



**LDS HOSPITAL  
ALTA VIEW HOSPITAL  
COTTONWOOD HOSPITAL**

GARY W.M. FARNES, CHIEF EXECUTIVE OFFICER

31 August 1993

Phillip A. Hemes  
President, Vitalograph  
8347 Quivera Road  
Lenexa, KS 66215

Dear Mr. Hemes:

I am enclosing the report on the Vitalograph peak flow meters. These meters were tested at the LDS Hospital on 28-30 August 1993 against the multiples of ATS wave form #24 as recommended by the National Asthma Education Program. In addition we tested them at multiples of wave form #24 to give target values of about 800 L/min, 550 L/min, and 400 L/min. Each peak flow meter was tested five times on each of the 12 target values for peak flow.

All portable peak flow meters under read peak flow at altitude and we adjusted each target value for the altitude at Salt Lake City (1400 m). The correction factor used is based on information obtained from testing peak flow meters in the hyper/hypobaric chambers at Duke University using an earlier version of the Vitalograph peak flow meter. The formula reduces the target value by  $[9.423 - 0.00698 \times \text{target value}] \%$ . Since there is some small uncertainty about the calculation of the altitude correction, we adjusted the acceptable range to  $\pm 11\%$  (up from  $\pm 10\%$ ).

It is important to remember the variability of the readings on portable peak flow meters will include (1) the variability of the peak flow meter itself; (2) variability attributable to the wave form simulator; (3) variability associated with the readers; and (4) variability in the altitude correction factor.

You will find a separate report sheet for each target value. This contains all the raw data for all five trials on all 12 peak flow meters. In addition, it includes the average for all trials of each peak flow meter, the standard deviation, the coefficient of variation, and the average value as a percent of the altitude corrected target value. Inter- and intra-device coefficients of variation are found at the bottom of each report.

The graphs show:

1. Overall average flow against the altitude-corrected target flows. The line of identity is displayed. There is evidence of good linearity for these peak flow meters. It is

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SUMMARY

The Vitalograph peak flow meters meet the NAEP recommendations for accuracy and for inter- and intra-device variability.

If you have any questions about this data or the reports and conclusions, please do not hesitate to call.

Sincerely yours,

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Copy of a Letter from the LDS Hospital in Salt Lake City assuring conformity of the Vitalograph Peak Flow Meter to NAEP requirements for accuracy.

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excellent for peak flows up to 500 liters/minute. The small tail off above 600 liters/minute is of no clinical consequence.

2. Target value against the overall average values expressed as a % of the target.

NAEP TECHNICAL STANDARDS FOR PEAK FLOW METERS

1. The NAEP standard is that peak flow meters be accurate over their full range within  $\pm 10\%$  of the readings. On the 12 Vitalograph peak flow meters we tested, the overall averages are within 10% of the altitude target value. All individual meters were within 10% of the altitude corrected value for target values up to 700 L/minute. For the target value 701 L/minute, 11 out of 12 individual meters had average values within 10% of the target value. One meter read 89.5% of the target value. This meter was within the acceptable range for altitude ( $\pm 11\%$ ).

For the target value 803.1 L/minute, a target value not required by the NAEP, 7 out of 12 of the meters were within the  $\pm 10\%$  of target. Of the 5 meters that were not within  $\pm 10\%$ , 4 of the 5 were within the acceptable  $\pm 11\%$  range. One of the meters (#11) fell just below the acceptable range. Again, this flow rate is not one required by the NAEP.

Conclusion: The Vitalograph peak flow meters meet the NAEP requirements for accuracy.

2. The NAEP requirements suggest the devices have good reproducibility within 10 L/min or  $\pm 5\%$  of reading, whichever is larger. The NAEP does not specify how the  $\pm 5\%$  is calculated and we chose to use a coefficient of variation of  $\pm 5\%$  as the measure of good intra-device reproducibility. All intra-device coefficients of variation were less than 1%.

Conclusion: The Vitalograph peak flow meters are well within the NAEP recommendations for intra-device variability.

3. The NAEP recommends that inter-device variability should be within  $\pm 5\%$ . All inter-device coefficients of variation for all wave forms were less than 3%.

Conclusion: The Vitalograph peak flow meters are well within the NAEP recommendations for inter-device variability.