Respiratory Protection for Response to CBR Agents

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Respirator Leakage

- Primary determinant of respiratory protection
- Defines type of respirator used
- Determines respirator fit and performance
# Respirator Leakage vs. Respirator Fit

<table>
<thead>
<tr>
<th>Measure</th>
<th>Aerosol System</th>
<th>CNP System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fit Factor</td>
<td>$C_o / C_i$</td>
<td>$FR_{inh} / FR_{lk}$</td>
</tr>
<tr>
<td>Leak</td>
<td>$1 / \text{Fit Factor}$</td>
<td>ml / min</td>
</tr>
</tbody>
</table>
Need for Feedback on Respirator Leakage

- Determination of respirator type
- Selection of specific model and size
- Certification of adequate “fit”
- Training on respirator wear and use
Measuring Respirator Leakage

- Aerosol based (generated, ambient) systems
  - TSI Portacount
  - TSI M-41

- Controlled Negative Pressure (CNP) system
  - OHD FitTester 3000
CNP vs. Aerosol Systems

- CNP detects >> leakage during paired tests
- CNP more accurate and less variable when measuring known leakage
- CNP substantially faster than aerosol
- Respirator donning has greater effect on leakage than fit test exercises
Detection of Known Leakage

![Graph showing detection of known leakage for Breathing Machine and Human Subjects. The graph compares detection rates for CNP and Portacount. For Breathing Machine, CNP has a significantly higher detection rate than Portacount. For Human Subjects, both CNP and Portacount have lower detection rates compared to Breathing Machine.]
Marine-2 Fit Factors

Number of Paired Fit Tests

Measured Fit Factor

- M-41 System
- CNP System
- FF = 6,667
- FF = 1,000

Marine-2 Fit Factors

Number of Paired Fit Tests

Measured Fit Factor

- M-41 System
- CNP System
- FF = 6,667
- FF = 1,000
MCU-2P Fit Factors w/o Eyewear Inserts

Number of Paired Fit Tests

Measured Fit Factor

Portacount
CNP
FF = 1,667
MCU-2P Fit Factors with Eyewear Inserts

Number of Paired Fit Tests

Measured Fit Factor

- Portacount
- CNP
- FF = 1,667
## Fit Test Exercise Effect?

<table>
<thead>
<tr>
<th>Sub #</th>
<th>NB1</th>
<th>DB</th>
<th>SS</th>
<th>UD</th>
<th>TK</th>
<th>GM</th>
<th>BO</th>
<th>JOG</th>
<th>NB2</th>
<th>OA</th>
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</thead>
<tbody>
<tr>
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<td></td>
</tr>
<tr>
<td><strong>Fit Factor</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>111,000</td>
<td>102,000</td>
<td>110,000</td>
<td>112,000</td>
<td>35,700</td>
<td>72,500</td>
<td>94,600</td>
<td>86,800</td>
<td>84,300</td>
<td>79,900</td>
</tr>
<tr>
<td>2</td>
<td>64,700</td>
<td>106,000</td>
<td>75,200</td>
<td>79,800</td>
<td>21,700</td>
<td>116,000</td>
<td>242,000</td>
<td>59,000</td>
<td>89,200</td>
<td>65,300</td>
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<tr>
<td>4</td>
<td>17,400</td>
<td>27,200</td>
<td>21,000</td>
<td>18,100</td>
<td>7,650</td>
<td>24,500</td>
<td>8,830</td>
<td>8,050</td>
<td>16,500</td>
<td>13,400</td>
</tr>
<tr>
<td><strong>Equivalent Leak Rate, ml/min</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.48</td>
<td>0.53</td>
<td>0.49</td>
<td>0.48</td>
<td>1.51</td>
<td>0.74</td>
<td>0.57</td>
<td>0.62</td>
<td>0.64</td>
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<tr>
<td>2</td>
<td>0.83</td>
<td>0.51</td>
<td>0.72</td>
<td>0.67</td>
<td>2.48</td>
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<td>0.91</td>
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<tr>
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<td>6.68</td>
<td>3.26</td>
<td>4.01</td>
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From OSHA Docket No. H-049, Exhibit No. 54-114
CNP OSHA vs. REDON Protocols

- OSHA Protocol [ Fit Test Number = Number of Fit Tests / 4]
- REDON Protocol