C-A Unreviewed Safety Issue (USI) Form

Title of USI: New Cable Penetrations at Booster

Description of USI (use attachments if necessary):

See attached

Title and Date of Relevant SAD: Booster SAR, 2-27-91

Committee Chair or ESHQ Division Head must initial all items. Leave no blanks:

ITEM	APPLIES	DOES NOT APPLY
Decision to not revise the current SAD and/or ASE at this time:		ETL
The hazard associated with the proposed work or event is covered within an existing SAD and/or ASE.	ETL	
SAD Title and Date: Booster SAR, 2-27-91.	ETL	
This Form and attachments, if necessary, shall be used to document the USI until the next revision of the appropriate SAD.	ETL	
Decision to submit a revised SAD and/or ASE to the BNL ESH Committee:		ETL
The hazard associated with the proposed work is not appropriately included in an SAD.		ETL

Ray Karol
Signature of C-A Committee Chair or C-A ESHQ Division Head

6/19/02
Date

Edward T Lessard
Signature of C-A Associate Chair for ESHQ

June 19, 2002
Date

Lessard, Edward T

From: Dana Beavis [Beavis@sgs1.hirg.bnl.gov]

Sent: Wednesday, June 19, 2002 12:59 AM

To: Javidfar, Alireza; Lo Presti, Penny

Cc: Pendzick, Alexander F; Stevens, Alan J; McNerney, Andrew J; Karol, Raymond C; Gardner, Christopher J; Lessard, Ed; Lessard, Edward T

Subject: New Booster Penetrations (penny please distribute to CC list)

There are three new penetrations being made to the booster for the B6 beam dump. The final design has three 8 inch diameter pipes space 2.5 feet apart. One pipe will act as a spare and is expected to have a concrete plug placed into it after measurements are conducted. The pipes are 18ft long. A. Stevens did an evaluation of the initial design with two 10 inch diameter pipes.

The initial estimate had a dose rates of:

	p/hr at 2 GeV	Dose rate
routine	2.15*10**16	1100 mrem/hr
fault	2.59*10**17	1340 mrem/yr

The change in the pipe diameter form 10 to 8 inches reduces these estimates by a factor of two. Another factor of 5 is desired so that the routine dose rate is less than 100 mrem/hr. The routine level is estimated at the maximum in the dose rate from the beam dump. The actual entrance dose be a factor of 5 lower at the actual pipe locations.

The area around these pipes will be roped off with a 5 foot distance to the penetrations till measurements can be conducted with beam on the dump. Based on these measurements a concrete cap to cover the pipes will be designed if measurements demonstrate that it is necessary.

Area roped off **(ck-booster-Fy2003-protons-300)**

Measurements of dose rates through penetrations complete.**(ck-booster-fy2003-protons-301)**

CC:RSC
Booster file
BAF file

BROOKHAVEN
NATIONAL LABORATORY

MEMORANDUM

Date: 05/03/02

To: A. Pendzick

From: A.J. Stevens AJS

Subj.: Recommendation Concerning New Penetration for Cables into the Booster Tunnel

This memorandum describes very briefly the results of my evaluation of your proposal to place a 10 inch diameter penetration at the C1 location of the Booster for new cabling. As proposed, the penetration would about 35 ft. downstream of the new dump at B6.

I ignore, for the moment, the fact that the proposed penetration is 35 ft. away from the dump and assume it is in the worst case location. For the entrance dose to this penetration, I use Tesch[1] modified by an MCNPX calculation which actually simulates loss on the dump.[2] The result is an entrance dose of 5.92×10^{-13} rem per 2 GeV proton. Dose attenuation through the penetration is assumed to be given by the first leg formula of Goebel, which is:

$$A = \frac{1}{1 + 2.5\sqrt{d} + 0.17d^{1.7} + 0.79d^{3}}$$

Where d is the 'universal length,' i.e, the physical length divided by the square root of the area. For the 10 inch diameter, 18 ft. long case, d is 24.37. Applying this gives an estimate of the exit dose of 5.17×10^{-17} rem/p.

The dump losses planned[3] are the equivalent of 2.15×10^{16} 2 GeV protons per hour. A worst case fault would be 2.59×10^{17} 2 GeV protons per hour.[4] This results in an estimated 1.11 rem/hr and 13.4 rem/hr. for the two cases respectively.

There are two concerns regarding the magnitude of the dose on the berm. The first is that the magnitude of the dose rate might change the classification of the area, and the second is an increase in the skyshine. Although the fact that the penetration is about 35 ft. downstream of the dump is likely worth a factor of 5 or more reduction, a local fault might well exceed the 5 rem/hr. which is the dividing line between a radiation area and a high radiation area. Although the increase in skyshine is not likely to be large,[5] clearly it should be minimized if at all practical. Both of these considerations lead to my very strong recommendation that 2 6 inch diameter pipes, spaced about 2.5 ft. or more apart, be substituted for the proposed 10 inch diameter pipe. This would achieve a reduction of a factor of 5 in the prompt dose and slightly more than this in the skyshine dose.

Clearly a better location for the penetration(s) would be either upstream of the dump or further downstream. The only alternative I have heard of is C6. Although much better in relation to the dump location, C6 is only 15-20 ft. downstream of Booster injection, which is an already existing high-loss location. I do not think this is a better alternative.

I do not know whether an RSC review is required prior to making any penetration, but at a minimum, approval from the RSC Chair (Dana Beavis) should be obtained. Please keep Dana informed of your plans.

References/Footnotes

1. The Tesch expression is that the neutron dose in rem per proton is $(1.5 \times 10^{-12})\times E^{0.8}\times\exp(-d/\lambda)/R^2$ where E is in GeV, d is the earth thickness in g/cm^2, λ is 107 g/cm2 and R is in m. I assume the density is 1.9 g/cm^3.

2. The reduction from Tesch is only a factor of 2.04.

3. C. Gardner, private communication. This is the ALARA limit.

4. Such a high fault dose would likely not be sustainable for an entire hour (without destroying the beam pipe.)

5. The 'solid earth' dose, using the same methodology (Tesch divided by 2.04) gives 24 mrem per hour. Although the ~ 1 rem/hr is a factor of ~ 40 higher than this, it is present over only about 0.5 ft.^{2} whereas the 24 mrem is present over 100 ft.^{2} or more. This naïve evaluation would give a 10% increase in skyshine.

Cc

D. Beavis
C. Gardner
E. Lessard