

Date: April 10, 2009

To: Idaho Accelerator Center personnel

From: Jason Bond, Technical Safety Office

Subject: Calibration of the Eberline Portable Noble Gas Monitor

The Eberline PNG monitor from the IAC was calibrated during the week of March 30, 2009. The air flow tubing was modified to produce uniform flow throughout the system. Calibration of the air flow system, noble gas chamber, and the beta particulate chamber was performed.

#### **Air Flow**

A calibrated mass flow meter was used to compare the PNG's flow meter reading. Beginning at 30 lpm and increasing by 10 lpm, flow rates on both the PNG and mass air flow meter were recorded, see Figure 1. The PNG air flow meter overestimates the air flow by about 16%.

#### **Noble Gas Chamber**

Efficiencies for the RSMII log and Bar scales were calculated. Two sources were used to calculate absolute efficiency. A zero-mass Am-241 standard source was hung in the center of the chamber at 1 inch away from the detector and the count rate was recorded to calculate alpha efficiency. A filter paper Cs-137 standard source was placed in the same geometry as the Am-241 source and the count rate was recorded to calculate beta efficiency. For results see Table 2.

#### **Beta Particulate Chamber**

The beta particulate chamber was calibrated using three filter paper standards. Each standard source was counted twice. Refer to Table 3 for the results.

\*Note – The RSMII readout should be used when analyzing samples in this chamber due to the low efficiency of the Bar reading.

## Results of the PNG Calibration

Date of Calibration: April 3, 2009

**Table 1.** Source information.

Type of source	Nuclide	Half-life (yrs)	Time decayed (yrs)	DPM
Filter paper standard	Cs-137	30.07	2.843835616	207916.7387
Zero mass	Am-241	432.7	12.47123288	230666.4479
Filter paper standard	Am-241	432.7	2.843835616	216571.353

**Table 2.** Noble gas chamber calibration.

Noble Gas Chamber				
Source at 1 in. away from detector	RSMII (cpm)	Absolute Efficiency	BAR	Absolute Efficiency
Am-241 zero mass	1250	0.54%	1100	0.48%
0.1 $\mu$ Ci Cs-137 filter paper standard	2.00E+04	9.62%	3.50E+04	16.83%

**Table 3.** Beta particulate chamber calibration.

Beta Particulate Chamber	Position of source face			
	Toward scintillator	Absolute Efficiency	Toward alpha detector	Absolute Efficiency
Am-241 filter paper standard	RSM: 150 BAR: 200	RSM: 0.07% BAR: 0.09%	RSM: 7000 BAR: 800	RSM: 3.23% BAR: 0.37%
0.1 $\mu$ Ci Cs-137 filter paper standard	RSM: 2E4 BAR: 200	RSM: 9.62% BAR: 0.10%	RSM: 500 BAR: 250	RSM: 0.24% BAR: 0.12%

**Table 4.** Air flow calibration.

Intake air flow		
Flow rate (lpm)	Flow meter reading (slpm)	Ratio of flow meter to observed flow rate
70 $\pm$ 5	59 $\pm$ 0.5	0.84
60 $\pm$ 5	49 $\pm$ 0.5	0.82
50 $\pm$ 5	42 $\pm$ 0.3	0.84
40 $\pm$ 5	33.6 $\pm$ 0.2	0.84
30 $\pm$ 5	25.5 $\pm$ 0.5	0.85

ave: 16% above Flow meter readings

**Note:** The BAR and RSM are referring to different read-outs on the front panel.

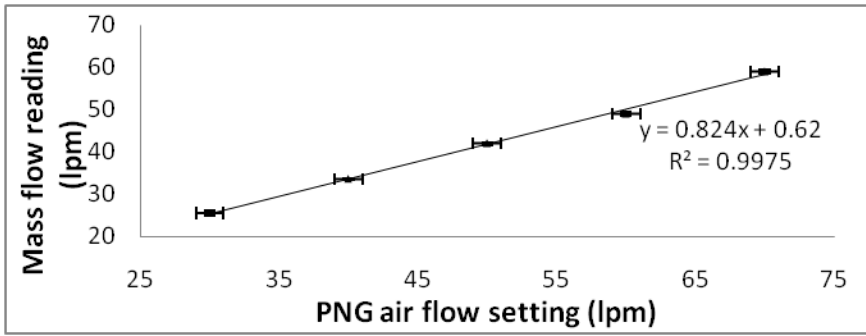


Figure 1. PNG and mass air flow meter flow rates.