MI-309 Beamline Cut Analysis
1/11/22

Assume contamination on beam pipe 2000 pCi/ 100cm2 (7Be)

2000 E -12 Ci / 100 cm2 = 2 E -11 Ci/cm2
Say cut size is 1 cm x 20 cm

Total activity represented in this removable material 2E-11 Ci/cm2 x 20 cm2 / 0.1 wipe efficiency = 4E-9 Ci = 0.004 uCi

To estimate the airborne radioactivity hazard, we start with the extremely conservative assumption that all of the removable activation is resuspended in air.

ALI 4E+04 uCi (oral ingestion) 2E+04 uCi (inhalation)

If all is ingested: 0.004 uCi/ 4E4 uCi / 5000 mrem = 0.0005 mrem = 0.5 urem

In this case, the received dose of 0.5 urem, is much lower than the external dose that is expected. An ALARA calculation (ala NUREG/CR-0041, Section 2) would indicate against specifying respiratory PPE due to the worker inefficiency factor of wearing PPE (~15%).

Check

4E-9 Ci = 148 Bq

ICRP 68 dose coefficient 2.8E-11 Sv/Bq ingestion

Ingested dose: 148 Bq * 2.8E-11 Sv/Bq = 4.2E-9 Sv = 0.42 urem

Contamination on magnet

Assume contamination on beam pipe 2000 pCi/ 100cm2 (7Be)
2000 E -12 Ci / 100 cm2 = 2 E -11 Ci/cm2

Assume magnet is 1m x 3m = 100 cm x 300 cm
Area is then 30,000 cm2
Activity: 2E-11 Ci/cm2 * 30000 cm2 = 6E-7 Ci = 0.6 uCi
So using the results from above if a worker ingested all of the removable contamination on the magnet:
Ingested dose: 0.00025 mrem * 30000 cm2 /10 cm2 = 0.75 mrem

10 CFR 835 Appendix E value 7Be = 3.1E03 uCi

0.6/3.1E03 = 0.019% of Appendix E value.

Internal from cutting 30 mrem/hr component.

RP Note 116: cutting steel 0.1 DAC = 525 mrem/hr component

DAC values used in RP 116 are 1-3x lower than the values in the current (Aug. 11, 2017) version of 10 CFR 835, so the note is conservative.

500 mrem/hr -> 0.1 DAC = 0.1 * 5000 mrem/2000 hr = 0.25 mrem/hr

30/500 * 0.25 = 0.015 mrem/hr

For 3.5 hr cutting work dose: 3.5 hr * 0.015 mrem/hr = 0.0525 mrem