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 µCi 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 µCi 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 ± 5 | 59 ± 0.5 | 0.84 |
| 60 ± 5 | 49 ± 0.5 | 0.82 |
| 50 ± 5 | 42 ± 0.3 | 0.84 |
| 40 ± 5 | 33.6 ± 0.2 | 0.84 |
| 30 ± 5 | 25.5 ± 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.

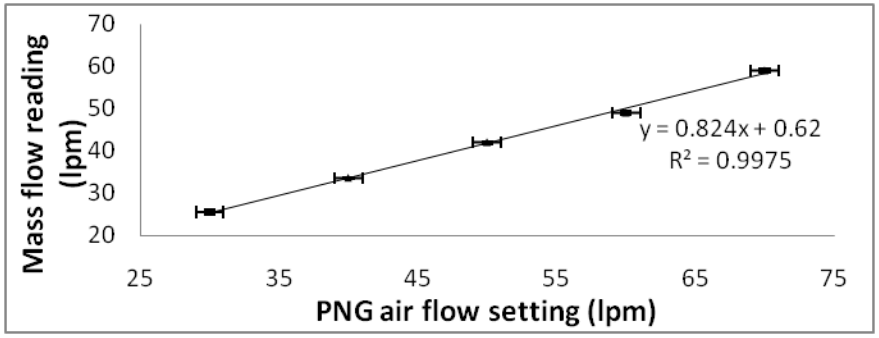


**Figure 1.** PNG and mass air flow meter flow rates.