Fermilab Permit Type Job-Specific Radiological Work Permit No. AD-20-140 **Issue Date** Sep 11, 2020 Area Name **MI** Collimators **Issue Time** 12:05 PM **Expiration Date** Nov 30, 2020 Access Type **Description of Work** This RWP will cover two jobs in the MI-30 collimator regions. First will be restoring O Controlled Access Supervised Access horizontal motion to the collimators and then installing collimator inserts. There is an ALARA plan associated with each job. O Open Access O Other - Secured Area O N/A **Additional Work Area Conditions** Area Posting **Basic Work Area Conditions** High Radiation Area Poor lighting - bring supplemental None lighting Contamination Area Deenergize motors prior to connection to hand controller when used **Time Limits Dose Limits Work Documents** See ALARA plans and individual None see attached job plan(s) checkpoints and job-stop limits. HA when applicable **Dosimetry Requirements Other Training Requirements Basic Training Requirements** ■ None Required Radiological Worker Training None ■ Dosimetry Badge Ring Badge ▼ Digidose See Special Requirements **Portable Survey Instruments** Minimum Personal Protective Equipment **Additional Instructions** ☐ None Required ☐ None Required Notify ESH&Q Prior to Work □ LSM **X** Gloves X Rad Tech Coverage Required Ludlum 14C **X** Shoecovers Review Survey Map ▼ Pre-Job Briefing ■ Pre-Job Briefing ☐ E140N/Portable Frisker ☐ Labcoats ☐ Coveralls Personal Frisk on Exit ☐ Minimeter ☐ Teletector ☐ Hood ■ Survey & Label Materials on Exit ▼ Post-Job De-Briefing ☐ Bicron Analyst ☐ Eye Protection ☐ Respiratory Protection No Eating, Drinking, Smoking See Special Requirements ☐ See attached instructions ☐ See Special Requirements See special requirements SPECIAL REQUIREMENTS Work stops at collective dose as per each ALARA plans. RSO or designee approval required before proceeding if work is stopped. RCT(s) will conduct radiation surveys as necessary, will provide supplemental dosimetry as

Work stops at collective dose as per each ALARA plans. RSO or designee approval required before proceeding if work is stopped. RCT(s) will conduct radiation surveys as necessary, will provide supplemental dosimetry as needed and provide instructions for placement. Take precautions to prevent the spread of contamination. If water on the floor is encountered, rubber boots must be worn and herculite must be placed to prevent contact with personnel. Parts of these jobs will also require lab coats and/or coveralls. Wear PPE as directed by the RCT. Dispose of all PPE in rad bags. All activated components are assumed to be contaminated.

J#4-17

Prepared By

Susan McGimpsey

RSO Authorization

Name of Worker	Fermi ID	Worker Signature and D	
Dale White	10017	Dallyto 9/14	/20
Mike Coburn	5558	ry and and	
Beth Klein	37908	Begn Kun	
KYLE HAZELWOOD	14740	1/1/2001	13SEPAO
ROBERT AINS-OR TH	308/50	The state of the s	
PHIL ADAMIAN	12563 N	Volan	AND CONTRACTOR OF THE PROPERTY
Cons Guttes.	8022 N		
Dave Capista	8194	Hair Copul	\$ 9/15/2000
J.B.MPI MORRIS	14869	in hour	\$ /15/20ro
	311200		10/06/20
Elias Lopez ROM BACINO	8961C	Roberto	10/6/2020
John Anderson	12886	Wish	10/6/2020
Jason KuBmi W	13724 W	- Chille	10 15 2020
RUAN MONTIEC	12545N	Row Metal	10/15/20
ABRIAN MARQUEZ	35076N	alles	10/15/2020
Vino Chelidze	34887N	N. Chotidel	10/29/2020
BLASZYNSKI WOLCIECH	13/64	Juny Blows-	
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RR-300 Region Collimators ALARA

RWP AD-20-140

MI 300 area collimator Horizontal Motion Restoration & Insert Installation as per ALARA plan.

Insert Installation Person-mRem

Name	Dose (mRem)
ES&H	
Dale White	17
Sue McGimpsey	0
AD/MS	
Beth Klein	3
John Anderson	21
Rom Bacino	10
Justin Briney	10
Elias Lopez	0
Ryan Montiel	23
Jason Kubinski	27
Adrian Marquez	0
Wojciech Blaszynski	15
MI	
Denton Morris	3
Phil Adamson	7
Total	136.0

Summary

10/6 & 10/15-16/20 Person-mrem for this job was 136 with an estimate of 752

307:Person-mrem 22 estimate 200

303:Person-mrem 32 estimate 164

301:Person-mrem 82 estimate 388

The main scope of this job was to install inserts in the beamline on the downstream side of three collimators; 307, 303 and 301 in that order. The inserts are designed to aid in keeping the beam focused thereby minimizing beam losses. The lowest rad levels are at 307 collimator so this went first to learn as the job progressed to minimize radiation doses. Doserate in area worked varied from location to location, see ALARA for more info. The first attempt on 10/6 at 307 had some problems. The screws were not threading in properly so all the parts for each location had to be re-machined. This resulted in getting 7 extra mrem. Job started back up 10/15. Inserts went in reasonably well and job went as smooth as possible. Overall dose was well below what was initially thought.

As per RWP requirements, workers wore full anti-c's with double shoe covers and gloves. Full set of protective clothing were removed and placed in a bag and sorted through after completion of job disposing of contaminated items as rad waste. Personnel and items were checked periodically and when switching locations. A few items had to be de-coned along the way. The guide tool scraped inside the beamline and had a few hundred counts above background that was fixed. This item was bagged and disposed of as radiation waste.

Horizontal Restoration Person-mRem

Name	Dose (mRem)
ES&H	
Dale White	14
Nino Chelidze	4
AD/MS	
Beth Klein	6
John Anderson	7
Controls	
Mike Coburn	40
MI	
Kyle Hazelwood	10
Phil Adamson	10
Rob Ainsworth	9
Dave Capista	23
Denton Morris	15
Cons Gattuso	16
Total	154.0

Summary

9/15-11/23/20 Person-mrem for this job was 154 with a total estimate of 883

307:Person-mrem 22 estimate 87

Add on 2 estimate 5

Total 24 estimate 92

308:Person-mrem 26 estimate 217

Add on 3 estimate 15

Total 29 estimate 232

303:Person-mrem 19 estimate 116

Add on 3 estimate 6

Total 22 estimate 122

301:Person-mrem 40 estimate 399

Add on 6 estimate 26

Horizontal Investigation/Repair 33 estimate 12

Total 79 estimate 437

The main scope of this job was to restore Horizontal motion for 4 collimators; 307, 308, 303 and 301 in that order. Doserates for areas worked can be found on ALARAs. LVDT replacement was cancelled as parts were not in yet and it is also believed that these are not damaged. After attempting to place hard stops in at 307 it was discovered they did not fit in as planned so that step was eliminated for all collimators. Switch blocks were replaced and burndy connector repaired. An add on was made to the ALARA to adjust Switch Block assemblies for each location. This only resulted in a small amount of exposure. After testing each location it was discovered 301 Horizontal motion was not fully operational. This resulted in an add on to the ALARA. After investigating problem it was discovered that the motor was bad. This motor was replaced.

As per RWP requirements, workers wore full anti-c's with double shoe covers and gloves. Full set of protective clothing were removed and placed in a bag and sorted through after completion of job disposing of contaminated items as rad waste. Personnel and items were checked periodically and when switching locations.

100 Stop limit =		AD-20-140 Restoration of Horizontal Movement for MI307 Collimator	ator					
International checkpoint								
Time Number Exposure Total Estimate Total Estim		Job Stop limit =	109	mrem (incl	I. 25% contige	ency)		
Time Number Exposure Total Estimated Dose		Individual checkpoint =	75	mrem per I	person, and n	ot to exceed 300 mre	m per quart	er
Time Numbers Total Estimates Dose People People								
Nours PEOPLE MR/hr. Person mrem mrem	STEP		TIME	NUMBER	EXPOSURE	TOTAL ESTIMATED	DOSE	COMMENTS
Nous PeroPLE mR/hr. person mrem Install new LVDT and bracket assembly 0.05 1 0.05 1.2 0.05				OF	RATE	COLLECTIVE DOSE	RECEIVED	
Sign Collimator Sign Colli			hours	PEOPLE	mR/hr.	person mrem	mrem	
Remove LVDT and bracket assembly a07 US 0.1 1 65 6.5 0.8 0 0 0.1 1 65 6.5 0.8 0 0 0.1 1 65 6.5 8 0.8 0 0 0.1 1 65 6.5 3.25 0 0.1 1 0.5 1 6.5 3.25 0 0.1 1 0.05 1 0.5 1 0.5 1 0.5 1 0.5 1 0.5 0.5 0.0		307 Collimator						
Sort US	~		0.05	7	∞	0.8	0	
Remove LVDT and bracket assembly Remove LVDT and bracket assembly Remove LVDT Tee 0.05 1 65 6.5 6.5 3.25 8.25 8.25 8.25 9.24 9.24 9.24 9.24 9.24 9.24 9.24 9.24 9.24		307 US						
Remove LVDT Tee 0.05 1 65 3.25 Apply Clamp and Connector 0.0 1 1 65 6.5 Apply Clamp and Connector 0.05 1 0.0 1 5 3.25 Place hard stop between collimator and wall 0.05 1 20 1 5 8 Remove switch block assemblies (2) 0.1 1 1 100 10 1 Install new right and left switch angles 0.1 1 1 100 10 1 Remove right and left switch angles (2) 0.1 1 1 100 10 1 Remove existing 3 Burndy pins and install new switch block assemblies (2) 0.1 1 1 100 10 1 Remove existing 3 Burndy pins and install new ones. 0.05 1 2 4 2 Place hard stop between collimator and wall. 0.05 1 2 4 2 Rad Coverage 1 2 2 4 2 3 2	*2		0.1	-	65			
Install new LVDT and bracket assembly	*		0.05	1	9			
Apply Clamp and Connector 0.05 1 65 3.25 8.25 Place hard stop between collimator and wall 0.05 1 20 1 5 8 9 <td>* 4</td> <td>Install new LVDT tee and LVDT and bracket asse</td> <td>0.1</td> <td>1</td> <td>65</td> <td></td> <td></td> <td></td>	* 4	Install new LVDT tee and LVDT and bracket asse	0.1	1	65			
Place hard stop between collimator and wall 0.05 1 20 1 5 307 DS 307 DS 1 1 100 10 10 Remove switch block assemblies (2) 0.1 1 1 100 10 Install new right and left switch angles. Align to correct positions 0.1 1 1 100 10 Remove existing 3 Burndy pins and install new ones. 0.05 1 1 1 1 1 Remove existing 3 Burndy pins and install new ones. 0.05 1 1 1 1 1 Place hard stop between collimator and wall 0.05 1 2 4 2 4 Test system to make sure everything works properly 0.4 2 5 4 2 Add on (10/1) Add on (10/1) 1 1 1 1 2 2 Add on (10/1) 1 1 1 1 1 2 2 2 Add on (10/1) 1 1 1 1 1	*		0.05	1	65			Not performed
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Install new right and left switch angles. Align to correct positions 0.1 1 100 10 11 11 100 10 11 12 2 2 1 2 4 2 2 4	00		0.1	1	100			
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0.05 1 100 5 8 5 5 9 5 5		Add on (10/1)						
5		Adjust both switch angles	0.05	1	100		2	
						5	7	
						91.8	24	

Miletans presumed to be radioactively contaminated 10b Stop limit = 17 Immediate 18 Immediate		AD-20-140 Restoration of Horizontal Movement for MI308 Collimator	ior.					
Time Contiguence Continuation Continuation		-						i.
Time Number Exposure		Job Stop limit =	272	mrem (inc	I. 25% contige	incy)		
Time Number Exposure		Individual checkpoint =	75	mrem per	person, and n	ot to exceed 300	300 mrem per quarter	ıarter
TIME NUMBER EXPOSURE						i d		
Nours PEOPLE RATE	STEP		TIME	NUMBER	EXPOSURE	ESTIMATED	DOSE	COMMENTS
Bours BEOPLE mR/hr.				PP	RATE	COLLECTIVE	RECEIVED	
308 Collimator 308 Inches			hours	PEOPLE	mR/hr.	person mrem	mrem	
Nemove Barricade 0.05 2		308 Collimator						
Turn off ion pump(remotely). Disconnect HV connector 308 US Remove LVDT and bracket assembly Remove LVDT and bracket assembly Apply Clamp and Connector Place hard stop between collimator and wall Put ion pump feedthrough back/Connect HV 308 DS Remove switch block assemblies (2) Remove switch block assemblies (2) Install new right and left switch angles Install new switch block assemblies (2) Remove existing 3 Burndy pins and install new ones. Remove existing 3 Burndy pins and install new ones. Replace hard stop between collimator and wall Replace aisle barricade Add on (10/1) Add on (10/1) Add ut (10/1) Add ut (10/1) Add ut (10/1)	_	Remove Barricade	0.05	2	9	9.0	0	
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Install new LVDT tee and LVDT and bracket assembly	4	Remove LVDT Tee	0.05	1	30	1.5		
Apply Clamp and Connector 0.05 1 Place hard stop between collimator and wall 0.05 1 Put ion pump feedthrough back/Connect HV 0.02 1 308 DS	5	Install new LVDT tee and LVDT and bracket assembly	0.1	1	30	3		
Place hard stop between collimator and wall 0.05 1 Put ion pump feedthrough back/Connect HV 308 DS	9	Apply Clamp and Connector	0.05	1	30	1.5		
Put ion pump feedthrough back/Connect HV 308 DS Remove switch block assemblies (2) Remove right and left switch angles Install new right and left switch angles. Align to correct positions Install new switch block assemblies (2) Remove existing 3 Burndy pins and install new ones. Place hard stop between collimator and wall Test system to make sure everything works properly Replace aisle barricade Rad Coverage Add on (10/1) Add un (10/1) Add un (10/1)	7	Place hard stop between collimator and wall	0.05		10	0.5		Not performed
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Remove switch block assemblies (2) 0.1 1 Remove right and left switch angles 0.1 1 Install new right and left switch angles. Align to correct positions 0.1 1 Remove existing 3 Burndy pins and install new ones. 0.05 1 Place hard stop between collimator and wall 0.05 1 Test system to make sure everything works properly 0.4 2 Replace aisle barricade 0.05 2 Rad Coverage Add on (10/1) 0.05 1 Add on (10/1) 0.05 1		308 DS						
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Place hard stop between collimator and wall Test system to make sure everything works properly Replace aisle barricade Rad Coverage Add on (10/1) Add on (10/1) Add on (10/1)	13	Remove existing 3 Burndy pins and install new	0.05		400	20	2	
Test system to make sure everything works properly Replace aisle barricade Rad Coverage Add on (10/1) Add on (10/1) Add on (10/1) Adjust both switch angles 0.05 1	14	Place hard stop between collimator and wall	0.05	1	100	5	16	Not performed
Replace aisle barricade Rad Coverage Add on (10/1) Add vist both switch angles O.05 1	15		0.4	2	2	1.6	2	
0.05 1	16		0.05	2	5	0.5		
0.05 1		Rad Coverage				20	3	
0.05 1						217.44	1 26	
0.05 1		Add on (10/1)						
		Adjust both switch angles	0.05	1	300	15	3	
						15	3	
						232.44	29	

	Il items presumed to be radioactively contaminated						
Job Stop limit =	imit =	145	mrem (inc	145 mrem (incl. 25% contigency)	incy)		
vidual	Individual checkpoint =	75	mrem per	person, and n	75 mrem per person, and not to exceed 300 mrem per quarter	n per quarte	_
		TIME	NUMBER	EXPOSURE	TOTAL ESTIMATED	DOSE	COMMENTS
			P	RATE	COLLECTIVE DOSE	RECEIVED	
		hours	PEOPLE	mR/hr.	person mrem	mrem	
	303 Collimator						
	Remove Barricade	0.05	7	15	1.5	0	
	303 US						
	Remove LVDT and bracket assembly	0.1	П	100	10		
	Remove LVDT Tee	0.05	-	100	5		
lns	Install new LVDT tee and LVDT and bracket assembly	0.1	1	100	10		
	Apply Clamp and Connector	0.05	П	100	5		
	Place hard stop between collimator and wall	0.05	1	50	2.5		Not performed
	303 DS						
	Remove switch block assemblies (2)	0.1	1	115	11.5		
	Remove right and left switch angles	0.1	1	115	11.5	9	
Install r	Install new right and left switch angles. Align to correct positions	0.1	1	115	11.5		
	Install new switch block assemblies (2)	0.1	1	115	11.5		
Ren	Remove existing 3 Burndy pins and install new ones.	0.05	1	115	5.75	2	
	Place hard stop between collimator and wall	0.05	1	50	2.5		Not performed
-	Test system to make sure everything works properly	0.4	2	10	8	2	
	Rad Coverage			-	20	3	
					116.25	19	
	Add on (10/1)						
	Adjust both switch angles	0.05	П	110	5.5	m	
					5.5	3	
					L 70	(

March Marc		AD-20-140 Restoration of Horizontal Movement for MI301 Collimator						
Time		presumed to be radioactively						
Time Number Person, and not to exceed 300 mrem per quarter		Job Stop limit =	499	mrem (inc	I. 25% contige	ency)		
Time Number Exposure Expression Dose			75	mrem per	person, and n	not to exceed 300	mrem per qua	rter
Solution	STEP		TIME	NUMBER	EXPOSURE	TOTAL ESTIMATED	DOSE	COMMENTS
Popularian				PO	RATE	COLLECTIVE	RECEIVED	
301 Collimator			hours	PEOPLE	mR/hr.	person mrem	mrem	
Turn off ion pump(remotely), Disconnect HV connector		301 Collimator						
Change Light Bulbs Turn off ion pump(remotely). Disconnect HV connector 301 US Remove LVDT and bracket assembly Remove LVDT and bracket assembly Place hard stop between collimator and wall Remove switch block assemblies (2) Remove existing 3 Burndy pins and left switch angles Install new switch block assemblies (2) Remove existing 3 Burndy pins and install new ones. Remove existing 3 Burndy pins and install new ones. Remove existing 3 Burndy pins and install new ones. Remove existing 3 Burndy pins and install new ones. Read Coverage Rad Coverage SubTotal SubTotal Rad Coverage SubTotal SubTotal Rad Coverage SubTotal SubTotal Rad Coverage Sol 125 SubTotal SubTotal	~	Remove Barricade	0.05	2	15	1.5		
Turn off ion pump(remotely). Disconnect HV connector 0.02 1 30 0.6 301 US 301 US 0.1 1 250 25 Remove LVDT and bracket assembly 0.05 1 250 12.5 Remove LVDT and bracket assembly 0.1 1 250 12.5 Apply Clamp and Connector 0.05 1 250 12.5 Apply Clamp and Connector 0.05 1 250 12.5 Place hard stop between collimator and wall 0.05 1 30 0.6 Remove switch block assemblies (2) 0.1 1 600 60 9 Install new right and left switch angles 0.1 1 600 60 9 Install new right and left switch angles 0.1 1 600 60 9 Remove existing 3 Burndy pins and install new ones. 0.05 1 1.0 600 60 9 Place hard stop between collimator and wall 0.05 1 1.0 600 60 19 Test sy	2	Change Light Bulbs	0.17	1	15	2.55		
Solution	3	Turn off ion pump(remotely). Disconnect HV connector	0.02	1	30	9.0		
Remove LVDT and bracket assembly		301 US						
Install new LVDT fee and LVDT and bracket assembly	4	Remove LVDT and bracket assembly	0.1	1	250	25		
Install new LVDT tee and LVDT and bracket assembly	5	Remove LVDT Tee	0.05	Н	250			
Apply Clamp and Connector 0.05 1 250 12.5 Place hard stop between collimator and wall 0.05 1 70 3.5 Put ion pump feedthrough back/Connect HV 0.02 1 70 3.6 Remove switch block assemblies (2) 0.1 1 600 60 9 Remove right and left switch angles 0.1 1 600 60 9 Install new right and left switch angles. Align to correct positions 0.1 1 600 60 9 Install new switch block assemblies (2) 0.1 1 600 60 9 Remove existing 3 Burndy pins and install new ones. 0.05 1 1 600 60 9 Place hard stop between collimator and wall 0.05 1 600 60 7.5 Test system to make sure everything works properly 0.4 2 10 8 4 Rad Coverage 1 1 600 60 9 9 Rad Coverage 1 2 1 1 </td <td>9</td> <td>Install new LVDT tee and LVDT and bracket assembly</td> <td>0.1</td> <td>1</td> <td>250</td> <td>25</td> <td></td> <td></td>	9	Install new LVDT tee and LVDT and bracket assembly	0.1	1	250	25		
Place hard stop between collimator and wall 0.05 1 70 3.5 Put ion pump feedthrough back/Connect HV 0.02 1 30 0.6 Remove switch block assemblies (2) 0.1 1 600 60 9 Remove right and left switch angles. Align to correct positions 0.1 1 600 60 9 Install new right and left switch angles. Align to correct positions 0.1 1 600 60 9 Remove existing 3 Burndy pins and install new ones. 0.05 1 1 600 60 19 Place hard stop between collimator and wall 0.05 1 150 7.5 7.5 Place hard stop between collimator and wall 0.05 1 2 10 8 4 Rad Coverage 1 2 1 399.25 40 Rad Coverage 1 1 1 1 1 1 Rad Coverage 1 1 1 1 1 1 1 Rad Coverage 1	7	Apply Clamp and Connector	0.05	1	250	12.5		
Put ion pump feedthrough back/Connect HV 0.02 1 30 0.6 301 DS 301 DS	00	Place hard stop between collimator and wall	0.05	1	70	3.5		
301 DS 301 DS Remove switch block assemblies (2) 0.1 1 600 60 9 Remove right and left switch angles. Align to correct positions 0.1 1 600 60 9 Install new right and left switch angles. Align to correct positions 0.1 1 600 60 19 Remove existing 3 Burndy pins and install new ones. 0.05 1 600 30 3 Place hard stop between collimator and wall 0.05 1 150 7.5 7.5 Test system to make sure everything works properly 0.4 2 10 8 4 Rad Coverage Rad Coverage 399.25 40	တ	Put ion pump feedthrough back/Connect HV	0.02	Н	30	9.0		Not performed
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Remove right and left switch angles. Align to correct positions 0.1 1 600 60 9 Install new right and left switch angles. Align to correct positions 0.1 1 600 60 9 Install new switch block assemblies (2) 0.1 1 600 60 19 Remove existing 3 Burndy pins and install new ones. 0.05 1 600 30 3 Place hard stop between collimator and wall 0.05 1 150 7.5 Test system to make sure everything works properly 0.4 2 10 8 4 Rad Coverage 30 399.25 40	10		0.1	1	009			
Install new right and left switch angles. Align to correct positions 0.1 1 600 60 19 Install new switch block assemblies (2) 0.1 1 600 60 19 Remove existing 3 Burndy pins and install new ones. 0.05 1 600 30 3 Place hard stop between collimator and wall 0.05 1 150 7.5 4 Test system to make sure everything works properly 0.4 2 10 8 4 Rad Coverage 399.25 40	7	Remove right and left switch angles	0.1	П	009			
Remove existing 3 Burndy pins and install new ones. 0.05 1 600 60 19 Remove existing 3 Burndy pins and install new ones. 0.05 1 600 30 3 Place hard stop between collimator and wall 0.05 1 150 7.5 4 Test system to make sure everything works properly 0.4 2 10 8 4 Rad Coverage 399.25 40 1 1 1 399.25 40	12		0.1	1	009	09		
Remove existing 3 Burndy pins and install new ones. 0.05 1 600 30 3 Place hard stop between collimator and wall 0.05 1 150 7.5 4 Test system to make sure everything works properly 0.4 2 10 8 4 Rad Coverage 30 5 40 Rad Coverage 399.25 40	13		0.1	1	009	09		
Place hard stop between collimator and wall0.0511507.5Test system to make sure everything works properly0.421084Rad Coverage305Rad Coverage40	14		0.05	П	009			
Test system to make sure everything works properly Rad Coverage SubTotal 399.25	15		0.05	1	150			Not performed
30 30 30 30 30 30 30 30 30 30 30 30 30 3	16		0.4	2	10			
399.25		Rad Coverage				30		
					SubTotal	399.25	40	-
						0		

					IOI AL		
STEP		TIME	NUMBER	EXPOSURE	ESTIMATED	DOSE	COMMENTS
					COLLECTIVE		
			OF	RATE	DOSE	RECEIVED	
		hours	PEOPLE	mR/hr.	person mrem	mrem	
	Add on (10/1)						
	Adjust both switch angles	0.05	1	200	25	3	
	Re-wire Primary Collimator to series	0.15	1	10	1.5	3	
		,		SubTotal	26.5	9	
	Add on (10/6) Investigate 301 H Movement						
	Remove the top side cover to allow visual observation of motor drive						
	motion.	0.05		10	0.5		
	Test motion in the tunnel with a portable 6 amp stepper driver to						
-	verify the behavior.	0.2	1	10	2	12	
	If the motor works fine we need to understand why one 6 amp						
	driver works while the other doesn't.						
	If the motor still stalls:						
	Remove guard rail and side cover to open up more observation						
	options. Move the collimator with the portable 10 amp controller			8 "			
	and inspect for binding, alignment issues or possible damage.	0.2	2	10	4		
	Re-align components if necessary. Identify any components needed						7
	to be replaced.	0.1	2	10	2	17	
	Rad Coverage	-			3	4	
				SubTotal	11.5	33	
				Total	437.25	79	
		2					

STEP Time Designation Time Time		AD-20-140 inserts for MI307 Collimator						
Job Stop limit = 250 mrem finot. 25% contigency) Total mem per person, and not to exceed 300 mrem per quarter Individual checkpoint = 75 mrem per person, and not to exceed 300 mrem per quarter Time NUMBER EXPOSURE TOTAL ESTIMATED DOSE Stage Equipment 1.25 4 5 2.5		/ contan						
Individual checkpoint = 75 mrem per person, and not to exceed 300 mrem Per control of the control o		Job Stop limit =	250	mrem (incl. 2	5% contigenc	у)		
TIME NUMBER EXPOSURE TOTAL ESTIMATED DOSE		Individual checkpoint =	75	mrem per pe	rson, and not	to exceed 300 mrem p	oer quarter	
TIME NUMBER EXPOSURE TOTAL ESTIMATED DOSE								
307 Collimator hours PEOPLE mR/hr. person mrem Stage Equipment 1.25 4 5 25 Vent Vacuum Sector 307-309 0.2 2 10 4 Disconnect 2 Flanges to Remove Downstream Bellows 0.08 2 100 16 Inspect Collimator (MI Department) 0.02 2 100 16 Prep Seals and Polish Bellows Vacuum Flange Faces 0.25 2 100 50 Inspect Assembly (MI Department) 0.02 2 100 4 Connect Upstream Flange to Install Bellows 0.2 1 1 4 Connect Downstream Flange to Install Bellows 0.2 1 40 8 Replace Aisle Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 2 0 Rad Coverage 1 2 2 0	STEP		TIME	NUMBER	EXPOSURE	TOTAL ESTIMATED	DOSE	COMMENTS
307 Collimator hours PEOPLE mR/hr. person mrem Stage Equipment 1.25 4 5 25 Vent Vacuum Sector 307-309 0.2 2 10 4 Disconnect 2 Flanges to Remove Downstream Bellows 0.08 2 10 4 Inspect Collimator (MI Department) 0.02 2 10 16 Inspect Machine Collimator Insert Assembly 0.1 1 1 12.5 Prep Seals and Polish Bellows Vacuum Flange Faces 0.25 2 100 4 Inspect Assembly (MI Department) 0.02 2 100 4 Connect Upstream Flange to Install Bellows 0.2 1 40 8 Replace Aisle Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 0 0 Rad Coverage 1 2 2 0 0 Rad Coverage 1 2 2 0 0 0				OF	RATE	COLLECTIVE DOSE	RECEIVED	
Stage Equipment 1.25 4 5 25 Vent Vacuum Sector 307-309 0.2 2 10 4 Disconnect 2 Flanges to Remove Downstream Bellows 0.08 2 100 16 Inspect Collimator (MI Department) 0.02 2 100 16 Prep Seals and Polish Bellows Vacuum Flange Faces 0.25 2 100 4 Inspect Assembly (MI Department) 0.02 2 100 4 Connect Upstream Flange to Install Bellows 0.2 1 100 2 Connect Downstream Flange to Install Bellows 0.2 1 40 8 Replace Alsie Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 20 40 Rad Coverage 1 2 2 20 300.3			hours	PEOPLE	mR/hr.	person mrem	mrem	
Stage Equipment 1.25 4 5 25 Vent Vacuum Sector 307-309 0.2 2 10 4 Disconnect 2 Flanges to Remove Downstream Bellows 0.08 2 100 16 Install Collimator (MI Department) 0.02 2 125 5 Prep Seals and Polish Bellows Vacuum Flange Faces 0.25 2 100 8 Inspect Assembly (MI Department) 0.02 2 100 4 Connect Upstream Flange to Install Bellows 0.2 1 10 20 Connect Downstream Flange to Install Bellows 0.2 1 40 8 Replace Aisle Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 20 40 Rad Coverage 1 2 2 40 Rad Coverage 2 2 4 40 Annual Leak Check Vacuum System 1 2 2 40 Annual Leak Check Vacuum System 2 2 4		307 Collimator						
Vent Vacuum Sector 307-309 0.2 2 10 4 Disconnect 2 Flanges to Remove Downstream Bellows 0.08 2 100 16 Inspect Collimator (MI Department) 0.02 2 125 5 Prep Seals and Polish Bellows Vacuum Flange Faces 0.25 2 100 4 Inspect Assembly (MI Department) 0.02 2 100 4 Connect Upstream Flange to Install Bellows 0.2 1 40 8 Connect Downstream Flange to Install Bellows 0.05 2 8 0.8 Replace Aisle Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 20 40 Rad Coverage 15 2 2 40	_		1.25	4	5	25		
Disconnect 2 Flanges to Remove Downstream Bellows 0.08 2 100 16 Inspect Collimator (MI Department) 0.02 2 125 5 Install Collimator Insert Assembly 0.1 1 125 12.5 Prep Seals and Polish Bellows Vacuum Flange Faces 0.25 2 100 4 Inspect Assembly (MI Department) 0.02 2 100 4 Connect Upstream Flange to Install Bellows 0.2 1 40 8 Connect Downstream Flange to Install Bellows 0.05 2 8 0.8 Replace Aisle Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 20 40 Rad Coverage 1 2 200.3 15	N		0.2	2	10	4	1	
Inspect Collimator (MI Department)	(C)	Disconnect 2 Flanges to Remove Downstream	0.08	2	100	16		
Install Collimator Insert Assembly 0.1 1 125 12.5 Prep Seals and Polish Bellows Vacuum Flange Faces 0.25 2 100 50 Inspect Assembly (MI Department) 0.02 2 100 4 Connect Upstream Flange to Install Bellows 0.2 1 40 8 Connect Downstream Flange to Install Bellows 0.05 2 8 0.8 Replace Aisle Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 20 40 Rad Coverage 1 2 20 40 Rad Coverage 2 2 2 40	4		0.02	2	125	5		
Prep Seals and Polish Bellows Vacuum Flange Faces 0.25 2 100 50 Inspect Assembly (MI Department) 0.02 2 100 4 Connect Upstream Flange to Install Bellows 0.2 1 100 20 Connect Downstream Flange to Install Bellows 0.2 1 40 8 Replace Aisle Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 20 40 Rad Coverage 1 2 20 200.3	5		0.1		125	12.5		
Connect Assembly (MI Department) 0.02 2 100 4 Connect Upstream Flange to Install Bellows 0.2 1 40 20 Replace Aisle Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 20 40 Rad Coverage 15 200.3	9		0.25	2	100	50		
Connect Upstream Flange to Install Bellows 0.2 1 100 20 Connect Downstream Flange to Install Bellows 0.2 1 40 8 Replace Aisle Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 20 40 Rad Coverage 15 200.3	7		0.02	2	100	4		
Connect Downstream Flange to Install Bellows 0.02 1 40 8 Replace Aisle Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 20 40 Rad Coverage 15 200.3	88		0.2	1	100	20		
Replace Aisle Barricade 0.05 2 8 0.8 Pump Down and Leak Check Vacuum System 1 2 20 40 Rad Coverage 15 Rad Coverage 200.3	86	Connect Downstream Flange to Install Bel	0.2	1	40	8		
Pump Down and Leak Check Vacuum System 1 2 20 40 Rad Coverage 15 200.3	O		0.05	2	8	0.8		
15 200.3	10		П	2	20	40		
		Rad Coverage				15		
						200.3		

	AD-20-140 Inserts for Mi303 Collimator						
	All items presumed to be radioactively contaminated						
	Job Stop limit =	205	mrem (incl.	205 mrem (incl. 25% contigency)	cy)		
	Individual checkpoint =	75	mrem per p	erson, and no	75 mrem per person, and not to exceed 300 mrem per quarter	n per quarter	
STEP		TIME	NUMBER	EXPOSURE	TOTAL ESTIMATED	DOSE	COMMENTS
			OF	RATE	COLLECTIVE DOSE	RECEIVED	
		hours	PEOPLE	mR/hr.	person mrem	mrem	
	303 Collimator						
_	Stage Equipment	0.2	2	10	4		
2	Vent Vacuum Sector 301-305	0.2	2	30	12	П	
n	Disconnect 2 Flanges to Remove Downstream Bellows	0.08	7	110	17.6	9	
4	Inspect Collimator (MI Department)	0.02	2	125	5	7	
5	Install Collimator Insert Assembly	0.1		125	12.5	8	
9	Prep Seals and Polish Bellows Vacuum Flange Faces	0.25	7	100	50	4	
7	Inspect Assembly (MI Department)	0.02	2	100	4	1	
8a	Connect Upstream Flange to Install Bellows	0.2	1	110	22		
8b	Connect Downstream Flange to Install Bellows	0.2	1	50	10	9	
တ	Replace Aisle Barricade	0.05	2	15	1.5		
	Rad Coverage				25	4	
		-			163.6	32	

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	AD-20-140 Hiselts for Wison Commission						
	All items presumed to be radioactively contaminated						
	Job Stop limit =	484	mrem (incl. 2	484 mrem (incl. 25% contigency)			
	Individual checkpoint =	75	mrem per pe	rson, and not to	75 mrem per person, and not to exceed 300 mrem per quarter	er quarter	
STEP		TIME	NUMBER	EXPOSURE	TOTAL ESTIMATED	DOSE	COMMENTS
			OF	RATE	COLLECTIVE DOSE	RECEIVED	
		hours	PEOPLE	mR/hr.	person mrem	mrem	
	301 Collimator						
1	Stage Equipment	0.2	2	10	4		
7	Disconnect 2 Flanges to Remove Downstream Bellows	0.08	7	300	48	33	
8	Inspect Collimator (MI Department)	0.02	2	200	8	3	
4	Install Collimator Insert Assembly	0.1	1	200	20	15	,
Ŋ	Prep Seals and Polish Bellows Vacuum Flange Faces	0.25	2	200	100	24	
9	Inspect Assembly (MI Department)	0.02	2	200	8	2	
7a	Connect Upstream Flange to Install Bellows	0.2	1	500	100		
7b	Connect Downstream Flange to Install Bellows	0.2	1	100	20	10	
ω	Replace Aisle Barricade	0.05	2	15	1.5		
O	Pump Down and Leak Check Vacuum System	1	2	20	40	14	
10	Remove Equipment from Tunnel	0.4	4	5	8	2	
	Rad Coverage				30	6	
					387.5	82	

Post-Job Critique and Analysis

Should include comments on such factors as:

Written by: Dale White

Doses actually received versus anticipated doses,

Reviewed by: Sue McGimpsey whether ALARA goals were met,

whether work procedures and controls were adequate, and

suggestions for improvements

Horizontal Motion Summary

9/15-11/23/20 Person-mrem for this job was 154 with a total estimate of 883

307:Person-mrem 22 estimate 87

Add on 2 estimate 5

Total 24 estimate 92

308:Person-mrem 26 estimate 217

Add on 3 estimate 15

Total 29 estimate 232

303:Person-mrem 19 estimate 116

Add on 3 estimate 6

Total 22 estimate 122

301:Person-mrem 40 estimate 399

Add on 6 estimate 26

Horizontal Investigation/Repair 33 estimate 12

Total 79 estimate 437

The main scope of this job was to restore Horizontal motion for 4 collimators; 307, 308, 303 and 301 in that order. Doserates for areas worked can be found on ALARAs. LVDT replacement was cancelled as parts were not in yet and it is also believed that these are not damaged. After attempting to place hard stops in at 307 it was discovered they did not fit in as planned so that step was eliminated for all collimators. Switch blocks were replaced and burndy connector repaired. An add on was made to the ALARA to adjust Switch Block assemblies for each location. This only resulted in a small amount of exposure. After testing each location it was discovered 301 Horizontal motion was not fully operational. This resulted in an add on to the ALARA. After investigating problem it was discovered that the motor was bad. This motor was replaced.

As per RWP requirements, workers wore full anti-c's with double shoe covers and gloves. Full set of protective clothing were removed and placed in a bag and sorted through after completion of job disposing of contaminated items as rad waste. Personnel and items were checked periodically and when switching locations.

Name	Dose (mRem)				
ES&H		Controls		MI	
Dale White	14	Mike Coburn	40	Dave Capista	23
Nino Chelidze	4	MI		Denton Morris	15
AD/MS		Kyle Hazelwood	10	Cons Gattuso	16
Beth Klein	6	Phil Adamson	10	Total	154.0
John Anderson	7	Rob Ainsworth	9		

Permit No. AD-20-140

Post-Job Critique and Analysis - Page 2

Should include comments on such factors as:

Written by: Dale White

Reviewed by: Sue McGimpsey

Doses actually received versus anticipated doses,

whether ALARA goals were met,

whether work procedures and controls were adequate, and

suggestions for improvements

Inserts Summary

10/6 & 10/15-16/20 Person-mrem for this job was 136 with an estimate of 752

307:Person-mrem 22 estimate 200 303:Person-mrem 32 estimate 164

301:Person-mrem 82 estimate 388

The main scope of this job was to install inserts in the beamline on the downstream side of three collimators; 307, 303 and 301 in that order. The inserts are designed to aid in keeping the beam focused thereby minimizing beam losses. The lowest rad levels are at 307 collimator so this went first to learn as the job progressed to minimize radiation doses. Doserate in area worked varied from location to location, see ALARA for more info. The first attempt on 10/6 at 307 had some problems. The screws were not threading in properly so all the parts for each location had to be re-machined. This resulted in getting 7 extra mrem. Job started back up 10/15. Inserts went in reasonably well and job went as smooth as possible. Overall dose was well below what was initially thought.

As per RWP requirements, workers wore full anti-c's with double shoe covers and gloves. Full set of protective clothing were removed and placed in a bag and sorted through after completion of job disposing of contaminated items as rad waste. Personnel and items were checked periodically and when switching locations. A few items had to be de-coned along the way. The guide tool scraped inside the beamline and had a few hundred counts above background that was fixed. This item was bagged and disposed of as radiation waste.

Name	Dose (mRem)
ES&H	
Dale White	17
Sue McGimpsey	0
AD/MS	
Beth Klein	3
John Anderson	21
Rom Bacino	10
Justin Briney	10
Elias Lopez	0
Ryan Montiel	23
Jason Kubinski	27
Adrian Marquez	0
Wojciech Blaszyna	ski 15
MI	
Denton Morris	3
Phil Adamson	7
Total	136.0