MEMORANDUM

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De/From: Th. Otto, SC-RP

Conc.:   Radiological consequences of CNGS beam tuning for TT2A

In 2002, a study of the shielding wall between TT2 and TT2A was performed [1]. A proton beam extracted from the PS and directed towards TT10 may hit this wall. It was found, that under worst-case conditions, a lost beam with a momentum of p=26 GeV/c and a proton intensity of 2.3 10^{13} during a supercycle of 14.4 s duration could hit the separation wall directly. It would expose personnel in TT2A to an effective dose of E = 250 mSv during a single supercycle. Consequently, in the following shutdown, 160 cm of additional iron shielding was installed in tunnel TT2 close to dump D3. The additional shielding provides an attenuation factor of exp(160/17.8) = 8000 and the effective dose in a supercycle is now limited to 30 µSv. In addition, an interlock coupled to a radiation monitor will stop the extraction from the PS once a dose rate of 100 µSv/h during 15 min (or 25 µSv in a single pulse) is measured in TT2A. This interlock is generated with a dedicated, high-reliability hardware.

A possible scenario in 2006 is a full beam loss on the reinforced shielding wall between TT2 and TT2A during tuning of a CNGS beam. In this condition, 3 10^{13} protons at p = 14 GeV/c would be extracted every 1.2 s from the PS. In order to judge if and how much additional shielding is necessary, a simple comparison of dose equivalent source terms is performed instead of performing a Monte-Carlo simulation as in [1]. The following table summarises the source terms for the two conditions, calculated after [2]:

Year	Momentum (GeV/c)	Source term [2] (Sv m² proton⁻¹)	Intensity	Source term (Sv m²)
2002-2004	26	4.2 10^{-11}	2.6 10^{13}/14.4 s	1103/14.4 s
2006	14	1.3 10^{-11}	3.0 10^{13}/1.2 s	390/1.2 s

Personnel in TT2A would be exposed to a dose 3 times smaller per lost pulse than in the previous situation. Under worst-case conditions, the radiation monitor could interlock further extraction after 3 failed pulses at the latest. Additional shielding in TT2 does not seem mandatory under these circumstances.

[1] M. Silari, H. Vincke, TIS-RP/TN/2002-018, EDMS No. 341 746
[2] A. H. Sullivan, *A Guide to Radiation and Radioactivity Levels near High-Energy particle Accelerators*, Nuclear Technology Publishing (1992)