July 6, 2004

Mr. Charles Arnott
Division of Radiological Health
Department of Environmental and Conservation
3rd Floor, L and C Annex
401 Church Street
Nashville, TN 37243-1532

Dear Mr. Arnott,

This letter is in response to your letters to Nuclear Regulatory Commission's Region I office dated March 29, 2004, and May 6, 2004, requesting technical assistance concerning vibration testing performed by Berthold Technologies. We have reviewed the test documents provided by Berthold.

Berthold tested their device to a swept sinusoidal vibration input on each of the three principal axes over a duration of approximately 1.5 hours. The input frequency was from 5 to 200 to 5 Hertz (Hz) at a sweep rate of 4 Hz per minute. There was an input of 1.5*gravity (g) acceleration.

We calculated the vibration amplitude and the peak to peak displacement using the formula:

$A = \frac{a}{(2\pi f)^2}$, where A is the single amplitude (m), f is frequency (Hz), and a = 1.5g ($m/s^2$).

We have summarized the results of the calculation in the following table:

Vibration Amplitude vs Frequency at a Constant Acceleration of 1.5g

| Frequency (f) (Hz) | Single Amplitude (A) (mm) | Peak to Peak Displacement (2A) (mm) |
|---|---|---|
| 5 | 14.9 | 29.8 |
| 10 | 3.7 | 7.4 |
| 20 | 0.9 | 1.8 |
| 30 | 0.4 | 0.8 |
| 40 | 0.2 | 0.4 |
| 50 | 0.15 | 0.3 |
| 100 | 0.037 | 0.074 |
| 150 | 0.016 | 0.032 |
| 200 | 0.01 | 0.02 |

Therefore, we concur with your conclusion of setting a maximum frequency of 200 Hz as a limiting condition since Berthold did not provide data on testing done over 200 Hz. Additionally, we recommend:

1. Informing the licensee that the peak to peak displacement will be limited in the registration certificate to the values shown in the Table above.

2. Ask the licensee how the test results apply for continual use in a vibration environment. Specifically, testing lasted approximately 1.5 hours for each axis, and even shorter periods for each of the frequencies. Berthold should provide information showing that this testing method accurately represents normal operation conditions of a mounted device in a state of continuous operation under the highest vibration load of 1.5g (i.e. worst case scenario).

If you have any questions, please contact Nima Ashkeboussi of my staff at 301-415-7637.

Sincerely,

R/A Thomas Essig for

Charles L. Miller, Director
Division of Industrial and
Medical Nuclear Safety
Office of Nuclear Material Safety
and Safeguards

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