

Memo

date: February 11, 2010

to: RSC

from: D. Beavis 

subject: Potential Dose near Misc. Penetrations at RHIC

Introduction

There are a variety of miscellaneous penetrations at RHIC that are discussed in the RHIC Project documentation and some that have been added after the project was complete. The potential dose from these penetrations will be tabulated for beam faults, potential upgrades, and low energy operations.

The methods used for Maximum Credible Incidents (MCI) and chronic loss conditions have been discussed in a series of memorandums¹ on RHIC operations and will not be discussed here.

Miscellaneous Penetrations at RHIC

The RHIC project had several types of miscellaneous penetrations. Many of the small penetrations were not directly discussed since their small size made the potential dose exiting them is small. Most if not all of the small penetrations have multiple legs. They will not be discussed in this report and none are expected to present an issue. The RHIC ring has a series of survey shafts distributed around the ring that are straight penetrations from the top of the berm. They have a polyethylene plug in them to reduce the potential dose. Finally, there was a series of pipes added at 10 O'clock out the side of the berm for PHOBOS cables. In addition to the penetration considered by the RHIC Project, a series of penetrations have been added for Stochastic Cooling (SC) pickups and kickers and the Jet target at 12 O'clock.

Table I. Doses Near Penetrations

Penetration	Full Energy MCI mrem	Upgrades MCI mrem	Chronic ² Low Energy (mrem/hr)	References
Survey shafts-22 inch diameter	255	640	2.7	3
10 O'clock cable ports	34 (0.5)	85 (1.25)	0.6	4
12 O'clock	15 (0.9)	38 (2.2)	0.3	5
SC at 11 O'clock	10	25	0.2	6
SC at 1 O'clock	2.5	6	0.04	7
SC at 4 O'clock	16	40	0.3	8

SC at 3 O'clock	4	10	0.07	9
SC Utilities at 3 O'clock	40	100	0.7	10

Recommendations and Comments

The potential dose rates are small for low-energy operations. Surveys should be conducted at a few of the penetrations to ensure that no unexpected dose rates exist. Most of the areas have occupancy levels that substantially reduce the risk of integrated exposure. It is recommended that the survey shafts be considered more closely for upgrades. (CK-FY2011-RHIC-688)

References

1. See for example: D. Beavis, "[Potential Dose on RHIC Berm](#)", Dec. 30, 2009; D. Beavis, "[RHIC Labyrinths](#)", January 14, 2010
2. For chronic low energy dose rates the injection energy of 3.85 GeV is used with 3 fills per hour. 25 % of the each beam is assumed to scrape near each of the six IRs. For the survey shafts it is assumed that 10% of the beam is scrapping at the worst location possible.
3. RSC Minutes of [Nov. 25, 1998 and Nov. 30, 1998](#). The 22 inch penetration has 6 inches of polyethylene in it. 2.2 rem was estimated if the plug is not present. Smaller diameter survey shafts may have less polyethylene in them since the dose is lower before the polyethylene.
4. RSC Minutes of [Oct. 19, 1998](#). These are the values given in parenthesis. The values used here are from estimates of D. Beavis using the methods discussed in references 6 through 10 below.
5. D. Beavis memorandum, "Review of proposed Penetrations at 12 O'clock for the Jet Target", July 28, 2003. This provides the number in parenthesis and was based on reference 3 minutes. The other value uses the methods described in references 6 to 10.
6. D. Beavis memorandum, "[Penetrations for Stochastic Cooling at 11 O'clock-Revisited](#)", August 6, 2009.
7. D. Beavis memorandum, "Stochastic Cooling Penetrations at 1 O'clock", August 29, 2006. The 2.5 mrem value discussed is used for a full body exposure rather than the 52 mrem at the exit of the pipe.
8. D. Beavis memorandum, "Stochastic Cooling Penetration at 4 O'clock", Aug. 26, 2006.
9. D. Beavis memorandum, "[Stochastic Cooling Penetration at 3 O'clock](#)", Sept. 28, 2009. The 78 mrem has been reduced to 4 mrem to account for full body exposure one foot from the exit of the pipe. The reduction assumes a 45 degree opening angle.
10. D. Beavis memorandum, "Two 12-inch Diameter Penetrations for Stochastic Cooling Penetration at 3 O'clock", May 19, 2008.

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