

Environmental Challenges During the Salvage of the M/V Dali

Todd Duke, Resolve Marine





Frances Scott Key Bridge



A drawing showing M/V Dali, aground on pier 17, and an early assumption of where the truss sections lay in the three bridge central spans.



UNIFIED COMMAND



Additional Stakeholders

- Resolve Marine
- US Navy SupSalv
- Donjon Marine
- Skanska
- FBI
- NTSB
- EPA
- Dept of Justice
- OSHA
- Port of Virginia
- Virginia DEQ



Incident Command System (ICS)

ICS as a Resource

- Help w/ CBP on discharging containers
- USCG ballast water treatment
- Baltimore Gas and Electric
- Cut through red tape
 - Getting everyone onboard with explosives....
- Whether you're the Responsible Party or other stakeholder, participate!!

Local Impact

- The Francis Scott Key Bridge carried 12.5 million vehicles in 2023, averaging more than 34,000 vehicles a day -equivalent to a line of cars from Washington D.C. to Philadelphia.
- The bridge was also the sole artery allowing hazardous materials transport, but those vehicles are prohibited from using the harbor tunnels. Now, those trucks must make 30 miles of detours incurring additional fuel expense.
- The Baltimore Bridge incident highlights the interconnectedness of infrastructure failures and broader impacts.
- Planning for future framework and emergency response strategies.

Incident Command System (ICS)



OBJECTIVES of UNIFIED COMMAND

RESPONSE MILESTONES

- Missing Persons Recovery
- Temporary Alternate Channel
- Limited Deep Draft Access Channel
- Dali Re-Location
- Full Channel Reconstitution
- Wreckage and Debris Removal

Salvage efforts were one part of a much larger effort related to the general incident, and the social and economic ramifications,



OBJECTIVES of DALI SALVAGE PLAN Phase 1

SALVAGE PLAN MILESTONES

- Vessel Assessment and Stabilization
- Container Unloading/ DG Cargo etc.
- Free bridge sections from vessel
- Refloating
- Tow vessel to Baltimore Terminal for Further works (Bridge road sections removal)
- Phase 2 Sail Vessel to Norfolk for Final Bridge removal, Further Cargo Removal, Hazmat Mitigation, Temporary Repairs



SALVAGE PLAN MILESTONES

VESSEL ASSESSMENT & STABILIZATION

"Unseen" Hazards

- High Voltage Transmission Lines for the Eastern Seaboard
- The Dali was sitting directly on top of a 40 inch Natural Gas Main
- Having Baltimore Gas and Electric reps in the Incident Command Post assisted in the redirection of power and gas so that crane barges could operate.



VESSEL ASSESSMENT & STABILISATION

- Make site safe
- Understand how the bridge structure was laying on the ship. What was moving? What wasn't?
- Restore fire main forward
- Restore power and repair mooring winches
- Additional Anchors and Ballast



VESSEL ASSESSMENT & STABILISATION

• Install sensors to monitor changes





VESSEL STABILISATION



INSTALL BALLAST SYSTEM FOR VOID TANKS



SALVAGE PLAN MILESTONES

CONTAINER UNLOADING / DG CARGO

CONTAINER UNLOADING / DG CARGO



CONTAINER UNLOADING / DG CARGO

• Soybean removal (90 tons by hand)





Progress





HSU 1969 2

C 31

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5400 795720

22G

200

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Bay 6 Chaos

5

/ YHL

M

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Separating Stuck Containers

100 5

1

Connulation





Damaged Hazmat Locations





Testing of liquid found in bow thruster room. Suspected sulphonic acid, onsite test inconclusive – needs lab test



- ARARARODD

Transfer of Sulphonic Acid from Damaged Tanks to Intact Tanks

UIC RAILWAYS

34000KG

ON

36000KG

79365Lb

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SALVAGE PLAN MILESTONES

FREE BRIDGE SECTION FROM VESSEL

Precutting East Side Structure

KENDALL

JLG ULTRA BOOM

Cold Cutting Machine in Place

1:1







35

C-8-

Preparing the charges

33

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RUSTO

(0)

Gas Pre-Cutting 0 .






Plywood to protect the glass

all i

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SALVAGE PLAN MILESTONES

REFLOAT / TOW TO TERMINAL



OBJECTIVES of DALI SALVAGE PLAN Phase 2

SALVAGE PLAN MILESTONES Phase 2

- Removal and disposal of Bridge Road structure (tarmac)
- Removal and disposal of Bridge Main Structure
 / Pillars
- Removal and disposal of debris from Bow
- Removal of damaged containers from Hold No1 (including DG Containers)
- Waste handling and disposal for all damaged cargo
- Cleaning of holds from contaminants and preparation of vessel for ocean voyage to repair yard.









Environmental Remediation & Waste Stream Management Partners

ambipar[®]





Inspected Road Deck for Potential Cutting

10A

110000

ironclab

RESOLVE SHATHAATUR



REMOVAL & DISPOSAL OF TARMAC

With the vessel relocated alongside to the container terminal in Baltimore the road sections of the bridge were cut/ sectioned and removed





Main metal structure for the bridge deck/road removed to reveal all the cement pillars and supporting structures







Remediation Phase



Departure Baltimore June 24

Arrival Norfolk VA June 25



Concrete Pillar Removal

July 15 Final Bridge Piece Removed



REMOVAL & DISPOSAL OF DEBRIS



Site Lay Out



Processing and Scrap Barges





What was underneath

EV Vehicles



REMOVAL OF DAMAGED CONTAINERS



Loose Soybeans







Loose Soybeans





WASTE HANDLING/DISPOSAL OF DAMAGED CARGO





Hazmat



Cargo Hold Half Empty



Salvage Master Fortune Cookie





Gross Decon





Personnel Decon
Weston 705 T Adhesive Base Initially over 28 to 30 inches deep Still Acidic























Once Container Removal Operations Completed Hand shoveling of Soybeans Pump Out of Contaminated liquids Decon and Pressure wash Acid Pools







In the muck







Nitrogen Purge







We've Finally Reached the Bottom



By The Numbers

Planning Documents

• Salvage Plan

- Engineering Addendum
- Container Removal
- Vessel Stabilization for Channel
 Opening
- Structural Monitoring Plan
- Explosive Demolition
- Deballast and Refloat
- Post Refloat
- Bow Panel Removal & Transport
- Multiple Transit Plans

- Waste Management Plan
 - Waste Stream Assessment
 - Waste Stream Sampling and Analysis
 - Liquids Transfer
- Safety and Emergency Response
 - Atmospheric Monitoring
 - Fire Protection
 - Risk Assessment & Risk Registry
 - Site Safety Plan
 - Respiratory Protection
 - Confined Space Entry



Skills Utilized

- Fire Protection Planning and Setup
- Structural Collapse and Shoring
- Heavy Extrication
- Cold Cutting Multiple Methods
- Explosive Demolition
- Confined Space Entry
- Air Monitoring
- Liquid and Solid Sampling and Analysis
- Level A and B Hazmat Operations
- Pumping Operations
- Heavy Equipment Operations
- Marine Operations

Identified Waste Streams

| HAZARDOUS | BRIDGE | CONTAINERS | GENERAL | PERISHABLE |
|---------------------|----------|----------------|-----------------------|----------------------------|
| Perfume | Steel | Steel | Consumer Goods | Soybeans |
| | | | Wood | |
| Household Chemicals | | | Nurdles | Animal Skins Mayonnaise |
| Li Ion Battony | Concrete | | Plastic | |
| Li Ion Battery | | | Automobiles | |
| Sulphuric Acid | | Container Dock | Fertilizers | |
| 6 | | | Resins | |
| Copper Powder | | | Lubricants | Tobacco |
| Alcohol | | | Chemicals | |
| | Asphalt | | #2 STV Void Rainwater | Flour |
| Car | | | Forepeak Rainwater | |
| | | | | |

Waste Stream Management



- 6 storage and segregation sites
- 9 TSD facilities
- 32 Waste Profiles
- 327 Manifest Loads Truck
- 59 Bill of Lading Loads Truck
- 13 Barge Loads
- 40,000 Tons of Waste
- 35,000 Tons Bridge Components
- 21 Written Planning Documents
- 3 Primary Regulatory Agencies



| Туре | Weight (tons) | Volume | Location |
|-------------------|---------------|-----------------------------|---------------------------|
| Flammable Liquids | 8.18 | 29 Gaylord Boxes 9 Drums | Heritage Environmental |
| Flammable Liquids | 7.48 | 57 Gaylord Boxes | Rineco-Heritage Benton |
| Caustic Liquids | 0.23 | 1 Gaylord Box | Heritage Thermal Services |
| Acidic Liquids | 6.58 | 2 totes | Bethel Landfill |

Hazardous Waste

Recycling Program

Approximately 70.66 tons of lumber was donated to charitable organizations including Habitat for Humanity and Virginia Beach Fire Academy



Approximately 32 tons of lead acid batteries were delivered to American Scrap Iron & Metal for recycling

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Approximately 7.12 tons of copper powder was returned to SCM Metal Products



Approximately 346 tons of scrap metal, including automotive parts, damaged shipping containers, and deck plates were sent to SIMS metal for recycling



Approximately 27.28 tons of used tires were delivered to SPSA Suffolk for recycling



Approximately 1.36 tons of E-waste including lithium-ion batteries were delivered to Lighting Resources, LLC for recycling



Approximately 12,000 gallons of HiTec 052 Alkylsylphonic acid was returned to owners



Approximately 15 tons of various hydrocarbons including hydraulic fluid and lubricants as well as impacted solids were delivered to Clearfied MMG for recycling





Disposal





CONSTRUCTION MATERIALS & GENERAL DEBRIS

542 tons of C&D / general debris was disposed of during this project.

PERISHABLES & MIXED NON-HAZARDOUS

1,760.69 tons of perishables and mixed non-hazardous wastes generated during the MV Dali salvage project.

LIQUID WASTES

A total of **642.26 tons** of liquid wastes were disposed of during the MV Dali salvage project, of which approximately **619.25 tons** was determined to be non-hazardous, while **22.47 tons** of liquid waste was determined to be hazardous.



HAZARDOUS WASTES

A total of 22.47 tons of hazardous waste was generated during the MV Dali salvage project.

UNIVERSAL WASTES

- Universal wastes generated during the MV Dali salvage project are as follows:
- Lead acid Batteries approximately 32 tons
- Mercury containing lamps/Mercury containing thermometers one 6.5-gallon bucket
- Lithium-Ion Batteries one 6.5-gallon bucket
- Lithium-Ion Batteries contained in devices two 6.5-gallon buckets
- Electronic wastes approximately 3,000 lbs.

GENERAL WASTE DISPOSAL INFORMATION

- 32 Individual waste profile approvals were received from various waste disposal facilities
- 327 loads of waste were disposed of under manifests
- Only 5 of the 327 loads of waste were determined to be hazardous
- 59 additional loads of wastes were removed under Bill of Lading
- 13 barge loads of scrap metal and/or concrete were delivered to various recycling facilities





Mission Accomplished

- Sept 3 Salvage and Remediation operations on ship completed
- September 25
 - Completed Waste Disposal
 - VaDEQ notified that Episodic Event had been concluded
- 186 Days Start to Finish
 - 55 days to Stabilize and Refloat
 - 131 Debris & Waste Stream Management
- Tens of thousands of person hours of Planning and Execution
- There were no Fires
- There were no Spills
- There were no Personnel Injuries



THANK YOU

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