

Target System Transportation and Decommissioning

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Hg System Safety Review

CERN

June 19-20, 2006

Outline



Transportation

- **Transportation Plan (incl. schedule)**
- **Container Shipment**
- **Receive and Return Shipment**

Decommissioning

- **Cool Down and Dismantling**
- **Mercury Unloading Procedure**

Summary and Conclusions

Transportation Plan

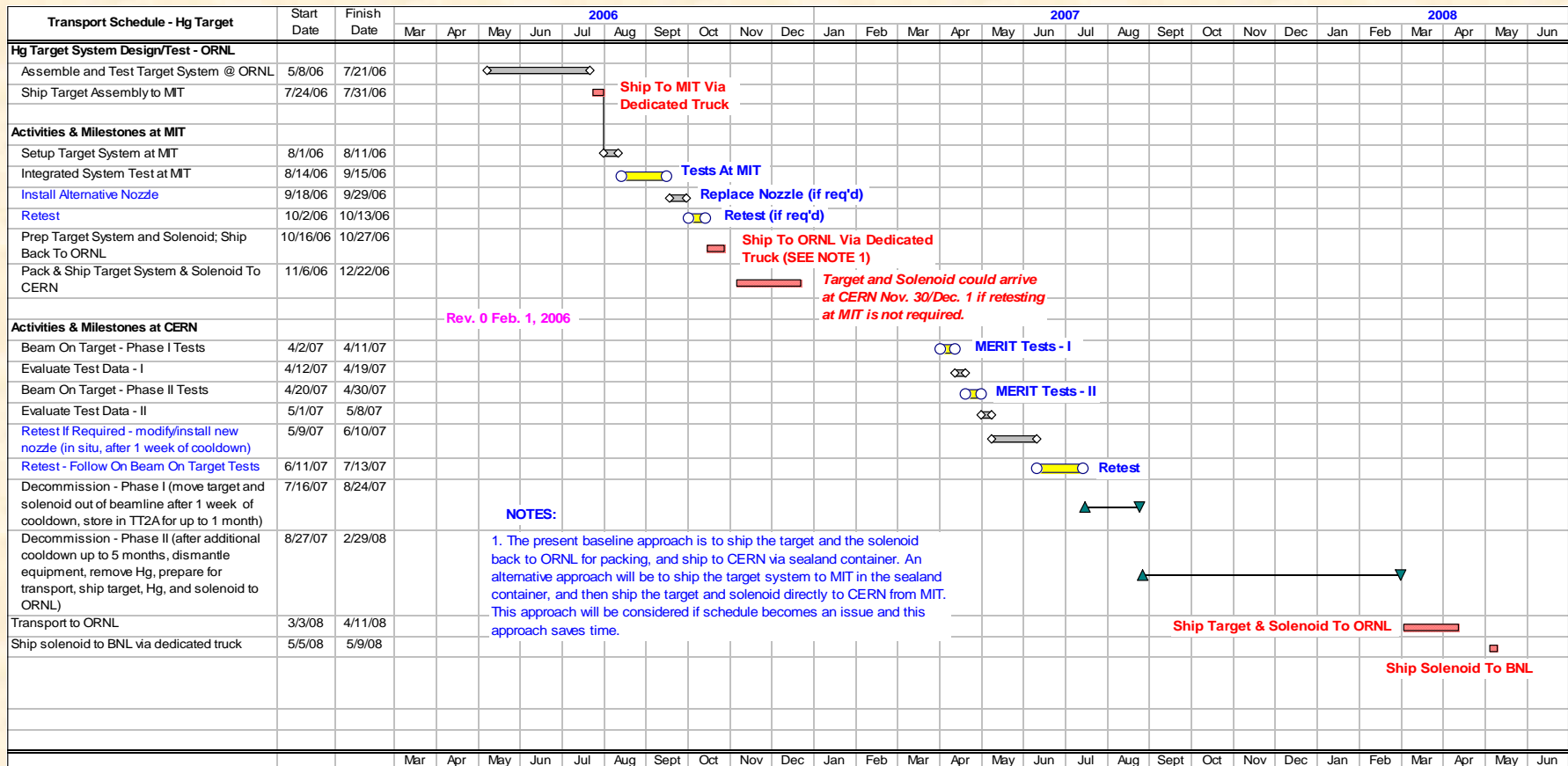


- **Discussions with ORNL Transportation Group for the past 6 months**
- **According to current schedule (Feb'06)**
 - Pack/ship target and support equipment to MIT Jul-Aug'06 via dedicated truck
 - Pack/ship target/solenoid and support equipment back to ORNL Oct'06
 - Pack/ship target/solenoid and support equipment to CERN Nov-Dec'06 via short sealand container
 - Truck to U.S. port, ship to Genoa?, truck to CERN
 - Ship everything back to ORNL Mar-Apr'08
(based on 6-month cool down – 1 month could be sufficient for e/o 2007 delivery to ORNL)
 - Solenoid shipped to BNL in early 2008

Transportation Schedule



- The schedule will be updated to reflect current fabrication and testing plans



Packing/Shipping



- **ORNL will be responsible for all packing and shipping activities to MIT and to CERN**
 - Fabricate reusable crates and packing materials
 - Documentation for domestic shipment and international shipment
 - Issue ORNL documentation for “green tag” certification to MIT and CERN 1 week before shipping
- **MIT and CERN participate in return shipments**
 - Issue shipping documents
 - Pack target equipment and solenoid as required
 - Load truck (MIT) and sealand container (CERN)

Packing/Shipping (cont.)



- **ORNL obtain approval from Export Control Group 1 month before shipping to CERN**
- **ORNL obtain DOE letter for duty-free exemption for “export” and “import”**
- **1 month notice to TG to purchase container for shipping to CERN**
 - **\$2400-2600 FOB S.C. + tax + shipping + unloading + light test + water test + gasket inspection = \$5800**
- **1 week notice to Transportation Group to arrange for truck shipment to MIT**

Packing/Shipping (cont.)



- **TG will need list of radionuclides and activities at the end of testing to quantify shipment of radioactive material**
 - **Exclude items having a half-life <10 days**

"Short" Sealand Container



- **The container requires storage at CERN for duration of MERIT project**
 - Use the same container with the same cargo
 - Container is certified and documented for rad material shipping

20' Intermodal-Sealand

Interior Dimensions

Length: 19'-4"
Width: 7'-9 1/2"
Height: 7'-9 1/2" (3'7" Half-High)

Exterior Dimensions

Length: 19'10"
Width: 8'
Height: 8'-6" (4'3" Half-High)

20' Wood Floor Container



Tare Weight: 4,760 lbs
Payload Capacity: 48,150 lbs
Max. Gross Weight: 52,910 lbs
Cubic Capacity: 1,173 cu. ft.

ACS Model: 210STU
WSRC Model: IM20WEL
SRS Material ID: 32-13412.01

CAR-SWE-96-0027
WITS# 468 SEALAND CONTAINER-20FT

ORNL's Environment, Safety & Health Group Is Involved

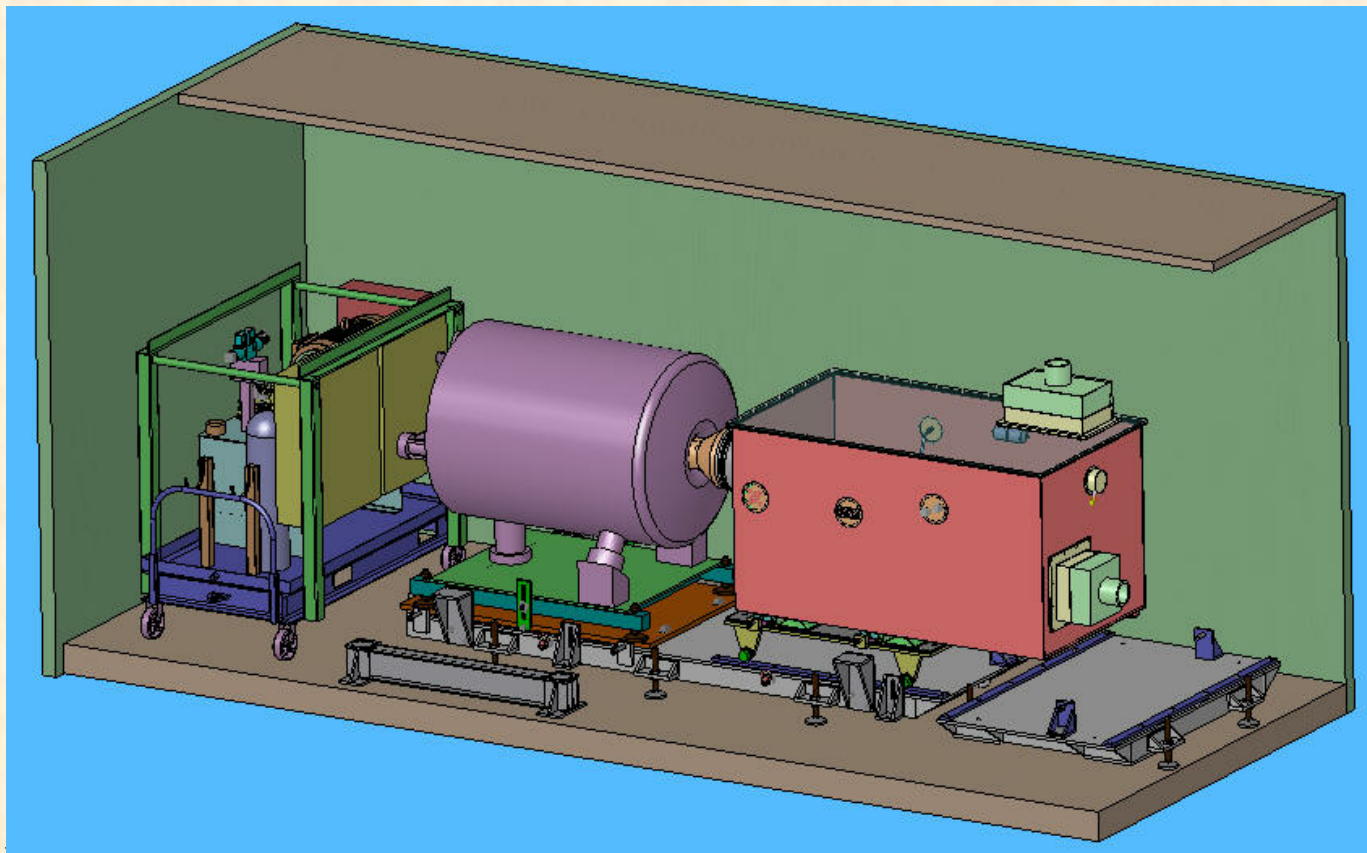


- **Compliance guidelines provided by**
 - **Division Safety Officer**
 - **Environmental Protection Officer**
 - **Environmental Compliance Representative**
 - **Waste Services Representative**
 - **Solid & Hazardous Waste Representative**

The Container Is Full!



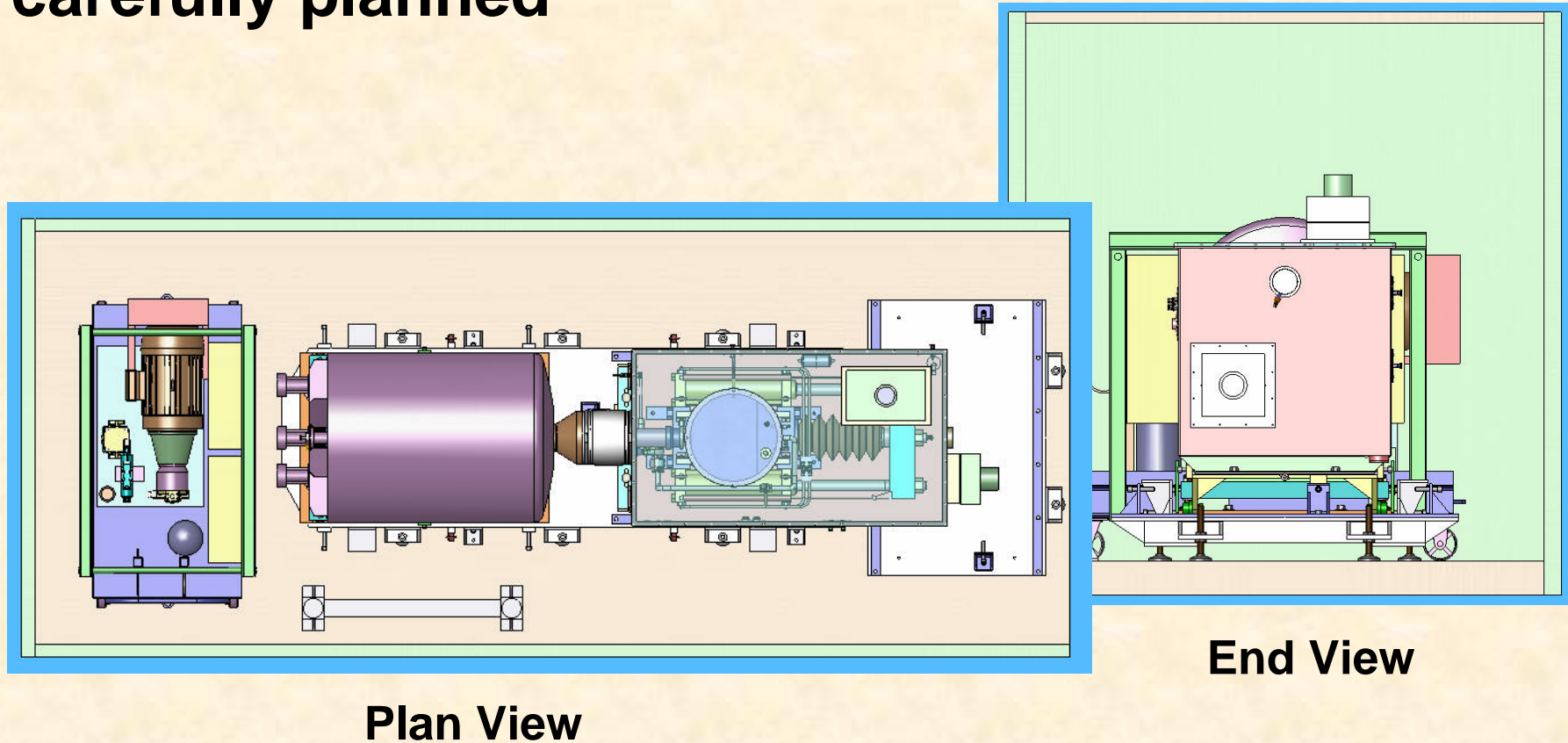
- Preliminary layouts show that the short container will accommodate all the target equipment and the solenoid



Container (cont.)



- **Equipment loading and unloading must be carefully planned**



Should We Add To The Schedule In Case Of Late Delivery ?



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The Equipment Will Be Tied Down In The Container and It Is Water Tight !



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Decommissioning



• Cool Down and Dismantling Plan

- Leave target/solenoid in TT2A beam line position for several weeks for Hg cool down to <1 mrem/h
- Move equipment out of the beam line, drain and store Hg in flasks
- Leave equipment in TT2A for additional cool down to <<1 mrem/h (2-4 weeks ?)
- Disassemble target and solenoid, move out of TT2A for packing and loading into container

| Component | Absorbed Dose (Gray/ 3×10^{15} protons) | Residual Dose Rate – at Shut Down (mSv/h 3×10^{15} protons/30day) | Residual Dose Rate – at Shut Down (mrem/h) | Residual Dose Rate – 100 Hrs Cool Down (mSv/h 3×10^{15} protons/30day) | Residual Dose Rate – 100 Hrs Cool Down (mrem/h) |
|---|---|---|---|--|--|
| Equipment in solenoid bore | $10^4 - 10^6$ | 1 | 100 | - | - |
| Equipment in secondary enclosure | $10^2 - 10^4$ | - | - | - | - |
| Syringe Pump | - | $10^{-2} - 10^{-3}$ | 1.0 - 0.1 | - | - |
| Top of secondary enclosure | - | $10^{-2} - 10^{-4}$ | 1.0 - 0.01 | - | - |
| Hg vapor monitor (top of enclosure) | 14.0 (<5-10 krad for electronics) | 0.95 | 95.0 | $<2.70 \times 10^{-3}$ | <0.27 |
| Hydraulic fluid | 125 | 0.023 | 2.30 | $<1.13 \times 10^{-4}$ | <0.01 |
| Ventilation filter in secondary encl. (1) | 505 | 1.55 | 155.0 | $<9.70 \times 10^{-4}$ | <0.09 |
| Mercury | $10^1 - 10^2$ | $10^{-1} - 10^{-2}$ | 10.0 | 30×10^{-3} (2) | 3.0 (2) (3) |

(1) Pure carbon material used for calculation; impregnated sulfur not included.

(2) 1 day of decay at 1 meter distance; M. Magistris and M. Silari, EDMS No. 601754, CERN Technical Note CERN-SC-2005-049-RP-TN, June 16, 2005.

(3) After 1 month, dose rate at 1 meter distance is 0.1 mrem/h.

Hg Unloading (review)



- Place a 3-liter bottle in a gauze-lined tray under the drain port
- Using the hand valve for flow control, gravity-drain Hg up to the 2-liter mark
 - Air will be allowed to vent into the Fill Port during the operation
- Transfer 2-liters of Hg from the bottle into a flask
- Install the steel plug and **weigh the flask**
- Remove Hg remaining in the sump tank or drain line using the pump



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UT-BATTELLE

Summary and Conclusions



- **Transportation plan is in place and includes participation by ORNL's Transportation Group**
- **Transportation schedule needs to be updated**
- **Details for shipping to/from MIT and CERN have been developed**
 - **Dedicated truck to/from MIT**
 - **Sealand container to/from CERN**
- **Decommissioning plan has been developed base on equipment activation**
- **Formal documentation outlining each institution's responsibilities may be needed, with agreements made at appropriate management levels**