Transportation and Storage Solutions

Mike Valenzano

Director, Transportation Projects

May 21, 2025

2025 National Transportation Stakeholders Forum

Southern States Energy Board

- NAC International has more than **55 Years** in the Nuclear Industry with annual **revenues greater than $130M**
- Service provider implementing environmentally friendly integrated fuel cycle, radioactive material, and waste management solutions
- Owned by Kanadevia Corporation (formerly known as Hitachi Zosen and headquartered in Osaka, Japan), originally founded in 1881
  - Annual Sales of more than ¥550B Yen (~$4.0B USD)
  - Employing more than 8,800 people worldwide

Kanadevia

Based in Osaka, Japan
Founded in 1881
Japan's largest industrial machinery and plant engineering corporation

NAC INTERNATIONAL
Kanadevia Group

Based in Peachtree Corners, Georgia | USA
Founded in 1968 – Acquired by Kanadevia in 2013
Implementing environmentally friendly integrated fuel cycle, radioactive material, and waste management solutions

NAC LPT LOGISTICS PACKAGING TECHNICAL SERVICES
Kanadevia Group

Based in Pittsburgh, Pennsylvania | USA
Founded in 2015 – Acquired by NAC in 2020
Offering expanded logistics, packaging, and technical services

NAC PHILOTECHNICS
Kanadevia Group

Offices in California & Tennessee | USA
Founded in 1981 – Acquired by NAC in 2022
Providing a full scope of low-level radioactive/hazardous waste management, radiological, and decommissioning services

NIAGARA ENERGY PRODUCTS
Kanadevia Group

Based in Niagara Falls, Ontario | Canada
Founded in 1960 – Acquired by NAC in 2023
Specializes in custom manufactured components for nuclear energy, petrochemical, and heavy industrial customers in North America and worldwide

Used Fuel Storage

- ✓ Design, engineering, licensing, fabrication, & loading of storage systems
- ✓ 4500+ PWR, BWR, & CANDU systems delivered worldwide

Transportation

- ✓ Packaging & turnkey logistics for spent fuel, LLW/HLW & Irradiated material
- ✓ Fleet of 14 casks
- ✓ 3,800+ safe spent nuclear fuel shipments from 70+ nuclear facilities worldwide
- ✓ 7+ million miles of safe nuclear materials transportation

Disposition & Storage Options

- ✓ Teamed with Deep Isolation for geologic disposal
- ✓ Teamed with Interim Storage Partners for Interim storage
- ✓ Licensed radioactive materials processing & consolidation facilities

Consulting

- ✓ Custom analysis from uranium mining to enrichment to final waste disposition
- ✓ Fuel cycle training seminars
- ✓ Material Control & Accountability (MC&A)

Heavy Manufacturing

- ✓ Design and fabricate pressure boundary nuclear components, packaging, & structures
- ✓ ASME NQA-1 Certified
- ✓ Over 200,000 Sq Ft of Manufacturing and Warehousing space

Comprehensive Fuel Management Solutions to Commercial, US Government, & International Customers

NAC Decommissioning Experience

Maine Yankee: 64 NAC-UMS (60+4)
Spent Fuel, GTCC Waste, Damaged Fuel

Yankee Rowe: 16 NAC-MPCs (15 +1)
Spent Fuel and GTCC Waste

Connecticut Yankee: 43 NAC-MPCs (40+3)
Spent Fuel and GTCC Waste

Dominion Kewaunee: 24 MAGNASTORs Spent & Damaged Fuel; 3 MAGNASTORs GTCC waste.
Shutdown Site - transitioned from TN

Exelon TMI-1: 46 +1 MAGNASTOR Systems
Spent Fuel and GTCC. Turnkey Services

ESJ TMI-2: 14 MAGNASTOR Systems GTCC

U.S. Department of Energy Site High Level Waste Storage

LaCrosse BWR : 5 NAC- MPCs
Spent Fuel, Damaged Fuel

Zion: 65 MAGNASTORs (61 + 4)
Spent Fuel, Damaged Fuel &GTCC Waste

West Valley Facility: 56 NAC-MPCs
High Level Waste Systems

NAC Operating Plant Dry Cask Storage Experience

Duke McGuire: 28 NAC UMS & 56 MAGNASTOR Spent Fuel Systems
Duke McGuire currently has 38 MAGNASTOR systems delivered and 35 MAGNASTORs loaded to date.

Duke Catawba: 24 NAC UMS & 60 MAGNASTOR Spent Fuel Systems
Catawba currently has 36 MAGNASTOR systems delivered and 30 MAGNASTORs loaded to date.

APS: 152 NAC UMS & 43 MAGNASTOR Spent Fuel Systems. Transitioned to MAGNASTOR 2018-2019. Currently 20 MAGNASTORs loaded.

Taiwan - Spent Fuel
Chinshan - 25 NAC UMS
Kuosheng - 27 MAGNASTOR

NAC's MAGNASTOR, UMS and/or NAC-MPC designs - suitable for LWR SMR fuel directly / adaptable through minor design modifications.

Used Fuel Transportation Experience and Expertise

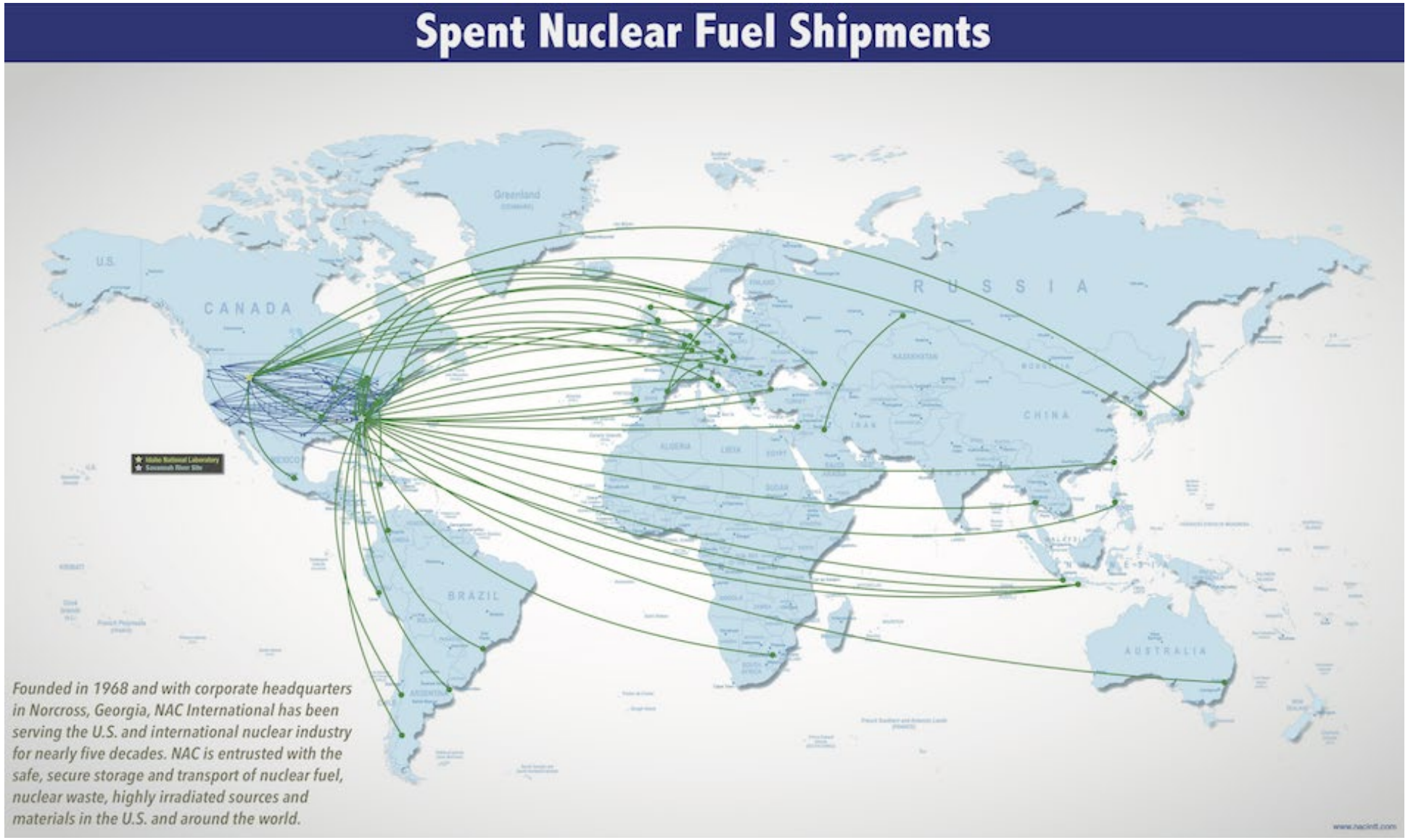
Spent Fuel & High-Level Waste Transportation Services

- Owns a commercial fleet of spent fuel transportation casks (NAC-LWT & OPTIMUS®) and equipment in the United States
- Safely completed more than 3,800 spent nuclear fuel shipments from more than 70 nuclear facilities worldwide
  - ***Over 7 Million Miles of Safe Nuclear Materials Transportation***
- More than 50 International Cask Validations for shipment of Spent Fuel
- Supported implementation of the first Chinese spent fuel transport campaign using NAC-STC transport casks
- Dominant package provider in support of U.S. Government Global Threat Reduction Initiative, in Repatriation of used Highly Enriched Uranium (HEU) fuel from Research & Test Reactors
- Recently received U.S. DOE Secretary's Honor Awards on a Joint U.S/Canadian project NRU/NRX spent fuel packaging and transportation project.

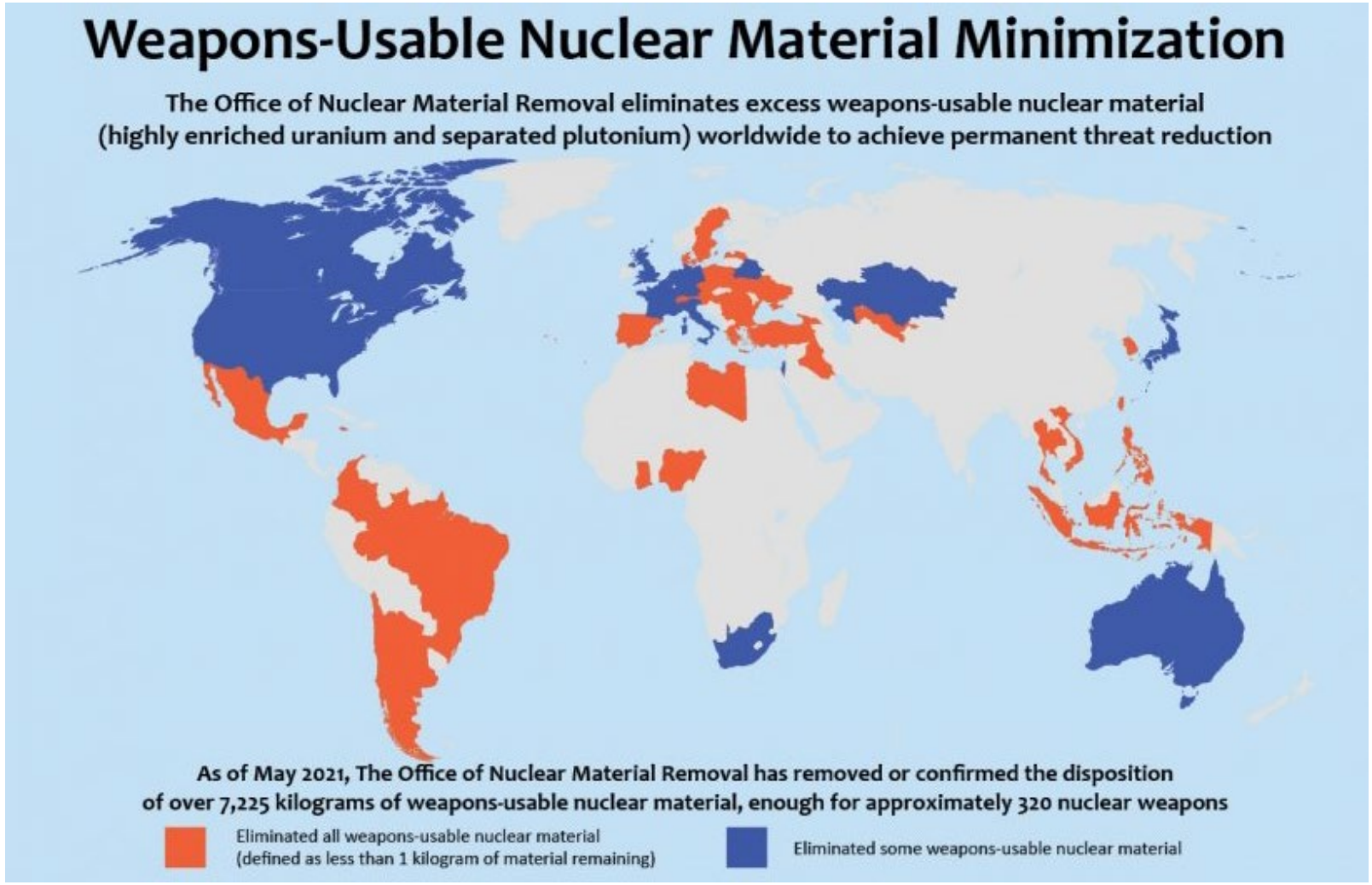
By Sea, Rail, Road and Air

NAC-LWT Transportation Cask

- Commercial fleet of 8 legal weight truck Type B casks (NAC-LWT)
- More than 50 International Cask Validations
- More than 250 packaging and transport projects
- More than 60 nuclear facilities worldwide.
- Key role in U.S. Government Global Threat Reduction Initiative,
  - Repatriation/Removal of used HEU fuel from Research & Test Reactors.
- Only Type B cask licensed and deployed to ship HEU liquid wastes (7g U235/L)


Spent Nuclear Fuel Shipments
Greenland
U.S.
CANADA
RUSSIA
CHINA
BRAZIL
AUSTRALIA
Idaho National Laboratory
Savannah River Site
Founded in 1968 and with corporate headquarters in Norcross, Georgia, NAC International has been serving the U.S. and international nuclear industry for nearly five decades. NAC is entrusted with the safe, secure storage and transport of nuclear fuel, nuclear waste, highly irradiated sources and materials in the U.S. and around the world.
www.nacintl.com

Supporting NNSA's Office of Material Management and Minimization (NA-23)



NAC Has Repatriated ~5,000 kg of Weapons-Usable Nuclear Material

OPTIMUS®-L Packaging

Packaging Attribute	OPTIMUS-L
Package Designation	CDN/2099/B(U)F-96 USA/9390/B(U)F-96
Controls	Exclusive-Use
Outer Dimensions	∅49.0 x 70.0 in / ∅1250 x 1800 mm
Cavity Size	∅32.5 x 47.0 in / ∅800 x 1230 mm (fits 110 gal drum)
Empty Weight	6,050 lbs / 2745 kg
Max. Content Weight	3,500 lbs / 1587 kg
Gross Weight	~6,500 to 9,200 lbs / 2950 – 4173 kg
Max. Heat Load	≤ 100 W
Packages per LWT Shipment	~6
MNOP	100 psig / 6.9 bar
Contents	Low Activity Contents: CH-TRU waste,(1) HALEU Fresh Fuel, Sources, and Fuel Waste

(1) Including aerosol cans with compressed gas propellant, liquified gas propellant, or unknown propellant.

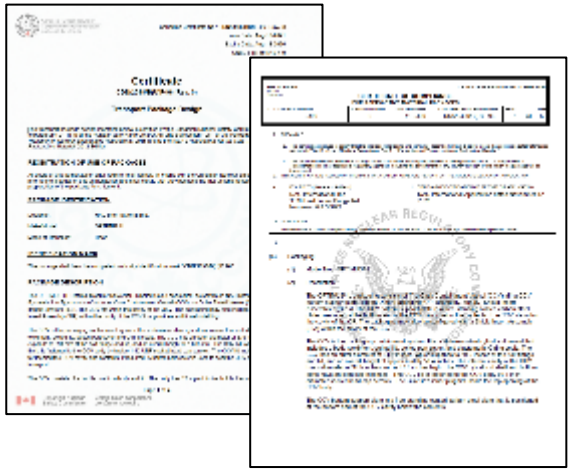
- Economical, robust, configurable for content, easily handled design, and multiple options for lift and tie downs allows for wide application

OPTIMUS®-H Packaging

Packaging Attribute	OPTIMUS-H
Package Designation	CDN/2098/B(U)F-96 USA/9392/B(U)F-96
Controls	Exclusive-Use
Outer Dimensions	∅74.2 x 83.2 in / ∅1880 x 2110 mm
Cavity Size	∅32.5 x 47.0 in / ∅800 x 1230 mm (fits 110 gal drum)
Empty Weight	24,700 lbs / 11.2 MT
Max. Content Weight	7,300 lbs / 3.3 MT
Gross Weight	~25,000 to 32,000 lbs / 11.3 – 14.5 MT
Max. Heat Load	≤ 1,500 W (fuel / debris)
Packages per LWT Shipment	2
MNOP	100 psig / 6.9 bar
Contents	High Activity Content: Irradiated hardware, fuel debris, HLW, GTCC, SNF, RH-TRU waste

- Cost Effective, modular, configurable for content, easily handled design, and adaptable for lifting and tie downs allows for wide application
- Multiple options for shielding

OPTIMUS® Certificates

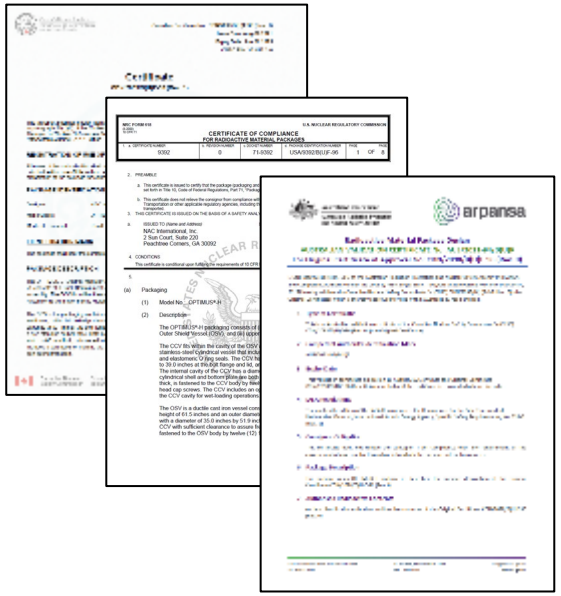


OPTIMUS®-L

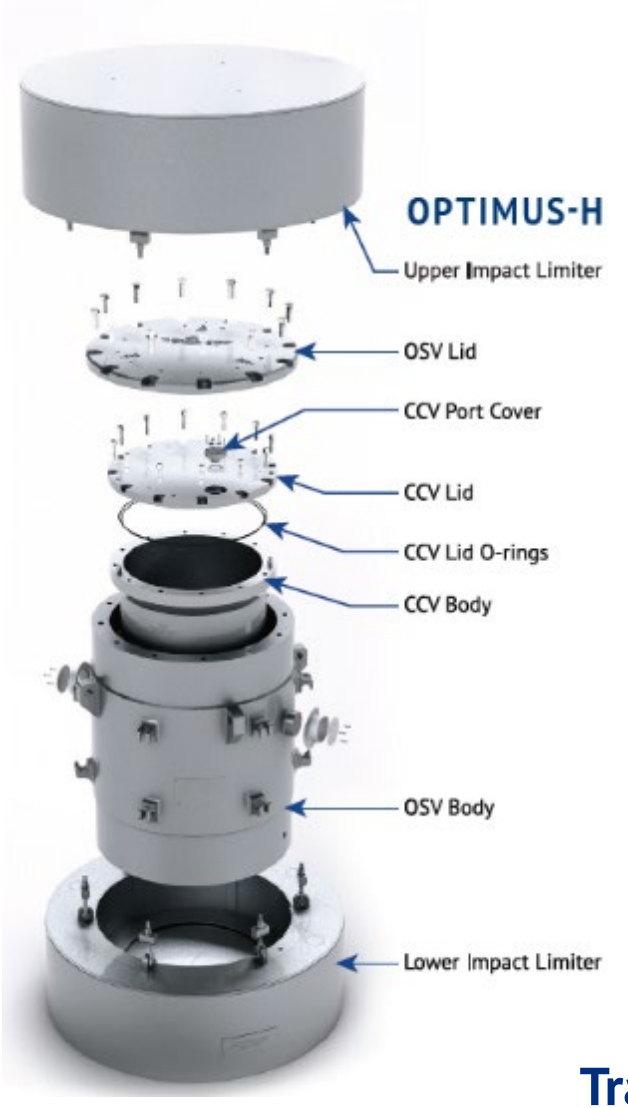
- Certified in Canada (CDN/2099/B(U)F-96)
- Certified in U.S. (USA/9390/B(U)F-96)
- U.S. NRC CoC Rev. 2 authorizing HALEU fuel contents for transport received 12/14/2023

OPTIMUS®-H

- Certified in Canada (CDN/2098/B(U)F-96)
- Certified in U.S. (USA/9392/B(U)F-96)
- Validated in Australia (AUS/2021-94/B(U)F)



OPTIMUS®-H – Transportation Solution for CANDU Spent Fuel



- NAC's OPTIMUS®-H cask is certified by the Canadian Nuclear Safety Commission to ship CANDU spent fuel (2 "basket" capacity)
- NAC currently contracted with Canadian Nuclear Laboratories (CNL) to ship CANDU spent fuel to support CNL's spent fuel consolidation initiative (using 4 OPTIMUS®-H)
- 3 of 44 planned shipments completed by CNL in 2024

Transportation Solutions for both LWR *and* CANDU Spent Fuel

NAC–STC Transport Experience

- Fleet of 16 systems now deployed routinely shipping used fuel
- Order for 10 additional systems received in early 2025
- Only NRC-Licensed Large Transport Cask routinely shipping used fuel
- 15 years of operating experience over 100 thousand miles
- Although it is a rail cask, other transport modalities addressed

NAC-STC is an ideal and proven technology for a Transportation Pilot

MAGNATRAN Transport Cask

- Transport Overpack for MAGNASTOR® Canisters
- Designed with Universal Transport Capabilities in Mind – UMS/MPC Canisters
- Compatible with NAC Transfer Systems for Consolidated Interim Storage Facility (CISF) Transport Readiness
- CoC 9356 Revision 5 is Now Approved expanding Transport Capabilities (ModEx/High BurnUp and Content)

Leveraging NAC's Experience for Transport Readiness and Assurance

NAC's Volunteer Packaging - Dimensions

The Industry's Latest High-Capacity Packaging For Road Transport

- **Application Submitted May 20, 2024**
- **Certificate of Compliance 9403, Rev. 0 issued April 30, 2025**
- **Package ID USA/9403/B(U)-96**

Key Advantages:

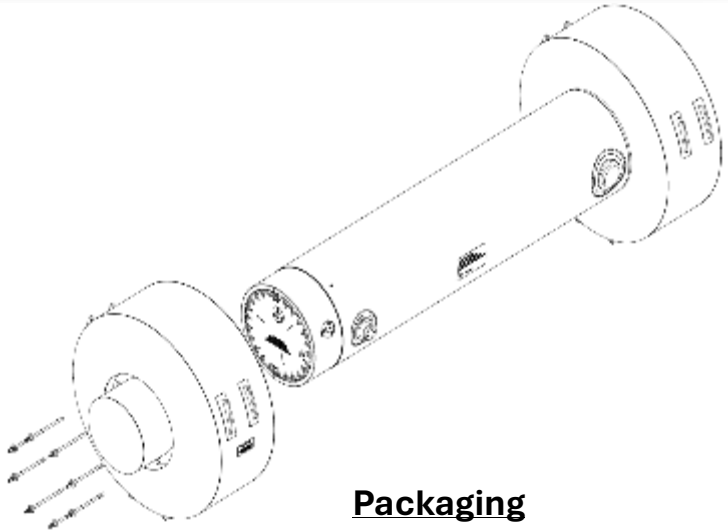
- ✓ Optimized Shielding vs Payload
- ✓ Ease of Operation
- ✓ Versatile and adaptable
- ✓ Multiple contents
- ✓ High Thermal Dissipation

Package Design Parameters	Values
Impact Limiter O.D.	*86.0 in.*
Cask Body Outer I.D.	*42.5 in.*
Cask Cavity Diameter	*26.5 in.*
Length: Overall* / Cavity Short: Standard: Long: * Overall Length with Impact Limiters	 *206.5 in. / 120.5 in.* *254.5 in. / 168.5 in.* *266.5 in./ 180.5 in.*
Max. Content Weight:	*11,500 lb.*
Max. Loaded Package Weight: Short: Standard: Long:	*64,800 lb.* *80,500 lb.* *84,400 lb.*

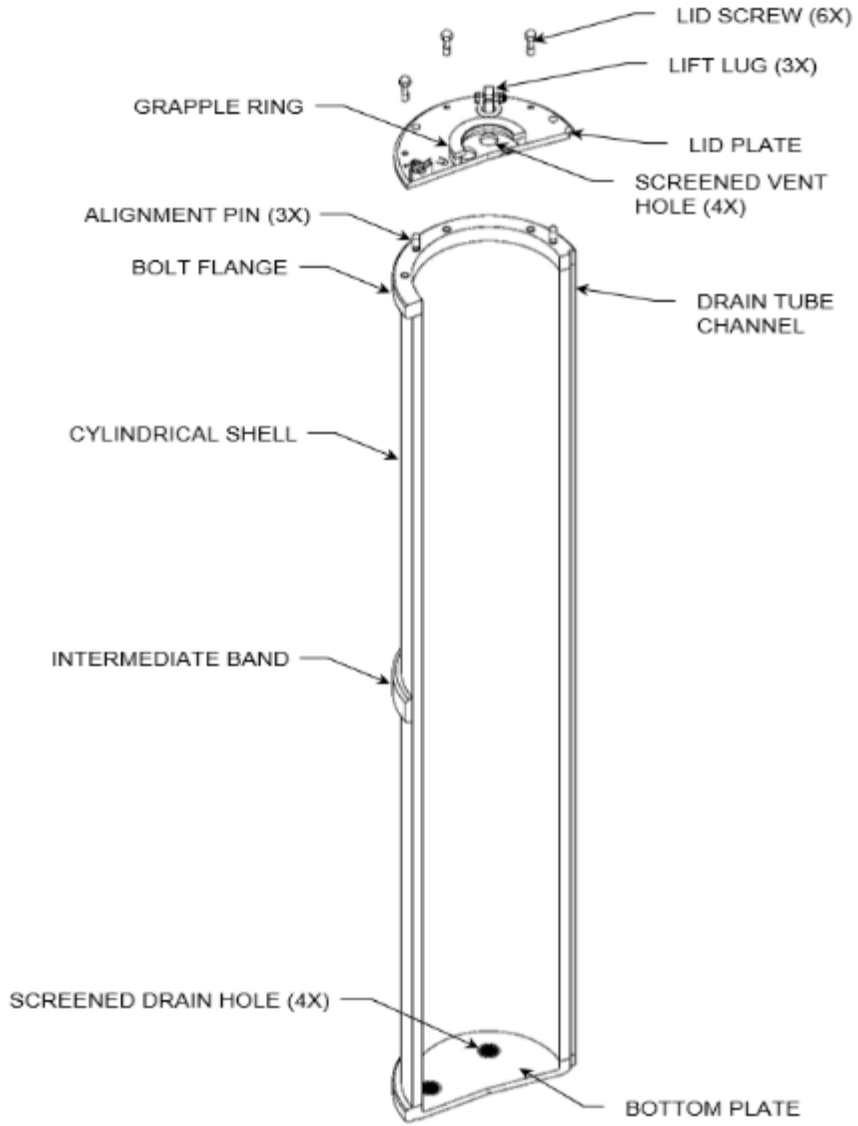
NAC's Volunteer Packaging - Contents

Contents	Max Quantity	Max. Heat Load
Vitrified HLW Canisters (10 ft and 15 ft)	*474 Ci/kg (γ) 2.15 Ci/kg (n)*	*2.75 kW (Short) 4.79 kW (Long)*
Irradiated Hardware (Steel)	*30,000 Ci (Co 60 activity)*	*0.47 kW*
TPBARs*	*1,200 TPBARs*	*3.30 kW*

*Not for disposal



Packaging



Shield Liner Assy. (Irradiated Steel)

NAC INTERNATIONAL | Kanadevia Group

NAC LPT | LOGISTICS PACKAGING TECHNICAL SERVICES

Kanadevia Group

Continue to expand NAC's nuclear materials packaging and transportation capabilities

- Privately owned fleet of 10 lidded IP-1 gondola railcars, 36 ABC railcars, and 200+ IP-1 25.4 yd^3 IMCs.
- Specialty equipment to transport radioactive, hazardous, and industrial materials
- Multimodal systems combine intermodal, rail, truck, and marine conveyances
- Direct Rail Transport or Overweight and oversize shipments
- Type B cask expansion – OPTIMUS® fleet
- Low level radioactive/hazardous waste characterization, packaging, brokering, disposal

End-to-End Solutions for Nuclear Materials Shipping Directly Applicable to Large Scale Used Fuel Transport

NAC PHILOTECHNICS

Kanadevia Group

- In November of 2022, NAC International Inc. acquired a health physics, radiological services, and waste management company headquartered in Oak Ridge, TN with a satellite facility in San Diego, CA. The company, now under NAC International ownership, has been renamed **NAC Philotechnics, Ltd**.
- NAC Philotechnics is a full-scope radiological services company providing mixed and radioactive waste processing and brokerage, MARSSIM D&D, facility/site release for unrestricted use, license termination, field services, and health physics support; including, characterization, shipping, and disposal services. NAC Philotechnics operates two fixed-base Radioactive Materials Licensed processing and material storage facilities in Oak Ridge, TN and San Diego, CA.
- NAC Philotechnics has successfully performed over 100 decommissioning projects, with zero rejections of Final Status Survey Reports.

NIAGARA ENERGY PRODUCTS

Kanadevia Group

- NAC International Inc. recently acquired substantially all of the assets of Niagara Energy Products Inc. (NEP), a leading manufacturer of pressure boundary components as well as radioactive waste containers for transportation, interim storage, final disposal, and every stage in between.
- Establishes a Canadian subsidiary for NAC (NEP is headquartered in Niagara Falls, Ontario, Canada, with additional facilities in Fort Erie and Brantford, Ontario).
- NEP has a long history with the nuclear, defense, industrial, and extractive industries (Established in 1960s)
- Over 220,000 ft^2 of manufacturing, warehousing and laydown facilities
- NEP has supplies self supporting, shielded, composite, spent fuel and many other similar stackable, metal (steel, lead, etc.) and composite isotope, HLW, ILW, and LLW containers and overpacks. NEP is an established reactor component supplier for ongoing CANDU refurbishments.
- NEP is the Leading Shielded Container Supplier in Canada with more than 5,000 Containers delivered – more than 3,400 CANDU Spent Fuel DSCs.
- NAC now the only company that provides dry storage solutions for both LWR and CANDU spent nuclear fuel

ISP Consolidated Interim Storage

- Participating with the Interim Storage Partners (ISP) team on CISF in Andrews County, Texas
- ***U.S. NRC issued its license (SNM-2125) for the ISP CISF on September 13, 2021 (now vacated)***
- Phase 1 focused on shutdown/stranded sites; includes all 3 NAC Dry Storage Technologies (MPC, UMS, MAGNASTOR)
- Legal Challenges filed in early 2022 in Federal Appeals Courts against NRC Licensing the ISP CISF:
  - D.C. Circuit Court of Appeals rejected/dismissed all claims against NRC on 1/26/2023
  - 10th Circuit Court (Denver) rejected/dismissed all claims against NRC on 2/13/2023
  - 5th (New Orleans) Circuit Court granted petition and vacated license on 8/25/2023
    - *On 10/4/2024 the U.S. Supreme Court agreed to hear the U.S. NRC's appeal against the 5th Circuit Court ruling; oral arguments held on 3/5/2025 and a decision is expected in mid-2025.*
- Texas' HB7, signed September 9, 2021, prohibits the Texas Commission on Environmental Quality (TCEQ) from issuing permits required by the ISP CISF

INTERIM STORAGE PARTNERS

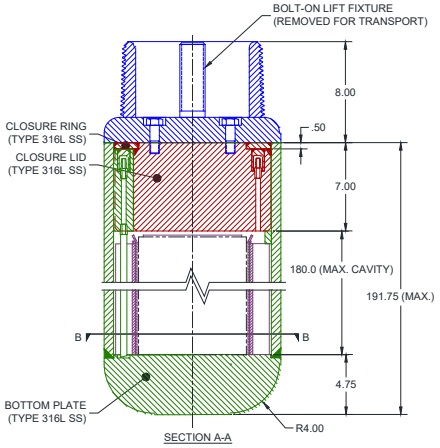
NAC Remains Committed to Consolidated Interim Storage

Near-Term Focus on Addressing Legal Challenges

NAC - Deep Isolation Collaboration

- Long-Term Cooperation & Licensing Agreement announced July 2020
  - *NAC to design, manufacture and supply the canisters to safely store and/or dispose of nuclear waste in deep boreholes*
- Lead Investor for $20M Series A raise closed in November 2020
  - *NAC has a seat on Deep Isolation's Board of Directors*
- Working with Deep Isolation to break through the barriers that have previously constrained implementation of disposal solutions
- Innovative approach creates unique options
  - *Cost-effective solution for countries with smaller nuclear programs*
  - *Potential integrated advanced reactor/deep borehole disposal solutions*

DEEP ISOLATION



Development of Future Disposal Options

“Technology Test Event” at the Deep Borehole Demonstration Center in Cameron, TX
February 23, 2023

Selected Current/Recent Transportation Projects

ATF PIE Spent Fuel Shipment from Byron to INL – Dec. 2023

Commercial advanced nuclear fuel arrives in Idaho for testing

January 25, 2024

By INL Media Relations

Selected Current/Recent Projects for USG/National Labs

- NAC-LWT ATF PIE Shipment from Clinton to ORNL (Jan. 2024)
- NAC-LWT TPBAR Shipments from Watts Bar to SRS (ongoing)
- NAC-LWT ATF PIE Shipment from Limerick to PNNL (Q2 2025)
- TRIGA SNF Basket Fabrication for BEA/INL (delivery Q3 2025)
- OPTIMUS®-L U waste shipments from SNL to NNSS (Q3 2025)
- USDA Irradiator Special Permit shipment to NNSS (Q3/Q4 2025)
- NAC-LWT ATF PIE Shipment from Byron to INL (Q4 2025)
- NAC-LWT MOX rodlet shipments from LANL to NNSS (~2026)
- NAC-LWT Soreq Nuclear Research Center (Israel) SNF shipment to SRS (~2026)
- NAC-LWT TRIGA SNF Shipments from the Pennsylvania State University to INL (Q4 2026)
- NAC-LWT Hanford WESF Sr-90 Universal Canister Sleeve Shipment Support (~2027)

Summary & Conclusions

- NAC offers a broad array of fuel cycle, radioactive material, and waste management solutions through Storage, Packaging & Transportation, Consulting, Design Engineering & Licensing, Related Services, and Integrated Offers
- Decades-long Successful track record of supporting U.S. Government Agencies (DOE, NNSA, DOD, etc.) and the National Laboratories
- Recent growth through selective acquisitions has expanded breadth and depth of services NAC can offer to now include the capability to provide previously unavailable “turnkey” options

Questions & Discussion

Thank you for your attention!

NAC INTERNATIONAL | Kanadevia Group

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