

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 <u>dedicated</u> 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



Transport Schodulo Ha Target	Start	Finish	2006							2007												2008									
	Date	Date	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	No	v Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	N	v	Dec	Jan	Feb	Mar	Apr	May	Jun
Hg Target System Design/Test - ORNL																															
Assemble and Test Target System @ ORNL	5/8/06	7/21/06			<u>م</u>																										
Ship Target Assembly to MIT	7/24/06	7/31/06						Shi	р То М	IT Via																					
								Dec	Icated		(—																				
Activities & Milestones at MIT																															
Setup Target System at MIT	8/1/06	8/11/06						╘																							
Integrated System Test at MIT	8/14/06	9/15/06						0		ests A	At MIT																				
Install Alternative Nozzle	9/18/06	9/29/06							<u> </u>	Rep	lace	Nozzle	(if req	d)																	
Retest	10/2/06	10/13/06							(Rete	st (if re	q'd)																		
Prep Target System and Solenoid; Ship Back To ORNL	10/16/06	10/27/06									Sh	nip To (ia Deo = 1)	dicated																
Pack & Ship Target System & Solenoid To	11/6/06	12/22/06									÷			- ''									-								_
CERN													at C	jet ani FRN N	1 Solen Iov 30/	ola co. Dec 1	if roto	ive tina													
				Boy	0 Eab	4 200							at N	T is r	ot real	ired.	II Teles	sang													
Activities & Milestones at CERN						. 1, 200 								1	1		1														
Beam On Target - Phase I Tests	4/2/07	4/11/07														<u>oo</u>	MERIT	Tests	- I												
Evaluate Test Data - I	4/12/07	4/19/07														8															
Beam On Target - Phase II Tests	4/20/07	4/30/07														0	ME	RIT Te	sts - II												
Evaluate Test Data - II	5/1/07	5/8/07															8														
Retest If Required - modify/install new	5/9/07	6/10/07															~	~													
nozzle (in situ, after 1 week of cooldown)																	×	\top													
Retest - Follow On Beam On Target Tests	6/11/07	7/13/07																0		Retest											
Decommission - Phase I (move target and	7/16/07	8/24/07																											1		
solenoid out of beamline after 1 week of cooldown, store in TT2A for up to 1 month)					N	OTES:															'										
Decommission - Phase II (after additional	8/27/07	2/29/08			1. Tł	ne pres	ent bas	seline a	pproact	h is to	ship	the taro	et and t	he sol	enoid																
cooldown up to 5 months, dismantle					back	to OR	NL for	packing	, and s	ship to	CER	N via se	aland c	ontain	er. An														1		
equipment, remove Hg, prepare for					alter	native a	approad	h will b	e to sh	ip the	targe	t svster	n to Ml	in the	sealan	d					<u> </u>		_	_				7	1		
transport, ship target, Hg, and solenoid to					cont	ainer. a	nd the	n ship t	he taro	et and	sole	noid dire	ctly to	CERN	from M	T.													1		
ORNL)					This	approa	ch will	be con	sidered	l if sch	edule	becom	es an is	sue a	nd this														L		
Transport to ORNL	3/3/08	4/11/08			appr	oach s	aves tir	ne.													Sh	nip Tar	rget	& S(olenoi	id To C	ORNL		<u> </u>		
Ship solenoid to BNL via dedicated truck	5/5/08	5/9/08																													
																											Sh	nip Sol	enoid	To BNI	<u> </u>
											-												-	-							
														-																	
			Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	No	v Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	N	v	Dec	Jan	Feb	Mar	Apr	May	Jun

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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</p>

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"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: 4,780 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-95-0027 WITS# 468 SEALAND CONTAINER-20FT



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ORNL's Environment, Safety & Health Group Is Involved



- Division Safety Officer
- Environmental Protection Officer
- Environmental Compliance Representive
- 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



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 Equipment loading and unloading must be carefully planned

Plan View

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Container (cont.)



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

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	Absorbed	Residual Dose	Residual	Residual Dose	Residual
Component	Dose	Rate – at Shut Down	– at Shut	Cool Down	100 Hrs
Component	(Gray/3*10 ¹⁵ protons)	(mSv/h 3*10 ¹⁵ protons/30day)	Down (mrem/h)	(mSv/h 3*10 ¹⁵ protons/30day)	Cool Down (mrem/h)
Equipment in solenoid bore	$10^4 - 10^6$	1	100		2.5
Equipment in secondary enclosure	$10^2 - 10^4$	71-1-1	-	1	7
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 x 10 ⁻³	<0.27
Hydraulic fluid	125	0.023	2.30	<1.13 x 10 ⁻⁴	<0.01
Ventilation filter in secondary encl. (1)	505	1.55	155.0	<9.70 x 10 ⁻⁴	<0.09
Mercury	$10^1 - 10^2$	$10^{-1} - 10^{-2}$	10.0	$30 \times 10^{-3} (2)$	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 gauzelined 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



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

