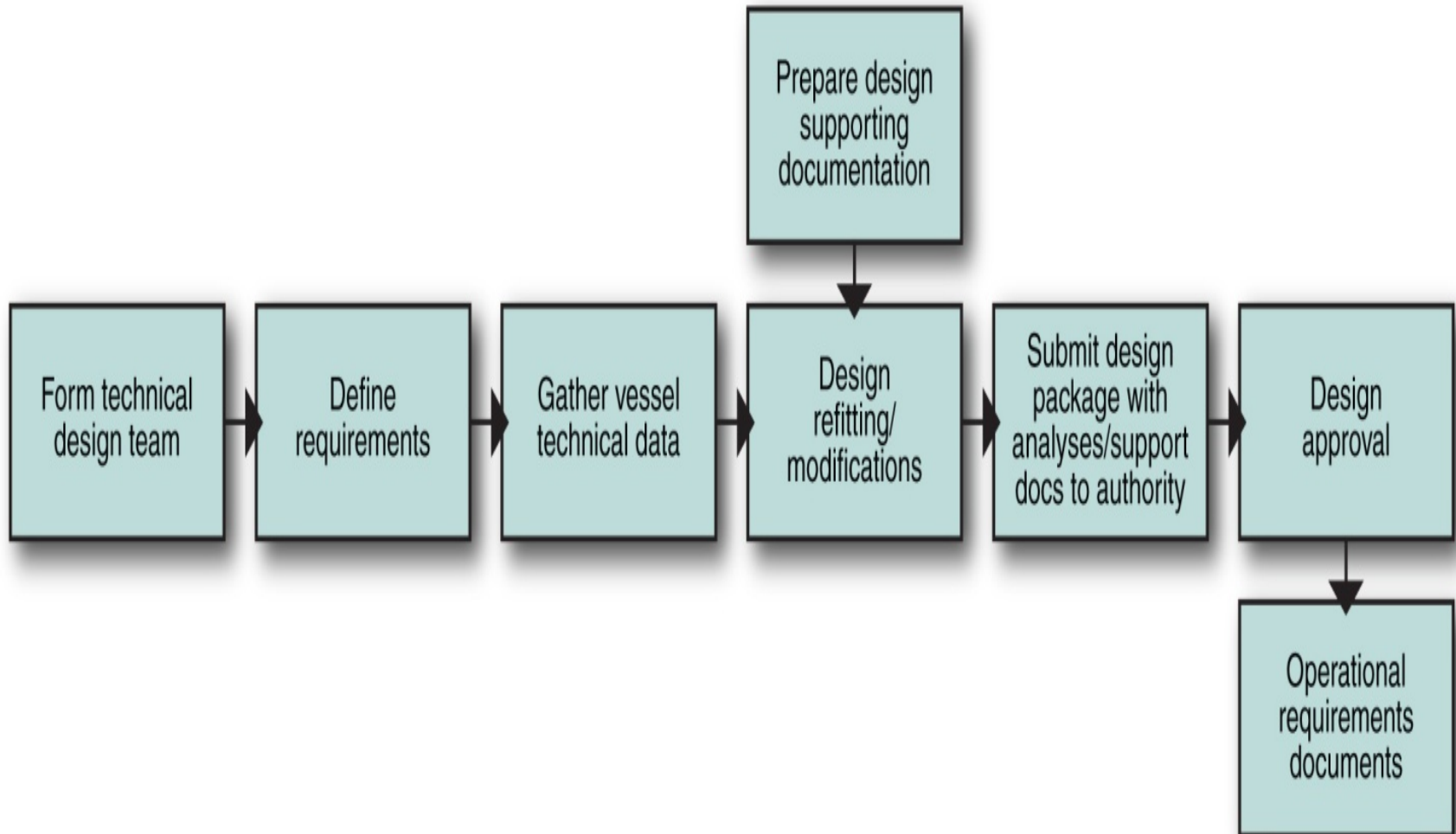
## ***Identify Authorities: Russian Authorities Vessel Licensing for SNF***

- **Russian Maritime Register of Shipping (RMRS)** – approves vessel design and modifications for SNF carrier.
- **Krylov Shipbuilding Research Institute** – design vessel modifications for SNF.
- **Rostekhnadzor** – competent-authority over nuclear and radiation safety, physical protection, and vessel licensing.
- **Federal Medical and Biological Agency** – medical and ecological compliance.
- **Sanitary and Epidemiological Control Center** – onboard sanitary and epidemiological conditions.

## ***Russian Authorities Vessel Licensing for SNF (con't)***

- **St. Petersburg Administration of the Federal Supervision Service for Rights Protection of the Consumers and Inhabitants Well-Being** – regional authority for vessel conformity to safety requirements.
- **St. Petersburg Center of Hygiene and Epidemiology for Transport** - regional medical authority for sanitary safety onboard the vessels.
- **Scientific Research Institute of Industrial and Sea Medicine** – Calculates maximum permissible emissions and waste from vessel refitting.
- **Murmansk Sea Biological Institute** - Performs environmental impact assessment.

# *Design/Approval: Refitting Design*



## *Technical Design Team*

- ASPOL-Baltic
- Sosny R&D Company
- Krylov Shipbuilding Research Institute,
- RMRS
- Branch Scientifically-Methodical Center for Labor Safety on Sea Transport
- St. Petersburg Administration of Federal Supervision Service for Right Protection of the Consumer and Inhabitants Well Being
- St. Petersburg Center of Hygiene and Epidemiology for Transport
- Scientific Research Institute of Industrial and Sea Medicine
- Murmansk Medical Biological Institute
- Federal Medical and Biological Agency

## *Define Requirements*

- **Stability of vessel in a damaged condition**
- **Vessel should be equipped with water fire-control unit near Category A machinery and for cooling of nuclear cargo.**
- **Independent, and duplicated ventilation and cooling systems in the cargo hold to insure ambient  $< 55^{\circ}\text{C}$ .**
- **Constructional durability of the deck and supporting devices for cargo loading.**
- **Adequate fastening devices to prevent cargo shifting during sea transport.**
- **Emergency backup electric power for all emergency services on the vessel for at least 36 hours.**

## *Define Requirements (cont.)*

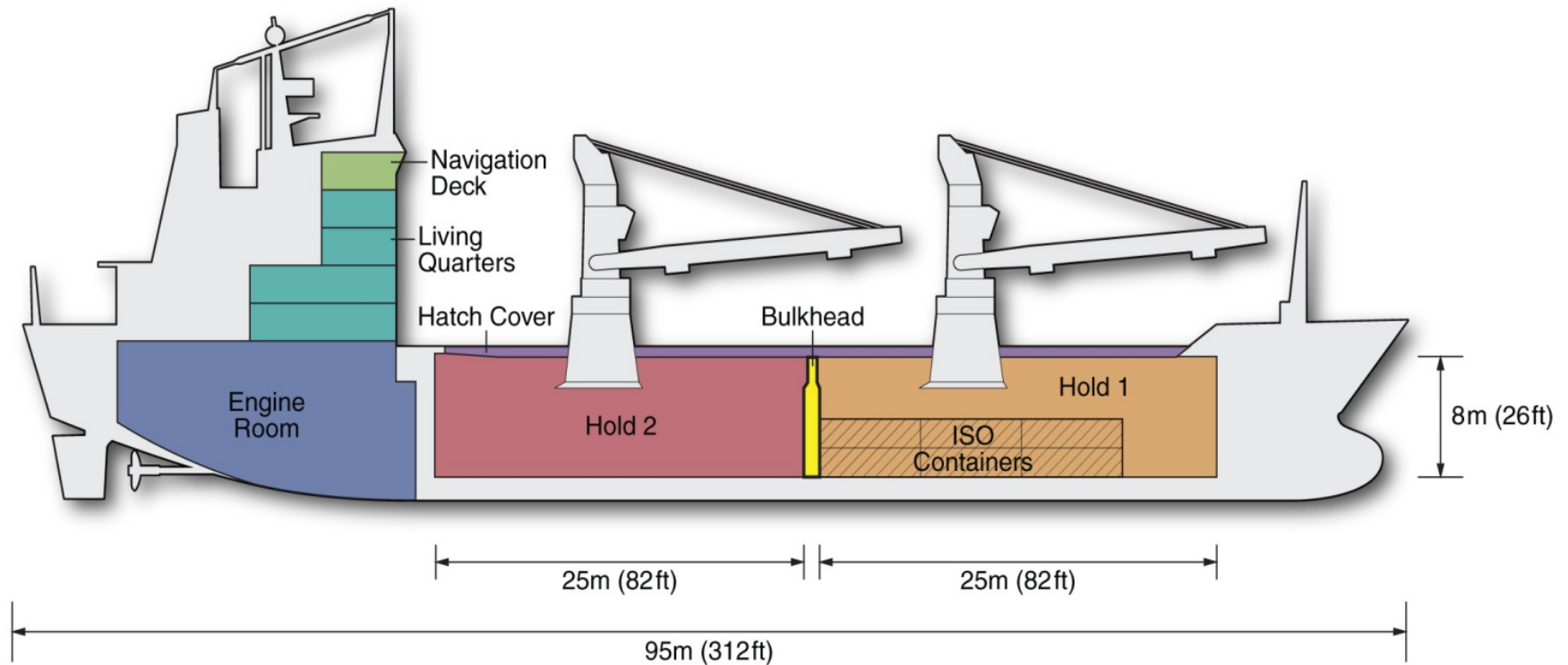
- **Radiation protection devices and equipment needed to meet the the International Code for the Safe Carriage of Packaged Irritated Nuclear Fuel regulations.**
- **Physical barriers to prevent unauthorized access into a cargo hold, and a detection, supervision, and a disturbance-calling alarm system.**
- **Environmental impact assessment of the dangers and health risks to the public from vessel refitting.**
- **Ship emergency response plan of action in extreme situations.**



## ***Gathered Vessel Technical Data***

- ***General*** – equipment, materials, and radiation safety
- ***Vessel*** – overall strength calculations and drawings
- ***Devices and equipment*** – holes, superstructures, deck
- ***Stability*** – hydrostatic curve for frame
- ***Compartment*** – all water-tight structures and holes
- ***Fire protection*** – fire alarm circuits and fire plan
- ***Automated equip.*** – drainage/ballast/power/alarm
- ***Piping and systems*** – ballast/drainage systems
- ***Electrical equipment*** – types, voltage, and protection
- ***Special issues*** – ecological and biological shield
- ***Communications and navigation***
- ***Operations*** – loading/unloading/ballast procedures

# Design Refitting/Modifications



## *Final Approved Refitting/Modification Objectives*

- **Russian Maritime Register of Shipping (RMRS)**
  - **Crew working conditions**
  - **General vessel characteristics**
  - **Vessel sanitary status**
  - **SNF cargo, radiation safety, and construction durability**

## *Design Documentation and Authorization*

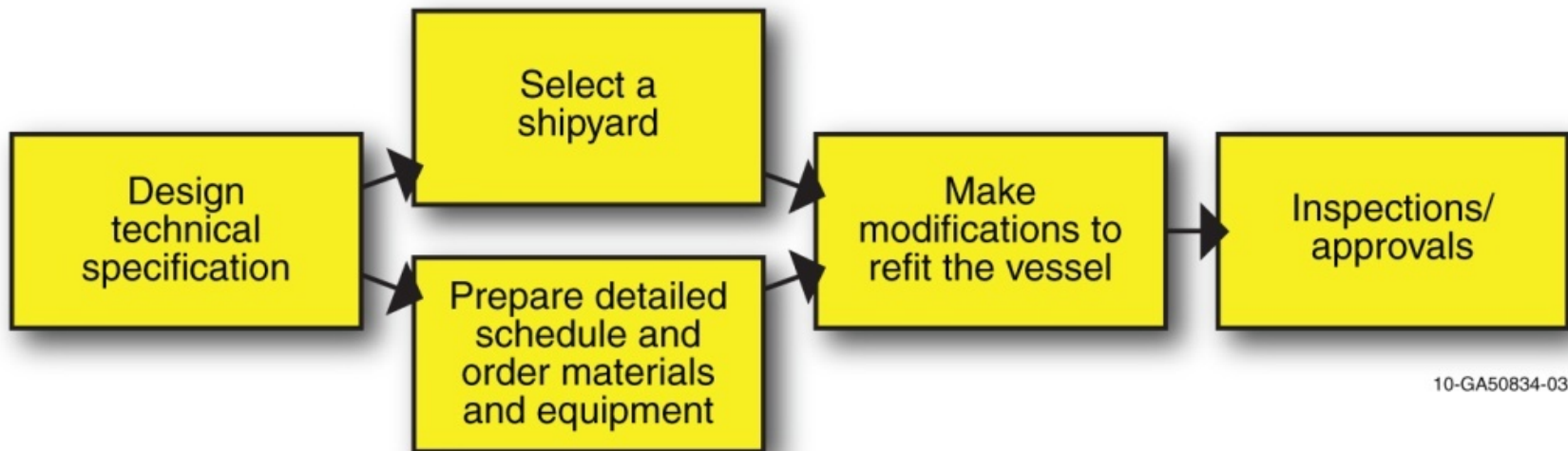
**RMRS approved the following documents:**

- **Vessel stability information**
- **Manual for shipping SNF casks**
- **Radiation securing program**
- **Regulations and instructions for fixing the cargo**
- **Cargo security manual**
- **Radiation protection feasibility study**
- **Environmental impact declaration**

## ***Design Approval: Final Authorization***

- ***Rostekhnadzor - regulates nuclear material vessels leaving Russia ports***
  - ***Radiation protection program safety reports***
  - ***Quality control program***
  - ***Vessel emergency plan***
  - ***Personal right to work***
  - ***Security certificate***
  - ***Certificates for SKODA and TUK-19 packaging***
  - ***Government Agreement between Russian/Poland***
  - ***Foreign Trade Contract***
  - ***Universal Time-Charter (Baltime 1939)***
  - ***Physical Protection Procedure for SNF***
  - ***Emergency card for nuclear materials and radioactive substances***
  - ***Crew training and testing***

# Refitting/Refurbishment



## *Shipyard Refitting Options*

- **Netaman Shipyard, Tallinn, Estonia**
- **Kanonersky Ship Repair Yard, St. Petersburg, Russia**
- **Nauta Shipyard, Poland**
- **Tallinn Shipyard, Tallinn, Estonia**
- **Niestern Sanders, Holland.**

## ***Shipyard Selection: Scope***

- **Refit vessel per ASPOL-Baltic specifications**
- **Oversight and inspection of the refitting operations**
- **Refitting hatch covers and build partition/bulkhead wall dividing vessel hold in half**
- **Clean and paint vessel and storage tanks**
- **Dispose of refitting waste - tank sludge, old paint, etc.**
- **Provide materials and spare parts per specifications**
- **Dry docking**
- **Provide surveyor**



# ***Vessel Modifications: Refitting***



# Vessel Refitting (con't)



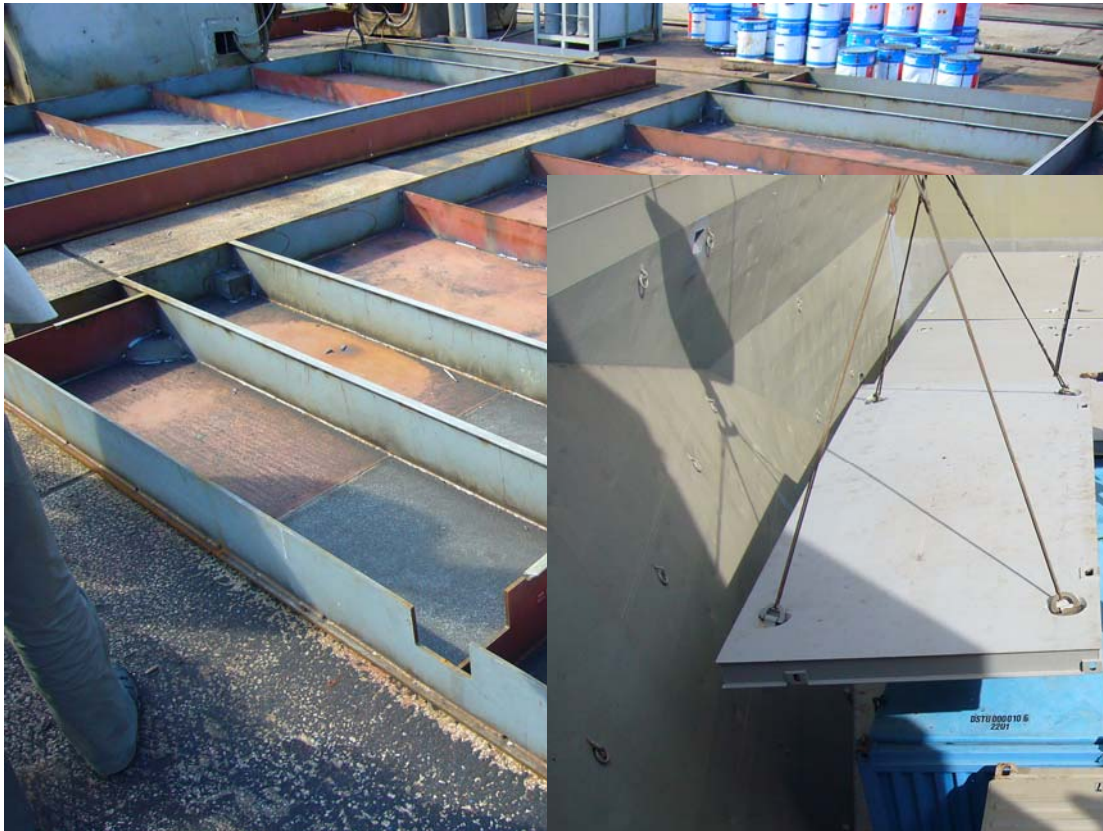
## *Vessel Refitting (con't)*



# Vessel Refitting (con't)



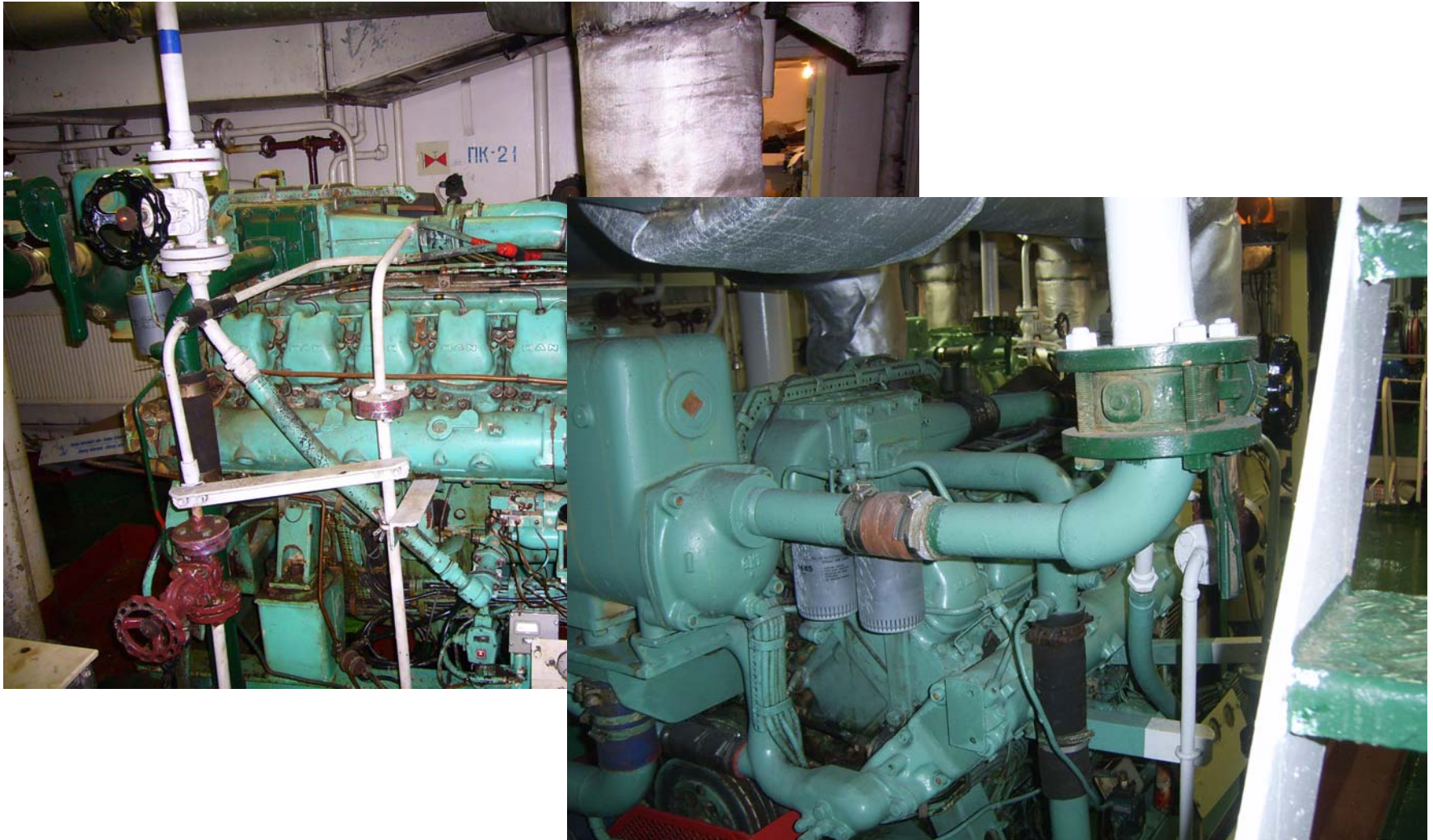
## *Vessel Refitting (con't)*



## *Vessel Refitting (con't)*



## *Vessel Refitting (con't)*



## *Vessel Refitting (con't)*





## ***Vessel Use Experience***

- **Vessel, with crew, arrives at Polish seaport.**
- **Hold No. 1 is opened and prepared for loading.**
- **Train with SNF cargo arrives at seaport.**
- **ISO containers are transferred from train to Hold No. 1 (up to 16 ISO containers).**
- **Biological/radiation shielding placed on top containers.**
- **Hold area surveyed, workers evacuated, hold deck cover closed, and access/exit covers shut and tamper seals attached.**
- **Customs and Immigrations clears vessel to leave Poland.**
- **Vessel travels to Russia.**

## *Vessel Use Experience (con't)*



## *Vessel Use Experience (con't)*



## *Vessel Use Experience (con't)*



## *Vessel Use Experience (con't)*



## *Vessel Use Experience (con't)*



## *Vessel Use Experience (con't)*



## ***Conclusion***

- **Transportation of SNF by sea is a reliable and safe mode for transport of SNF.**
- **Highly-qualified and respected design team is critical to an accelerated schedule and overall project success.**
- **Good communications by shipment participants help resolve regulatory compliance, technical, and other issues that arise.**
- **Well-trained, permanent, and experienced crew members ensure the highest level of safety and reliability.**
- **Confidentiality and other protective measures are critical to security and safety of SNF shipment.**



## ***Conclusion (Con't)***

- **Early planning/preparations for making a shipment ensure participants are aware of organizational and technical procedures.**
- **All factors that could impact the schedule should be identified and evaluated, and counter-measures developed prior to shipment.**
- **Vessel should be in good “readiness.”**
- **An adequate number of crew members with good accommodations, food, and working conditions is critical to a safe and efficient transport.**

**Questions?**