



# Handling, Storage, & Disposal of Neutrino Beam Components at Fermilab

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2018 High Power Targetry Workshop

06 June 2018

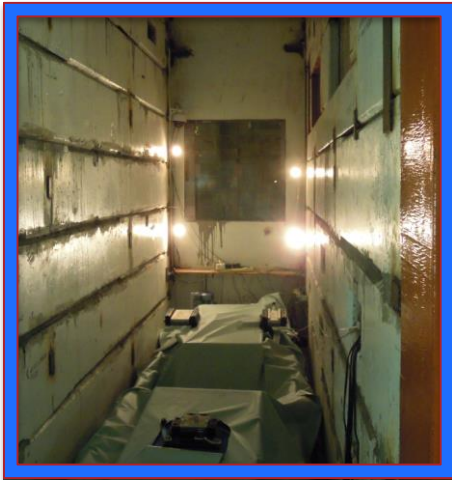
# Overview

- Handling
  - Radiological Surveys
  - On-Site Transport
- Storage
  - Existing Facilities
  - Hot Handling & Storage Area
- Disposal
  - Primary Disposal Structures
  - Transfer Process at Fermilab
- Future Considerations
  - Process Improvement



# Handling – Lead-up to Storage & Disposal

- Autopsy / Radiological Surveys
  - Radiation Safety must be able to accurately & consistently measure dose rates at various locations on beamline components.
  - Components are fairly large, and rates can vary by orders of magnitude from one end to another.



NuMI Work Cell



C0 RHF Work Cell

<b>FERMILAB</b> ACCELERATOR DIVISION		DATE: 5/26/17	TIME: 0900	PURPOSE: disposal survey	RWP #
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NUMI Horn #1-01	
Point	Doserate @ 1 foot (mr/hour)
1	1800
2	3100
3	3500
4	2800

All Dose Rates Below: N/A mR/hr Unless Noted.	Flg'd: _____ cpm	Highest Dose Rate Found: 3500 mR/hr at 1 ft.
Inst. Type: Telelector	Wgt #: _____	Note: BSO approval required to work in areas where it is >100 mR/hr @ 1 foot OR >100 CPM on a wipe.
Inst. No: 4	Beam Off: N/A	Comments:
Inst. Source Chk: SH	Date: _____	Surveyed By: Busch
Cal. Due Date: 8/20/17	Time: _____	Reviewed By:
<b>LEGEND</b> Numbers appearing on map are mR/hr @ 1 ft readings unless denoted with symbols below * = mR/hr @ contact A = Air Sample    ○ = Wipe    ⊙ = Floor wipe		

Horn PH1-01 Survey

<b>Fermilab</b> ESH&Q		DATE: 8/2/17	TIME: 0900	PURPOSE: informational survey	RWP #
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NUMI Target NT-05 Beam Right	
Point	Doserate @ 1 foot (mr/hour)
1	40
2	150
3	350
4	400

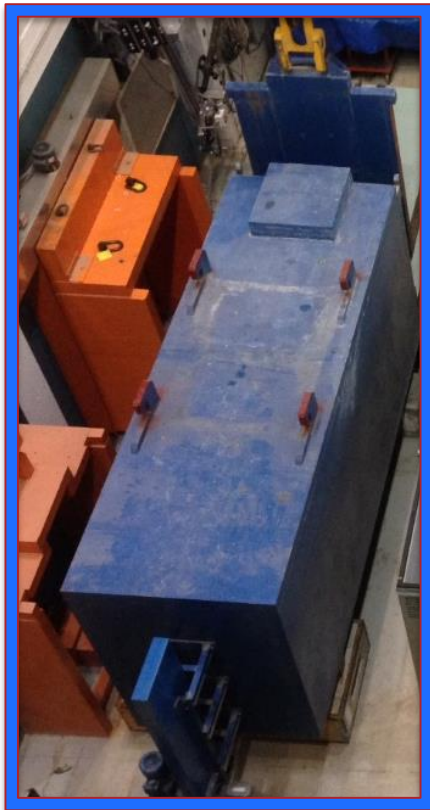
All Dose Rates Below: N/A mR/hr Unless Noted.	Flg'd: _____ cpm	Highest Dose Rate Found: 400 mR/hr at 1 ft.
Inst. Type: LSM	Wgt #: _____	Note: BSO approval required to work in areas where it is >100 mR/hr @ 1 foot OR >100 CPM on a wipe.
Inst. No: 24	Beam Off: N/A	Comments:
Inst. Source Chk: SH	Date: _____	Surveyed By: Busch
Cal. Due Date: 3/20/18	Time: _____	Reviewed By:
<b>LEGEND</b> Numbers appearing on map are mR/hr @ 1 ft readings unless denoted with symbols below * = mR/hr @ contact A = Air Sample    ○ = Wipe    ⊙ = Floor wipe		

Target NT-05 Survey



# Handling – Fermi Site Transport

- Building to Building Moves
  - All NuMI devices are transported using 4” thick steel coffin from MI-65 Target Hall to C0 Remote Handling Facility (RHF).



NuMI Transport Coffin

- MiniBooNE Horns have their own transport coffins and are brought to the Target Service Building (TSB) for storage.
- Coffins must be internally lined with plastic to capture contamination & are cleaned after each component move.
- External tarping required for contamination control.

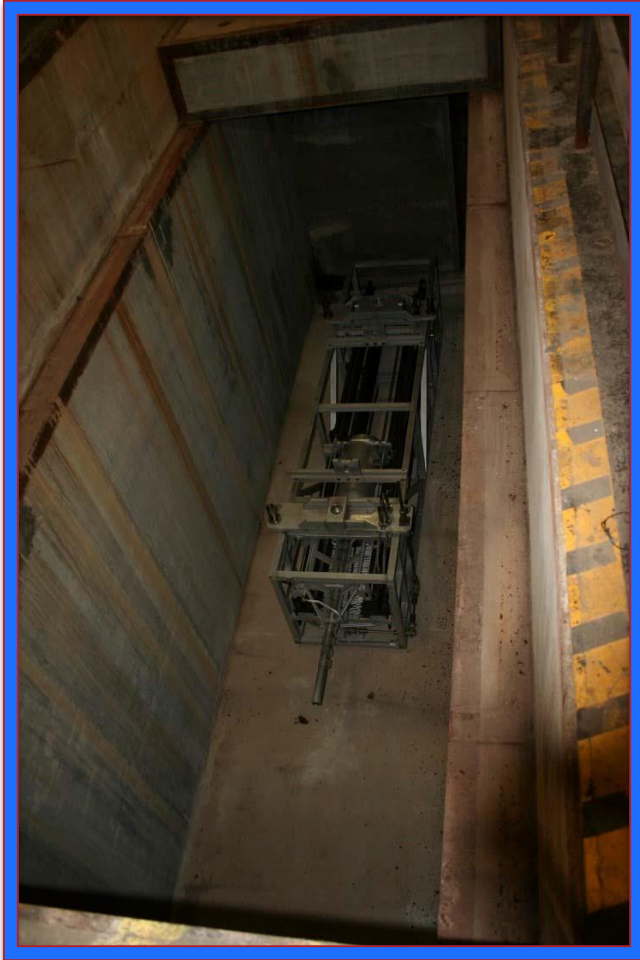


MiniBooNE Horn Coffin



Tarped Load for Transfer

# Storage – Existing Facilities



NuMI Morgue Bay With Target

- NuMI Target Hall
  - One large morgue bay available.
  - Holds 2 components + ancillary structures.
- C0 Remote Handling Facility Morgue Bays
  - Three individual bays hold any NuMI component, plus work cell space if required.



C0 RHF Morgue Bays + Transfer Coffin

# Storage – Existing Facilities

- Second Facility – Target Service Building (TSB)
  - Contains North & South dual rail lines.



TSB Electric Locomotive



Main Storage Rail Line



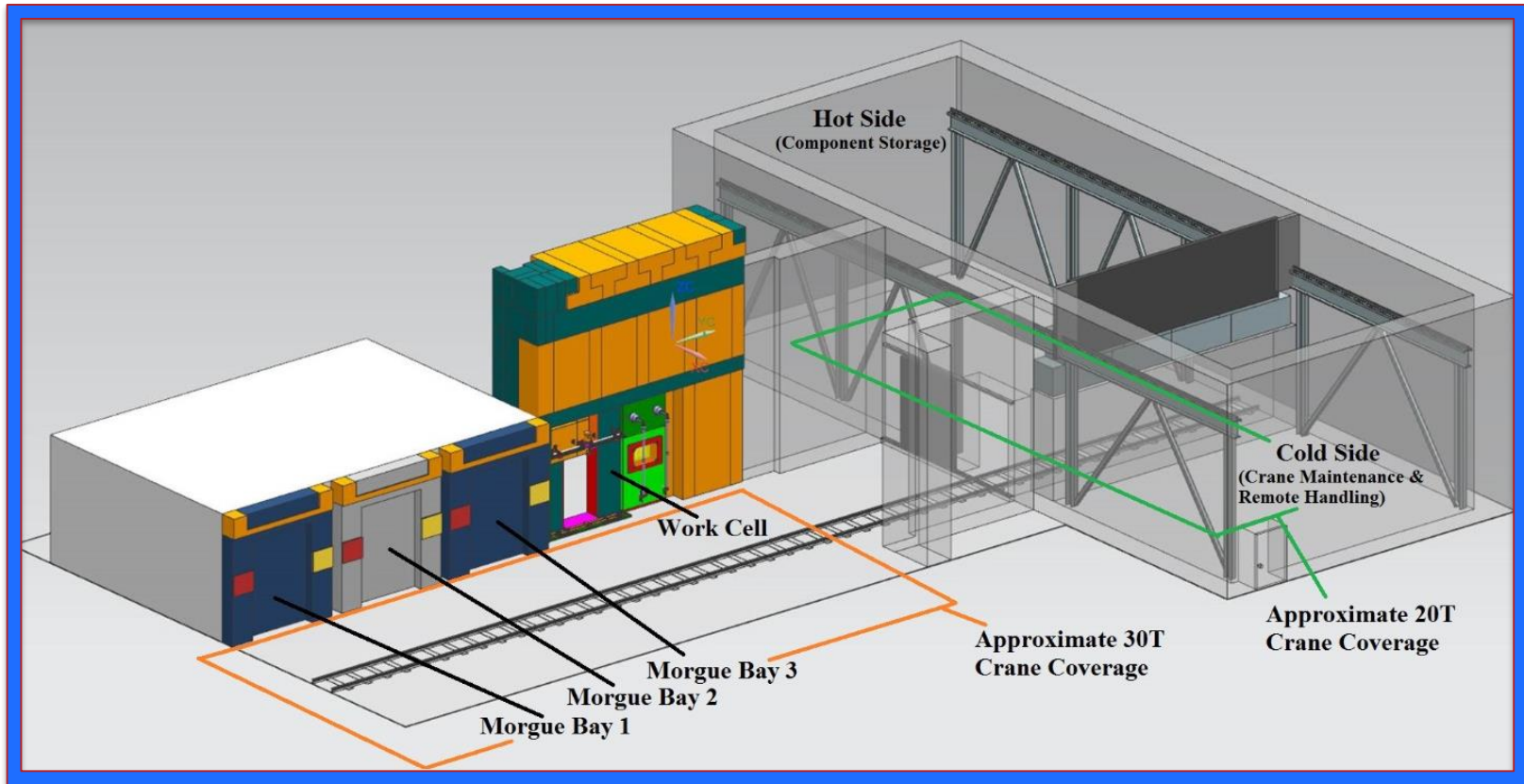
MiniBooNE Coffin Handling

- Operational Issues
  - Ceiling height limitations.
  - First-in / last-out process (tracks dead end).
  - Crane capacity / hook height issues.
  - Old tracks, locomotives get stuck.

# Storage – Long Term Solution

- Retrofit C0 Remote Handling Facility (RHF)
- Utilize Old Detector Hall & Empty out TSB

Concept Credit:  
Patrick Hurh &  
Ryan Schultz

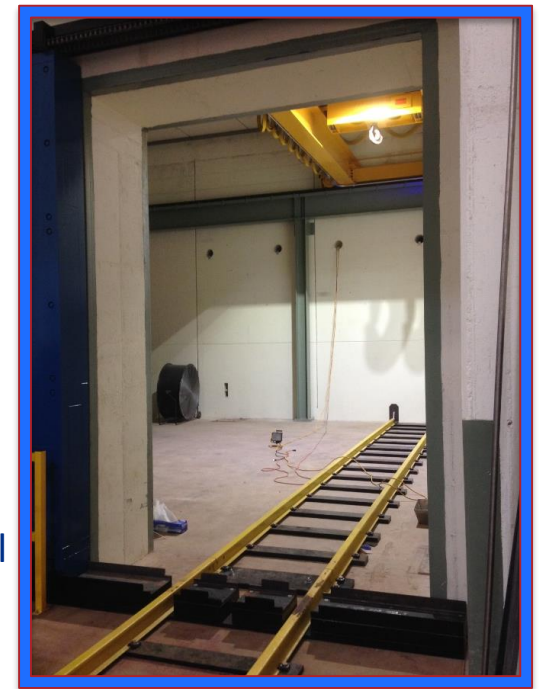


Conceptual Remote Handling Facility Expansion

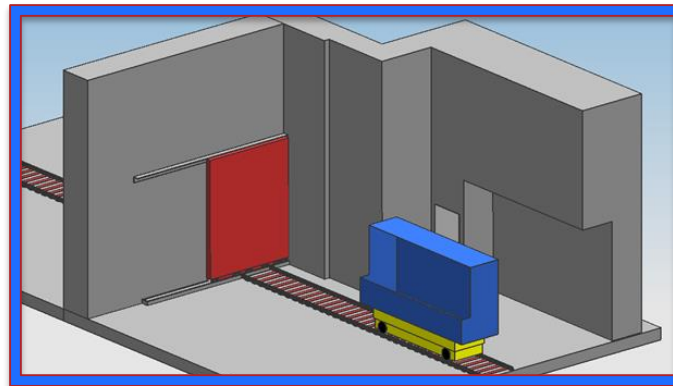
# Storage – RHF Build Status

- Transfer Door Construction
  - Construction 95% complete; door operational, transfer car electronics & controls to be finished in June / July timeframe.
  - Maximum permissible coffin / IP-1 size of 7.5' Wide X 8.5' Tall X 30' Long.
- Maximum Capability
  - Allows for stackable IP-1 burial containers.
  - Holds 24 IP-1's at full capacity.
- Inherent Flexibility
  - Camera & light placement.
- Reliability
  - No sensitive electronics.
  - Nothing to replace.

Design Credit:  
Mike Campbell



Transfer Door as of 5/28/18



Transfer Door Concept 6/22/15

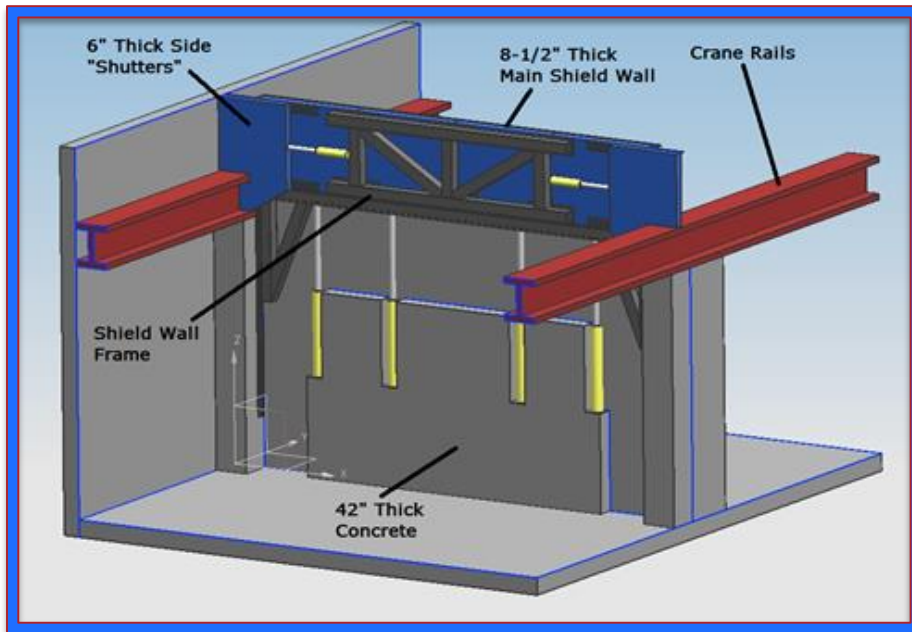


Interior of Hot Bay



# Storage – RHF Build Status

- Crane Shield Wall
  - Construction 95% complete; testing to occur mid-late June. Closeout in July.
  - Provides fully shielded “cold-side” for crane maintenance & RH team.
  - 40 tons of steel (8” thick plate, 6’ vertical actuation, individually operated crane rail shutters with festoon feed-through).



Crane Shield Wall Concept 6/22/15



Crane Shield Wall as of 5/28/18

# Disposal

- How to Transfer Offsite?
  - Must meet DOT safety guidelines for over-the-road travel.
  - Must limit dose to all personnel during hand-over / transfer.
  - Must be economically feasible, safe, reliable, & repeatable.
- Chosen Method
  - Utilize transport coffin supplier + NNSS Disposal + Fermilab oversight.



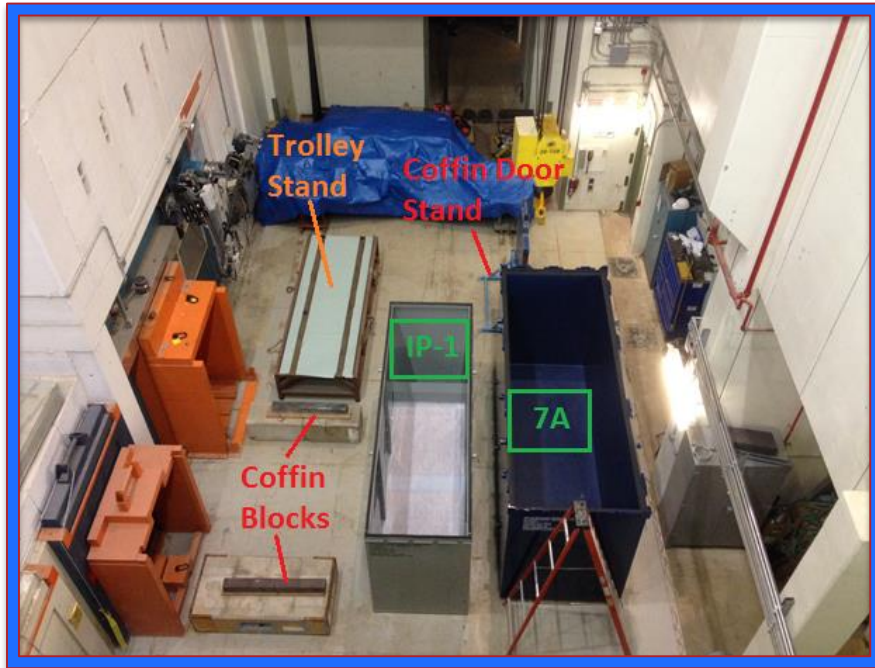
7A Transport Coffin + IP-1 Burial Container



Component Disposal at NNSS

# Disposal – RHF Staging

- Prepare for Component Moves
  - Must minimize radiation dose to workers, have major parts of system ready:
    - Coffins, Lids, & Fixturing
    - Rigging, Support Personnel, Cameras / Lighting.
  - Account for handling room, crane travel, accessibility for final closure.



Main Bay Staging at C0 RHF

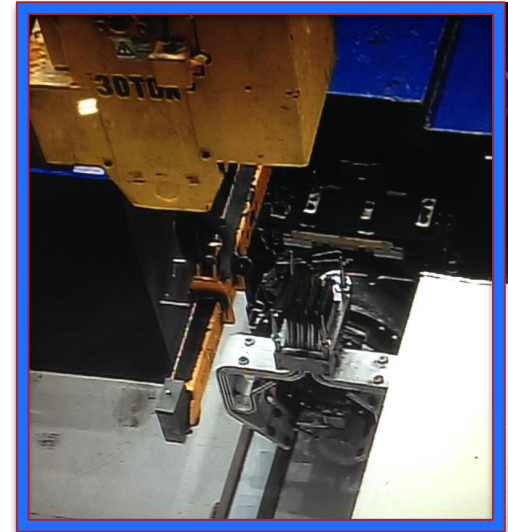


Placement of Fermilab Transfer Coffin

# Disposal – Component Loading

- Component Staging
  - Fermilab transport coffin door opens.
  - Component is retracted on orange trolley.
- Insertion into IP-1 Burial Container
  - Lifting fixture change, followed by retrieval from trolley.
  - Component placed in to IP-1.
  - Three components done to date!

PH2-01 Retraction  
From Coffin



Horn 2 PH2-01 (10/16)



Horn 1 PH1-01 (10/17)



NuMI Target, NT-05 (10/17)

# Disposal – Containment Sealing

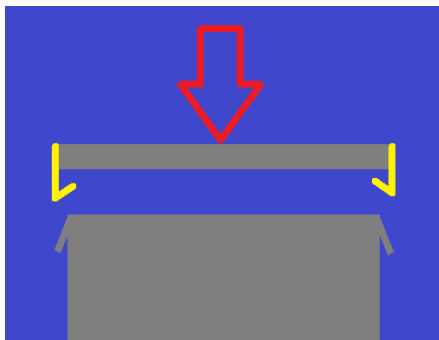
- Closure of IP-1 Burial Container
  - Change to universal lifting fixture for placement of IP-1 lid.
  - Lid rotated and placed in “Locked” position in preparation of sealing.
  - Yellow locking tabs now aligned with retention plate on main body; additional weight / downward movement will permanently close the container.

Universal  
Lifting Fixture  
+ IP-1 Lid

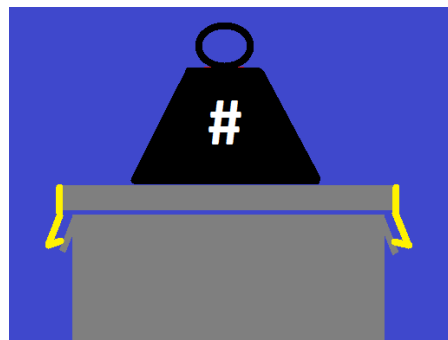


IP-1 Burial  
Container +  
Lid

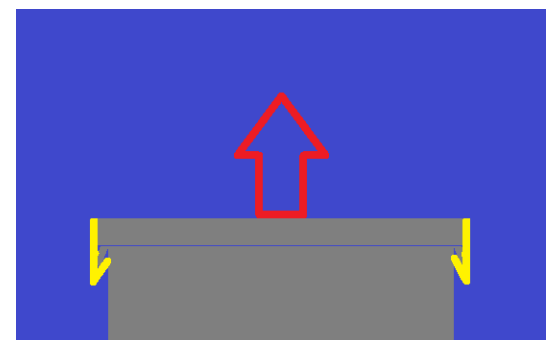
1



2



3



# Disposal – Loading of Transport Coffin



Fixture Attachment to 7A Lid



Lowering of 7A Lid for IP-1 Closure



IP-1 Placement into 7A Coffin



7A Lid Movement to Enclose IP-1

# Disposal – Final Stages

- Sealing of Transport Coffin
  - Lid lifted into place, fixture released, & Rad-disposal crew completes DOT mandated closure procedure.
  - Lifted on to tractor-trailer at RHF, then transferred to rad-disposal facility.
- Transport Coffin Shipping Preparation
  - Coffin must be secured, have dose-rate levels recorded, & tarped for over-the-road transport to NNSS.



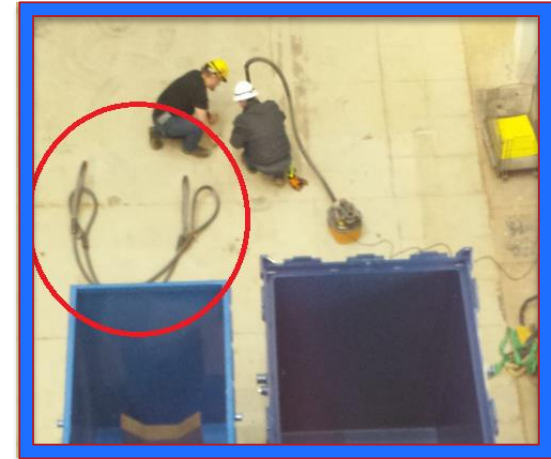
Lid Placement on 7A Coffin



7A Transport Preparation to NNSS

# Future Considerations – Process Improvement

- Paint / Geometry Changes
  - Different color for locking tabs.
  - Utilize lid guides for initial placement.
  - Resize lid for tighter fit.
- Fixturing Improvements
  - Duplicate universal lifting fixture for future savings.
  - Eliminate wire rope lifting cables.
    - Soon to be replaced with dedicated 7A lifting fixture.



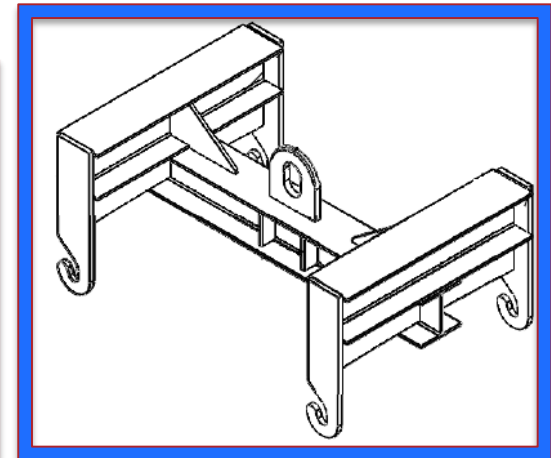
Original 7A Lift Cables



Original IP-1 Lid



Revised IP-1 Lid



7A Coffin Lifting Fixture



# Thank You

Questions?

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