C-AD
Radiation
Safety
Committee

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Minutes of Radiation Safety Sub-Committee of April 29, 2003

PTR (E963) in the U line

Present: D. Beavis, J. Scaduto, G. Greene, E. Lessard, A. Etkin, D. Ryan, N. Tsoupas, N. Williams, K. Yip, P. Ingrassia, D. Clark, A. Hanson, and J.W. Glenn

Proton radiography (PTR) experiments have been conducted in the U line several times in the past. The experiment has proposed to run under similar conditions as previously except for the limit on integrated beam. A description of the experiment can be found in the MOU between LANL and BNL (See attachment 1).

N. Williams noted that the access control system was ready for use. The hand reader and associated key tree will be used for controlled access. Users will enroll in MCR. The database will be updated and previous users will be required to re-enroll. A temporary procedure will be provided that ties the elements together for the remote controlled access. **(Ck-FY2003-Uline-protons-332)**

A job specific RWP will be written as in the previous run to monitor the dose for personnel. Most dose results from the activation present in the blockhouse from high intensity neutrino operations. D. Ryan will resurrect similar controls as the previous run, which will allow users into the area without surveys once a baseline is established. This worked well during the last PTR run. The appropriate areas will be labeled as RMA Areas. The dose during the last operation was well tracked and accounted for. Users will use EPDs with a dose rate limit of 90 mrem/hr. Should the alarm go off the user will exit and await for an RCT. CA-D log sheets will be used for sign in to the area. The area will be posted as a Radiation Area. RCT will monitor for hot spots and post these areas appropriately. D. Ryan will verify that the RWP is ready and all necessary "HP" procedures. **(Ck-FY2003-Uline-333)**

A list of materials that may be exposed are listed in the MOU. This is the same list of materials provided in the past. It was noted after the meeting that Be and depleted U would not be used as targets.

A temporary sweep procedure will be written to account for the changes in the target area. The experiment stated that the sensitive items can be removed before sweeps, allowing the sweep teams into the enclosed area. **(Ck-FY2003-Uline-334)**

N. Tsoupas discussed the beam optics and running conditions. The 24 GeV operations will have one bunch in the AGS and the 7.5 GeV operation will have 4 bunches in the AGS with one bunch extracted one at a time a few microseconds apart. The beam line is well understood and there are no locations upstream of WD1, which are expected to have any substantial losses. WD1 must be examined for losses. There may be a change in the polarity of some magnets to improve the transport past WD1. There are loss monitors upstream and downstream of WD1. N. Tsoupas will ensure that the losses on WD1 are less than 3% of the beam. This limit ensures that the beam intensity limit (due to potential soil activation) is set by the limiting aperture of the first quadrupole downstream of the diffuser. **(Ck-FY2003-Uline-335)**

The 20-degree bend will be RS LOTOed off. **(Ck-FY2003-Uline-336)**
The W line will remain secured as is required by the interlock system. There has been no expressed interest to access the W line while beam is delivered to the U line.

The berm over the transport will remain locked. **(Ck-FY2003-Uline-337)**

The A20 transformer will remain active. **(Ck-FY2003-Uline-338)**

The high intensity source will be used with the standard approved intensity reduction methods RS LOLOed. **(Ck-FY2003-Uline-339)**

The committee asked that the CME consider if there were any concerns with the pulsed beam damaging items it would strike such as the diffuser. **(Ck-FY2003-Uline-340)** It was noted that pulsed beam of this intensity have been used before.

The integrated beam into the experiment is determined by the requirement to meet the BNL ground water standard. The ^{22}Na concentration produced outside of the tunnel wall is the most restrictive limit. G. Greene presented calculations (see attachment 2) on the estimated concentrations produced in the soil at locations where it is expected to be the highest. The calculations used a combination of MCNPX and ORIGEN2S. The results were averaged over a distance of 1m and 60 cm. The committee felt the 60cm average was more appropriate and the beam limit will be based on the results for 60cm averaging. Previously the committee has not allowed averaging. Previous calculations were compared to the results presented and were comparable.

The diffuser causes the beam to interact and scatter. The largest concentration occurs as a result particles striking the first quadrupole of the lens system downstream of the diffuser. The calculations were presented with the thickest diffuser, 0.5 inches of Ta, and a beam energy of 24 GeV. The integrated beam limit based on the presented calculations is 15,000 pulses of 10^{11} protons/pulse at 24 GeV. Therefore the committee has approved the experiment to run with an integrated beam of $3.6*10^{16}$ nucleon-GeV. Energy scaling can be used to the lower energy beam. A procedure must be written where the LP or designated representative of the experiment monitors the integrated beam to the experiment. **(Ck-FY2003-Uline-341)**

The multiple scattering in the diffuser will be a factor of 4 larger for the 7.5 GeV beam. The multiple scattering is the dominate cause of the beam losses at the first quadrupole. The experiment must use a diffuser, which is 4 times thinner for operations at 7.5 GeV or produce calculations, which provide an estimate the appropriate limit. A procedure must be written for the experiment to check that the appropriate diffuser in place for the 7.5 GeV data taking. **(Ck-FY2003-Uline-342)**

The anti-collimator is used sparingly in the experiment. The numbers presented assumed that the anti-collimator would be used 10% of the time. A procedure must be written to monitor and limit the amount of beam striking the anti-collimator. **(Ck-FY2003-Uline-343)**

The beam will exit the experiment with a divergence of approximately 15 milliradians. The beam size on the dump will have a radius of about 1 meter. The beam will travel through a substantial potion of air on the way to the beam dump. The air activation was not considered to be an issue and D. Ryan reported that air sampling would be conducted. The beam interactions in air are well below the soil activation limits established by the diffuser.

The beam dump and 20 feet upstream of the dump have a waterproof cap. A calculation needs to be done to ensure that the cap in the upstream direction is sufficient for the integrated protons being delivered to the experiment. **(Ck-FY2003-Uline-344)**

The tunnel is posted as a radiation area. The committee requested that an estimate be made of the potential residual activity levels. **(Ck-FY2003-Uline-345)**

The committee recommended that soil sample coupons be placed at several of the expected high loss locations**. (Ck-FY2003-Uline_346)**

G.A. Greene has provided details on several items after the meeting (see attachment 3).

Attachments (File copy only):

1) BNL AGS Experiment 963 Memorandum of Understanding, April 24, 2003.
2) A.L. Hanson and G.A. Greene, "Calculated Estimates of Soil Activation at the AGS U-Line for Proton Radiography", Power point presentation.
3) G.A. Greene, May 2, 2003 Memorandum to D. Beavis.

CC:

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U Line file