

Memorandum

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Date: July 7, 2020
To: Matt Quinn, Senior Radiation Safety Officer (SRSO)
From: Nino Chelidze, Radiation Safety Officer
Re: Estimated Dose for Summer 2020 Shutdown & SRSO Approval Request for Select ALARA Jobs Per FRCM Article 354.8

Message:

The Fermilab 2020 shutdown began on June 15, 2020 and will last for about 19 weeks, with beam operations planned to begin being restored on October 1st. Due to COVID-19 outbreak, all jobs require extra time and planning and COVID-19 hazards are addressed in HA-s along with extra PPE requirements. Moreover, the jobs will be given priorities in the summer shutdown priority list and some may not get accomplished.

All shutdown jobs in the electronic worklist and IMPACT have been reviewed by ES&H Radiation Physics Operations (RPO) Department RSOs & RCTs, and jobs requiring various levels of RP coverage, described in Table 1, have been identified. The accelerator has been off since March 20th, therefore significant cool-off time has been passed. The tasks will get started based on their priority and readiness as well as time dependency within an overall project management completion schedule.

Table 1. RP Coverage Categories and Descriptions & Requirements. These categories were created before the 2018 shutdown to help clarify and disambiguate requirements for specific jobs.

RP Coverage Category	Description & Requirements
No Coverage	No restrictions by Radiation Safety. No need to contact RSO/RCT prior to start of work. No job-specific RWP will be issued. General (enclosure) RWPs remain in force. Record pocket dosimeter readings for the week in GetDose on Mondays.
RCT Coverage	Must contact RCT prior to start of work. RCT will determine how much coverage is needed for each part of the job. No job-specific RWP will be issued. General (enclosure) RWPs remain in force. Record pocket dosimeter readings for the job for the week in GetDose on Mondays.
RCT & RWP	Must contact RCT prior to start of work. RCT will determine how much coverage is needed for each part of the job. Must read and sign applicable job-specific RWP (with the RCT), in addition to the general (enclosure) RWP, prior to start of work. Record pocket dosimeter readings for the job with the RCT, and for the week in GetDose on Mondays.
RCT, RWP & ALARA	Requires SRSO approval. Must contact RCT prior to start of work, may require pre-job briefing with RSO, RCT will determine how much coverage is needed for each part of the job, must read and sign applicable job-specific RWP (with the RCT), in addition to the general (enclosure) RWP, prior to start of work, record pocket dosimeter readings for the job with the RCT, and for the week in GetDose on Mondays, may require post-job briefing with RSO.

At this time of preparing this report, there were 238 jobs entered into the worklist to occur during shutdown, 55 of which were flagged by Radiation Safety for further review. Of these jobs 23 were marked as “RCT Coverage”, 11 as “RCT & RWP”, and 20 were marked as “RCT, RWP & ALARA”.

Please see Table 1 below, noting that this list represents the ALARA jobs reviewed by Radiation Safety as of 7/7/2020 and may not be inclusive of all jobs occurring during the shutdown. If additional jobs are added into the worklist, they will be reviewed by RPO and covered as needed. Dose estimates are conservative estimates from the RSOs, RCTs and/or machine experts noted in their specific job plans, which may be used for ALARA plans if needed. Dose estimates for specific jobs listed in Table 1 and throughout this memo contain a 25% contingency. Job plans and dose estimates may be added, updated and/or removed as needed as the shutdown progresses.

There are twenty (20) jobs that currently surpass the ALARA trigger levels specified in FRCM Article 354:

1. ¹Permanent posting of the contaminated beam line elements in Booster periods 3 and 6.
2. ¹Permanent posting of the contaminated beam line elements in MI-8 collimator region.
3. ¹Permanent posting of the contaminated beam line elements in MI-30 collimator region.

¹These three jobs are included under one ALARA plan for MI posting and pre-shutdown estimate is 42 person-mrem.

4. In Booster, adjust 6-1 girder capacitance due to choke imbalance current is running a little higher. The goal is to lower choke imbalance current. The job plan received, and total pre-shutdown estimate is 5 person-mrem.
5. In Booster visually inspect all BLM cables and connections in tunnel. Repair or replace any as needed. May need to do response checks to verify operation. Pre-shutdown estimate is 13 person-mrem.
6. MI-8 Ion Pump cable pulls. Pre-shutdown estimate for this job is 126 person-mrem.
7. Recycler Ion Pump Cable pulls in RR 30 section. Pre-shutdown estimate for this job is 51 person-mrem.
8. ²Repair the bus leak in section 302 in MI.
9. ²Repair various LCW water leaks in MI tunnel.
10. ²Remove two white EPDM hoses for testing. One from MI-300 area and the other from a low radiation area and replace with spare hoses.
11. ²Physically inspect IP307C for any damage and check status of high voltage cable in MI 300 section.
12. Restore Horizontal Motion to Primary and Secondary MI Collimators, MI-30 region. Pre-shutdown estimate for this job is 791 person-mrem.
13. Install MI30 collimator inserts. Pre-shutdown estimate per ALARA plan is 1547 person-mrem.
14. ²Install a blower motor and ~200 feet of 12-inch round HVAC duct work in the NuMI Target Hall and inside the Target Chase.
15. Replace Pre-filters for NuMI Target Pile ventilation system. Pre-shutdown estimate is 65 person-mrem.
16. NuMI Horn 1 Module Repairs. Pre-shutdown estimate is 371 person-mrem.

17. ³Remove the operational NuMI Horn-1 PH1-03 and replace it with 1-MW PH1-05. PH1-03 will rest in the MI65 morgue following removal.
18. ³Perform "as-found" survey of components in the NuMI Chase. Specific components are TBD, but might be horn-1 and horn-2.
19. ³Remove and clean first course of R-Blocks in NuMI chase in preparation for alignment of Target, Horn-1 and Horn-2. Preparations for Horn-1 replacement.
³Block removal and as found survey is included under Horn 1 replacement ALARA plan (17 and 18) and the pre shutdown estimate is 1076 person-mrem.
20. Transfer Used NuMI target TA-03 from the Morgue in MI65 Target Hall to the High Rad storage facility at C0. Pre-shutdown estimate is 21 person-mrem.

¹These jobs are combined under one ALARA plan and total pre-shutdown estimates are given.

²No ALARA plans available for these jobs yet, as overall shutdown schedules and priorities are still being determined. Job plans are still under development and will be available and reviewed by RPO prior to the start of the jobs.

³These jobs are combined under one ALARA plan and total-pre-shutdown estimates are given.

The jobs that are listed separately but covered under one ALARA plan are combined. Table below summarizes which ones are combined and total dose estimates are given.

No	ALARA Job Plan	Pre-Shutdown Dose Estimate
1, 2, 3	Permanently post contaminated beamline elements in Booster, MI-8 and MI-30 regions	42
4	Period 6 Girder Capacitor Adjustment in Booster	5
5	BLM Check in Booster	13
6	MI-8 Cable Pulls	126
7	Recycler Ion Pump Cable Pulls RR300	51
8	MI Bus leak 302	Not yet available
9	Repair MI LCW leaks in the tunnel	Not yet available
10	Remove and replace 2 white EPDM hoses	Not yet available
11	Inspect IP307C for any physical damage	Not yet available
12	Restore Horizontal Motion to Primary and Secondary MI Collimators, MI-30 region	791
13	Install MI30 collimator inserts	1547
14	Install an HVAC duct work in the NuMI Target Hall and inside the Target Chase	Not yet available
15	Replace Pre-filters for NuMI Target Pile ventilation system	65
16	Remove and replace NuMI Horn 1	1076
17,18,19	NuMI Horn 1 Module repairs	371
20	Transfer NuMI target TA-03 from MI65 TH to C0.	21
		4108

Table 2: Summary of RCT, RWP & ALARA jobs known and reviewed pre-shutdown

I request advanced SRSO approval for these specific ALARA jobs with developed job plans and dose estimates per the requirements in FRCM Article 354. SRSO approval will be requested for the jobs still under development when their jobs are reviewed by the RSO as needed. As the shutdown progresses, SRSO approval will be requested for specific “RCT, RWP & ALARA” jobs if/when they are added.

The initial total pre-shutdown estimated dose, including 25% contingency, is 6759 person-mrem:

- 4108 person-mrem for the Rad Coverage ALARA Jobs (“RCT, RWP & ALARA” jobs).
- 2651 person-mrem for other miscellaneous jobs (including RP reviewed “no coverage” and “RCT Coverage” jobs, which will be tracked in GetDose).

The estimated miscellaneous dose for the 2020 shutdown is based on the actual dose received for the 2019 shutdown Rad Coverage Jobs, and the final pocket dosimeter (PD) report.

$$2020 \text{ misc. dose} = (2019 \text{ PD report} - 2019 \text{ RP actual dose received}) \times \left(\frac{\# \text{ weeks in 2020 shutdown}}{\# \text{ weeks in 2019 shutdown}} \right)$$

$$2020 \text{ misc. dose} = (4053 \text{ person} - \text{mrem} - 1960 \text{ person} - \text{mrem}) \times \left(\frac{19 \text{ weeks}}{15 \text{ weeks}} \right)$$

$$2020 \text{ misc. dose} = 2651 \text{ person} - \text{mrem}$$

This estimated total may change as the job plans are adjusted as the jobs proceed, or additional RCT Coverage, RCT & RWP, and/or RCT, RWP & ALARA jobs are added upon discovery of unforeseen problems. In addition, due to the COVID-19 pandemic and the Lab being in a COVID-safe mode and limiting personnel on site, the miscellaneous dose for the 2020 shutdown is likely to be below estimates. The total estimated dose for the current year shutdown is 6759 person-mrem. Dose to individuals will be managed by work planning, the use of temporary shielding, and distribution of dose among several individuals.

The shutdown is planned to be within 2nd and 3rd calendar quarters. Total effective doses will be limited to the 350 mrem in a calendar quarter limit. In previous shutdowns, individuals received less than 300 mrem for the duration of the shutdown, so there is little chance of exceeding the 350 mrem limit in the calendar quarter during the shutdown.

SRSO approval is requested for all of the 2020 shutdown jobs, in addition to specific jobs noted above, with the described RPO review and coverage throughout the shutdown.

I approve this plan: _____ Date: _____
 Matt Quinn, Senior Radiation Safety Officer (SRSO)

Cc: M. Lindgren M. Convery C. Gattuso T. Sullivan J. Compton
 E. McHugh A. Kenney M. Schoell S. McGimpsey K. Graden

J. Fulgham