Proposed Total Inward Leakage Testing in NIOSH Certification
Technical Concept

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NIOSH/NPPTL PUBLIC MEETING
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Total Inward Leakage Program

- Technical Concepts
  - Proposed Requirements
  - Test subjects
  - Test protocol
  - Applicability/Schedule
Total Inward Leakage Program

- **Proposed Requirements**
  - Uses the NRFTP
  - Based on Manufacturers' User Instructions for sizing
  - $\text{TIL} \leq 5\%$
  - 26 out of 35 Test Subjects
  - Applicable to all Subpart K Half-mask respirators

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**Process for Subject Selection**

1. Measure 10 facial dimensions
2. Classify subjects by the PCA Panel
3. Outliers?
   - Yes: Do Not Use
   - No: Classify subjects by the NRFTP
### Total Inward Leakage Program

**NRFTP**

<table>
<thead>
<tr>
<th>Face Width (mm)</th>
<th>134.5</th>
<th>146.5</th>
<th>158.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>138.5</td>
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<td>128.5</td>
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**Face Length (mm)**

<table>
<thead>
<tr>
<th>Length (mm)</th>
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</tr>
<tr>
<td>128.5</td>
<td></td>
<td>5.2%</td>
<td>3.5%</td>
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<tr>
<td>118.5</td>
<td>5.7%</td>
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<td>108.5</td>
<td>21.3%</td>
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<td>98.5</td>
<td>10.5%</td>
<td>25.0%</td>
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**Total Inward Leakage Program**

**PCA Facial Shape Trends**

- **Long/Narrow Nose**
  - Long Face
  - **Shape**
    - Small
    - Overall Size
    - Large

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**CDC Workplace Safety and Health**
Total Inward Leakage Program

Subject Selection

- Based on the NIOSH test panel
  - Will screen out subjects not fitting into the PCA panel
- Select 35 subjects for each facepiece
  - Unlike what is done today
- User instructions must dictate which subjects correspond to a given facepiece
- Correlation of respirator size to facial dimensions is not required to follow the NRFTP

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Total Inward Leakage Program

One size fits all facepiece
35 subjects

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## Total Inward Leakage Program

### Small that fits 1, 2, 3, 4 & 6
35 subjects

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## Total Inward Leakage Program

### Large that fits 7, 8, 9 & 10
35 subjects

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Total Inward Leakage Program

- Test Protocol
  - Instrumentation
    - TSI PortaCount® with Companion™ in direct reading mode
  - Challenge agent
    - Generated NaCl ≥500 particles/cc
  - Sample preparation
    - Flush probe located as close as possible between the subject's nose and mouth

Total Inward Leakage Program

- Test Protocol
  - Donning
    - Trained using the manufacturer's User Instructions
  - Pretest acclimation
    - Wait 5 minutes before starting
  - Exercises
    - OSHA exercises for 30 seconds/exercise
Total Inward Leakage Program

• Test Protocol
  - Exercises
    • Normal breathing
    • Deep Breathing
    • Turning head from side to side
    • Moving head up and down
    • Recite the Rainbow Passage out load
    • Reaching for the floor and ceiling
    • Grimace (not included in the TIL calculation)
    • Normal Breathing

Total Inward Leakage Program

• Test Protocol
  - Individual test TIL Calculation
    • TIL= Average penetration for the 7 exercises
  - Duplication
    • Each test is repeated three times for each subject/respirator combination
  - TIL Calculation
    • Average TIL for the three tests
Total Inward Leakage Program

- Recap
  - Each subject dons the respirator 3 times and completes a range of exercises
  - Calculate average penetration over all exercises
  - Calculate average over the 3 donnings
  - If penetration ≤ 5%, fit is considered acceptable
  - For each model (facepiece), count the number of subjects with acceptable fit (out of 35)
  - 26 of 35 must have an acceptable fit
  - TIL ≠ APF

Total Inward Leakage Program

- Cost
  - Estimated cost of testing each facepiece is $8,500 - $12,000
Total Inward Leakage Program

- Proposed Implementation Concept
  - Effective 30 days after codification
  - Applicable to all new approvals
  - 3 year grandfathering of old approvals

- Other Possible Scenarios
  - Process extensions of old approvals for 2 years
  - Comments and Suggestions welcome!

Quality Partnerships
Enhance Worker Safety & Health

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Thank you

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