C-AD

Radiation

Safety Minutes of Radiation Safety Committee of April 12, 2006

Committee

Issued: April 17, 2006

Subject: EBIS

Present: D. Beavis, E.T. Lessard, A Pendzick, N. Kling, B. Van Kuik, L. Ahrens, C. Gardner, J. Alessi, I.-H. Chiang, J. Reich, J.W. Glenn, R. Karol, W. Mackay, L. Snydstrup, and P. Bergh

The committee reviewed several aspects of the EBIS injector. Discussions included the stairs for the second floor, the penetration into the booster from the linac building, x-ray sources, critical devices, and the lack of radiation caused by EBIS beam losses.

The stairs

New egress stairs are proposed which are along the linac building but inside the present booster fence perimeter. D. Beavis presented the potential dose rates due to Booster and linac beam faults (see attachment1).

The committee recommended that the proposal be followed and the fault study be reviewed when available.

(CK-Booster-Protons-2007-465) Follow design presented.

(CK-Booster-Protons-2007-466) No high intensity operation until fault study is reviewed. The fault study needs to ensure that issues of soil activation and equipment damage are considered. The C3 inflector can be damaged if hit with too much beam. C5 is the likely loss location for this fault study. Consideration should be given to which energy could create the largest localized fault, but be at least 1 GeV.

(CK-Booster-Protons-2007-467) Consider making the access way between the booster berm and the Booster power supply building a Controlled Area before any high intensity proton operations in the booster. This is due to concerns of the trench and berm groundshine.

It was noted that the ALARA procedure, which uses the alarm system to actively warn operators of high losses for high intensity operations, limits the losses in the booster to 6*10**12 p/sec. at 1.7 GeV or about 0.07 assumed in the analysis for a fault.

The EBIS Penetration into the Booster

D. Beavis made a presentation of the potential radiation issues related to dose from the penetration into the linac building (see attachment 2). The uncertainties are large in the potential maximum dose rate in a fault.

The committee recommended that more details be added to the simulations to decrease the uncertainty in the expected dose rate. These calculations should include the expected packing at both ends of the penetration, the quadrupole, and source position sensitivity. Information obtained from these calculations should be used to determine if there is a benefit in changing the design of the beam-cross over to remove the potential source from the penetration. **(CK-EBIS-FY2007-468-protons)**

The overall plan presented can be followed for design planning. This plan minimizes the horizontal bends in the EBIS beam and has no vertical bends to preserve spin. However, the penetration at beam height with such small or zero angles to a potential linac scrapping fault means that the reduction of dose with shielding and bends will need to occur in the linac building with possible interferences occurring in the linac building.

The committee recommends that the final design have a dose in a maximum credible fault to be 20 mrem. **(Ck-EBIS-fy2007-469)**

The fast beam interrupt can be used to limit the duration of the fault but may only be used to limit the dose to a factor of 10 below what the chipmunk would allow. If the FBI system is used a latch must be installed so that pulses are prevented. A special cable should be considered for this signal. The portion of the FBI system that is used should be sufficiently documented.**(Ck-EBIS-fy2007-470)**

The chipmunk must limit the dose in a maximum credible fault to 20 mrem or if the FBI system is used then 200 mrem. The latency of the interlock system and beam stops must be included in the estimate of the dose. **(CK-Booster-FY2007-471)**

The committee does not expect that a maximum credible fault can be sustained for any portion of an hour. Therefore, the committee was not as concerned with the dose in an hour.

The temporary configuration in the linac building near the penetration must be reviewed before any beam is allowed into the booster. This should include the shielding, the dose beyond the shielding (including the second floor and outside the building), the area postings, access to the penetration, and the chipmunk interlock. The chipmunk must interlock all booster beam stops pending review of the fault studies. **(CK-EBIS-FY2007-472)**

The final configuration will rely on fault study information. A fault study should be conducted as soon as possible. Consideration for potential equipment damage or soil activation needs to be considered in the fault study plan. **(CK-Booster-FY2007-473)**

High intensity protons are to be prevented by RS LOTOed or the equivalent until sufficient information on initial fault studies have been reviewed. **(CK-Booster-FY2007-proton-474)**

EBIS x-ray sources

J. Alessi made a presentation on the potential for several of the devices in the EBIS system to generate x-rays (see attachment 3). There was not sufficient time to completely review the presented material and it will be presented again in the near future. Several examples were shown of similar devices at CERN. The committee was concerned about using stationary x-ray shields that personnel could walk around. Where possible, the committee would prefer to see shields attached to the devices with a procedure to remove and replace. It is desired that removable shields have an interlock cable run through them such that the source is prevented if the shield is removed. The design should establish a dose limit such that workers on the devices will be well below the department ACL.
The x-rays sources and shields will be reviewed at a future meeting. **(CK-EBIS-FY2007-proton-475)**

Critical Devices for EBIS Beam

Two critical devices will be required to prevent beam from being transported into the booster and accelerated. No proposal was presented on specific devices. The committee would prefer the devices to be dissimilar if possible such as turning off a bend and inserting a beam stop. The committee also prefers that the devices go to the safe state if they loss power, air pressure etc. unless that creates unusual problems in design or reliability. One or both devices can be located in the Booster tunnel provided that it is demonstrated that there is no radiation from the beam striking the device.
Review of critical devices. **(CK-EBIS-FY2007-proton-476)**

Radiation Produced by EBIS Beam Losses

Data for the potential radiation or lack thereof for the EBIS beam striking objects will be presented and reviewed at a future meeting. **(CK-EBIS-FY2007-proton-477)**

There are no concerns for air, water, or soil activation. There are no expected issues for residual activity.

Attachments (file copy only)

1) D. Beavis, "Relocation of the Linac Building Second Floor Stairs", March 31, 2006.
2) D. Beavis, "EBIS Penetration into the Booster", March 29, 2006.
3) J. Alessi, PowerPoint presentation.

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