

Proposed Total Inward Leakage Testing in NIOSH Certification Benchmark Testing

William Newcomb

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Total Inward Leakage Program

Benchmark Tests

- 57 Filtering Facepiece Respirators
- 43 Elastomeric Half-Mask Respirators
- 1 Quarter-Mask Respirator
- Entire panel of 25 Subjects per model
- Three donnings per respirator per subject
- 8250 Fit Factor data points

Total Inward Leakage Program

$$TIL = 100 / FF$$

Assume that the measured Fit Factor (FF) \approx Protection factor
(not Assigned Protection Factor [APF])

A TIL of 1% \approx Protection factor of 100

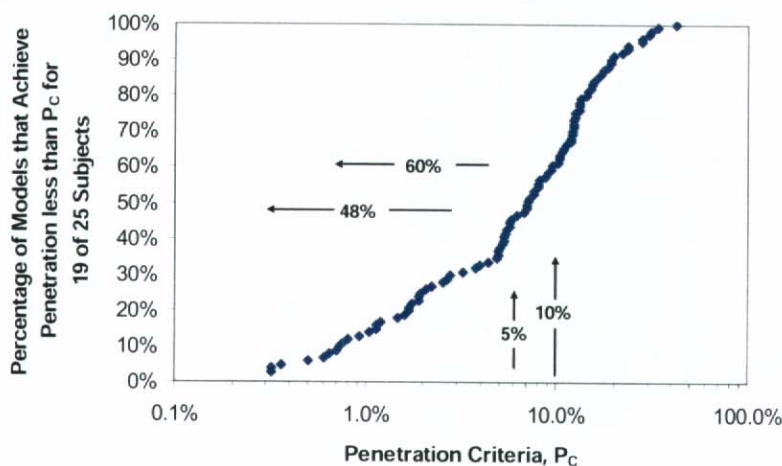
A TIL of 5% \approx Protection factor of 20

A TIL of 10% \approx Protection factor of 10

A TIL of 20% \approx Protection factor of 5

Total Inward Leakage Program

TIL Test Results: 101 Respirator Models



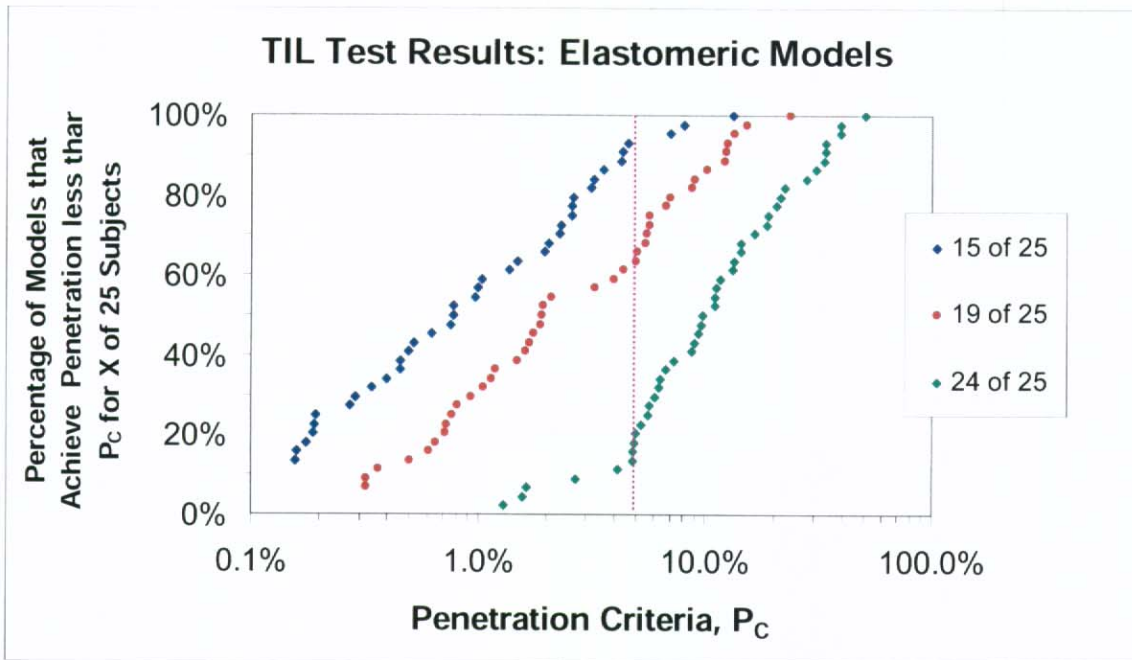
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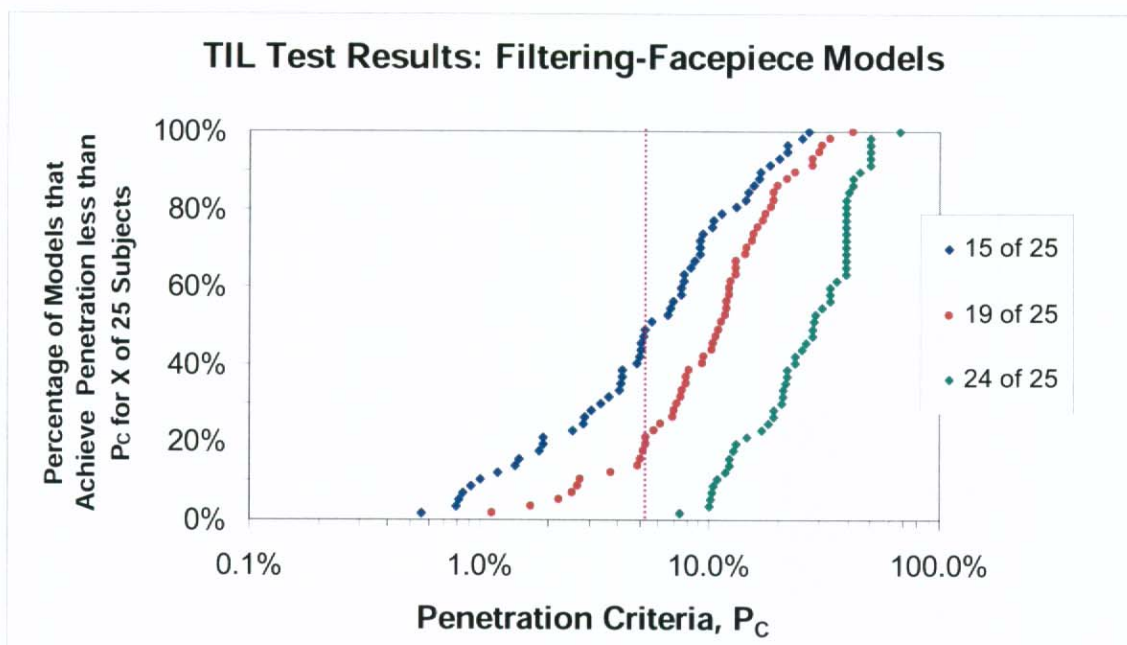
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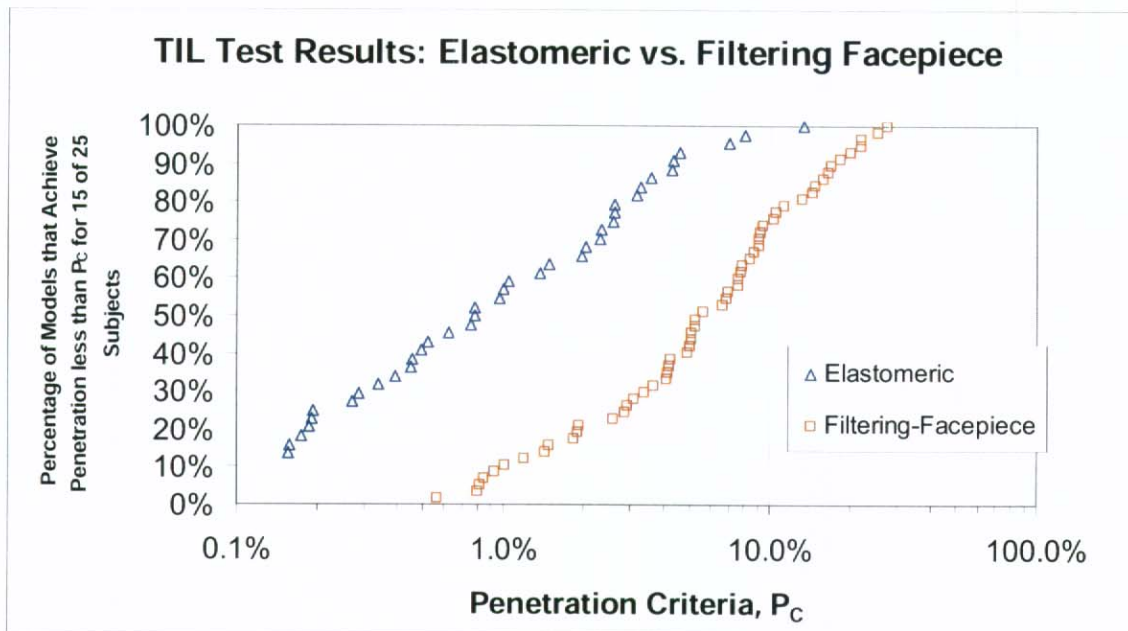
Total Inward Leakage Program



Total Inward Leakage Program



Total Inward Leakage Program



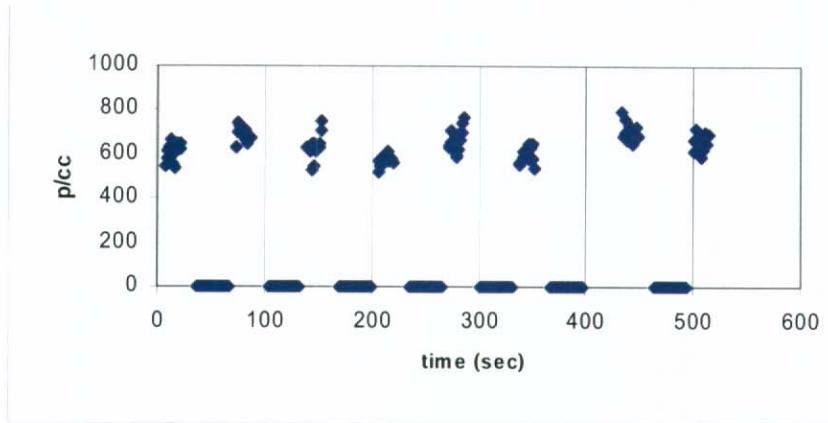
Total Inward Leakage Program

Data Anomalies

- No primary ambient sample
- Missing last in-mask sample
- Other switching errors
- Low ambient concentrations

Total Inward Leakage Program

Typical Data Plot

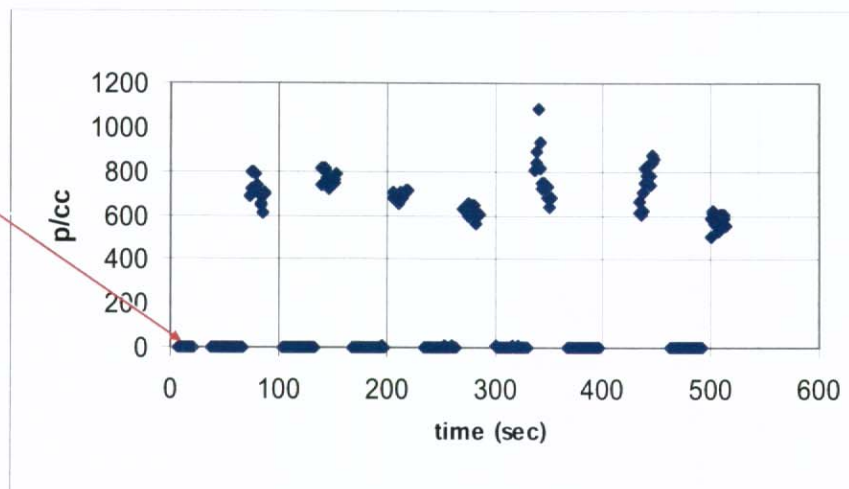


Total Inward Leakage Program

Abnormal Data Plot

Failed to take initial ambient sample

To correct this switching error, the second ambient measurement was used to replace the first

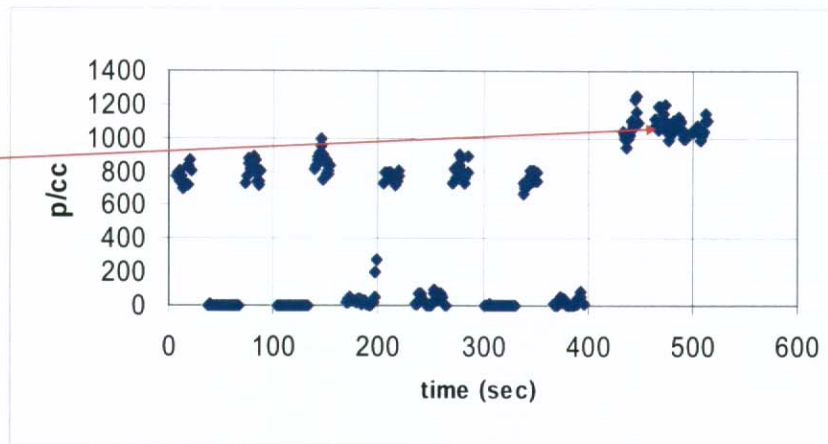


Total Inward Leakage Program

Abnormal Data Plot

Failed to take final in-mask sample

To correct this switching error, the fit factor was calculated without the last in-mask (normal breathing) sample

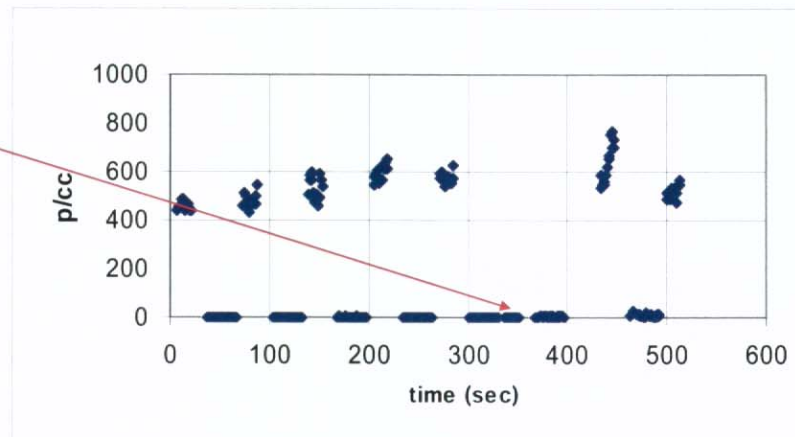


Total Inward Leakage Program

Abnormal Data Plot

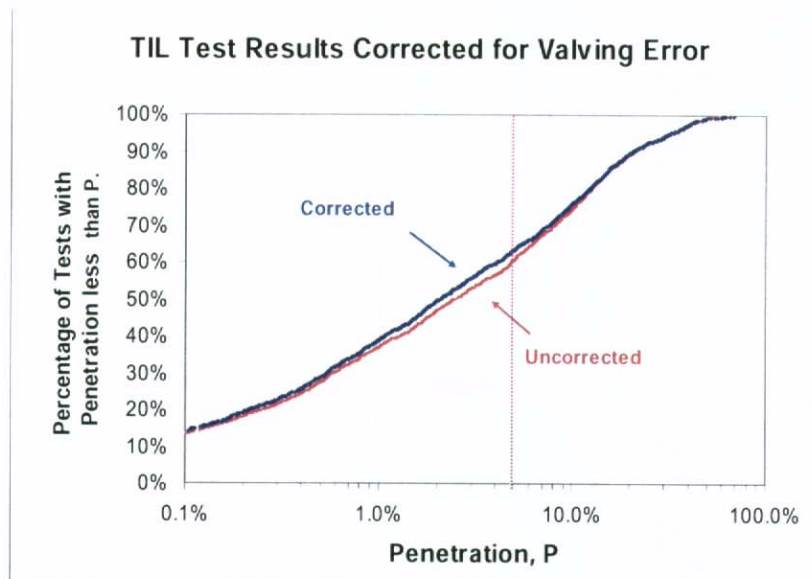
Failed to take middle ambient sample

To correct this switching error, the prior and subsequent ambient measurements were used to replace the averages



Total Inward Leakage Program

Comparison of Corrected and Uncorrected Data



Total Inward Leakage Program

- Summary of Data Review
 - Data was corrected where applicable
 - Uncorrectable data not used
 - Corrections did not significantly change the results

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Data Availability

- Data will be made available to those Manufacturers who wish to review their data

Total Inward Leakage Program

• Summary of TIL Benchmark Results

- A wide variation exists between the overall fitting characteristics of half-mask respirators
- Statistical difference was observed between elastomeric half-mask TIL and filtering facepiece TIL, but there is overlap

• Conclusion

- A TIL performance requirement as part of respirator certification is necessary
- With the tested respirators, it should be easier for a potential wearer to obtain the OSHA required Fit Factor during a fit test with an elastomeric half-mask than with a filtering facepiece

Quality Partnerships Enhance Worker Safety & Health

Disclaimer: The findings and conclusions in this presentation have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy.

Thank you

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